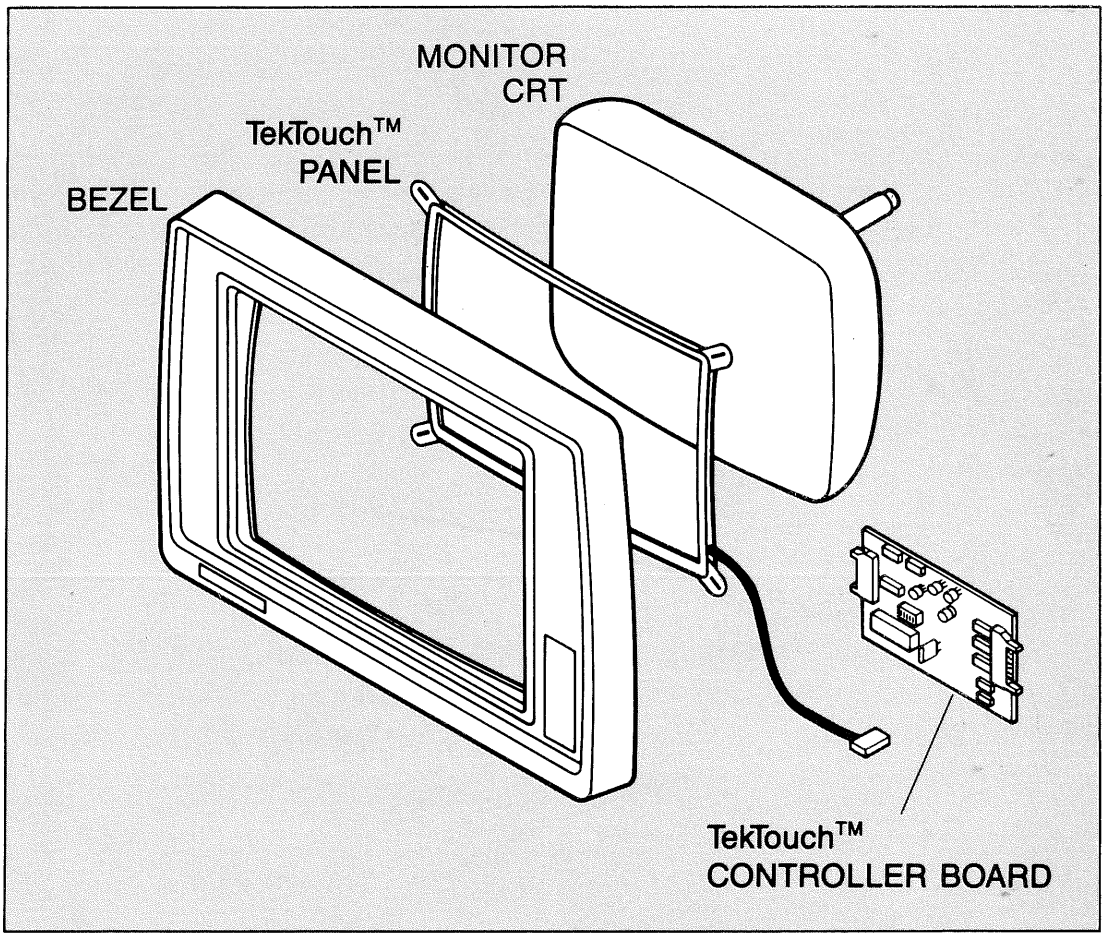
PART NO. 070-6349-00
JANUARY 1987

TekTouch ™



Technical Reference Guide

NOTICE

This instrument, in whole or in part, may be protected by one or more U.S. or foreign patents or patent applications. Information provided on request by Tektronix, Inc., P.O. Box 500, Beaverton, Oregon 97077.

Prices and specifications subject to change without notice.

CONTENTS

Operator's Safety Summary

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms in this manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statments identify conditions or practices that could result in personal injury or loss of life.

Power source

This product is intended to operate from a power module connected to a power source that will not apply more than 250 volts rms between the supply connectors or between either supply connector and ground.

Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the power cord grounding conductor is essential for safe operation.

Danger arising from loss of ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Do not operate in explosive atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

Do not operate without covers

To avoid personal injury, don not operate this product without covers installed. Do not apply power to the plug-in via a plug-in extender.

Section 1
INTRODUCTION

The TekTouch™ Touch Panel System

TekTouch™, the Tektronix interactive touch input system, consists of a transparent glass panel designed to mount over the face of a Cathode Ray Tube (CRT), and touch panel controller electronics. TekTouch™ translates a touch position into an electrical signal, allowing easy communication between a human operator and an electronic system. In turn, the electrical signal is converted into physical coordinate data and transmitted to the host via a standard RS232C or parallel interface.

TekTouch™ may be easily installed over most existing CRTs, requiring only 0.20-inch perpendicular clearance. Its thin screen construction minimizes visual distortions common in other touch panel technologies, and allows 256 x 256 addressable points over the panel surface, with a typical resolution of 1%.

How does it work? A continuous, transparent film is deposited on a glass panel. The touched position is determined by measuring changes to a small AC signal applied to the touch panel. Variation in the signal corresponds to the touch location.

Intent of this Manual

The first four sections of this manual are intended for TekTouch™ OEM customers, and cover day-to-day operation, cleaning, calibration, simple diagnostics and sample applications. System specifications are included for information purposes.

Installation instructions are located in Section 5, and are intended for qualified technical personnel only. For service questions, call Tektronix Touch Panel Marketing at (503) 627-6868.

This manual is divided into the following sections:

Section 1	Introductory information on the touch panel system and this manual. System components, configuration information and interface options. Cleaning and maintenance information.
Section 2	Calibration and testing procedures.
Section 3	Applications information, data transmission modes and sample applications code.
Section 4	Installation instructions.
Section 5	System specifications information.

System Components

Basic OEM System

The standard OEM TekTouch™ system includes the following components:

- A conductive film-coated glass panel
- A panel-to-circuit board cable
- A TekTouch™ controller board with RS232C or parallel interface

Tektouch™ Evaluation Kit

For fast evaluation, the TekTouch™ Evaluation Kit includes the following components in addition to the basic system:

- A controller board cable
- An external interface cable from monitor exterior to host system (DB15 to DB25)
- An external power supply unit

Optional Equipment

The following OEM optional equipment is also available:

- Power supplies, external and internal
- Controller board cables, with external, internal or no power supply connection
- External interface cable, from monitor exterior to host (DB15 to DB25)
- External enclosure for controller board and connections

OEM System Configuration

The OEM TekTouch™ system configuration involves interconnection between the panel and its controller board. Controller board interface cabling to the host computer and a separate power supply unit are available optionally.

Modifications to the user's system include mechanical accommodation of the touch panel and controller board, and the host system interface connection, including power requirements as specified in section 2 of this guide. The panel typically mounts between the display CRT and the existing CRT bezel.

The touch-sensitive film is on the viewing (convex) side of the panel. The film is as rugged as glass, therefore should require no more care than would be given to any glass surface. While most commercial glass cleaners may be used to clean the touch panel, avoid any fluids which might leave conductive residues.

Compatibility

TekTouch™ touch panels are manufactured in a variety of sizes and radii of curvature, designed to fit CRTs from 9 to 13 inches diagonal measure. Touch panel to host system interfaces are available in either RS-232 or 8-bit parallel formats. For information about other touch panel configurations and interfaces, please contact Tektronix Touch Panel Marketing at (503) 627-6868.

Section 2
CALIBRATION AND TESTING

Coordinates

Positional information is presented to the host system as coordinates ranging from 0 to 255 for X, Y and Z. The touch panel X and Y origin is usually configured by user software to be the lower left corner of the panel, so that the upper right corner is the maximum value for both axes. The Z origin (a Z coordinate of 0) represents infinite electrical contact with the panel surface. However, infinite electrical contact will cause the panel to momentarily shut down to protect the user and controller electronics.

The Z coordinate is useful to control the definition of a touch. The panel may be used with thin gloves, such as surgical or clean-room gloves. In most environments it is desirable to require the user to actually contact the panel. Touch locations outside of the specified quality area will exhibit a certain amount of geometric distortion. This outside area may not be usable for an application, depending on the resolution requirements.

Calibration Procedure

When a touch panel is placed on a display device, the panel must be calibrated to the device. Drift in the display or touch panel may require this calibration to be performed periodically depending on resolution requirements and user interface design. An interface designed with visual feedback for user touch selections will require less frequent calibration. For example, assuming the CRT beam location is to be correlated with touch panel position, and the CRT coordinates are such that upper left is (0,0), the transformation of touch panel position (X,Y) to display graphics coordinate (X',Y') can be calibrated in a linear fashion as follows:

Place a cursor at CRT origin (0,0)
Read the touch panel position (X_1,Y_1)
Place a cursor at (Cursor Max X, Cursor Max Y)
Read the touch panel position (X_2,Y_2)

$$a_1 = \frac{\text{Cursor Max X}}{X_2 - X_1}$$

$$a_0 = \frac{-X_1(\text{Cursor Max X})}{X_2 - X_1}$$

$$X' = X(a_1) + a_0$$

$$b_1 = \frac{\text{Cursor Max Y}}{Y_1 - Y_2}$$

$$b_0 = \frac{Y_1(\text{Cursor Max Y})}{Y_1 - Y_2}$$

$$Y' = b_0 - (b_1)Y$$

Display graphics coordinate is (X',Y'), which is derived from the calibration coefficients a_0, a_1, b_0, b_1. In this case the coefficients a_0, b_0 represent an offset, and the coefficients a_1, b_1 represent a magnification factor. These coefficients may be different for each TekTouch system. For example, this calibration procedure corrects for inaccuracies in touch panel mounting, which is one source of variation between systems.

The calibration coefficients and the transformation equations relating the display coordinates (X,Y) to the touch panel coordinates (X',Y') should be stored in the host system, thus eliminating the need for re-calibration at each power up.

After calibration, data is typically transformed as follows:

1. Panel is touched.
2. Touch coordinates (X,Y) are sent to the host system.
3. The host system converts coordinates from the touch panel coordinate system to the display coordinate system (calibration) using a_0, a_1, b_0, b_1 to give (X',Y').
4. The host system takes action based on the value (X',Y').

The above is a representation of a simple linear transformation. Higher than standard touch panel accuracy (greater than 256 points per axis) can be obtained by the use of a higher order calibration procedure. In the linear case given above, two points need to be touched during calibration. For the general case of n^{th} order, n+1 points need to be touched during calibration. For example, for a quadratic calibration, three points should be referenced, resulting in calibration coordinates a_0, a_1, a_2, b_0, b_1, b_2, with the X' coordinate related to the X coordinate as follows:

$$X' = a_2(X^2) + a_1(x)+a_0$$

In general there are many standard methods and algorithms for this type of calibration, including translation and rotation.

Users with extreme accuracy requirements (greater than 256 points per axis) may benefit from a higher order calibration procedure. Methods for general position transformations can be found in graphics text books. Two good references are *Principles of Interactive Computer Graphics,* William M. Newman and Robert F. Sproull, McGraw-Hill, 1979, 1973; and *Fundamentals of Interactive Computer Graphics,* J.D. Foley and A. Van Dam, Addison-Wesley, 1982.

Controller Board Calibration

TekTouch™ system setup was performed at the factory to suit the requirements of the monitor designated in your application. Normally, no adjustment is required other than to assure that DIP switches controlling the operating modes have been correctly configured for this application.

The information for DIP switch configuration is as follows:

DIP Switch Configuration

Operation	**Switch Positions**
Delta	1 closed, 2 closed
Touch on Make	1 closed, 2 open
Touch on Break	1 open, 2 closed
Continuous	1 open, 2 open
Baud/Stop Bits	**Switch Position**
1200/2	3 closed, 4 open
9600/1	3 open, 4 closed
19200/1	3 open, 4 open
Parity	**Switch Position**
Even	5 closed, 6 closed
Odd	5 closed, 6 open
None	5 open, 6 open
Format/Character Bit Length	**Switch Position**
Binary/8 no parity	7 closed
ASCII/8 including parity	7 open

Failure Detection

The touch panel will shut down if a low resistance to ground is detected, causing possible excessive current flow. The shut down can be detected by a Z coordinate of zero. The touch panel will remain shut down until the fault connection from panel to ground is removed. The touch panel executes internal diagnostics at reset. After reset, when internal testing is complete, X and Y values of zero and a Z value of 255 will be transmitted in all modes. If this first point is not received, an error exists and the touch data should be considered invalid. The *Data Set Ready* line will also remain in the low state. The touch panel continuously monitors internal operation. Failure detection will cause the touch panel to continuously transmit X, Y and Z values of 255. After the first such transmission, the *Data Set Ready* line will drop low.

LED Indicator

The touch panel provides visual feedback on the system status via an LED indicator on the TekTouch™ controller board. The LED should be bright briefly at power on or reset. After initialization the LED will dim. The LED will become bright if the panel is touched. An LED which remains at full brightness after reset indicates a failure. Please examine your circuit connections. If the problem cannot be isolated, contact Tektronix Touch Panel Marketing at (503) 627-6868.

Reset

The touch panel will reset at power on. If panel is equipped with a separate power supply, powering-up monitor itself will not reset the touch panel. The touch panel may be manually reset by pushing the red reset button (provided only in TekTouch™ evaluation kits) or by pulling the reset line low. This line is compatible with either TTL or RS232 logic levels. Over the serial interface, the touch panel may be also be reset by the host transmitting a Ctrl-R. The only time the user must reset the touch panel system is after an error is detected or after changing the switch mode.

Section 3
APPLICATIONS INFORMATION

TekTouch™ allows a variety of methods to transmit user touch positions to the host system. Modes of operation, interface formats and data transmission rates may be varied. This offers the system designer maximum flexibility when implementing software applications.

Operating Modes

Multiple modes with different host processing or transmission bandwidth requirements are provided. This feature allows the system integrator to choose the most appropriate mode for a particular application. After changing a mode the touch panel must be reset. The available operating modes are:

Operation	Switch Positions
Delta	1 closed, 2 closed
Make	1 closed, 2 open
Break	1 open, 2 closed
Continuous	1 open, 2 open

In the *delta* mode the touch panel system sends a data point any time X, Y or Z changes. The touch panel system is set up at the factory in the *delta* mode. The *delta* mode is the typical setting for optimizing host processing/communications bandwidth versus user complexity/control.

The *make* and *break* modes are intended for systems with very low processing power or communications bandwidth. The threshold is selected to include gloved applications. The threshold may be inappropriate for some applications and it is recommended that *delta* mode be used wherever possible. Interpreted computer languages, for example BASIC, might require these modes because of limited processing speed.

In the *continuous* mode, the system transmits data continuously, even when the touch point is unchanging. No data point averaging is performed by the touch system in this mode. There is a tradeoff between the speed (response time) and the accuracy of the touch. This tradeoff can be controlled by selecting the number of points to be averaged.

Using the Z Axis

The Z coordinate can be thought of as the distance between a finger and the panel. Thus, Z is very large when there is no touch, less large when the finger is separated from the panel surface by a glove, and small when the panel is shorted to ground. Specifically, the Z value reflects touch pressure – the harder the touch, the lower the value. Typical Z values are:

Z Value	Condition
255	no touch
130	light touch through surgical glove
110	moderate touch through surgical glove
90	firm touch through surgical glove or light touch without glove
70	firm touch without glove
0	panel shorted to ground

The basic application of the Z value is to identify a touch or near-touch condition. Any value of Z below 255 represents a touch. Different Z axis sensitivity levels can be set for particular areas of the screen. Some examples of this might be to reject too-light or near-touches in a given area, or to accept extremely light touches in a frequently used location.

The recommended method to accept only a deliberate touch is to set a Z threshold of 120. This means that only Z values below 120 represent a touch condition, and very light touches will be rejected.

Another application of the Z coordinate is to provide additional protection in soft-key applications. For example, keys with storage-modifying functions such as *delete* or *save* can be set to have a low Z threshold, and thus require very firm touch pressure. Keys with less critical functions such as *help* can be set up with a high Z threshold for easy operation.

Sample Application Code

The following Pascal code illustrates the sample interaction described previously:

```
CONST
    TouchThreshold = 120;

PROCEDURE TouchSelection(VAR sel: INTEGER);
    VAR
        x,y,z,
        lastsel:INTEGER;
    BEGIN
        REPEAT
            ReadPanel(x,y,z)
            UNTIL z <= TouchThreshold;
        sel := 0;
        REPEAT
            BEGIN
            lastsel := sel;
            sel := SelectByPosition(x,y);
            IF sel <> lastsel THEN
                BEGIN
                NormalIntensity(lastsel);
                HighIntensity(sel)
                END;
            ReadPanel(x,y,z)
            END
            UNTIL z >= TouchThreshold;
        NormalIntensity(sel)
    END;
```

Make or *Break* Emulation

If the application requires only *make* or *break* information, the host system can transform *continuous* or *delta* mode data to emulate either *make* or *break* data. Pascal code to transform *delta* mode into *make* mode follows:

```
PROCEDURE TouchOnMake(VAR x,y,z:INTEGER);
    BEGIN
        REPEAT
            ReadPanel(x,y,z)
            UNTIL z >= TouchThreshold;
        REPEAT
            ReadPanel(x,y,z)
            UNTIL z <= TouchThreshold;
        sel := SelectByPostion(x,y)
    END;
```

Data Format

Touch data may be formatted as ASCII or binary data. The parallel connection supports only binary data. ASCII data is hexadecimal encoded into two bytes, one for each four bits. The data format is:

Mode	Bytes
ASCII	high X, low X, space, high Y, low Y space, high Z, low Z, return
Binary	X, Y, Z

Data Transmission

The data can be transmitted via a parallel or serial connection to the host system. Be sure to reset the touch panel after changing any switch settings.

Parallel Interface

The parallel interface is intended for OEM applications such as direct connection with a host system processor. The TekTouch™ parallel connection is similar to a Centronics parallel interface, though data flows in the opposite direction. The parallel interface contains eight data lines, an active low strobe line, and an active low acknowledge line:

Operation	Line
Parallel Strobe	1
8 Bit Data Port	2-9
Acknowledge	10
Reset	11

The parallel communication sequence is: the data byte is placed on the eight data lines, then the strobe line is pulsed low. Normally the strobe line is utilized to interrupt the host system. The data lines remain stable until the data is read by the host system. After the host system reads the data, it should pulse the acknowledge line low. The process is repeated as data is available. Parallel port data is always in binary format. The data contains no separators or position indicators. The transmission of data must remain synchronized between the touch panel and host, beginning at touch panel reset. To enable parallel transmission, set switches 3 through 7 in the closed position.

Serial Interface

The serial interface requires an RS232 connection to the host system. The interface lines available are:

Operation	Line
Transmit Data	15
Receive Data	14
Clear To Send	10
Request to Send	13
Signal Ground	12
Data Set Ready	16
Touch Panel Reset	11

The input lines to the touch panel are *Receive Data* and *Clear To Send.* The output lines from the touch panel are *Transmit Data, Request To Send* and *Data Set Ready.* The *Signal Ground* line is shared by the touch panel and host system. The minimum lines required for touch panel operation are *Transmit Data* and *Signal Ground,* with all other lines not connected. The available transmission formats for the *Transmit Data* and *Receive Data* are:

Baud/Stop Bits	Switch Position
1200/2	3 closed, 4 open
9600/1*	3 open, 4 closed
19200/1	3 open, 4 open
Parity	**Switch Position**
Even	5 closed, 6 closed
Odd	5 closed, 6 open
None	5 open, 6 open
Format/Char Bit Length	**Switch Position**
Binary/8 plus parity	7 closed
ASCII/8 including parity	7 open

The *Transmit Data* line is the connection from the touch panel to the host. The *Receive Data* line is the connection to delay or reset the touch panel from the host. The characters recognized by the touch panel are:

Operation	Character
Stop	Ctrl S
Start	Ctrl Q
Reset	Ctrl R

The *Request To Send* line is driven high by the touch panel before each character is transmitted to the host.

The *Clear To Send* line is tested for high state before each character is transmitted. This line will remain high if not connected to the host.

The *Data Set Ready* line is driven high by the touch panel while the touch panel is operational. If the touch panel detects an internal failure this line will drop low.

* The number of stop bits at 9600 baud has changed from early three board prototypes. This may require minor modifications to applications code written for these prototypes.

Section 4
INSTALLATION

This section covers sample installation instructions and is intended for use by your OEM design engineer. For basic user information, see the Introduction in Section 1.

TekTouch™ can be installed on many different systems. Hence, the names of internal components will be addressed only in a general sense. Where circumstances differ from what follows, or are unique to a particular user system, supplemental instruction sheets will be made available separately.

Unpacking the System

As a rule, the touch panel system should arrive in a single container. Before unpacking the components, check the package exterior for large dents, tears and/or crushed corners. If damage is evident, it is recommended that the carrier be present when the container is opened.

Compare the parts list with the items received to assure that the system is complete for your application.

Inspect all parts for transit damage.

WARNINGS

1. EVEN WITH POWER DISCONNECTED, STORED CHARGES ON AN EXPOSED CRT HIGH VOLTAGE CONNECTOR AND OTHER METAL PARTS CAN PRODUCE A STRONG SHOCK.

2. WEAR ADEQUATE FACE, EYE AND BODY PROTECTION DURING REMOVAL OF CABINET AND WHILE EXPOSED TO AN UNPROTECTED CRT. THIS IS TO PROTECT YOU FROM FLYING GLASS SHOULD THE CRT IMPLODE.

3. THE CRT NECK IS FRAGILE - DO NOT APPLY PRESSURE. TO MOVE THE CRT, GRASP THE FRONT PORTION (FACEPLATE AREA) OR THE MOUNTING TABS.

4. CONSULT MONITOR MANUFACTURER TO ASCERTAIN WHETHER THE ORIGINAL WARRANTY WILL BE AFFECTED BY TOUCH PANEL INSTALLATION.

Engineering and Product Safety Considerations

While installation of the Tektouch™ system is fairly straightforward, the following issues must be addressed by the installer to insure continued product safety and reliability. These include:

Safety

NOTE: TekTouch™ is not intended to serve as an implosion shield for the CRT.

Maintain enclosure integrity with respect to structural (E.M.I.) and flammability (U.L.) requirements. When installing the touch panel, avoid leaving openings in the enclosure or weak areas which might gap open under slight pressure.

CRT mounting hardware must be adequate to withstand the stresses induced by mounting the touch panel. For example, the spacing introduced between the CRT and bezel due to the panel thickness limits the engagement of original CRT mounting hardware, especially in bezel mount applications. Therefore, longer mounting hardware will be required.

Internal clearances must remain adequate to prevent damage to monitor components. The CRT is often moved to the rear during panel installation, reducing clearance between the CRT and enclosure.

To avoid a shock hazard to the operator, voltages which exceed wire insulation ratings must be segregated from all cables and the controller board using physical restraints or isolation. A full size grounded metal plate is recommended as a means of mounting the board, improving electrical shielding and providing some isolation of voltages.

A normal temperature test should be employed to determine that the temperature rating of the insulation and the operating temperature range of the controller board will not be exceeded.

Reliability

The controller board will dissipate a maximum of four watts. If an internal touch panel power supply is added, it will approximately double the controller board dissipation. This should be taken into consideration regarding both local and total monitor dissipation. If this will exceed 10% of the total monitor consumption, the ratings plate must be revised to conform to U.L. requirements.

During the temperature testing, effects on heat ventilation patterns (convection, air flow, etc.) must be considered to assure that no detrimental changes occur.

Environmental

The finished monitor should be subjected to shake and shock tests to assure that CRT mounting strength is adequate, and that the controller board and power supply are securely mounted.

Electrical

Location of touch panel components should be evaluated with respect to electromagnetic interference. Induced A.C. signals may affect touch panel operation as well as radiated emission limits imposed by the F.C.C. or similar agencies. Avoid routing the touch panel cables or locating the controller board near sources of interference, such as switching power supplies, deflection yokes or other sources of high-level A.C. signals.

If an internal power supply is used, its location should be evaluated with respect to magnetic effects on CRT components. Power supply primary connections will require high potential testing to assure adequate insulation breakdown resistance and isolation between primary and secondary circuits.

Re-certification of the finished product will be necessary to comply with the requirements of U.L., F.C.C. or other applicable agencies.

Required Tools and Materials

Tools required during touch panel installation are indicated below. Other tools or materials may be required depending on the specific system being adapted.

Safety goggles
Drill and 1/8" bit (suitable for #6 screw)
Misc. hand tools (screwdrivers, nut drivers, etc.)
Glass cleaner – Windex or equivalent
Lint free tissues – Kimwipes or equivalent
Urethane padding for work surface
#6 self tapping screws, washers, spacers, etc. as needed
Coarse and medium grit emery cloth
CRT mounting hardware (0.25" longer than existing hardware for bezel mount)

Installing the Touch Panel

1. Place the display on a suitably padded work surface and assure that power to the display has been disconnected. Remove the cabinet (if any) referring to the relevant maintenance manual.

   If the CRT is mounted to the chassis, proceed directly to step 4. Steps 2 and 3 apply to bezel-mounted CRTs.

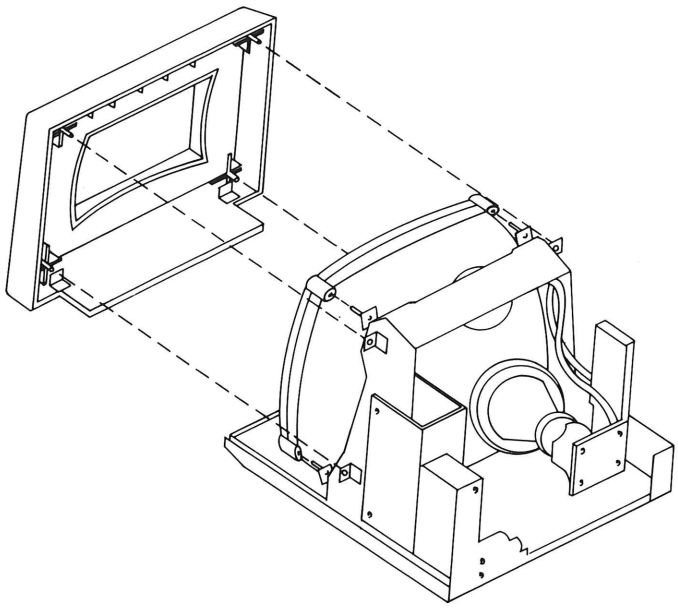


Figure 1.
Chassis mount monitor.

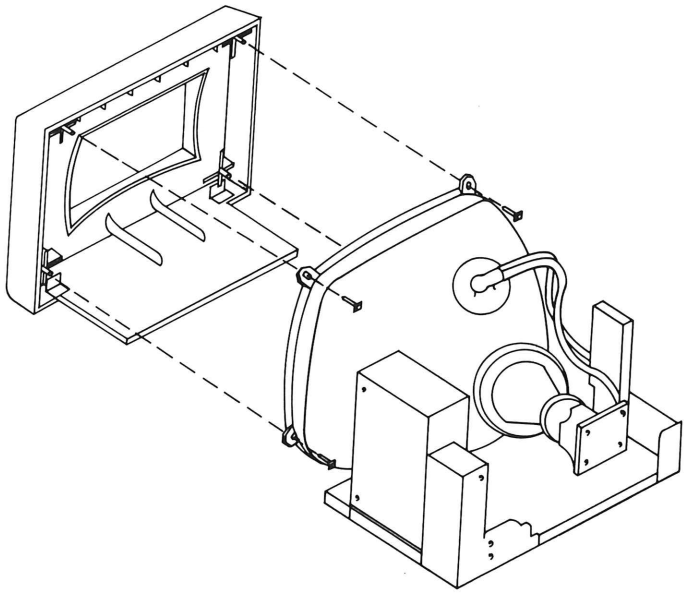


Figure 2.
Bezel mount monitor.

2. Recall the warning regarding stored charges. Discharge the CRT by attaching a lead to the chassis (ground) and then contacting the high voltage button with an insulated probe. Remove the lead. Remove all remaining electrical connections to the CRT (and the bezel if possible). Remove the mechanical connections between the monitor chassis and the bezel/CRT assembly.

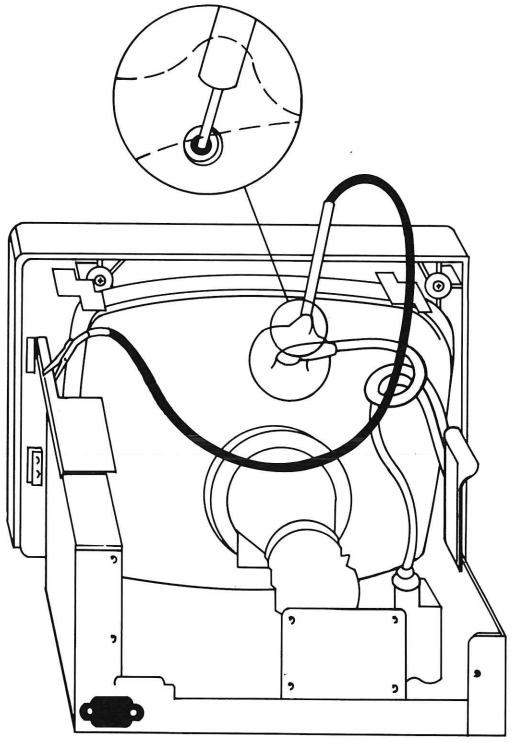


Figure 3.
Discharging CRT voltage.

3.4 Place bezel/CRT assembly face down on pad. Remove the CRT mounting screws. Set CRT aside for later touch panel installation.

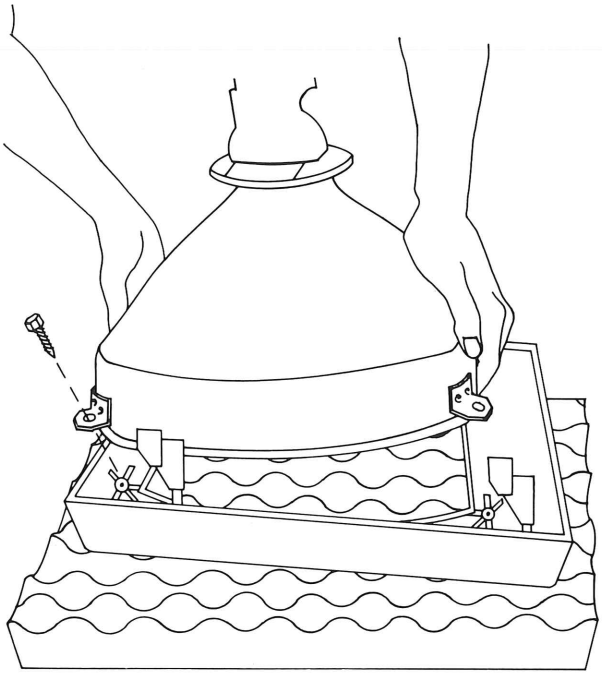


Figure 4.
Removing CRT from bezel.

4. Check bezel opening area for presence of conductive coatings which might present a false "touch" to the touch panel. These coatings are frequently added to the inside of the bezel to provide EMI shielding, and may have been overpainted. Any such coating contacting or in close proximity to the touch panel must be removed to avoid excess capacitive coupling to ground. Sanding the area with emery cloth will accomplish this. Blow out contaminants with compressed air. Glue the degauss coil into the bezel so as to prevent possible contact with the touch panel which also might result in a false "touch."

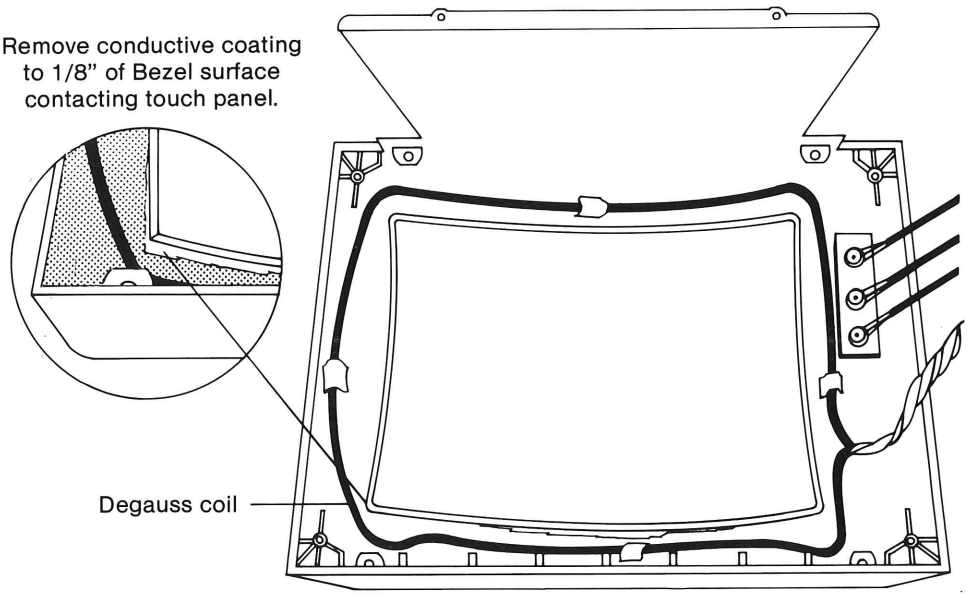


Figure 5.
Removing conductive coating and securing degauss coil.

5. Due to high frequency switching power supply noise on the degauss coil, it may be desirable to shield the coil from the touch panel. (This is applicable for monitors which mount the degauss coil in front of the touch panel.)

   Wrap the degauss coil with metallic foil and connect the foil to ground. Then insulate the foil with a suitable insulating tape, as shown in Figure 6. This method has proved to be very effective in reducing high frequency noise injection from this source.

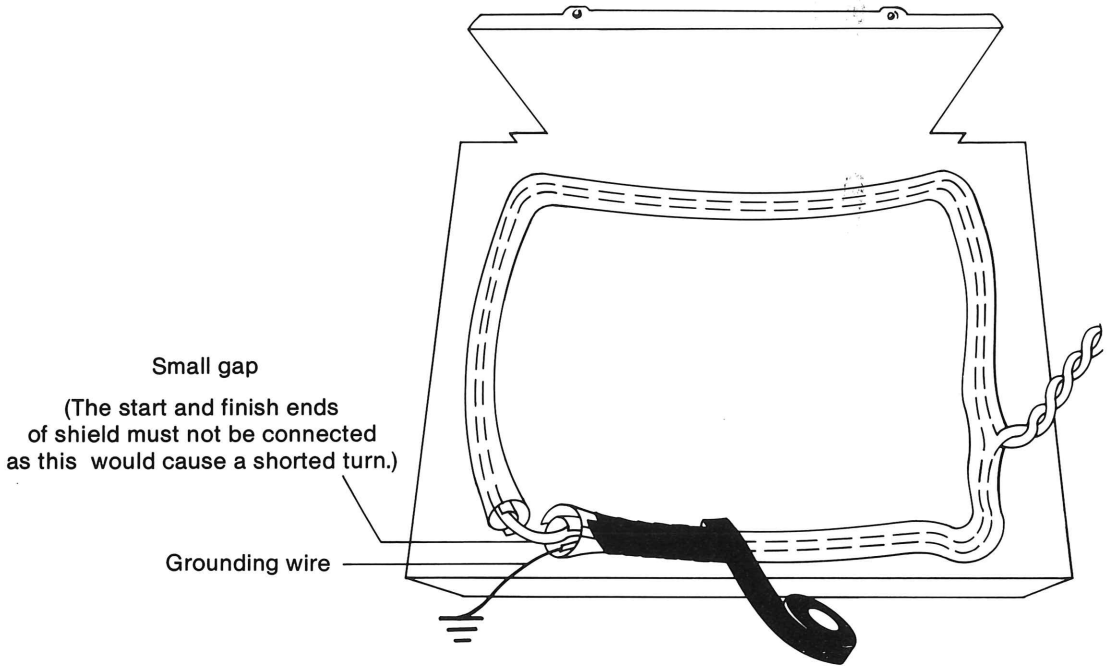


Figure 6.
Degauss coil shielding. The shielded and insulated degauss coil should be installed in its original location and fastened in place with as much space between it and the touch panel as possible.

   Additional methods of solving this problem are to electrostatically shield the degauss coil by installing a momentary switch (manual degauss) connecting both leads of the coil, or to bypass it to chassis ground. Usually .02 µF U.L. style, appropriately rated capacitors from each leg of the coil to the chassis ground will adequately attenuate this noise. Note that U.L./CSA safety regulations may be a consideration here, as the degauss coil is probably floating on the power line.

   Monitors which have the degauss coil on the bell of the CRT normally pose no noise problem.

   A simple method to test for degauss coil noise is to shut off the horizontal flyback supply alleviating this noise source, disconnect touch panel from the circuit board, and look at a lead from the touch panel cable with an oscilloscope and 10mm probe. If more than approximately .1V of high frequency (20kHz) switcher noise is observed (ignore 60Hz portion of the oscilloscope display), it will probably be necessary to clean it up with one of the methods suggested above.

6. Check the fit of the touch panel gasket relative to the bezel. The gasket should not be visible from the exterior of the monitor or interfere with bezel reassembly. Small sections of the gasket may be trimmed off if necessary, or touch panel alignment may need to be adjusted.

7. Clean the concave side of the touch panel and the convex CRT faceplate with glass cleaner applied to a lint free wipe. Compressed air may be used to remove any fibers or particles remaining. The touch panel is then oriented such that the cable extends from the touch panel toward the lower right corner of the CRT as seen from the viewer (convex) side.

NOTE

Due to the installation of the touch panel, the spacing between the CRT and bezel will be increased by about 0.20". This should be considered when determining the length of CRT attachment screws and cabinet dimensions. Spacers must be used on many bezel-mounted CRTs to avoid undue bezel pressure on touch panel.

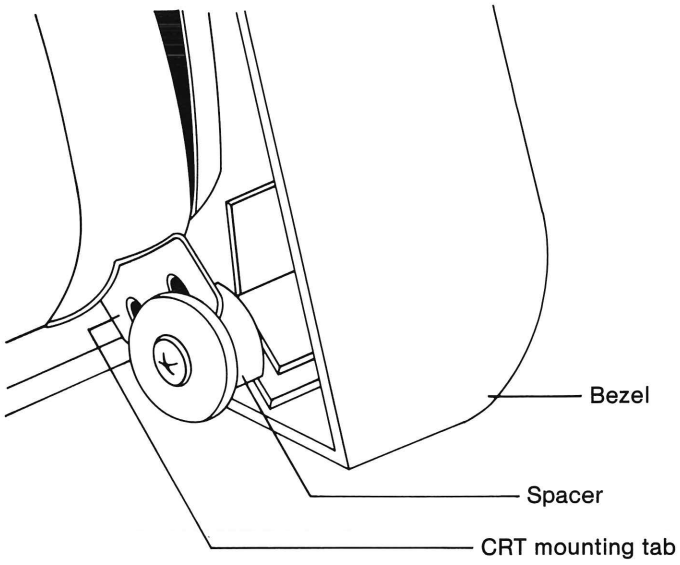


Figure 7.
Use of spacers to compensate for touch panel thickness.

Different monitors require a variety of installation procedures. Determine which mounting scheme your monitor requires and refer to the step 8 instructions appropriate for that method.

Bezel-mounted CRTs

8a. Place clips in bezel and position touch panel on clips. Pieces of rod may be required to keep clips in place until panel and CRT are positioned. Center the touch panel in the bezel opening. Then place the CRT on the touch panel and secure with appropriate hardware, e.g., mounting clips or gasket tabs.

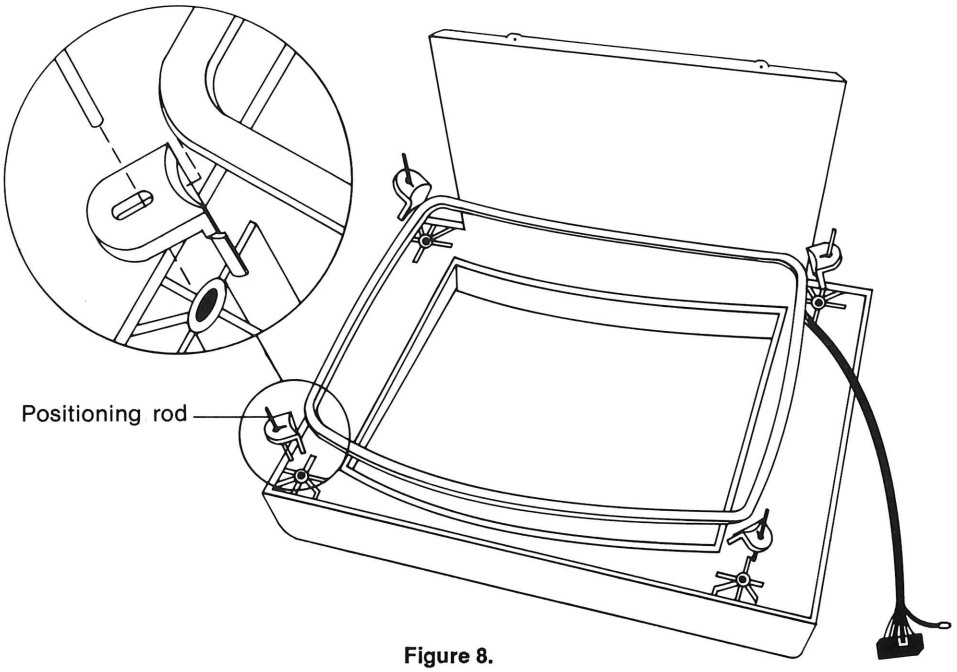


Figure 8.
Bezel-mounted touch panel installation using mounting clips.

Chassis-mounted CRTs

8b. Remove CRT attachment screws two at a time, diagonally, mounting touch panel to these points with appropriate hardware, e.g., mounting clips or gasket tabs.

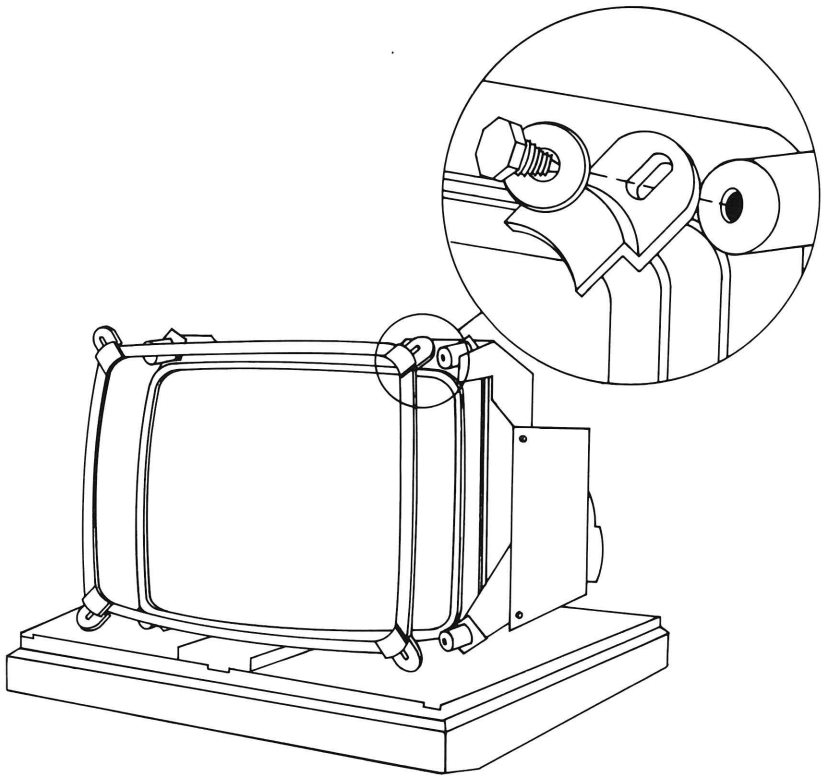


Figure 9.
Chassis-mounted touch panel installation using mounting clips.

Controller Board Installation

Using standoffs suitable for #6 screws, locate the controller board, such that the cable from the touch panel will reach the J2 connector.

NOTE

To assure proper operation and to bleed static charge, the controller board and touch panel cable shield MUST BE GROUNDED at the mounting hole closest to the J2 connector.

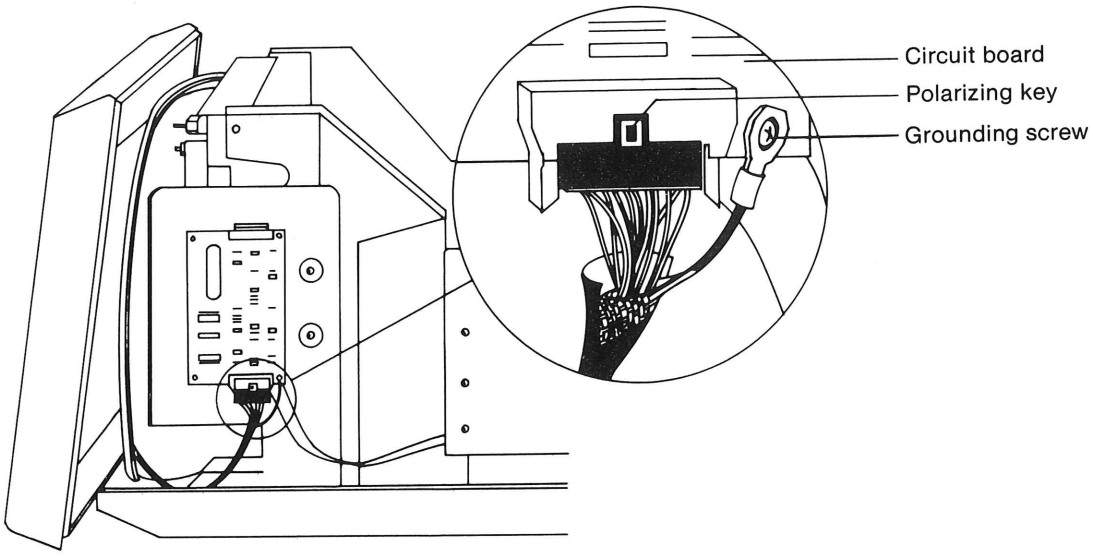


Figure 10.
Mounting and grounding the controller board.

The connections to J1 (interface connector) include both power and communication lines. Normally, the user is responsible for the manufacture of cabling to this connector, assuring the proper pinout, and adequate power supplies. Although available optionally, your installation may not include the cable or power supply. Refer to Section 2 of this manual for connector pinouts and power supply requirements, if necessary.

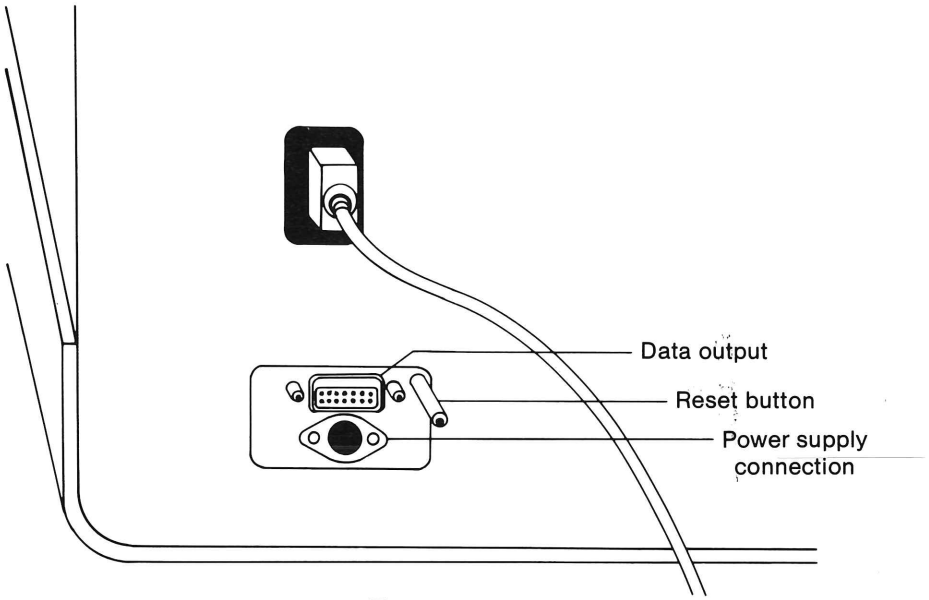


Figure 11.
Typical connector configuration on monitor exterior

Monitor Reassembly

CAUTION

The addition of the touch panel within the monitor case will typically move the CRT assembly toward the rear of the case by approximately 0.2". Check to assure that adequate clearance remains between the CRT and other monitor components to ensure mechanical integrity and electrical isolation. It may be necessary in some applications to add a filler strip around the monitor case to account for the offset to the bezel. If so, the material used must meet enclosure requirements for electrical, flammability and impact safety. Electrical insulation to the CRT connections may also be required if enclosure clearance was minimal to begin with.

Verify that the grounding connections to the controller board and cable shield are tight.

Reverse disassembly procedure to reassemble monitor including such materials/methods as necessary to conform to the caution statement above.

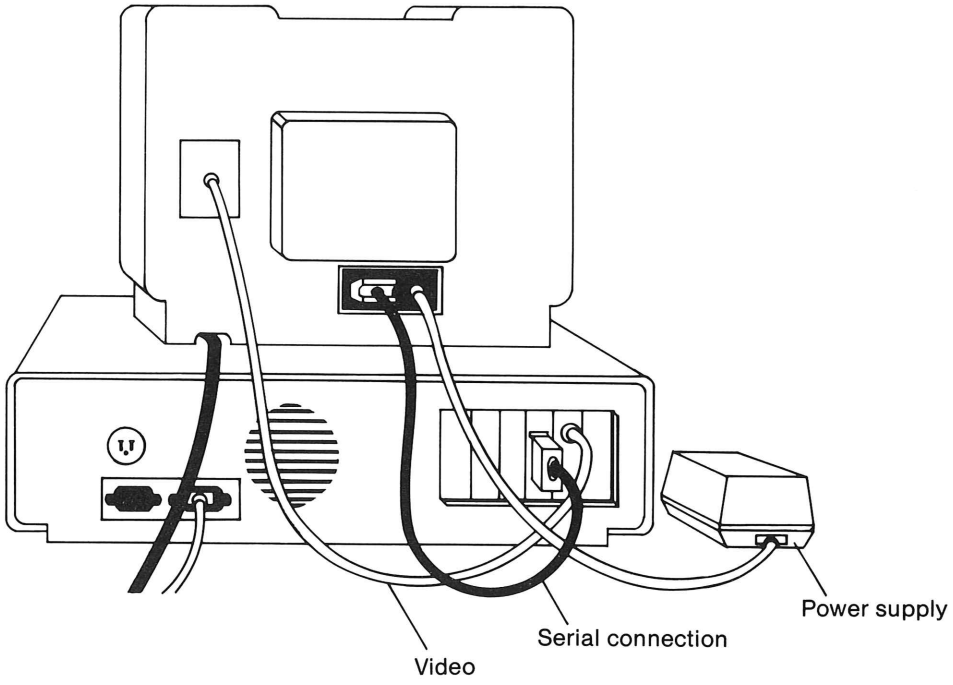


Figure 12.
Typical system configuration.

Final Test

Test monitor and circuit board operation using the test and calibration procedures described in Section 3 of this manual.

Section 5
SYSTEM SPECIFICATIONS

This section covers physical, optical and environmental specifications for the TekTouch™ touch panel system. Specifications are subject to change without notice. To verify current information, please contact Tektronix Touch Panel Marketing at (503) 627-6868.

High touch resolution
High transmissivity
Simple data link

TekTouch™ The New Interactive Panel from Tektronix

TekTouch™ Capabilities

TekTouch allows simple interactive communication between an operator and an electronic system. Versatility of the TekTouch™ system provides easy access to even the most complex data input requirements.

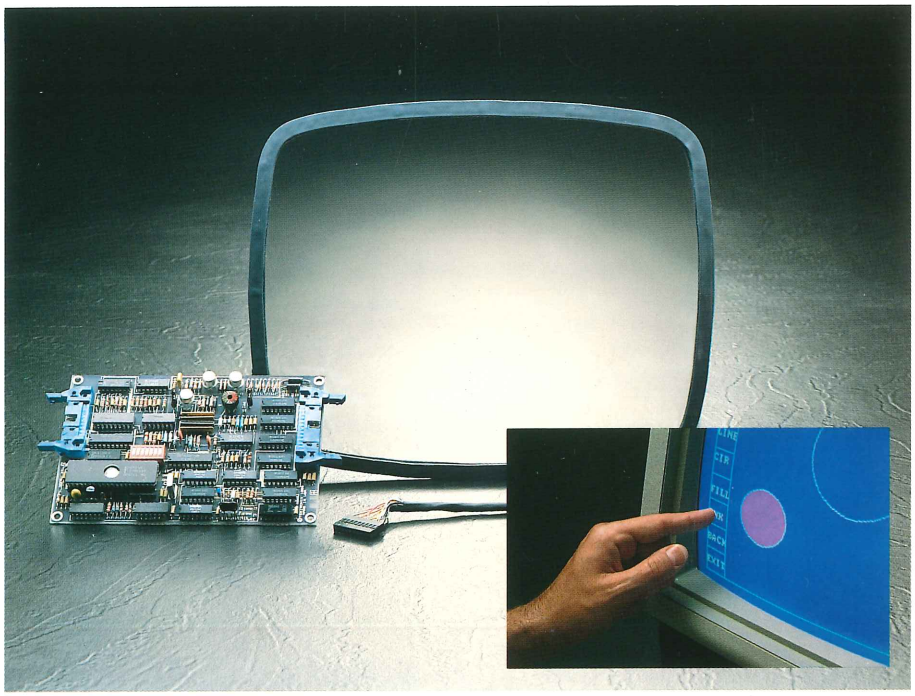
Soft keys can be defined up to 256 points per axis. TekTouch™ electronics will compute and transmit touch locations to the host system. TekTouch™ links to your computer through either RS-232C or parallel interfaces.

The Technology

TekTouch™ consists of a thin, continuous, transparent film deposited on a glass panel. The touched position is determined by measuring changes to a small AC signal applied to the touch panel. Variation in the signal corresponds to the touch location.

TekTouch's™ panel construction eliminates many visual distortions commonly found in other touch panels. Minimum parallax error and its 85% transmissivity allow excellent optical clarity.

TekTouch™, engineered at Tektronix, provides a reliable, low cost data entry solution.



TekTouch™ provides high transmission, has no moving parts, and is not subject to dust intrusion. It does not extend laterally past existing display CRT dimensions.

Installation

TekTouch™ conveniently mounts under the present CRT/monitor bezel, requiring only about 0.20 inch clearance. The controller circuitry fits on a 4 by 6 inch circuit board designed to mount directly inside the monitor. A harness connecting the panel and controller board is supplied.

Applications

Built to withstand environments such as process control stations, automatic teller machines, and public information kiosks, TekTouch™ is also a valuable aid for many test and measurement applications. Other uses include:

- Menu selection
- Interactive graphics
- Programmable 'soft keys' for display front panel or as existing keyboard extension.

Tektronix®
COMMITTED TO EXCELLENCE

SPECIFICATIONS

I. TOUCH PANEL

Technology: Continuous capacitive
Touch Resolution: Up to 256 points per axis to panel edge
Touch Accuracy: Standard error—nominally 1% of panel size
Touch Sampling Rate: 50–100 samples per second
Touch Response Time: 20 msec (typical)
Transmissivity: 85% at 520 nm (typical of antiglare-etched surface)
Size Range: 9 to 13 inches (228 to 330 mm) diagonal
Active Touch Area: Within 0.75 inch (19.05 mm) of panel edges
Input Power:

	Nom.	Max.
+5 V	250 mA	320 mA
+12 V	60 mA	100 mA
–12 V	60 mA	100 mA

II. MECHANICAL

Panel Size: See Figure 1 and Table 1
Glass Thickness: 0.125 inch (3.175 mm)
Panel Mounting Accommodations: Gasket supplied with tabs, clips or mounting tape as appropriate
Controller Board Size: 4 by 6 inches (101.6 by 152.4 mm) (see Figure 2)
Mating Interface (J1) Connector: Berg 66900-220 or equivalent
Controller Board Mounting Accommodations: Designed to mount within 15 inches (381 mm) of Touch Panel

III. COMMUNICATIONS

Format

– RS-232C Interface

Selectable Baud Rate: 1200, 9600, 19200
Transmission Code: asynchronous ASCII, selectable parity
Data Structure: X,Y,Z; 8-bits binary or 7-bit hex ASCII selectable
J1 Pinout: Per Table 2

– Parallel Interface

Transmission Code: Binary
Data Structure: 8-bit data with strobe and acknowledge lines
J1 Pinout: Per Table 2

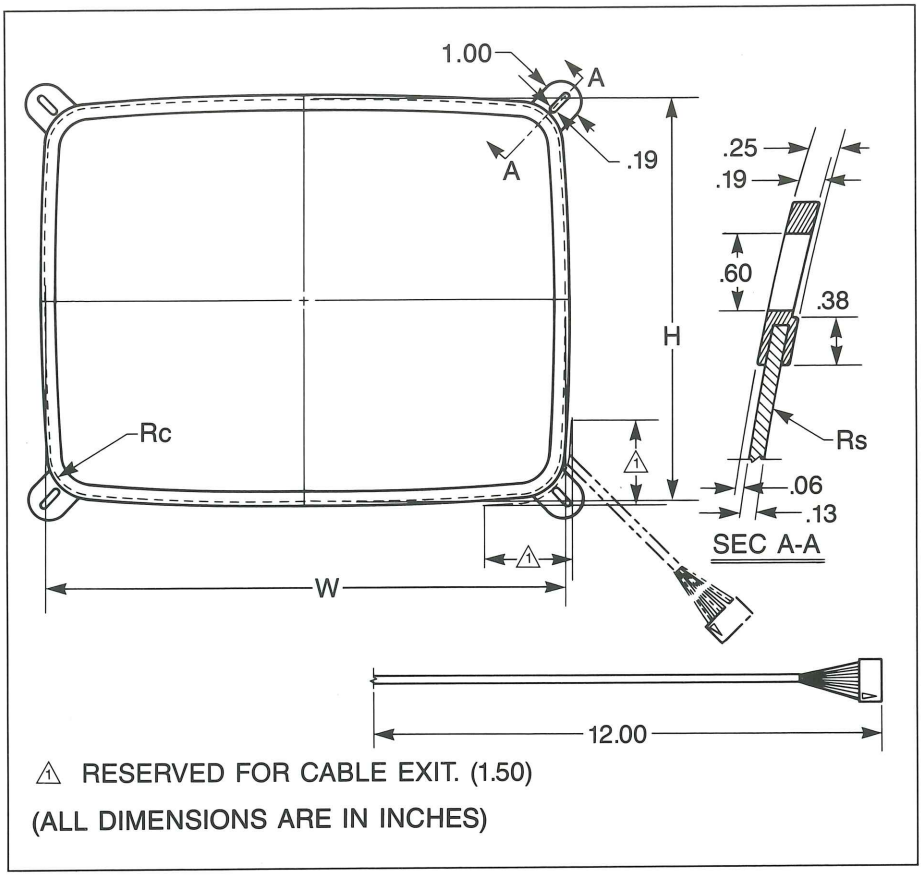


Figure 1. Drawing of Touch Panel. See Table 1 for specific dimensions.

Data Format Options

Alternative data formats available. Please consult Tektronix Display Devices Operation Marketing & Sales for quotation and availability.

IV. MODES OF OPERATION

Data Transmission Modes: Per Table 3 (user selectable through setting of dip switches on circuit board)

- Delta—send data on any change in x, y or z
- Make—send data on initiation of touch
- Break—send data on termination of touch
- Continuous

V. ENVIRONMENTAL

Operating Temperature Range: 0 to +70°C
Storage Temperature Range: –62 to +85°C
Operating Humidity Range: Up to 95% at 55°C

Moisture and Dust: Resistant to high humidity environments, moisture and dust: highly resistant to the corrosive effects of beverage spills, etc.

Altitude: Operating — Up to 15,000 ft (4.5 km)
Storage — Up to 50,000 ft (15 km)

Vibration: Operating — 0.025 in (0.635 mm) p-p, 10–55 Hz
Storage — 0.05 in (1.27 mm) p-p, 10–55 Hz

Shock: Operating — 50 g peak acceleration
Storage — 100 g peak acceleration

VI. CERTIFICATIONS

Safety: UL 478, UL 1244, and UL 544 (professional, non-patient care)

Regulatory: FCC Class B

Table 1. TekTouch™ Panel Dimensions

NOMINAL DIAGONAL	R_s SPHERICAL RADIUS (inches)	H HEIGHT (INCHES)	W WIDTH (INCHES)	R_c CORNER RADIUS (inches)	SAMPLE MONITORS
9 in.	24.0	6.4	8.4	0.75	IBM Portable PC
	27.0	6.1	8.1	0.75	Compaq II Portable PC
12 in.	19.0	8.5	10.6	1.25	IBM 5151
13 in.	22.8	9.5	12.3	1.00	IBM 5154 Zenith ZVM135 NEC Multisync
	24.0	9.4	12.3	1.12	IBM 5153

Table 2. J1 Connections

a) RS-232C SERIAL INTERFACE		b) PARALLEL INTERFACE	
1–9	RESERVED	1	PARALLEL $\overline{\text{STROBE}}$
10	RS-232 CTS	2–9	8 BIT DATA PORT (PIN #2 LSB)
11	$\overline{\text{RESET}}$	10	$\overline{\text{ACK}}$
12	SIGNAL GROUND	11	$\overline{\text{RESET}}$
13	RS-232 RTS	12	SIGNAL GROUND
14	RS-232 $\overline{\text{RXD}}$	13–16	RESERVED
15	RS-232 $\overline{\text{TXD}}$	17	–12 V
16	RS-232 DSR	18	+12 V
17	–12 V	19	+5 V
18	+12 V	20	GROUND
19	+5 V		
20	GROUND		

Table 3. Dip Switch Settings

MODE	1	00	DELTA
		01	MAKE
	2	10	BREAK
		11	CONTINUOUS
COMM	3	00	PARALLEL INTERFACE
		01	1200 BAUD 2 STOP BITS
	4	10	9600 BAUD 1 STOP BIT
		11	19200 BAUD 1 STOP BIT
PARITY	5	00	EVEN
		01	ODD
	6	10	NONE
		11	RESERVED
FORMAT	7	0	8 BIT BINARY
		1	7 BITS ASCII

VII. RELIABILITY

Diagnostics: TekTouch™ system is self-testing

MTBF: 20,000 hours

Touch Life: More than 1 million touches in any one location and 10 million touches spread randomly over the panel surface

Scratch Resistance: Touch panel's conductive film is harder than glass surface. Film not scratched by gold, platinum, low carbon steel or any object with Mohs hardness of 7 or less.

Electrostatic Discharge (Panel Surface): 20 kV

Cleaning: Cleanable with commercially available non-conductive glass cleaners and laboratory solvents.

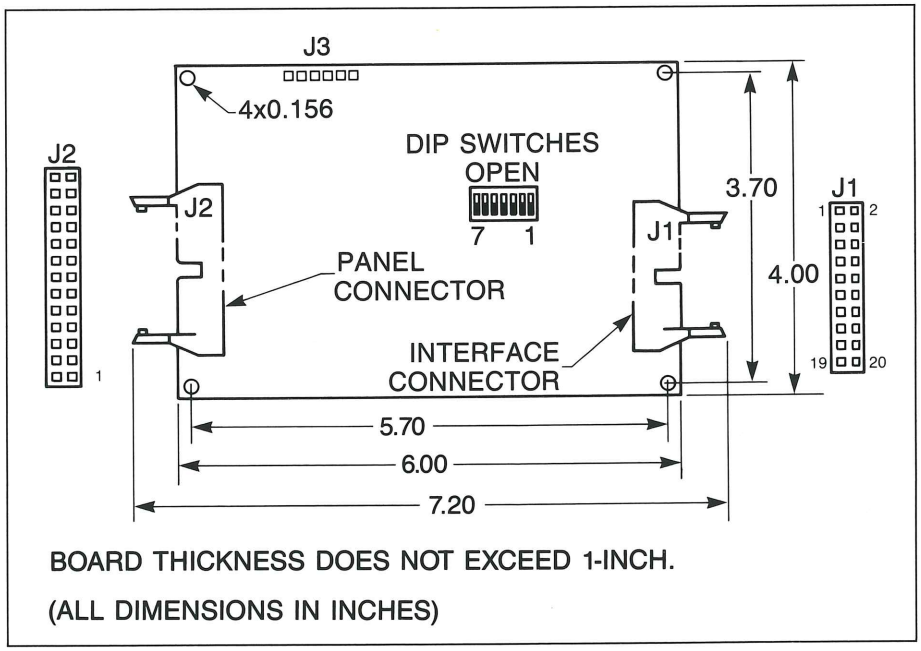


Figure 2. Controller board dimensions.

TekTouch™ ORDERING INFORMATION

Standard OEM Product

TekTouch™ comes complete with panel and controller board with either RS-232-C and parallel interface.

TekTouch™ panels are available to match CRTs in any of the standard sizes shown in Table 1. For other sizes, please consult Tektronix Display Devices Operation Marketing & Sales.

Evaluation Kit

For a quick evaluation, TekTouch™ evaluation kit comes complete with panel, appropriate mounting scheme, controller board, external power supply, controller board cable, external interface cable (DB 15 to DB 25) and Technical Reference Guide.

Options

Power Supplies
- External to monitor
- Internal to monitor

Controller Board Cables
- To monitor exterior
- To monitor exterior with internal or external power supply connector

External Interface Cable
- From monitor exterior to host system (DB 15 to DB 25)

External Enclosure
- For controller board and connections

For custom configurations, please consult Tektronix Display Devices Operation Marketing & Sales.

For Further Information Contact:

Tektronix, Inc.
Display Devices Operation
Marketing & Sales
MS 46-539
P.O. Box 500
Beaverton, Oregon 97077
(503) 627-6868

Specifications subject to change without notice.

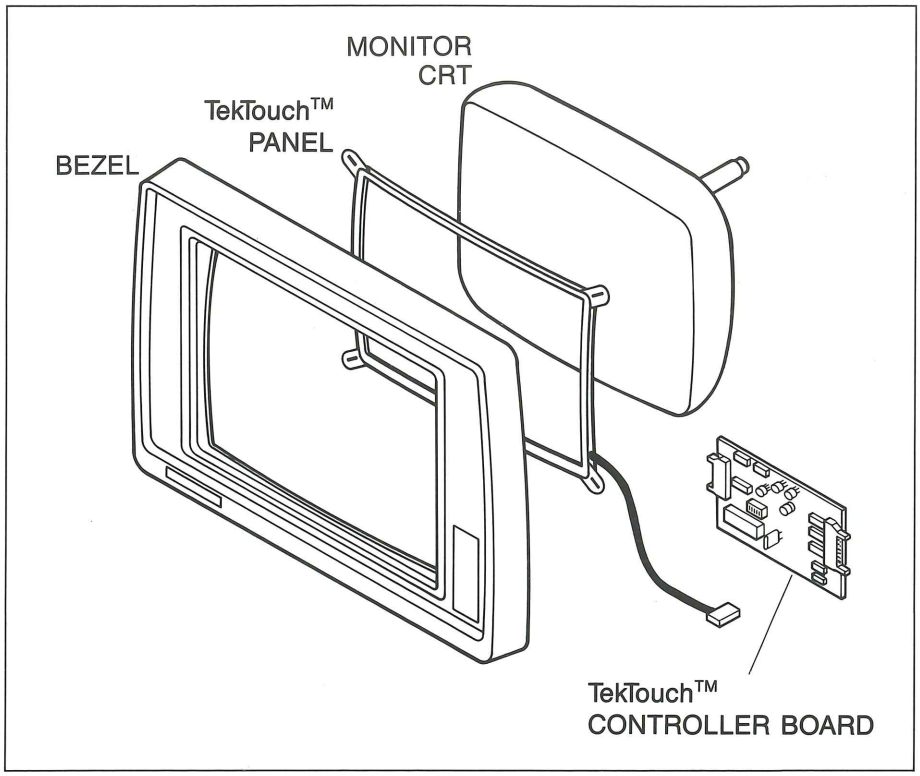


Figure 3. TekTouch™ mounts behind bezel, in front of CRT.

Tek Display Devices: Trusted technology for leading edge system integrators.

84A-2001
1/87 revised

Tektronix®
COMMITTED TO EXCELLENCE