



*TouchWare™ Software for Windows
User Guide*

3M Touch Systems

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

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Introduction

The 3M Touch Systems touch screen is a very intuitive pointing device available for the PC series of computers and monitors. Touch screens make using computers as simple as touching the screen.

Touch screens are ideal for a variety of applications, including entertainment, training systems, information and self-service kiosks, point-of-sale, factory automation, laboratory and medical instrumentation, interactive selling demonstrations, and educational programs.

About This Manual

This manual describes how to:

- Install TouchWare™ software, the software for your touch screen.
- Use the TouchWare™ software control panel to customize your work environment.
- Troubleshoot the touch screen.
- Configure your system to support multiple touch screens.

Before installing TouchWare™ software, you must complete the appropriate hardware connections for your type of controller. For instructions, refer to the CD booklet or your controller reference guide.

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.3mtouch.com/>, where you can download touch screen software and drivers, obtain regularly updated technical documentation on 3M Touch Systems products, and learn more about our company.

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

- Part number and serial number from your monitor
- Current driver version
- Operating system used

- Information on additional peripherals

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

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

- Technical Support Hot Line: 978-659-9200
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- Email: US-TS-techsupport@mmm.com

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CHAPTER 1

Installing TouchWare™ Software

TouchWare™ software for Windows is the software for your 3M Touch Systems touch screen. It provides full touch screen functionality for all applications running under Microsoft Windows XP, Windows 2000, Windows NT 4.0, Windows 9X, and Windows Me.

Once you install TouchWare™ software, you can select, launch, and drag objects using the touch screen. To make a selection, you simply touch the screen. It's that easy and natural — just touch to select.

TouchWare™ Software Overview

Your touch product includes several software tools to help you work with and customize the touch screen and the TouchPen. Software drivers are available for touch-based applications for use in different environments.

Specifically, TouchWare™ software includes the following programs and utilities:

- Touch screen drivers
- TouchWare™ software
- Online help
- MtsCal calibration utility
- TouchWare™ Software Uninstall utility

Touch Screen Drivers

TouchWare™ software includes touch screen drivers — the software the system uses to communicate with the touch screen. TouchWare™ software for Windows includes drivers for Windows XP, Windows 2000, Windows NT 4.0, Windows 9X, and Windows Me.

These drivers enable you to use the 3M Touch Systems touch screen with applications running in Windows environments. You can run Windows programs and use touch (finger or pen) input without any program modifications.

TouchWare™ Software

You can use TouchWare™ software to set your preferences for the touch screen. For example, you can define the following preferences:

- Whether the touch action occurs when you touch the screen or when you lift your finger (or pen) off the screen.
- Whether you hear a sound when you touch the screen.
- How fast you need to touch to produce a double-click.

You can also use the TouchWare™ software control panel to calibrate the touch screen, stabilize the cursor, define where the cursor appears relative to your touch (an offset), and run diagnostic programs.

Online Help

TouchWare™ software has online help for setting up and using the touch screen. These help files use standard Windows Help, complete with hypertext and hypergraphics, to create and display available topics.

MtsCal Calibration Utility

The MtsCal calibration utility allows you to calibrate the touch screen directly without opening the TouchWare™ software control panel.

TouchWare™ Software Uninstall Utility

The Uninstall utility automatically deletes all TouchWare™ software components from your computer and removes all TouchWare™ software entries from the system files.

Installing TouchWare™ Software

When you install TouchWare™ software, you have two installation options:

- Express Install
- Custom Install

The Express option automatically installs the required TouchWare™ software files, creates a TouchWare™ software program group, and places a TouchWare™ software icon on the Windows desktop and control panel. TouchWare™ software will also determine multiple monitor configurations at this time.

Additionally, the Custom option allows you to specify the destination folder and name the program group.

Note: If you have a Microsoft® IntelliPoint® or Kensington® Mouseworks® PS/2 mouse, installing TouchWare™ software will disable the special mouse functionality of these devices.

To install TouchWare™ software:

1. Make sure you have completed the appropriate hardware connections as described in the CD booklet or your controller reference guide. The connections differ depending on your controller type.
2. Power on your system. Make sure no other applications are open.
3. Insert the CD or diskette #1 into your PC.
4. Browse to the Disk1 folder and double-click the Setup.exe file.
5. Follow the onscreen instructions to begin the installation.

The system will prompt you to enter diskette #2 and #3 if necessary.

6. When prompted to choose the installation type, select whether to perform an Express Install or Custom Install.

If you choose Custom Install, you'll be prompted to specify the destination folder and name the program group.

7. Once installation is complete, load the touch screen driver as follows:
 - For serial controllers, restart the system. As the system restarts, Windows detects and loads the driver.

Note: This step is not necessary for Windows 2000 systems. The driver loads automatically.

- For USB controllers, connect the touch screen cable to the USB port in your computer. After a few seconds, the system beeps to indicate it has detected the touch screen and loaded the driver.

Performing a Silent Install

If you have to perform several installations, you may want to take advantage of the TouchWare™ software silent install facility. You can run a silent install from diskettes, a CD, hard drive, or network drive.

To begin, you must create a silent install script that contains the recorded install instructions. You create such a script by running the Setup program in record mode. During a silent install, the Setup program receives input from the recorded install script rather than from a user. Once you record an installation script, you can run it on as many systems as you like.

Installation from diskettes takes about 2 minutes, while installation from a fast hard drive takes about 20 seconds. Successful installation is indicated by a Result Code entry equal to 0 in the Setup.log file.

Silent Install From Diskettes

To perform a silent install from diskettes:

1. Insert diskette #1 into your computer's floppy drive.
2. Edit the silent.ini file to reflect the port and baud settings to be used for all silent installations.
3. Click Start → Run and type the following:
A:\Setup -r
This option enables the system to record your installation choices and create a Setup.iss file in the Windows directory containing the script.
4. Perform the installation for recording.
5. Copy the Setup.iss file to each of the three TouchWare™ software install diskettes and then delete the file from the Windows directory. Disk 4 contains a diagnostic utility not necessary to a silent install.
6. Reinsert diskette #1, click Start → Run and invoke the silent install facility by typing the following:
A:\Setup -s
The system prompts you to enter diskette #2 and #3 when required. If necessary, you'll have to remove diskette #3 before the system restarts.

Silent Install From a CD, Hard Drive, or Network Drive

To perform a silent install from a CD or other drive:

1. Create a temporary directory on your computer's hard drive.
2. From the temporary directory, copy each of the three TouchWare™ software directories into its own subdirectory called disk1, disk2, and disk3 respectively. Disk 4 contains a diagnostic utility not necessary to a silent install.
3. Edit the silent.ini file in the disk1 directory to reflect the port and baud settings to be used for all silent installations.
4. Click Start → Run and type the following:
C:\Temp\disk1\Setup -r (where C:\Temp is your temporary directory)
This option enables the system to record your installation choices and create a Setup.iss file in the Windows directory that contains the script.
5. Perform the installation for recording.
6. Copy the Setup.iss file into the disk1 directory and then delete the file from the Windows directory.
7. Copy all three disk directories onto the CD, hard drive, or network drive from which you want to perform the install, for example E:\Install.
8. Click Start → Run and invoke the silent install facility by typing the following:
E:\Install\disk1\Setup -s (where E:\Install is your install path)

Completing the Touch Screen Setup

Once you've installed TouchWare™ software, you can optimize the performance of the touch screen using the TouchWare™ software Control Panel. You can adjust settings for touch mode, touch sounds, double-click speed, double-click area, and other cursor options. You can also use the control panel to set your preferences and calibrate to a specific screen resolution or multiple monitor situations.

Uninstalling TouchWare™ Software

The Uninstall program removes all TouchWare™ software components from your computer. These components include TouchWare™ software files, directories, program folders, and folder items. The Uninstall program also removes all TouchWare™ software entries from the system registry files.

To uninstall TouchWare™ software:

1. Make sure the TouchWare™ software and Windows control panels are closed.
2. Click on Start → Programs → TouchWare™ software → Uninstall TouchWare™ software.
The path will be different if you performed a custom installation and chose a custom name for the TouchWare™ software program group.
3. Follow the onscreen instructions to remove TouchWare™ software.

You may see the following message when the Uninstall is complete: "Some elements could not be removed. You should manually remove items related to the application." This is perfectly normal, as several files remain in use until you restart the system. Click on Details to see the remaining files.

Note: If you have a serial controller, you must restart your system once the Uninstall is complete. The touch screen driver remains in use until you restart the system. USB controllers do not require a restart, as the driver is uninstalled when you disconnect the last touch screen.

CHAPTER 2

TouchWare™ Software Control Panel

You can use the TouchWare™ software control panel to change the TouchWare™ software settings for your system. You can change the calibration method, touch modes, cursor options, pen settings, hardware, and diagnostic tools to suit your preferences.

Control Panel Overview

The TouchWare™ software control panel consists of tabs that allow you to determine the best settings for your touch screen configuration.

- Use the Calibrate tab to calibrate the touch screen for the current video resolution.
- Use the Touch Settings tab to define the touch actions that equate to mouse actions and add right-click functionality to the touch screen.
- Use the Cursor tab to stabilize the cursor and tune the controller to the best frequency for the current monitor settings.
- Use the Hardware tab to determine the basic system settings for your touch screen, verify the touch screen is communicating properly, select baud rate, and restore system defaults.
- Use the Tools tab to run diagnostic tests from the desktop and to enable Advanced Functions for your touch screen.
- Use the Multiple Monitors tab to properly configure your multiple monitor setup. From this tab, you can map your monitors to your customized layout.

Note: If you have a Touch Pen or ThruGlass controller, an appropriate tab will automatically appear in the TouchWare™ software Control Panel for these configurations.

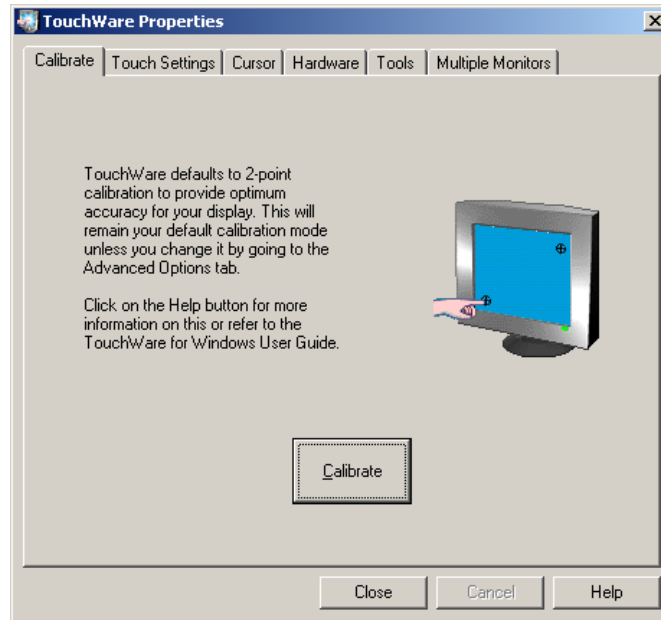
Opening the TouchWare™ Software Control Panel

You can open the TouchWare™ software control panel several ways:

- Double-click the TouchWare™ software icon on the desktop.
- Click Start → Settings → Control Panel and double-click the TouchWare™ icon.
- Click Start → Programs → TouchWare™ software → TouchWare™ software.

The path will be different if you performed a custom installation and chose a custom name for the TouchWare™ software program group.

Calibrate Tab



The calibration process aligns the touch screen with the underlying video. Specifically, calibration defines the dimensions of the active area of the touch screen and locates the center of the touch screen. If the screen is not calibrated, the active area of the touch screen may not be aligned properly or may be unnecessarily small in size.

Once calibrated, the information is saved by the touch screen for each video resolution. Therefore, you only need to recalibrate the touch screen the first time you change to a particular video resolution.

Note that the TouchWare™ software installation will automatically set the calibration style to 2-point calibration. Users may change calibration styles using the Tools tab → Options → Advanced → Calibration Style dialog.

When to Calibrate the Touch Screen

You should calibrate the touch screen in the following cases:

- The first time you change to a particular video resolution (for example 640x480 or 800x600) or video mode of your monitor. Your monitor's video card determines the available resolutions.
- Any time you change the size of the video image by adjusting the horizontal and vertical controls on your monitor.
- Any time you run the Stabilize Cursor function from the Cursor tab.
- Any time the cursor does not follow the movement of your finger, or does not reach the edges of the touch screen.

Calibrating the Touch Screen

1. Select the Calibrate tab.
2. Click the Calibrate button. Calibration targets appear on the screen. A hand guides you through the calibration process pointing, in turn, to the appropriate target.



Note: If you press Escape or do not touch the touch screen within 20 seconds, the system automatically cancels the calibration process with no change to the current settings.

3. Touch the touch screen and position your fingertip to completely cover the yellow target. The area around the hand will begin to flash the message “Hold”. When the calibration completes, the message “Touch Enabled” will appear. When touching the calibration target, make sure you:
 - Face the monitor directly.
 - Perform the calibration in the position (sitting or standing) you expect to use the touch screen.
 - Touch the calibration target firmly and precisely with your fingertip. Be careful to keep your other fingers away from the touch screen as you touch the target.
4. Repeat these instructions for additional calibration target(s).
5. A dialog box prompts you to test the calibration. If you accidentally touched the screen in the wrong place during calibration, you will distort the touch screen calibration. Test to make sure you are satisfied with the calibration results.
6. If you are using a TouchPen, repeat the calibration procedure with the pen.

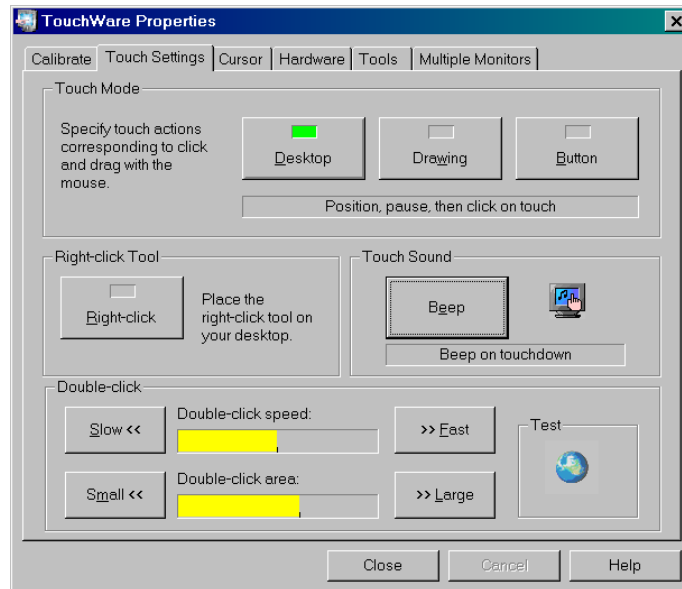
Note: Advanced users may disable calibration verification using the Advanced Touch Screen Settings dialog.

Testing the Calibration

Recalibrate the touch screen if any of the following tests fail.

- Touch random points on the screen. The cursor should be located underneath your finger or pen when you touch the screen.
- Drag your finger across the screen and check that the cursor follows your movements.
- Touch each corner and along the edges of the screen. Verify that the cursor reaches the full image area of the screen. Be sure you can touch and activate all icons and menus across the entire screen.
- If you need to recalibrate the screen, make sure to touch the targets carefully. It is possible that one of your touches did not register properly or you accidentally touched the screen in the wrong place during calibration. For example, if you touch beyond the targets or into the non-image area, you will distort the touch screen calibration.

Touch Settings Tab



You can use the Touch Settings tab to customize the response of your touch screen:

- Touch Mode – define the touch actions that equate to a mouse click, double-click, and drag.
- Right-click Tool – place the right-click tool on your desktop enabling you to utilize right-click functionality using the touch screen.
- Touch Sound – define whether you hear a sound when you touch the screen and when that sound occurs (touchdown or liftoff).
- Double-click speed and area – define how fast you need to touch and the space in which you must touch in order to produce a double-click.
- Test – enables you to test the double-click speed and area.

Touch Modes

Desktop Mode

Desktop mode is most useful for general-purpose desktop applications. In Desktop mode, a touch positions the cursor much like a mouse. Holding the touch steady is equivalent to pressing and holding the mouse button. Lifting off is equivalent to releasing the mouse button.

- To click, touch the object. Lift off the screen.
- To double-click, touch the object twice quickly at the same location.
- To drag, touch the object. Pause. Slide your finger to the new location. Lift your finger off the screen.

Note: When using the Draw diagnostic tool, you must pause for the system to recognize touch before drawing.

Drawing Mode

Drawing mode is most useful for draw, paint, illustrator, and graphics applications. In Drawing mode, a touch is equivalent to pressing and holding down the mouse button. This is considered the easiest mode to use with immediate reaction to touch. Lifting off is equivalent to releasing the mouse button.

- To click, touch the object. Lift off the screen.
- To double-click, touch the object twice quickly at the same location.
- To drag, touch the object. Slide your finger to the new location. Lift off the screen.

Button Mode

In Button mode, touching the screen is equivalent to pressing and releasing the mouse button. The action occurs as soon as you touch the screen. This mode is best for button based applications (like a calculator). This mode is not good for drawing or dragging objects.

Note: When you choose a Custom Touch mode (Tools → Options), the text on this button face will change from “Button” to “Custom”. You must then select Custom to activate your choice.

- To click, touch the object.
- To double-click, touch the object twice quickly at the same location.
- To drag, touch the object. Pause. Slide your finger to the new location. Lift off the screen. The object is still selected and can be activated with another touch.

Right-click Tool

Places an icon on the desktop (always on top) that allows you to select which mouse button to activate on touch. Note that this works for the next click action only. Control returns to the left mouse button as soon as you are done. In multiple monitor situations, you will get a separate right click tool for each touch screen.

You can position this icon anywhere on your desktop by selecting it, pausing until the four-pointed arrow appears, and dragging it wherever you want.

Left button is typically used for normal select and normal drag. Right button is typically used for applet properties such as context menu and special drag.

Touch Sound

Select audible beep on touchdown, liftoff, or no beep at all. Click on the Beep button to select the appropriate option for your application. The default setting is no beep on touch (Beep off).

Note: For additional customization, refer to the Custom Touch Sound option found on the Tools tab → Options dialog.

Double-click Speed and Area

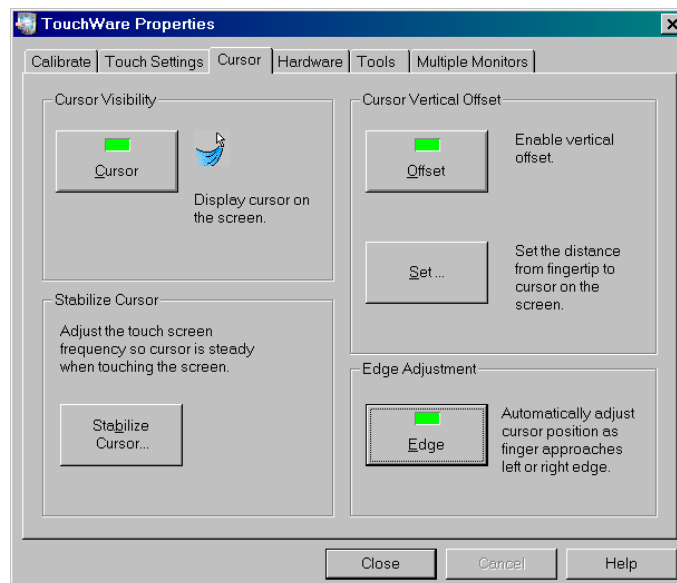
The *double-click speed* defines how quickly you must touch the screen for the system to interpret your actions as a double-click. Set the double-click speed in the slow to medium range for optimum performance with a touch screen. The black line on the display shows the default setting.

The *double-click area* defines the space in which you must touch the screen for the system to interpret your actions as a double-click. Set the double-click area in the medium to high range for optimum performance with a touch screen. The black line on the display shows the default setting.

Touch the globe twice to test the double-click speed and area settings. If the **MicroTouch Enabled** logo begins to circle the globe, the touch screen recognized your touch as a double-click.

Note: Altering the double-click settings for the touch screen will change the settings for the mouse, and vice versa.

Cursor Tab



The Cursor tab enables you to customize the response of the cursor to your touch. Using this tab, you can:

- Specify whether to display or hide the cursor.
- Define the vertical distance between your touch and the position of the cursor on the screen.
- Adjust the cursor movement on the horizontal axis.
- Stabilize the cursor.

Cursor Visibility

The Cursor Visibility option is for Windows 9X and Windows Me users who do not want to display the cursor when working with a touch application. By default, the touch screen displays the cursor in your application. Click on the Cursor button to toggle the cursor on or off.

While this option is disabled for Windows 2000 and NT 4.0, users can access the Mouse properties page to hide the cursor.

To hide the cursor in systems running Windows 2000 and NT 4.0:

1. Click Start → Settings → Control Panel.
2. Double-click the Mouse icon to open the Mouse Properties page.
3. Click on the Pointers tab.
4. Select Touch Screen Hidden Cursors scheme and click OK.

Note: Some applications can override this setting by loading their own cursors.

Cursor Vertical Offset

After you calibrate the touch screen, the cursor should be located directly underneath your finger when you touch the screen. However, you may prefer to offset the cursor slightly above your touch so you can see the cursor and point more easily and precisely to small objects.

The Cursor Vertical Offset option lets you define the distance between your fingertip and the position of the cursor on the screen. Offsetting the cursor is helpful when selecting small items, such as single letters in word processing, check boxes, or radio buttons.

To set the Cursor Vertical Offset:

1. In the Cursor Vertical Offset box on the Cursor tab, click the Offset button. The function is enabled (“ON”) when the green indicator is illuminated. The Set button then becomes active.
2. Click Set.
3. Touch the screen at the desired distance below the tip of the arrow, within the rectangular space provided. The distance between your liftoff position and the tip of the arrow is the offset distance. Thereafter, the cursor will be positioned above your finger or pen by a distance equal to the offset distance. As your finger or pen approaches the bottom edge of the screen, the cursor offset automatically decreases so you can touch items in this area.

Edge Adjustment

Sometimes the screen image extends beyond the edge of the monitor bezel. In these cases, it may be difficult to touch items at the left and right edges of the screen. If the Edge Adjustment option is on, TouchWare™ software automatically offsets the horizontal position of the cursor near the left and right edges, so you can easily reach the edges of the screen image.

TouchWare™ software only makes this adjustment at the left and right edges of the screen. You cannot define the horizontal offset amount.

Stabilize Cursor

The Stabilize Cursor option adjusts the operating frequency of the touch screen controller. In general, you will not need to stabilize the cursor for the touch screen. Some controllers do not require stabilization and thus do not support this option. However, if you are experiencing problems with a jittery cursor, ragged lines, or random touch points, you may want to run the Stabilize Cursor option.

Use the Stabilize Cursor option to test the available frequency settings and determine the best frequency. The range of frequency settings and the default setting depends on your touch screen controller. You can set a new operating frequency, and then check the performance of the touch screen at that frequency setting.

When to Stabilize the Cursor

You should stabilize the cursor any time the cursor movement is very erratic or jittery. This is *not* a subtle movement. The cursor will be very jumpy. To test stability, use the Tools → Options → Draw diagnostic program to draw some lines on the screen. Check that they are smooth and thin. If the lines are wide and have ragged edges, the frequency setting is probably not correct for your controller. Run Stabilize Cursor.

Note: This test will take several minutes. Do *not* touch the screen, mouse or keyboard during the test. The test is measuring the amount of noise when there is no touch.

Cursor Stabilization Procedure

1. Choose Stabilize Cursor from the Cursor tab.
2. If you are using a TouchPen controller in pen/finger mode, a dialog box appears asking if you want to adjust the frequency for pen or finger. Specify the desired touch method.

Note: On a TouchPen system, you must stabilize the cursor twice (once with your finger and once with the pen) if you are using both a pen and your finger as touch devices.

3. The system then does a preliminary check of all the frequency settings.
4. The Analyzing Frequencies dialog box appears. The system tests each frequency setting and determines the optimum setting.
5. Once the test is complete, a dialog box informs you of the best frequency as determined by the test. You can click on Accept to switch to this frequency setting or you may click on the Advanced... button to test and select the frequencies for yourself.
6. The test results are displayed in descending order with the recommended frequency at the top of the list. The current selected frequency is also indicated.
7. Select a different frequency and click Apply.

Testing the Newly Selected Frequency

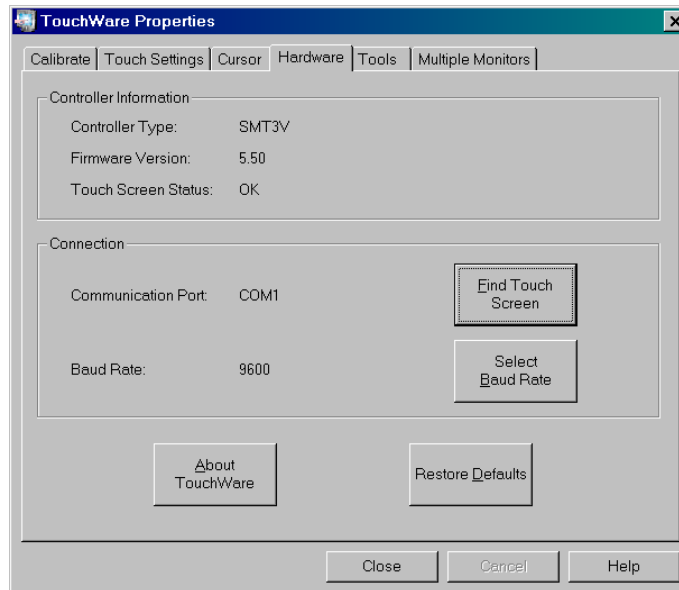
Any time you adjust the frequency you should test how the touch screen is working and verify you are satisfied with the operation of the touch screen.

Test the touch screen by touching the screen in several places and sliding your finger around the screen. The cursor should hold steady and smooth. If you see erratic or jittery cursor movement, readjust the controller frequency.

Adjust the frequency until your touch test produces acceptable results. A good test is to go to the Draw program and hold your finger steady on the screen. If the resulting pattern isn't fuzzy, you have a good frequency.

It is recommended that you recalibrate the touch screen after using Stabilize Cursor.

Hardware Tab



Note: For USB controllers, no Connection information is available.

Use the Hardware tab to determine the basic system settings for your touch screen, select the baud rate, and restore system defaults.

Controller Information

Controller Type

The following controllers are supported in this version of TouchWare™ software:

- EX II controllers
- Serial/SMT series of controllers
- MT series of controllers
- TouchPen controller

- ThruGlass controller
- USB controller
- MousePort controller

Firmware Version

These digits represent the version number and revision level of the touch screen controller firmware.

Touch Screen Status

Touch screen status refers to whether or not the touch screen has been found and is operational.

Possible messages include:

OK – Touch Screen found and operational.

Touch screen not found – The system could not detect the touch screen. Refer to Chapter 5 Troubleshooting the Touch Screen for further information on this message.

Any other error messages indicate a hardware failure. Refer to Error Messages or contact Technical Support for more information.

Connection

Communication Port

Displays the COM port used for the touch screen hardware connection.

If you have two serial devices operating together, such as a touch screen and a mouse, be sure each device uses a unique COM port and IRQ number. For example, the mouse can use COM1/IRQ4 and the touch screen can use COM2/IRQ3. Using the same COM port or IRQ creates device conflicts. The touch screen must have a unique IRQ; it cannot share an IRQ with another device.

Use the Microsoft Hardware Conflict Troubleshooter (available in Windows Help) to try and resolve this problem.

Find Touch Screen

When you select the Find Touch Screen option, TouchWare™ software:

- Scans the available communication ports supported by Windows for a touch screen. Find Touch Screen searches the baud rates used by the touch screen.

Note: TouchWare™ software will only work with COM ports configured, recognized, operational and supported by Windows at the time of install.

- Tries to communicate with the touch screen controller.
- Waits for the touch screen controller to respond.

- Requests information about the touch screen and its controller.

If TouchWare™ software does not find the touch screen, check that the touch screen is connected properly, and then repeat the search. Refer to Chapter 4 Troubleshooting the Touch Screen for more information on what to do if your touch screen is not found. Note that this option cannot search any COM ports in use by other applications.

Verify that any previously loaded hardware/software (i.e., mouse or modem) that used the same COM port as your touch screen has been uninstalled. Just because the hardware is disconnected doesn't mean that the software isn't claiming the port. Ensure that all components are completely removed from the system files.

Select Baud Rate

The standard baud rate for 3M Touch Systems controllers is 9600, which is generally acceptable for most applications. You may also select 19200 (for TouchPen only), 4800, 2400 or 1200 baud.

Note: The Select Baud Rate setting is not available for ThruGlass or PS/2. If you change the baud rate, you could render your ThruGlass touch screen inoperable.

About TouchWare™ Software

Lists the version of TouchWare™ software and its utilities currently installed on your system. This information is particularly helpful if you need to call Technical Support.

Restore Defaults

This option is useful if you have reconfigured the software and need to get back to the original TouchWare™ software settings.

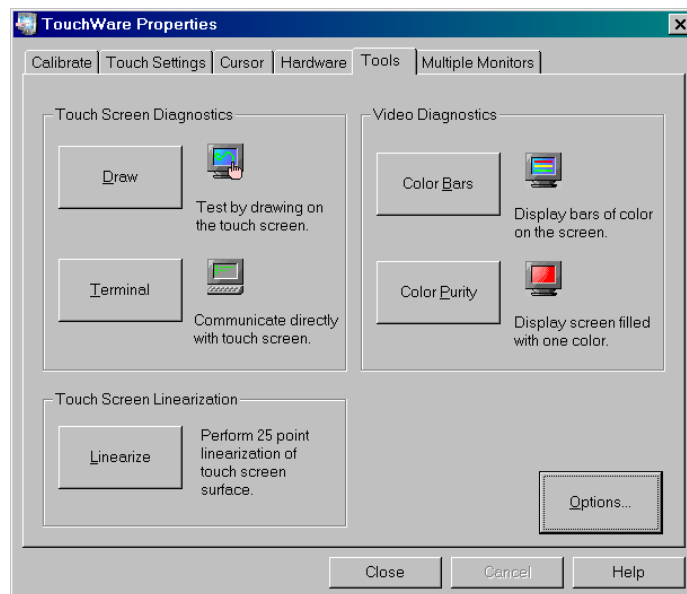
Note: This option does *not* restore calibration settings, frequency settings, or other controller parameters.

Restores original TouchWare™ software settings for:

- Cursor Visibility (On)
- Calibration style
- Touch Mode (Desktop)
In Multiple Monitor mode, the default is Click.
- Touch Sound (Off)
- Double-click Speed and Area (Midrange)
- Advanced Touch Screen Settings
 - Touch enabled
 - Splash screen enabled
 - Calibration reminder enabled

- Calibration verification enabled
- Linearization disabled (unless TP4)
- Noise filter disabled
- Diagnostic tools disabled
- Multiple monitor touch modes disabled (except for multiple monitors)
- Cursor Vertical Offset (Off)
- Edge Adjustment (Off)
- TouchPen Mode (Pen/Finger)

Tools Tab



Use the Tools tab to perform basic touch screen diagnostic tests to optimize the performance of your touch screen. This tab is also the gateway to additional options and advanced touch screen settings.

Touch Screen Diagnostics

Draw

The Draw program lets you test the operation of the touch screen and pen by checking the accuracy and speed with which the system responds to your touch. To draw, simply touch the screen and drag your finger or pen. When using Desktop Mode, you must pause for the system to recognize touch before drawing.

The Draw program includes the following options:

- B (blank) -- clears the screen and displays a blank drawing canvas.
- G (grid) -- clears the screen and displays a grid that you can use as a drawing guide (default setting).

- L (line) -- draws solid lines on the screen (default setting).
- D (dots) -- draws dotted lines on the screen, where each dot represents a point reported by the touch screen.
- Space Bar -- clears the screen instructions leaving the grid or a blank drawing area.

The Draw background reflects your Desktop color scheme. You may experience problems if your desktop includes a light background, as the Draw grid lines are white and may be difficult to see. For best results, change your background color to a dark selection. Click Start → Settings → Control Panel → Display → Appearance.

Terminal

In Terminal emulation mode, you can send firmware commands directly to the touch screen controller and view touch position data sent from the controller.

Note: Terminal mode is not available for USB controllers.

Developers and support personnel can use firmware commands to initialize the controller, select operating or touch modes, specify data formats, and execute diagnostic functions. For a complete description of the available firmware commands, refer to your controller reference guide.

CAUTION: You do *not* need to use firmware commands in order to use your touch system. If you are not familiar with the use of firmware commands, *do not use* this option. Executing some commands may alter the performance of your touch screen or render it inoperable.

Video Diagnostics

The Color Bars and Color Purity options let you test the monitor video output. These options *do not test* the touch screen. Typically, you do not need to use these options unless you are assembling or repairing touch screen monitors.

Advanced users may disable these video diagnostic tools using the Tools → Options → Advanced dialog.

Color Bars

When you select the Color Bars option, TouchWare™ software displays 15 bars that span the color spectrum from black to white.

When examining the colors, check the following items:

- Look at each color and ensure that it matches its description.
- Look at the edges of each color bar and ensure that it does not bleed at the edge or spread into other colors.
- If you notice problems, try adjusting the contrast and brightness controls on the monitor.

- If there are still problems with the video, you can continue to troubleshoot the problem by using the Color Purity option. Remember that bad video generally indicates a hardware problem with the monitor or video card, not the touch screen.

Color Purity

Most CRT monitors have three electron guns (or signals) that send the primary colors – red, green, and blue – to the screen. (The exception to this is flat panel displays.) The Color Purity option lets you test each primary color individually. You can also test combinations of these colors to produce some of the same colors shown in the Color Bars option.

The advantage of the Color Purity option is that the color fills the screen. You can check a color for consistent appearance and saturation across the screen. Refer to the following Color Table to learn how to produce each color by turning the color guns on or off. For example, turn on red and blue to view magenta, or turn on green and blue to view cyan.

When viewing a color with the Color Purity option, look for the color to be uniform across all areas of the screen. Shading, shadows, and distortion in the color indicate there may be problems with the video.

Some monitors have a Degauss button. If you notice any problems with the color, try pressing the Degauss button to neutralize the magnetic field that builds up on the CRT. Also, check that other monitor controls are set properly. For more information on these controls, refer to the documentation for your particular monitor.

If there are still problems with the video check that you reassembled the monitor properly. Remember that video problems indicate a problem with the monitor or video card, not the touch screen.

Table 1: Color Table

Color	Red	Green	Blue
Black	Off	Off	Off
Blue	Off	Off	On
Cyan	Off	On	On
Green	Off	On	Off
Magenta	On	Off	On
Red	On	Off	Off
Yellow	On	On	Off
White	On	On	On

Touch Screen Linearization

Note: Touch Screen linearization is typically available for pen systems only. However, advanced users may enable linearization using the Tools → Options → Advanced dialog.

To perform a 25-point linearization of the touch screen surface:

1. Make sure the video image is centered in the screen area using the horizontal and vertical controls.
2. Open the TouchWare™ software Control Panel and select the Tools tab.
3. Click Linearize. This will bring up 25 linearization targets on the screen. A hand guides you through the linearization process pointing, in turn, to the next appropriate target.



Note: If you press Escape or do not touch the touch screen within 20 seconds, the system automatically cancels the linearization process with no change to the current settings.

4. Touch the touch screen and position your fingertip to completely cover the yellow target. The area around the hand will begin to flash. When the linearization completes, the message “Touch Enabled” will appear.

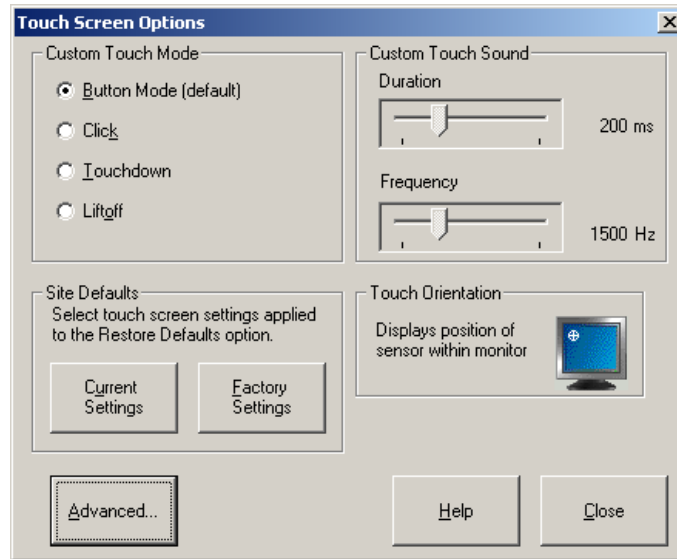
When touching the target, make sure you

- Face the monitor directly.
 - Perform the linearization in the position (sitting or standing) you expect to use the touch screen.
 - Touch the target firmly and precisely with your fingertip. Be careful to keep your other fingers away from the touch screen as you touch the target.
5. Repeat these instructions until all 25 targets have been touched.
 6. A dialog will ask if you wish to continue with this process. If so, the 25 targets will now be replaced with a set of 16 targets used to verify the linearization performed in steps 1 through 5.
 7. Repeat the previous process for each of these targets. This process automatically returns to the control panel once complete. If you are using a TouchPen, repeat the linearization procedure with the pen. The accuracy numbers should be below 1.5%.

To test the accuracy of the linearization process, use the Draw program to draw some lines on the screen. Check that they are smooth and thin.

To exit this program at any time during the process, press Escape.

Touch Screen Options



The Touch Screen Options button enables functions added to the original TouchWare™ software control panel. Using this dialog enables you to further customize TouchWare™ software to suit your setting. Touch Screen Options include:

- Custom Touch Mode
- Site Defaults (for NT users)
- Custom Touch Sound
- Advanced Touch Screen Settings

Custom Touch Mode

Custom Touch Mode provides three additional touch modes to the original Touch Modes found on the Touch Settings tab. In fact, Custom Touch Mode enables you to reconfigure how the third Touch Mode button works. If you choose a Custom Touch Mode (Click, Touchdown or Liftoff), the button name changes from “Button” to “Custom” on the Touch Settings tab. You must then select “Custom” to activate this choice.

- Button Mode (default)
- Click Mode
- Touchdown Mode
- Liftoff Mode

Refer to the Touch Settings tab for the standard touch mode options.

Button Mode (default)

This option is exactly the same as Button Mode on the Touch Settings tab.

Click Mode

Click mode provides button operation only. The touch screen sends a button-down, followed by a button-up to the operating system. Drawing or dragging is not supported in this mode.

Touchdown Mode

Touchdown Mode enables you to create an immediate button action as soon as you touch the screen. In Touchdown Mode, you cause a button down at the cursor location, with a short pause and then a button up. You can leave your finger on the screen but only a single touch is registered until you lift your finger off the screen and touch down again.

Touching the screen is equivalent to pressing and releasing the mouse button. The action occurs as soon as you touch the screen. This mode is best for button based applications (like a calculator). Drawing or dragging is not supported in this mode.

Liftoff Mode

Liftoff Mode enables you to position the cursor where you want before creating a button action. In Liftoff Mode, the cursor will follow your finger for more accurate touch. When you want to select an item, lifting your finger off the screen will cause a button down, short pause, and then a button up to occur.

Touching the screen is equivalent to moving the mouse position. The button down/button up action occurs when you remove your finger from the screen. This mode is useful for applications requiring greater accuracy because it lets you carefully position the cursor prior to acting on it. Drawing or dragging is not supported in this mode.

Site Defaults

The Site Defaults option (for Windows 2000 and NT 4.0 serial controller administrators only) enables you to restore system defaults to either your Current Settings (site-specific) or the original Factory Settings when you select Restore Defaults from the Hardware tab. This option does not restore calibration or frequency settings.

Custom Touch Sound

This option enables you to set the exact pitch and duration of the touch sound selected on the Touch Settings tab.

Note: If you have selected No Beep on the Touch Settings tab, this option will be disabled.

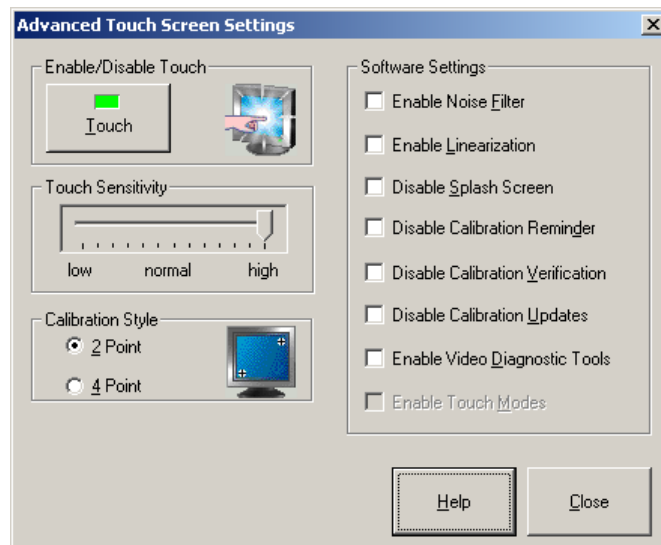
Touch Orientation

This is an information-only icon.

The Touch Orientation option is included for advanced users who alter the orientation of the touch screen in custom installations. This orientation (or direction of the sensor mounted in the monitor) is determined the first time calibration is run. Once TouchWare™ software is installed, the calibration program automatically determines the correct sensor positioning.

The touch screen icon illustrates how your sensor is placed in your monitor. The white target indicates the location of the upper left corner of the touch screen. Standard installation of the touch screen sensor matches this upper left corner point to the monitor.

Advanced Touch Screen Settings



Caution: Executing the Advanced Touch Screen options may alter the performance of your touch screen or render it inoperable. You should be aware of expected results before executing any option. If you are not familiar with the outcome of these settings, you should **not** be using these options.

Disable Touch

This option allows you to disable touch functionality. The only way to restore touch is with a keyboard or mouse. This setting will remain in effect until you reboot your system.

Touch Sensitivity

The configuration process sets the default sensitivity that, in most cases, will be appropriate for your touch screen. However, you can change this setting manually if you are not satisfied with the *response* of the touch screen.

- If the controller responds or the cursor moves before you actually touch the screen, you should decrease the sensitivity.

- If you need to press hard or use more than one finger in order to activate a touch, you should increase the sensitivity.

Calibration Style

The calibration process aligns the touch screen with the underlying video. Specifically, calibration defines the dimensions of the active area of the touch screen and locates the center of the touch screen. If the screen is improperly calibrated, the active area of the touch screen may not be aligned or may be unnecessarily small in size.

Once you calibrate for each video resolution, the information is saved by the touch screen. Therefore, you do not need to calibrate the touch screen each time you start your system.

TouchWare™ software provides 2 choices for calibration style:

- 2-point calibration is recommended for capacitive touch screens.
- 4-point calibration is recommended for resistive touch screens.

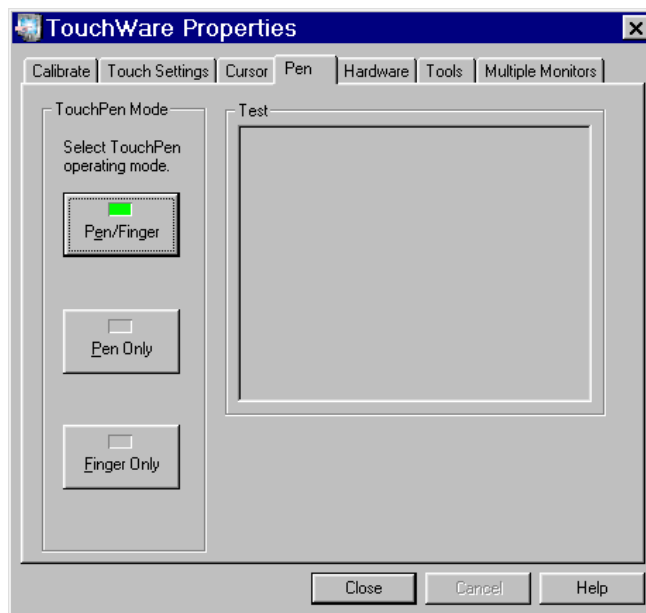
Software Settings

These Software Settings are intended for use by advanced users attempting to streamline the installation of TouchWare™ software on many systems at a time. These settings are not intended for use by individual users.

- Enable Noise Filter – use to correct grounding problems.
- Enable Linearization – activates 25-point linearization for use when viewable/touchable area is smaller than full screen.
- Disable Splash Screen – enabled on startup for advanced users.
- Disable Calibration Reminder – for advanced users, this option allows users to turn off the automatic calibration reminder message.
- Disable Calibration Verification – for advanced users, this option allows users to turn off the automatic calibration and linearization verification messages.
- Disable Calibration Update – this option disables automatic updating of calibration data in the controller whenever there is a change to the monitor resolution.
- Enable Video Diagnostic Tools – this option allows users to turn on color testing.
- Enable Touch Modes – this option allows users to turn on additional touch modes in a multiple monitor setup.

CHAPTER 3

Touch Pen Options



The Pen tab options are available only if your system has a TouchPen controller. TouchPen Mode defines whether the touch screen recognizes input from both a pen and a finger, from a pen only, or from a finger only. The default mode is Pen/Finger, which means that you can use either your finger or your pen to select options.

The pen works in much the same way as a mouse regardless of the Touch Mode setting. Touching the screen with a pen is equivalent to pressing and holding down the left mouse button. Lifting the pen off the screen is equivalent to releasing the mouse button. Touch Sound is disabled when using the pen (no beep on touch).

Certain pens come with a button which can be used for right-clicks. To right-click, press and hold the button while you touch the screen. After touching the screen, quickly lift the pen and release the button.

From the Pen tab, select one of the TouchPen mode buttons using the mouse, a pen, your finger, or the appropriate shortcut key.

Note the TouchPen mode is immediately active. For example, if you select Pen Only, the system recognizes only the pen as a touch device. You cannot use your finger to make a selection. You can still use shortcut keys or the mouse to select an option.

The system saves the TouchPen mode so that the next time you power up the system, the selected TouchPen mode is active.

Pen/Finger Mode

The system recognizes both pen and finger touches on the screen. This mode is the default mode for TouchPen controllers. If the system detects both pen and finger touches at the same time, it gives the pen higher priority and acknowledges only the pen touches. This priority prevents accidental touches from your finger or hand being interpreted as input.

If you are using the pen and you lift the pen from the screen, the system does not recognize finger (or hand) touch until after a system-defined time delay. If a finger or hand is on the screen when the pen lifts off, the system ignores the finger or hand until you lift off and touch the screen again.

For example, if you rest your hand on the screen while you write with the pen, you can lift the pen and put it back again without your hand touch being acknowledged.

You must calibrate the touch screen twice (once with your finger and once with the pen) if you are using Pen/Finger mode.

Note: Changing the TouchPen mode setting can optimize the performance of the touch screen. In Pen/Finger mode, the TouchPen controller checks for input from either a pen or a finger. The controller always gives priority to the pen. Therefore, if you are not currently using the pen for your touch application, use Finger Only mode for optimum system performance.

Pen Only Mode

The system recognizes only pen touches on the screen. The system ignores finger touches on the screen.

Finger Only Mode

The system recognizes only finger touches on the screen. The system ignores pen touches on the screen.

Stabilize Cursor for Finger and TouchPen

If you are using pen/finger mode when you select Stabilize Cursor from the Cursor tab, a dialog box appears asking if you want to adjust the frequency for pen or finger. The recommended frequency setting may be different for the pen and the finger; therefore you must adjust each input method independently. You could find that the performance of one touch method is acceptable, while another touch method may need stabilization.

Test TouchPen

Touch in the designated test area to sample draw mode and to determine if the selected TouchPen mode is working.

CHAPTER 4

ThruGlass Touch Screen Configuration

This chapter provides information unique to ThruGlass TouchWare™ software users. Refer to the *ThruGlass Touch Screen Hardware Installation Guide* for more detailed information on setting up ThruGlass. Refer to earlier chapters of this book for information on installing TouchWare™ software and the overall functionality of the TouchWare™ software control panel.

ThruGlass Overview

The ThruGlass tab enables you to:

- Specify the size and type of ThruGlass touch screen you are using.
- Adjust the controller sensitivity.
- Test the operation of the ThruGlass touch screen.
- Run ThruGlass diagnostic tests.
- Adjust the controller frequency.

After installing the ThruGlass touch screen and controller, use the ThruGlass tab to configure the touch screen for the current installation and environment. When you select the ThruGlass Screen Type, you automatically set in motion a configuration process that sets the default sensitivity and determines the best operating frequency for your controller.

Setting Up a ThruGlass Touch Screen

Install the ThruGlass controller using the *ThruGlass Touch Screen Hardware Installation Guide* for detailed information.

Note: You must have a keyboard or mouse attached to your system to initially configure your ThruGlass touch screen. When you initially install TouchWare™ software, touch is disabled until you specify the Screen Type in the ThruGlass tab. Use the keyboard or mouse to specify the ThruGlass screen type.

Before you configure the ThruGlass touch screen, make sure the video resolution¹ is appropriate for your touch application. Your monitor's video card determines the available resolutions.

Configure the ThruGlass touch screen by specifying the size of ThruGlass touch screen, such as 17-, 15-, 12- or 10-inch screens. The part number appears on the cable at the lower right corner of the touch screen.

When you select the ThruGlass Screen Type, you automatically set in motion a configuration process that sets the default sensitivity and determines the best frequency for your controller.

If you change video resolution or scan rate² a dialog box will automatically pop up advising you to reselect your screen type in order to optimize ThruGlass performance. *If you change **only** the scan rate on a Windows 95 system, this message will not appear. You must manually reset the screen type by selecting None and then reselect the screen type.*

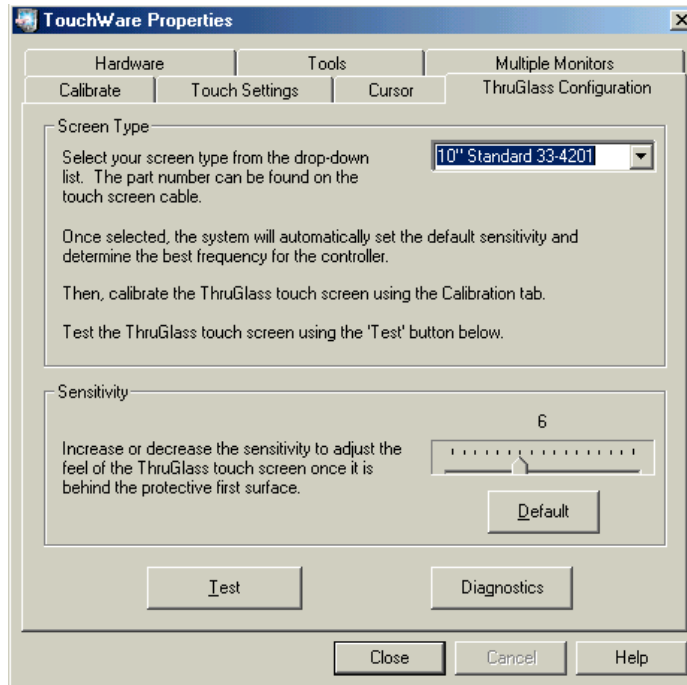
After you configure your ThruGlass touch screen, calibrate the touch screen using the Calibrate tab. You can then set preferences such as the double-click speed or touch mode using the other TouchWare™ software Control Panel tabs. Refer to Chapter 2 for more information.

Screen Type

Caution: You must have a keyboard or mouse attached to your system to initially configure your ThruGlass touch screen.

¹ Video resolution, i.e., 800x600 or 640x480, is also known as Desktop Area on the Settings/Control Panel/Display Properties Page.

² Scan rate is also known as Refresh rate depending on your video card.



If you are specifying the screen type for the first time, touch is disabled. Use the mouse or keyboard to select the screen type. However, do *not* touch the screen, keyboard or mouse once the configuration process has begun.

After you install the ThruGlass hardware, use Screen Type to specify the type of touch screen you are using. 3M Touch Systems makes different types of ThruGlass touch screens, such as 17-, 15-, 12- or 10-inch screens. The part number can be found on the touch screen cable at the lower right corner of the touch screen.

When you select the ThruGlass Screen Type, you automatically set in motion a configuration process that sets the default sensitivity and determines the best frequency for your controller.

Sensitivity

Using the Sensitivity setting, the touch response can be optimized for the thickness of the non-conductive material (for example, glass or plastic) in front of the ThruGlass touch screen.

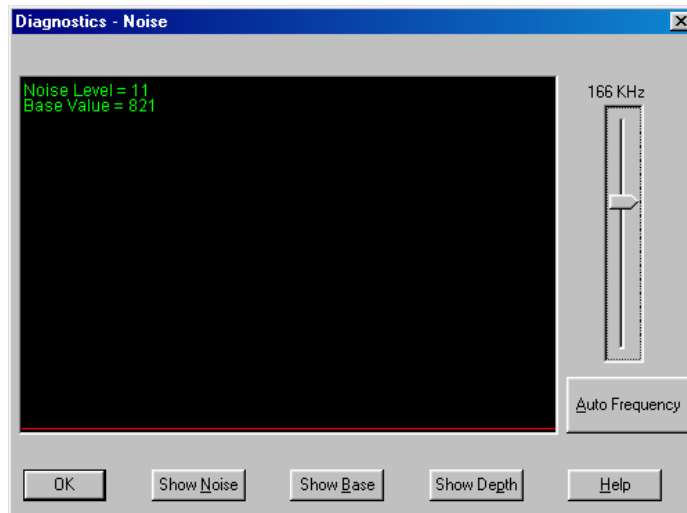
The configuration process sets the default sensitivity, which, in most cases, will be appropriate for your touch screen. However, you can change this setting manually if you are not satisfied with the response of the ThruGlass touch screen.

- If the controller responds or the cursor moves before you actually touch the first surface, you should decrease the sensitivity.
- If you need to press hard or use more than one finger in order to activate a touch, you should increase the sensitivity.

Diagnostics

Diagnostics will help to determine whether your ThruGlass touch screen is working correctly. Before running these tests, make sure the ThruGlass is installed in its operational position, i.e., kiosk doors closed, artwork installed, monitor in final operating location.

Show Noise

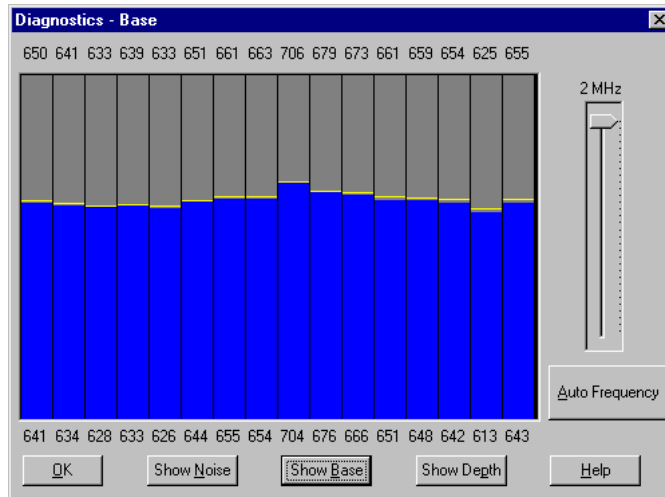


The Noise Level indicates the amount of noise detected by the controller at the current frequency. Ideally, the Noise Level should be less than 30. Choose Auto Frequency to determine the best frequency for your controller. If you are still unsatisfied with this setting, you can select a different frequency manually and retest.

The red line is a graphical representation of the noise level. It should be positioned low and hold steady as shown in the screen below.

Note that touching the screen affects the noise level. To obtain accurate readings of the overall system noise, do not touch the screen, keyboard or mouse during this process.

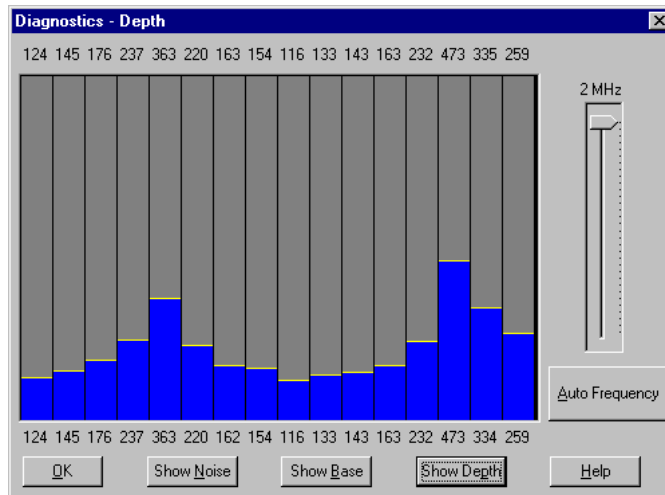
Show Base



Show Base shows the operating range of the controller. Optimal levels should be over 400 and less than 1023. The yellow lines represent peak holds. All values should be in the top half of the screen.

If any bar is substantially different from its neighbor, there may be a problem such as metal near the sensor or a broken connection. The exception to this is the change from the horizontal to vertical axis at bar 8, where you are likely to see a jump in height. Touching the screen should show a reduction in height of all bars with the lowest reading being the touch point.

Show Depth



Show Depth is a graphical representation of the amount of touch signal that the controller sees when the screen is touched. The best values are above 125. Overall, the higher the values, the better, without topping out the graph.

If you sweep your finger slowly from side to side and top to bottom across the screen, you should see that all bars reach a similar maximum height. The yellow lines indicate the maximum reading of any given bar.

The leftmost bars represent readings from the horizontal axis. The rightmost eight represent the vertical axis. There may be a slight difference in the average from these two groups.

Auto Frequency

The Auto Frequency function adjusts the operating frequency of the touch screen. In general, you will not need to adjust the frequency once you have configured the touch screen. However, if you are experiencing erratic or jittery cursor movement, ragged lines, or random touch points, you may want to use the Auto Frequency option and rerun the process.

You can manually set a new operating frequency, and then check the performance of the touch screen at that frequency setting. Use the Auto Frequency slide bar to select and test the available frequency settings and determine the best frequency. The range of frequency settings and the default setting depends on your installation. You can adjust the ThruGlass sensitivity after changing the frequency.

Do not touch the screen, keyboard or mouse during this process.

When to Adjust the Controller Frequency

You should adjust the controller frequency any time the cursor movement is very erratic or jittery. This is NOT a subtle movement. The cursor will be very jumpy. To test stability, use the Draw program to draw some lines on the screen. Check that they are smooth. If the lines appear ragged, the frequency setting is probably not correct for your controller.

To adjust the controller frequency:

- Open the ThruGlass tab.
- Click on Diagnostics then click on Auto Frequency.
- Do not touch the screen until the auto frequency process is complete. Touching the screen influences the results of the frequency adjustment.
- The results obtained from changing the frequency are not predictable. If you choose a frequency setting that does not work, keep trying. The next frequency setting (up or down) may be appropriate.

Calibrating the ThruGlass Touch Screen

You should calibrate the ThruGlass touch screen after you have set the screen type and adjusted sensitivity and frequency. Use the Calibrate tab to adjust the calibration of the ThruGlass touch screen.

Testing the ThruGlass Touch Screen

Use the Test button to check that the ThruGlass touch screen is correctly responding to your touch.

To test the ThruGlass touch screen:

- Open the ThruGlass tab.
- Click on Test. A dialog box prompts you to test the touch screen by touching the screen. A target appears on the screen.
- Touch the screen in several places and move your finger around the screen. Touch the corners and edges of the screen. The cursor should be steady and cursor movement should be smooth. If you see erratic or jittery cursor movement or if the controller registers random touch points, readjust the controller frequency.

Adjusting ThruGlass Video Resolution

3M Touch Systems recommends that you adjust the desired video resolution and scan rate before you configure the touch screen. Adjusting the video resolution after configuring the touch screen can cause touch to be erratic.

If you change the video resolution or scan rate after configuring the touch screen, you will see a message advising you to reselect your screen type in order to automatically configure the sensitivity and frequency. *If you change **only** the scan rate on a Windows 95 system, this message will not appear. You must manually reset the screen type by selecting None and then the screen type.*

Alternatively, you can adjust the controller frequency by selecting the Auto Frequency button from the Diagnostics screen.

Values for each video resolution are stored in the system registry so you need only do this once for each video resolution setting.

ThruGlass Troubleshooting

The ThruGlass touch screen should be sensitive to your touch and recognize a light touch. If not, you may be experiencing one of the following problems:

- If the controller responds or the cursor moves before you actually touch the first surface — decrease sensitivity.
- If you need to press hard or use more than one finger to activate a touch — increase sensitivity.
- If the cursor is erratic or jittery — adjust the controller frequency.
- If the controller is registering random touch points — adjust the controller frequency.
- If the cursor does not reach the edges of the video image — recalibrate the touch screen.
- If the cursor is not located underneath your finger — recalibrate the touch screen.

Multiple ThruGlass Touch Screens

Depending on your application, you may want to use more than one touch screen with your system. TouchWare™ software can support up to four ThruGlass touch screens. Also, you can include a combination of touch monitors and standard (non-touch) monitors with your system.

To set up multiple ThruGlass touch screens, you follow the same process as you do to set up multiple serial touch screens. See Appendix A for instructions.

Summary of Firmware Commands

ThruGlass controllers use an enhanced set of the commands detailed in the following tables. 3M Touch Systems recommends you use the commands listed in the following table.

If you are not familiar with the use of firmware commands, *do not use* them. Executing some commands may alter the performance of your touch screen or render it inoperable.

Table 2: Firmware Commands Recommended for Development

Command Name	ASCII Code
Calibrate Extended	CX
Format Tablet	FT
Mode Stream	MS
Null Command	Z
Output Identity	OI
Reset	R
Restore Defaults	RD
Unit Type	UT

Additional ThruGlass Specific Commands

These commands can be used for diagnostics and configuration of ThruGlass controllers.

Table 3: ThruGlass Specific Controller Commands

Command Name	ASCII Code	Description
Mode Noise	MN	Stream noise data packets
Extended Mode	MX	Send firmware algorithm data on press
Set Creep	SC [pressed released]	Set/show base update rates
Set Sensitivity	SS [max/min adjacent unused speed fast level release]	Set/show touch algorithm parameters
Set Frequency	SF [freq]	Set/show frequency
Set Phase	SP [resln delay]	Set/show phase
Set Type	ST [0..3]	Set/show controller & screen orientation
Set Correction X	SCX [xtbl X0 X1 X2 X3 X4 X5 X6 X7]	Set/show X depth correction parameters
Set Correction Y	SCY [ytbl Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7]	Set/show Y depth correction parameters

Format Raw ASCII	FRA	Show 16 sensor channel values
Format Base ASCII	FBA	Show 16 base values
Format Depth ASCII	FZA	Show 16 press depth values
Noise ASCII	NOA	Show noise data

ThruGlass Command Line Commands

Sending ESCAPE,ESCAPE,ESCAPE will place the ThruGlass controller into ‘terminal’ mode. The following commands are then active. Note that some parameter values can render the controller inoperative. FR will return the controller to factory default settings. Note that these commands are for diagnostic use only and are not recommended for normal operation.

- Enter either full command or abbreviation followed by <ENTER>.
- Angle brackets indicate required parameter.
- Square brackets indicate optional parameter(s).
- Vertical bar indicates a choice must be made from list.

Table 4: ThruGlass Terminal Mode Commands

Command	Abbreviation	Description
Adcall	aa	Show 16 sensor channel values
Baseall	ba	Show base values
baud [1200 2400 4800 9600]	bd	Set/show communication rate
coldreset	cr	Perform power-up restart
Depthall	de	Show press depth values
eeprom <address> [data]	ee	Set/show EEPROM values directly
Factoryreset	fr	Reset to factory default settings
Go	go	Start normal operation
help [command]	he	Show list of these commands
helpcta	hc	Show test of CTRL-A commands
mode [mode]	mo	Set/show operation mode
noise	no	Show noise analysis
sens [maxmin adjacent unused speed fast level release]	ss	Set/show touch algorithm parameters
scx [xtbl X0 X1 X2 X3 X4 X5 X6 X7]	scx	Set/show X depth correction parameters
scy [ytbl Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7]	scy	Set/show Y depth correction parameters
setcreep [pressed released]	sc	Set/show base update rates
setfreq [freq]	sf	Set/show frequency
setphase [resln delay]	sp	Set/show phase
setlinx [center edge offset]	slx	Set/show X linearity parameters
setliny [center edge offset]	sly	Set/show Y linearity parameters
Tpcal	tpc	Perform two-point calibration
tpval [X1 Y1 X2 Y2]	tpy	Set/show two-point calibration values
tpreset	tpr	Reset two-point calibration to default
type [0..3]	ty	Set/show controller & screen orientation
version	ve	Show version information
Warmreset	wr	Restart all processes

CHAPTER 5

Troubleshooting the Touch Screen

This chapter provides tips and strategies for problems you may encounter with the touch screen either during installation or normal use.

3M Touch Systems is committed to helping you get the most out of your touch screen. If you are unable to resolve your problem using the troubleshooting information contained in this chapter, contact 3M Touch Systems Technical Support. For information on how to reach technical support in your area, refer to “3M Touch Systems Support Services” on page 5.

Troubleshooting Overview

If you are experiencing problems with the touch screen, check that all cables are connected properly and restart your system.

For cursor adjustments, you may need to:

- Calibrate the touch screen.
- Define cursor offset.
- Stabilize the cursor.

If your touch screen or mouse is not working, the communication settings may be incorrect. If both devices are trying to use the same communication port or IRQ, a hardware device conflict will result. The touch screen cannot share an IRQ with another device.

Verify that any previously loaded hardware/software that used the same COM port as your touch screen has been uninstalled. Just because the hardware is disconnected doesn't mean that the software isn't claiming the port. Ensure that all components are completely removed from the system files. Refer to manufacturer's documentation for additional help.

To correct the communication settings, use the Windows Hardware Conflict Troubleshooter from Windows Help.

Touch Screen Status Lights

Some touch screens have a light-emitting diode (LED) that indicates the status of the touch screen unit and monitors several diagnostic features in the unit. Note that there is no LED on a TouchPen controller or any internally mounted controller.

When you first power up a touch screen monitor, the LED initially goes bright, then dim. When you touch the screen, the LED should brighten again. If you are experiencing problems with the touch screen, be sure to check the LED for status information.

- If the LED remains *bright* when you are not touching the screen, there may be a problem with your hardware.
- If the LED remains *dim* when you touch the screen, there may be a problem with your hardware.
- If the LED *continuously blinks*, this is an indication that the power-on self-test failed. A blinking status light usually indicates a problem with the controller hardware, such as a RAM error, ROM error or NOVRAM error.
- If the LED *is not lit*, power is not being supplied to the controller. If this is the case:
 - Check your power connections.
 - Check that the monitor is turned on.
 - Check that the keyboard power tap (optional) is connected.
 - Check that the power supply unit (optional) is plugged in.

Refer to your controller reference guide for more details. Contact Technical Support for additional information.

What to do if...

Cursor does not display on screen after starting Windows

On Windows 9X and Me systems, open the Cursor tab and make sure that Cursor Visibility is enabled. On Windows 2000 and NT 4.0 systems, check the Windows control panel Mouse properties page to make sure that Touch Screen Hidden Cursors is not selected. Refer to page 19 for more information.

Cursor does not reach out to edges of screen

Try calibrating the touch screen. When calibrating the screen, be sure you touch the center of each target firmly and precisely.

You may also want to turn on the Edge Adjustment in the Cursor tab.

Cursor is jittery

You need to stabilize the cursor by adjusting the controller frequency setting. Run the Stabilize Cursor option.

Any time you adjust the frequency you should test how the touch screen is working and verify you are satisfied with the operation of the touch screen. It is a good idea to calibrate the touch screen again.

Cursor jumps or bounces suddenly across screen

You are most likely touching the screen in more than one spot at the same time. Be sure to point and touch with one finger only. Keep your other fingers away from the touch screen. Don't rest your hand on the monitor or bezel while touching the screen.

Drawing lines are not straight and smooth

You need to stabilize the cursor by adjusting the controller frequency setting. Run the Stabilize Cursor option.

Any time you adjust the frequency you should test how the touch screen is working and verify you are satisfied with the operation of the touch screen. It is a good idea to calibrate the touch screen again.

Double-click on touch screen doesn't work

Use the Touch Settings tab to adjust the double-click speed and area. The double-click speed defines how quickly you must touch the screen for the system to interpret your actions as a double-click. Set the double-click speed in the slow to medium range for optimum performance with a touch screen. The tick mark on the bar indicates the default setting.

The double-click area defines the space in which you must touch the screen for the system to interpret your actions as a double-click. Set the double-click area in the medium to high range for optimum performance with a touch screen. The tick mark on the bar indicates the default setting.

Click on the globe (Test) to test the double-click speed and area settings. If the *MicroTouch Enabled* logo begins to circle the globe (or stop circling), the touch screen recognized your touch as a double-click.

Note: Changing this setting will affect the double-click setting of the mouse.

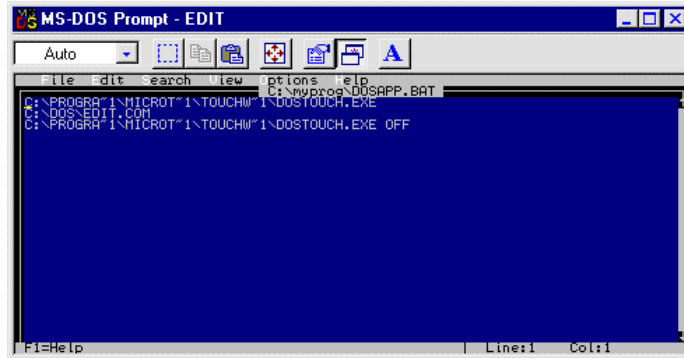
Full screen DOS needed

To run a touch application in a full screen DOS window in Windows 9X and Me, you must run the DOS touch screen driver DOSTOUCH.EXE before running your application. You can create a batch file that automatically loads the touch screen driver and then runs your application.

Note: To run DOSTOUCH from a batch file, you must include the full path to DOSTOUCH. By default, the Setup program installs the DOS touch screen driver to the following directory: C:\Program Files\TouchWare™ software\DOSTOUCH.EXE. If you changed the directory during installation, make sure you specify the correct DOSTOUCH path.

Create a batch file that executes your DOS application.

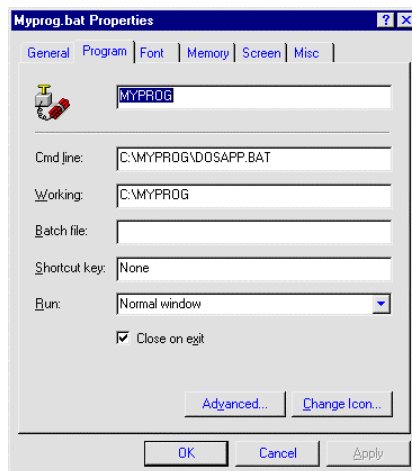
- The first line of the batch file will be `c:\progra~1\microt~1\touchw~1\dostouch` (or directory you installed the driver in if different).
- The second line will be your program name including the path.
- The third line will be `c:\progra~1\microt~1\touchw~1\dostouch off` (or directory you installed the driver in if different).



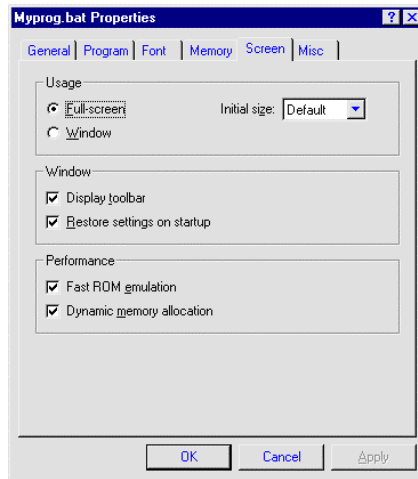
1. Create a shortcut on the desktop for the batch file. Right click on the shortcut, and go to Properties.



2. Make sure you have a check mark in the "Close on Exit" box.



3. Click on the Screen tab. Under "Usage" make sure "Full Screen" is selected.



4. Click on Apply and then click OK.

Operating two serial devices

If you have two serial devices operating together, such as a touch screen and a mouse, be sure each device uses a unique COM port and IRQ number. For example, the mouse can use COM1/IRQ4 and the touch screen can use COM2/IRQ3. Using the same COM port address or IRQ creates device conflicts. The touch screen must have a unique IRQ; it cannot share an IRQ with another device.

Verify that any previously loaded hardware/software that used the same COM port as your touch screen has been uninstalled. Just because the hardware is disconnected doesn't mean that the software isn't claiming the port. Ensure that all components are completely removed from the System files. Refer to manufacturer's documentation for additional help.

Use the Microsoft Hardware Conflict Troubleshooter (available in Windows Help) to try and resolve this problem.

Touch delayed in Windows 2000 or NT 4.0

In Windows 2000 and NT 4.0 systems, TouchWare™ software becomes active 10 to 15 seconds after the cursor appears when booting up your system. If touch does not become active early enough to suit your application, you can manually adjust the serial device driver startup order. These instructions are intended for use with a standard system. If you have a custom driver for your serial ports and know which device driver controls your touch screen COM port, you can make changes at your own discretion.

Caution: Make an Emergency Repair Disk (ERD) prior to making any changes to your system registry. Refer to Windows NT Help for instructions on using the Repair Disk utility to make an emergency repair disk.

To manually adjust the serial device driver startup order:

1. Log in to an account with administrator privileges.

2. Click on the Start button and point to Settings.
3. Click on Control Panel.
4. Double-click on Devices. Scroll down through the list until you get to Serial. Check to ensure that the Status is started.
5. Select Serial in the list window, then click Startup.
6. Change the Startup type from Automatic to System. Click OK.
7. Restart your system in order for this change to take effect.

Touch not working

The touch screen is not communicating with the controller. Check the following items:

- Make sure the touch screen controller is connected to the correct port.
- Review the installation procedures and verify all hardware is properly connected. Check the serial port and touch screen cable connections. Check that the touch screen and controller cables do not have any kinks and that connector pins are not bent.
- If you are using the PC Bus controller, check that the controller is firmly seated in the expansion bus slot in your computer. Check that the jumpers are properly set on the card.
- If your controller has an LED and you can see it, touch the screen to determine if the LED brightens to check for power. If the LED is flashing, refer to the touch screen status lights for a list of possible errors.
- Reset the touch screen and its controller. Turn off both the computer and the monitor, wait a few minutes, and then turn on each device again.
- If the touch screen is still not communicating after checking the hardware, verify that any previously loaded hardware/software that used the same COM port as your touch screen has been uninstalled. Just because the hardware is disconnected doesn't mean that the software isn't claiming the port. Ensure that all components are completely removed from the System files.
- If TouchWare™ software has located the appropriate communication port, this field will contain a COM port number. If the touch screen was not found, this field will be grayed out and the Find Touch Screen button will be active. Check to ensure that all cables are correctly fastened and click on Find Touch Screen to locate the COM port in use.

Touch screen not found

The touch screen is not communicating with the controller. If TouchWare™ software does not find the touch screen, check that the touch screen is connected properly, and then repeat the search. Note that this option cannot search any COM ports in use by other applications.

Note: Verify that any previously loaded hardware/software that used the same COM port as your touch screen has been uninstalled. Just because the hardware is disconnected doesn't mean that the software isn't claiming the port. Ensure that all components are completely removed from the System files.

Check the following items:

- Make sure the touch screen controller is connected to the correct port.
- Review the installation procedures and verify all hardware is properly connected. Check the serial port and touch screen cable connections. Check that the touch screen and controller cables do not have any kinks and that connector pins are not bent.
- If you are using the PC Bus controller, check that the controller is firmly seated in the expansion bus slot in your computer. Check that the jumpers are properly set on the card.
- If your controller has an LED and you can see it, check the controller's LED for power on. If the LED is flashing, refer to the controller status lights for a list of possible errors.
- Reset the touch screen and its controller. Turn off both the computer and the monitor, wait a few minutes, and then turn on each device again.
- If the touch screen is still not communicating after checking the hardware, verify the correct COM port and baud rate, and run Find Touch Screen again.
- If TouchWare™ software has located the appropriate communication port, this field will contain a COM port number. If the touch screen was not found, this field will be grayed out and the Find Touch Screen button will be active. Check to ensure that all cables are correctly fastened and click on Find Touch Screen to locate the COM port in use.
- If you are trying to use COM 4, be aware that some older video chip sets incorrectly map I/O addresses. TouchWare™ software will only work with COM ports configured, recognized, operational and supported by Windows at the time of install.

Pen controller not found

You tried to set the pen mode, and either the pen or TouchPen controller is not properly connected, or you do not have a TouchPen controller in your system. Check the following:

- If you have a pen, make sure that it is properly plugged into your monitor.
- If you have a TouchPen controller, review the installation procedures and verify all hardware is properly connected.

Error Messages

Some error messages that you might receive when using the touch screen include the following. Anything other than “OK” or “Touch screen not found” generally indicates a hardware failure. Contact Technical Support for more information.

- OK — Touch screen found and operational.
- Touch screen Not Found — Touch screen not located.
- A/D Error — Touch screen hardware error. (SMT2/TP4)
- ASIC Error — Touch screen hardware error. (SMT2/TP4)
- Hardware Error (HWD in USB) — Touch screen hardware error. (SMT3)
- NOVRAM Error (B1 and/or B2 in USB) — Checksum error in NOVRAM, using defaults.
- PWM Error — Touch screen hardware error (SMT3).
- RAM Error — Touch screen hardware error.
- ROM Error — Checksum error in ROM.

- CBL Error — Cable error in USB

Windows 2000 and NT 4.0 Error Messages

The following error messages are specific to Windows 2000 and NT 4.0 systems only and will appear in the system error log:

1. **Not enough memory is available for device \Device\PointerPort0**
The driver failed to allocate non-paged memory. This is an indication of *very* low memory resources.
What to do: Configure more RAM memory. The driver does not use much memory so it is likely that some other driver is the culprit.
2. **Too many PointerPort devices are defined. Could not create device: \DosDevices\MtsTch0.**
There is a large upper limit (about 64) on the total number of pointing devices (mice, tablet, touch screens) supported by the 3M Touch Systems driver.
What to do: Use fewer pointing devices.
3. **Could not create DeviceMap entry for device \Device\PointerPort0**
The driver failed to make an entry in the registry that identifies the driver to the operating system. This may indicate a corrupt registry.
What to do: Use your Emergency Recovery Disk to restore the registry.
4. **Could not create symbolic link for device \Device\PointerPort0**
The driver failed to make an entry in the registry that identifies the driver to user applications (i.e., the control panel). This may indicate a corrupt registry.
What to do: Use your Emergency Recovery Disk to restore the registry.
5. **Touch screen was not found on communications port \DosDevices\COM1 for device \Device\PointerPort0**
The indicated COM port was open correctly, but no touch screen responded when the driver probed the serial port. This is, by far, the most common error.
What to do: Check to make sure the touch screen is connected and powered correctly. Cycle the power on the touch screen. Check the controller LEDs to see if they indicate a problem (see page 48 for more information.) Check to make sure the port number is correct. Use the Find Touch Screen button on the TouchWare™ software Control Panel.
6. **Touch Screen was found, but failed to initialize properly for device \Device\PointerPort0**
A touch screen responded on the given serial port, but did not pass all the initialization commands at boot time.
What to do: Reboot. Cycle touch screen power. Call technical support with touch screen model number and TouchWare™ software version number.
7. **An internal error occurred in communications port for device \Device\PointerPort0**
An error occurred in configuring COM port.
What to do: Check that your serial driver is working correctly. Check that the COM port BIOS is enabled.
8. **Could not set timeouts on communications port \DosDevices\COM1, for touch screen device \Device\PointerPort0**
An error occurred in configuring COM port.
What to do: Check that your serial driver is working correctly. Check that the COM port BIOS is enabled.
9. **Could not set baud rate on communications port \DosDevices\COM1, for touch screen device \Device\PointerPort0**

An error occurred in configuring COM port.

What to do: Check that your serial driver is working correctly.

10. **Could not set line control on communications port \DosDevices\COM1, for touch screen device \Device\PointerPort0**

An error occurred in configuring COM port.

What to do: Check that your serial driver is working correctly. Check that the COM port BIOS is enabled.

11. **Unknown operation was requested for communications port \DosDevices\COM1, for touch screen device \Device\PointerPort0**

A bad command was issued to the COM port driver.

What to do: Check that your serial driver is working correctly. Power cycle the system.

APPENDIX A

Multiple Touch Screens

This appendix describes how to set up multiple touch screens. Depending on your application, you may want to use more than one touch screen with your system. TouchWare™ software can support up to four touch screens. Also, you can include a combination of touch monitors and standard (non-touch) monitors with your system. While you can mix PS/2 and serial controllers in multiple monitor setups, you cannot mix USB controllers with serial or PS/2.

Multiple Touch Screens Overview

Setting up multiple touch screens involves the following steps:

- Checking system requirements.
- Connecting multiple monitors and touch screens. You must install the hardware and software required to support multiple monitors before installing TouchWare™ software.
- Configuring Windows for multiple monitors.
- Installing TouchWare™ software and configuring it for multiple monitor support. For serial controllers, if you set up and subsequently decide to add or remove touch screens, you must uninstall and reinstall TouchWare™ software.

Checking System Requirements

The system requirements for multiple touch screens are as follows:

- Windows 2000, Windows 9X, or Windows Me (for serial and PS/2)
Windows 2000, Windows Me or Windows 98 (for USB)
- Up to 4 single-port video adapter cards or 1 or 2 dual-head (Windows 2000 and USB only) video adapter cards. Note that you cannot mix single and dual head cards in the same configuration.
- **Either** a COM port or a USB port for each touch screen
PCs typically include two COM ports and 2 USB ports. You must verify that all previously installed hardware or software that used any COM port you intend to use for a touch screen has been disconnected and completely uninstalled.

Note: You cannot share COM ports using a “Y” adapter.

Connecting Multiple Monitors and Touch Screens

Note: For USB configurations, you should *not* connect the touch screens until you have installed TouchWare™ software.

To connect multiple monitors and touch screens to your system:

1. Shut down your system.
2. Install additional video cards, if required.
3. Connect each monitor to a video port in your system.
4. Apply power to your system and monitors. Windows detects the new video adapters and loads the appropriate display drivers.

Configuring Windows for Multiple Monitors

Next you must configure Windows for multiple monitor support. If necessary, refer to your Windows documentation for more information.

For dual head video cards, you may have to further configure using the Advanced tab from the Windows Control Panel. Consult your video card documentation for additional details.

To configure multiple monitors in Windows:

1. Open the Windows Control Panel and double-click the Display icon.
2. Select the Settings tab.
3. Activate each monitor by selecting it and then checking Extend my Windows desktop onto this monitor (or by right-clicking the monitor icon and selecting Enable).
4. Display each monitor's label by clicking Identify (or by right-clicking its icon and selecting Identify).
5. Click and drag the monitor icons to position them according to the physical layout of the monitors.

Installing TouchWare™ Software for Multiple Touch Screens

You do not need to do anything special to install TouchWare™ software for multiple touch screens. During installation, TouchWare™ software will search all available COM ports to determine your setup for you. You can then make selections to customize each touch screen from the TouchWare™ Software Control Panel.

For serial controllers:

Before installing TouchWare™ software, make sure all *serial* touch screen monitors are connected and operational. The install program will search for available COM ports and touch screens and configure only the number of touch monitors found during installation.

For USB controllers:

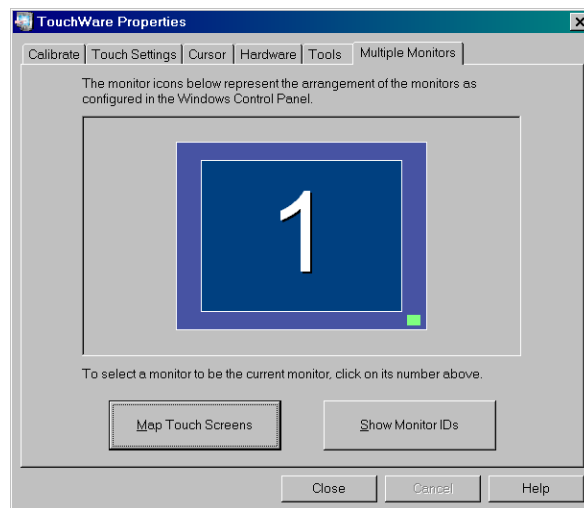
The opposite is true for USB controllers. *Do not connect USB* controllers until TouchWare™ software is installed. Once you have installed TouchWare™ software, plug in all USB touch monitors prior to opening the TouchWare™ software Control Panel.

Note: If you have previously loaded TouchWare™ software, you must completely uninstall the software and reboot your system prior to reinstalling.

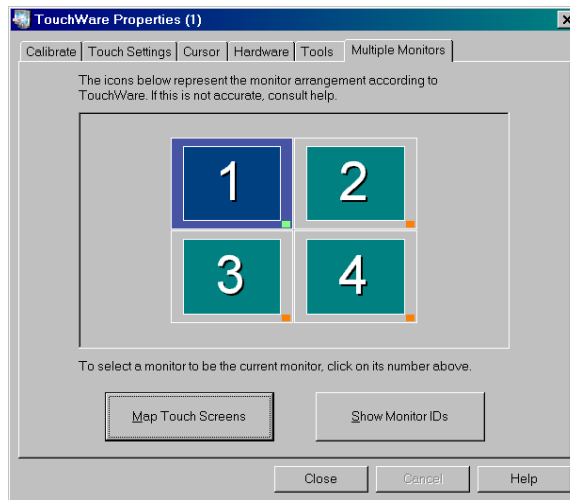
Mapping Multiple Monitors

Once you install TouchWare™ software, you must map each touch screen to a monitor using the Map Touch Screens button from the Multiple Monitors tab. You must do this in order to individually calibrate and configure each touch screen connected to your system using the TouchWare™ software Control Panel. Once you have properly mapped the touch screens, you set the current touch screen by selecting the icon of the desired monitor from the TouchWare™ software Multiple Monitors tab. In multiple touch screen configurations, touch screen properties are applied only to the *currently selected* touch screen.

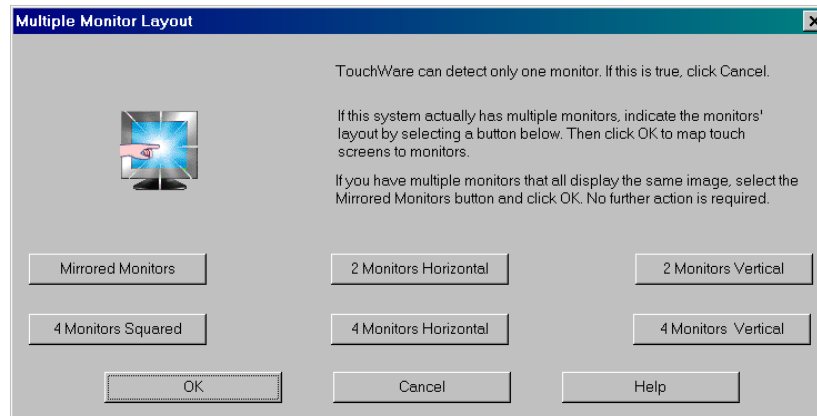
1. To map multiple touch screens, open TouchWare™ software and click on the Multiple Monitor tab. The following figure shows a single monitor or mirrored monitor configuration. All monitors show the same screen. All monitors are overlaid on top of each other for mapping purposes. To select a different touch screen, click on the icon to get to the next touch screen.



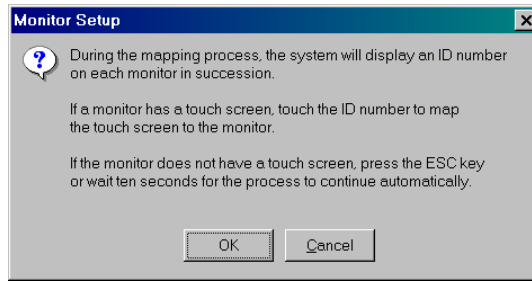
The following figure shows a 4 monitor configuration.



Note: The arrangement of the touch screens shown on the Multiple Monitors tab may not bear any resemblance to the arrangement portrayed on the Windows Control Panel. Sometimes when using dual head video cards, TouchWare™ software is not able to detect the proper monitor layout. In those cases, the following screen appears and the user is asked to select the appropriate layout, click OK and proceed to mapping.


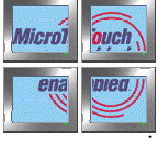




2. Ensure that the touch screens are mapped correctly. Click on the Map Touch Screens button. The following message will appear.



3. Choose the appropriate configuration for your multiple monitor setup. If you want mirrored or tiled monitors, refer to the following table for a description of each.

Mirrored and Tiled Monitor Options

Option	Illustration
Mirrored monitors Same image on all screens	
Tiled monitors All screens combine for a single image	 <p>4 Monitors Squared</p> <hr style="border-top: 1px dashed black;"/>  <p>2 Monitors Vertical (Up to 4 monitors possible)</p> <hr style="border-top: 1px dashed black;"/>  <p>2 Monitors Horizontal (Up to 4 monitors possible)</p>

Calibrating and Configuring the Touch Screens

Select the touch screen you want to calibrate or configure from the Multiple Monitors tab. Monitors with touch screens are indicated by a small green square located at the bottom right of each monitor. Monitors without touch screens display a small orange square.

Click on the monitor you wish to modify and use the other tabs in the TouchWare™ software Properties dialog box to calibrate and configure each touch screen. Repeat for each touch screen connected to your system. For more information on the configuration settings, refer to Chapter 2 of this guide or the online help.

For the most part, TouchWare™ software properties apply to individual touch screens. The only exceptions to this are the double-click and cursor visibility settings, which are applied globally.

Note: Multiple touch screens default to a single touch mode called Click mode that provides button operation only. Alternate touch modes on the Touch Settings tab are disabled until you select Enable Touch Modes from Tools→Options→ Software Settings.

APPENDIX B

Miscellaneous Information

This appendix contains information on:

- Touch screen driver settings.
- MtsCal calibration utility.
- MousePort controller.
- Touch screen care and cleaning.
- TouchWare™ software system files.

Touch Screen Driver Settings

You can define touch screen settings using the TouchWare™ software Control Panel. TouchWare™ software stores the touch screen settings in the Windows registry. Whenever you save changes to the TouchWare™ Software Control Panel, TouchWare™ software records the new settings in the System Registry. These changes take effect immediately.

MtsCal Calibration Utility

You can directly access calibration without opening the TouchWare™ software Control Panel by running the MtsCal calibration utility.

MtsCal offers the following options:

- /c – terminates the utility immediately after calibration.
- /c2 – for 2-point calibration.
- /c5 – for 4-point calibration.
- /e – to enable touch.
- /d – to disable touch.
- /n=? (1—4) – to determine which touch screen to calibrate in a multiple touch screen setup.

The /c option is particularly useful because it makes only the calibration screen available. The program immediately opens the calibration screen, and terminates when the calibration process is complete.

To run MtsCal:

1. Click on Start → Find→ Files or Folders.
2. In the Named box, type MtsCal.exe and press Enter to begin the search.
3. Select MtsCal.exe in the list window. Right click and select Create Shortcut. Then click Yes to place the shortcut on the desktop.
4. Right-click on the shortcut and select Properties. Edit the information in the target box to include any options you would like to use. For example, to disable touch, add the /d option as follows:

`"C:\Program Files\TouchWare™ software\MtsCal.exe" /d`

MousePort Touch Screen Controller Overview

The MousePort touch screen controller is a PS/2-compatible controller. The enclosed controller is externally mounted to the back of your monitor.

The controller cable has a 6-pin DIN male connector. Plug this cable into the PS/2 mouse connector on the back of your PC. This frees up the serial ports and bus slots for other peripheral devices.

System Requirements for the MousePort Controller

The hardware and software requirements for using a MousePort touch screen controller are as follows:

- PC with an available PS/2 mouse port connector.
- Microsoft Windows NT 4.0, Windows 2000, 9X or Me.

Connecting a MousePort Touch Screen Controller

Before attempting to install a MousePort controller, be sure of the following:

- If a mouse will be used in addition to the touch screen, the operating system must be functional with a standard serial mouse connected.
- MousePort driver installation adds a virtual COM port at COM9. Make sure the system is not currently using COM9.

Note: If you are not familiar with the operation of mouse drivers, *do not attempt to install the MousePort controller*. Installing a MousePort controller may alter the performance of your touch screen or render it inoperable.

To connect a MousePort controller, plug the controller cable into the PS/2 mouse connector on the back of your PC.

Testing the MousePort Controller

To verify and test that the MousePort controller is operating properly, you can use the MtsCal calibration utility.

Note: Remember that a MousePort touch screen controller does not connect to a serial port. Therefore, you cannot use standard communication programs (for example, ProComm, Telex, or Windows Terminal) to verify that the MousePort controller is operating properly.

Touch Screen Care and Cleaning

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

Typically, an isopropyl alcohol and water solution ratio of 50:50 is the best cleaning agent for your touch screen. You can also use straight isopropyl alcohol. In addition, 3M Screen Cleaner 675 has been tested and approved for this use.

CAUTION

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

- Follow all instructions and recommendations in the manufacturer's Material Safety Data Sheet and product label.
 - Be sure to follow solvent manufacturer's precautions and directions for use when using any solvents
 - It is important to avoid using any caustic chemicals on the touch screen. Do not use any vinegar-based solutions.
-
- Apply the cleaner with a soft, lint-free cloth. Avoid using gritty cloths.
 - Always dampen the cloth and then clean the screen. Be sure to spray the cleaning liquid onto the cloth, not the screen, so that drips do not seep inside the display or stain the bezel.
 - Always handle the touch screen with care. Do not pull on or stress cables.