

DOS and Windows[®] Driver Guide

Version 2.0

DOS and Windows Driver Guide

Version 2.0

Manual Version 2.0b

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Introduction

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ABOUT THIS MANUAL

This manual provides all of the information you need to install and use the software on the Elo TouchSystems *DOS and Windows Driver Disk*.

This manual is organized as follows:

- | | |
|-----------|---|
| Chapter 1 | Describes the included software and hardware requirements. |
| Chapter 2 | Gives instructions on how to install the software. |
| Chapter 3 | Describes the touchscreen demonstration program. |
| Chapter 4 | Describes the installation and use of ELODEV™ and ELOCALIB, the touchscreen driver and calibration program for DOS. |
| Chapter 5 | Details the use of MonitorMouse® for DOS, a mouse emulation driver. |

- Chapter 6 Details the use of MonitorMouse for Windows.
- Chapter 7 Describes the installation of TouchBack™, a keystroke emulation driver for DOS.
- Appendix A Provides detailed information on configuring your touchscreen controller.
- Appendix B Gives tips on troubleshooting an installation.
- Appendix C Lists error messages with explanations.
- Appendix D Contains information for programmers on MonitorMouse for DOS.
- Appendix E Contains information for programmers on MonitorMouse for Windows.

See the !READ.ME! file on the accompanying *DOS and Windows Driver Disk* for any additions or changes made after this manual was printed.

For details on available product configurations, touchscreen theory of operation, and general troubleshooting, see the *IntelliTouch® Product Manual* or the *AccuTouch® Product Manual* as appropriate.

ABOUT ELO SOFTWARE

Included Software

The accompanying *DOS and Windows Driver Disk* contains the following Elo driver software:

- | | |
|--------------------------|---|
| ELODEV | Touchscreen driver program for DOS. Makes all Elo touchscreen controllers, including serial RS-232, PC-Bus, and Micro Channel versions, look the same to other driver and application programs. |
| MonitorMouse for DOS | Mouse emulation driver for DOS. Combines touch input from ELODEV and mouse input from your mouse driver into a single MOUSE.COM compatible application interface. |
| MonitorMouse for Windows | Mouse emulation driver for Microsoft Windows. Allows all Windows programs to be used with a touchscreen. Your mouse |

may be used in conjunction with the touchscreen. DOS mouse-driven programs run from Windows may also use the touchscreen.

TouchBack

Keystroke emulation driver for DOS. Applications must be specially written for use with TouchBack. Your application documentation should specify if TouchBack is required.

The *DOS and Windows Driver Disk* also contains the following software:

ELODEMO

A VGA-graphics program for DOS which demonstrates the capabilities of the touchscreen hardware and many techniques for touchscreen software.

Utility and Diagnostic Programs

An assortment of programs are included to calibrate the touchscreen and verify the operation of serial ports, touchscreen controllers, and driver programs.

Other Software Available from Elo

MonitorMouse for DOS and MonitorMouse for Windows are only two in a family of MonitorMouse products for various operating systems available separately from Elo. Each has a similar "look and feel" for a consistent user interface across platforms:

MonitorMouse for OS/2

Mouse emulation driver for OS/2 2.x and 1.3. DOS and Windows programs run under OS/2 may also use the touchscreen.

MonitorMouse for Windows NT

Mouse emulation driver for Windows NT. DOS and Windows 3.1 programs run under Windows NT may also use the touchscreen.

MonitorMouse for Macintosh

Mouse emulation driver for the Apple Macintosh family of computers.

The following manuals and software are included in the *DOS Programmer's Toolkit*, also available separately from Elo:

ELODEV

Programmer's Reference

Defines the application programming interface for the ELODEV touchscreen driver. Includes sample source code in C, Pascal, and assembly. (70 pages).

TouchBack

Programmer's Reference

Defines the application programming interface for the TouchBack keystroke emulation driver. Includes sample source code in BASIC, dBase, Clipper, etc. (50 pages).

TouchUp™

User's Guide

Includes the touch zone definition utility for ELODEV and TouchBack, screen capture program, and example programs in C and Pascal. (85 pages).

Writing Your Own Driver

If you are using an operating system not supported by the Elo drivers described above, contact Elo Technical Support for information on the availability of other drivers. Technical manuals are also available on the touchscreen controllers with machine-independent example code for writing your own drivers.

Touchscreens and Controllers Supported

Elo produces two touchscreen technologies: resistive and surface wave (SW). The AccuTouch® resistive touchscreen consists of a glass panel molded to the precise shape of a display's face. The glass is coated with a transparent, conductive layer and then covered by a clear, hard-coated sheet of plastic. This cover sheet is suspended over the glass by less than one-thousandth of an inch with tiny separator dots. With a light touch, the conductive inner surface of the plastic sheet makes contact with the underlying glass. The resulting voltage is digitized for each axis and a coordinate determined.

The IntelliTouch® surface wave touchscreen consists of a clear glass overlay with piezoelectric transducers and a set of reflector stripes. Surface waves are transmitted by the transducers, reflected across the face of the overlay, and reconverted into an electronic signal. A finger or gloved hand touching the

touchscreen absorbs a portion of the wave at the touch location. The touchscreen controller's microprocessor analyzes the resulting change in the received signal and determines the touch coordinates. The IntelliTouch touchscreen can sense both touch location and touch pressure.

A touchscreen controller is required for both technologies to provide touchscreen drive signals, convert received analog signals into digital coordinates, and transmit coordinates to the PC. There are several types of controllers.

Serial controllers use a standard RS-232 port and are baud rate selectable. They can be mounted anywhere; for example, externally (in separate enclosures) or inside display enclosures.

Bus controllers plug directly into a card slot within an IBM PC, PS/2, or compatible computer, so external packaging and power is not required. Bus controllers are address and interrupt (IRQ) selectable and are available for PC-Bus (ISA/EISA) and Micro Channel architectures.

The software on the Elo *DOS and Windows Driver Disk* supports the Elo touchscreen controllers listed below. E281{A}-4002 refers to both the E281-4002 and E281A-4002 controllers. Likewise, E281{A}-4025 refers to both the E281-4025 and E281A-4025 controllers.

Controller Model	Enclosure Model	Interface	Touchscreen Type
E281-2300	N/A	RS-232	IntelliTouch
E281{A}-4002	E281{A}-2852	RS-232	IntelliTouch
E271-2210	E271-RS232BX	RS-232	AccuTouch
E271-2200	N/A	RS-232	AccuTouch & DuraTouch ¹
E271-140	E271-3{R}	RS-232	AccuTouch
E261-280	N/A	RS-232	DuraTouch
E281-4035	N/A	PC-Bus	IntelliTouch
E281{A}-4025	N/A	PC-Bus	IntelliTouch
E271-2201	N/A	PC-Bus	AccuTouch & DuraTouch
E271-141	N/A	PC-Bus	AccuTouch
E271-142	N/A	PC-Bus	DuraTouch
E271-2202	N/A	Micro Channel	AccuTouch & DuraTouch

The following obsolete part numbers can be cross-referenced to the controller model numbers referred to above.

¹ DuraTouch touchscreens are no longer manufactured by Elo.

Part Number	Controller Model
00285X-XXX Enclosure	Contains E281-4002 IntelliTouch Serial Controller, configured for Stream Mode, Binary Mode, Z-Axis Enabled, 9600 Baud.
E271-3 Enclosure	Contains E271-140 AccuTouch Serial Controller, configured for 2400 Baud, 8-Bit Data, Binary Mode, Filtered Mode, Stream Mode.
002710-XXX Controller	E271-140 AccuTouch Serial Controller.
002714-XXX Controller	E271-141 AccuTouch PC-Bus Controller.
002750-XXX Controller	E261-280 DuraTouch Serial Controller.
002751-XXX Controller	E271-142 DuraTouch PC-Bus Controller.
00285X-2-XXX Controller	E281-4002 IntelliTouch Serial Controller.
00285X-25-XXX Controller	E281-4025 IntelliTouch PC-Bus Controller.
E271-280 Controller	E261-280 DuraTouch Serial Controller.
E271-141 Controller with Daughter Board	E271-142 DuraTouch PC-Bus Controller.

System Requirements

The DOS drivers will run on any system with DOS version 2.0 or later. The Windows drivers will run on any system with Windows 3.1 or later. The DOS demonstration program requires a VGA color display. The touchscreen calibration program for DOS supports standard and VESA-compatible display modes. Otherwise, all software is video independent. An Elo touchscreen must be installed on the display and connected to a serial or bus controller.

Differences from Previous Versions

- The ELODEV and MonitorMouse for DOS/Windows disks and manuals have been combined into this single manual and disk. A new installation program is included. The installation program and Touchscreen Control Panel for Windows are included in English, German, French, and Spanish.

- The performance of MonitorMouse for DOS and MonitorMouse for Windows have been enhanced when using an IntelliTouch controller with firmware revision 2.2 or later, or a SmartSet™ controller (E271-22xx or E281-23xx).
- The DOS demonstration program has been converted to VGA and enhanced considerably.
- Many other minor improvements have been made to the various drivers and utility programs. For information on differences between all prior versions, see the DIFFER.* files, an option selectable when installing the *DOS and Windows Driver Disk*. All drivers are backwards compatible with previous versions.

Distribution Rights

ELODEV, MonitorMouse for DOS, MonitorMouse for Windows, TouchBack, and their support software may be distributed freely in executable form with any software you develop using them. See the license agreement at the beginning of this manual for details.

PRODUCT REGISTRATION

To stay informed on the latest product announcements and software releases, be sure to fill out and return the product registration card packaged with this manual.

Installation

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This chapter describes the installation procedure for the software on the *DOS and Windows Driver Disk*. Four steps are required:

Step 1	Configuring the touchscreen controller.
Step 2	Installing the controller.
Step 3	Running the INSTALL program.
Step 4	Calibrating the touchscreen.

STEP 1 - CONFIGURING THE TOUCHSCREEN CONTROLLER

Elo ships most touchscreen controllers preconfigured for use with Elo software.

- Serial controllers are usually ready to use.
- PC-Bus controllers require a hardware interrupt (IRQ) and a block of I/O ports that will not contend with another device. If IRQ5 and/or I/O ports 280-299 are not available, you may have to re-jumper your controller.
- Micro Channel controllers are configured with the Reference Disk included with your PS/2 or compatible computer.

Switch and jumper settings, as well as other configuration information, are given in Appendix A.

STEP 2 - INSTALLING THE CONTROLLER

If you need help installing the controller or making the connections, see the *AccuTouch Product Manual* or the *IntelliTouch Product Manual* as appropriate for step-by-step instructions.

STEP 3 - RUNNING THE INSTALL PROGRAM

The *DOS and Windows Driver Disk* contains an installation program which automatically transfers all necessary files to your hard disk.

If you will be installing the Windows drivers, be sure Windows is installed and operating properly before proceeding. *You must have a DOS mouse driver (MOUSE.COM) installed for your mouse if you wish to continue using your mouse along with the touchscreen in DOS or Windows.*

If you only wish to change the configuration of your touchscreen controller, see *Changing Your Hardware Configuration with SETUP*, page 14, for information on the SETUP utility.

To install the software, insert the *DOS and Windows Driver Disk* and type:

A:INSTALL [Enter]

or

B:INSTALL [Enter]

Respond to the on-screen prompts and instructions. You will be asked to specify the model and configuration of your controller, then select between DOS Express Installation, Windows Express Installation, or Selective Installation. The software to be installed and disk space requirements will be displayed for each installation option. You may specify the drive and directory for the files you choose to install, or use the default (C:\TOUCH).

Your AUTOEXEC.BAT file, (and SYSTEM.INI file for Windows installations), will be modified by the INSTALL program. Copies of the original files will be saved as AUTOEXEC.OLD and SYSTEM.OLD.

Command Line Flags

Several flags may be specified on the INSTALL command line.

To override the default system language used by INSTALL, specify the -L flag as follows:

```
INSTALL -L<x>
```

Use -Lg or -Ld for German, -Ls for Spanish, -Lf for French, or -Le for English.

To override the path to C:\AUTOEXEC.BAT, use the -a flag as follows:

```
INSTALL -a<filename with path>
```

To skip the VGA graphics sign-on screen, enter:

```
INSTALL :
```

More than one flag may be specified, separated by spaces. Flags may be in upper or lower case.

Updating Existing Drivers

If you are updating a previous version of the drivers, be sure to install and read the DIFFER.* files. These files explain the differences from all previous versions. The file extension corresponds to the version for which changes are listed. For example, ELODIFF.16 lists the changes made from ELODEV version 1.5b to version 1.6.

It is best to erase or overwrite any files from previous releases. All files are generally compatible, but mixing files from different versions may cause problems. If you are updating to a hard disk, specify the paths containing the earlier version and the INSTALL program will overwrite the obsolete files.

NOTE

All files are now installed into a single directory (default is \TOUCH). You will probably want to delete the old version of MonitorMouse for DOS which was previously installed in a separate directory (typically \MONMOUSE). INSTALL does not delete this directory.

STEP 4 - CALIBRATING THE TOUCHSCREEN

The final installation step is calibrating the touchscreen. Type "GO" when instructed to begin the calibration sequence.

You will be prompted to touch three calibration points on the screen. Before you do so, position yourself in front of the screen in normal sitting (or standing) position, with normal height and reach.

Using your finger as accurately as possible, touch each of the three points as they appear in the corners of the screen. The program responds with a beep as you lift your finger from each point.

Calibration is performed in four common video modes: 80x25 text mode, CGA 320x200 graphics, VGA 320x200 graphics, and VGA 640x480. If your DOS application runs in another video mode, see Chapter 4 for additional information on ELOCALIB. If you are running Windows in another video mode such as super VGA, see Chapter 6 for information on calibrating the touchscreen in Windows with the Touchscreen Control Panel.

The numerical values for the calibration points for the last video mode are displayed. X or Y axis inversion is normal.

If the calibration program does not respond to a touch, check the cabling, the switch and/or jumper settings on the controller, and the configuration you selected when installing the software. Run SETUP to change the configuration (see page 14). See Appendix B, page 93 for additional troubleshooting information.

Why Calibration is Necessary

The need for calibration is unique to the touchscreen. Unlike mouse or keyboard applications where the cursor is part of the image, a touchscreen is a physical overlay with an independent coordinate system. Only by knowing the position of the image can the PC software convert touchscreen coordinates into image coordinates.

Besides the differences among touchscreens and controllers, calibration also compensates for the variation in video image among displays. The image is affected by horizontal and vertical adjustments on the monitor and by the physical mounting of the touchscreen.

Additional calibration complications include image blooming, where bright colored images expand, and the "pin cushion" effect, which causes the corners of the display to be stretched. Poor display linearity can cause similarly sized boxes to be larger at the edges of the screen than they are in the middle, or vice versa.

The displayed image can also be tilted. Even changing video modes can affect the screen size.

Perfect calibration cannot be achieved in all circumstances. For example, the user can encounter parallax problems with a change in position, or because the present user is not the same stature as the person who calibrated the screen.

Even the most sophisticated calibration techniques can only partially overcome such variations. Therefore, most touchscreen software uses only a two or three-point calibration sequence and relies instead on well placed touch zones and appropriate user feedback.

The three-point calibration sequence used by Elo automatically corrects inverted touchscreen installations and backwards cable connections. X or Y-axis inversion is normal for most touchscreens.

When Recalibration is Necessary

Once calibrated, the touchscreen will be ready to run automatically each time the system is restarted. Recalibration should only be necessary after moving or resizing the video image, or after changing either the touchscreen, controller, or monitor.

Type "DEMOCAL" or click on Calibrate in the Windows Touchscreen Control Panel to re-run the calibration sequence.

WHERE TO GO FROM HERE

If you chose:

DOS Express Installation

Proceed to Chapter 3 for information on running the demonstration program. Then see Chapter 5 if you will be using the MonitorMouse for DOS mouse emulator or Chapter 7 for the TouchBack driver.

Windows Express Installation

Skip to Chapter 6 for information on MonitorMouse for Windows, the Windows mouse emulator.

Selective Installation

See Chapters 3-7 as appropriate.

If you will doing software development under DOS, see the *DOS Programmer's Toolkit*, available separately from Elo.

For details on available product configurations, theory of operation, touchscreen installation, and general troubleshooting, see the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* as appropriate.

Technical Reference manuals are also available for Elo touchscreen controllers.

The remainder of this chapter discusses changing your hardware configuration and uninstalling the software.

CHANGING YOUR HARDWARE CONFIGURATION WITH SETUP

If you reconfigure your hardware settings, run the SETUP program from your hard disk to reconfigure the drivers. SETUP is typically found in the \TOUCH directory. *Be careful not to confuse this program with the Windows Setup program.* To run SETUP, type:

```
SETUP [Enter]
```

The procedure is very similar to the INSTALL program, except no software is installed and the *DOS and Windows Driver Disk* is not required.

Flags may be specified for SETUP as with INSTALL. See page 11.

UNINSTALLING THE SOFTWARE

Demonstration Program

You may wish to delete the demonstration program from your hard disk after you have run it. This will free approximately 1.7 Mbytes of disk space. Delete ELODEMO.EXE, *.PIC, *.IMG, and *.BGI, typically found in the \TOUCH directory.

Previous Versions of MonitorMouse for DOS

If you have a previous version of MonitorMouse for DOS already installed (version 1.4x or earlier), you should delete it as it was previously installed in a separate directory (typically \MONMOUSE).

MonitorMouse for Windows

Delete CURSOFF.EXE and ELO.BMP from the \WINDOWS directory. Delete MONMOUSE.DRV, VMMD.386, ELOCALW.*, and OEMELO.INF from

\WINDOWS\SYSTEM. Delete the lines indicated by comments as added by Elo from your SYSTEM.INI file. Delete the [EloCalW] section from WIN.INI. Run Windows Setup and re-select your mouse.

All Elo Software

Delete the Elo directory (typically \TOUCH) and then follow the instructions above for deleting MonitorMouse for Windows if necessary. Remove any lines for ELODEV, MONMOUSE, NOMOUSE, and TCHBACK from AUTOEXEC.BAT as necessary.

DOS Demonstration Program

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-

INTRODUCTION

Included on the accompanying *DOS and Windows Driver Disk* is ELODEMO, a touchscreen demonstration program for DOS. ELODEMO has several sample applications, but its main purpose is to demonstrate the capabilities of the hardware.

Programmers: ELODEMO also demonstrates various user interface programming techniques. If you will be doing software development under DOS, see the *DOS Programmer's Toolkit*, available separately from Elo for technical details.

INSTALLATION

ELODEMO is installed with the INSTALL program on *the DOS and Windows Driver Disk* by choosing DOS Express Installation or Selective Installation. To conserve disk space, ELODEMO is *not* installed if you choose Windows Express Installation. You may choose later to install ELODEMO with Selective Installation.

ELODEMO requires a 286 computer or better with VGA graphics, approximately 400K of available RAM, and 1.7 Mbytes of hard disk space.

Included Files

The following files are typically installed in the \TOUCH directory:

ELODEMO.EXE	Demo program.
.PIC,.IMG	Screen images used by ELODEMO.EXE.
*.BGI	Video driver used by ELODEMO.EXE.

To delete the demonstration program from your hard disk after you have run it, see *Uninstalling the Software*, page 14.

RUNNING ELODEMO

To run ELODEMO, type:

```
ELODEMO [Enter]
```

typically from the \TOUCH directory. The main menu is shown in Figure 3-1.

Command Line Flags

Several flags are available when running ELODEMO.

To prevent the main menu from timing out to the DOS prompt after one minute of no activity, type:

```
ELODEMO -x
```

This flag is especially useful at trade shows. To exit, you must either press the [Esc] key or touch the *secret button* (extreme lower-left corner of the screen), then touch the normal "Stop Demo" button.

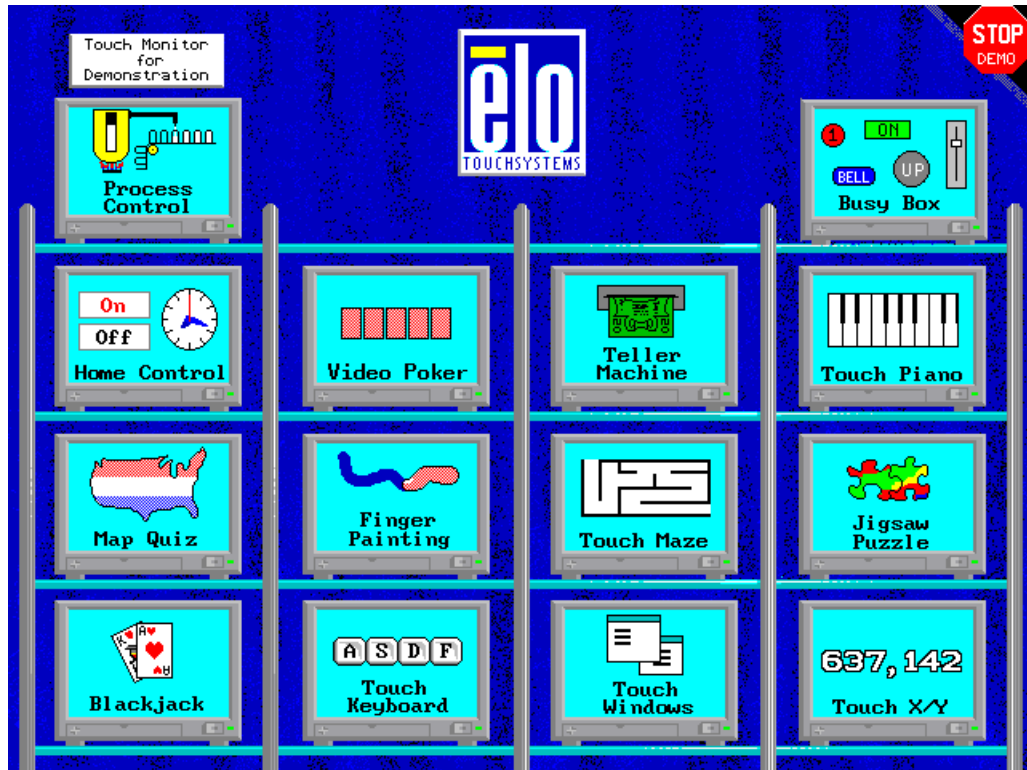


Figure 3-1. ELODEMO Main Menu

To prevent the various demos from timing out to the main menu, type:

```
ELODEMO -t
```

To customize your demo with a trade show or company name, use the `-c` flag. The text between the quotes can be up to 15 characters:

```
ELODEMO -c"<Name>"
```

Two other flags are available. The `-i` flag specifies which copy of ELODEV to use if multiple copies are loaded. For example:

```
ELODEMO -i62
```

See *Using Multiple Co-Resident Copies of ELODEV*, page 34, for more information.

The `-h` flag lists the available flags.

Flags may be upper or lower case. Multiple flags may be specified, separated by spaces. For example, to run ELODEMO at a trade show without any screen timing out, type:

```
ELODEMO -x -t
```

Demo Descriptions

The following is information on ELODEMO that may not be obvious.

Main Menu

This screen demonstrates a "secret zone". If the "-x" flag is used when running ELODEMO to prevent users from exiting to DOS, you must touch the extreme lower left corner of the screen, then touch the normal "Stop Demo" zone to exit. Secret zones may be used by applications to select diagnostic or set-up modes.

Process Control

This screen simulates a process or industrial control system. The screen appears to operate in *real time*, meaning it senses and reacts to data from on-line machinery. The object is to stabilize the system by making adjustments until the flashing warning messages are eliminated.

Adjusting the flame affects the temperature and pressure. The pressure release valve can be used to adjust the pressure in the tank. The bottles must be filled, but filling them too much will cause them to overflow. The tank must also be filled periodically. With IntelliTouch touchscreens, pressing the "Fill" button harder fills the tank faster.

The speed of the line can be adjusted, as well as halted with the "Stop" button. "Stop" and "Start" must be held continuously for five seconds before they will activate.

Busy Box

This screen demonstrates various types of buttons, slide switches, dials, pull-down menus, keypads, etc. If you have an IntelliTouch touchscreen, the Z-axis (pressure) is also demonstrated.

Map Quiz

Tests how well you can identify the states of the U.S. or the countries of Europe in this educational demo.

Touch each state or country as prompted. After 10 questions, your score will be displayed.

Studies have shown that scores are generally higher when computerized interactive training programs use a touchscreen. Other input devices detract from the lesson, while the touchscreen permits focused attention.

Stereo Unit

Touch the "Power" button to activate and quit the equalizer/spectrum analyzer.

It is easy to set all the levels at once. Simply slide your finger horizontally across all of the slide controls.

Finger Painting

This screen demonstrates the speed, resolution, and accuracy of Elo touchscreens. You can choose a color and thin or wide lines. With wide lines selected, the width of the line is based on the Z-axis if using an IntelliTouch touchscreen, or the speed of motion if using an AccuTouch touchscreen. The Erase button works like an erasure. The Clear button clears the whole screen.

Touch Keyboard

This screen demonstrates the feasibility of data entry using a touchscreen. While it is not always practical to replace standard keyboards with touchscreen keyboards, there are instances where a keyboard such as this may suffice for limited text entry.

Keys are only entered on *untouch*, (when you lift your finger), allowing for correction of missed touches. Using this software technique with a trained operator, keyboard screens can be made even smaller.

Do not touch "Shift" at the same time as a key. Touch "Shift", release, then touch the key to be shifted. Touchscreens cannot distinguish between two simultaneous touches.

This screen also demonstrates an implementation of touch timing. Hold your finger on a key and it begins to repeat. Continue holding and it repeats even faster.

Teller Machine

This screen simulates an Automated Teller Machine (ATM). It allows deposits, withdrawals, transfers, balance and check clearing inquiries.

The ATM demonstrates a public-oriented user interface. All such applications should use Point Mode, where the software acts immediately on touch-down and ignores all other touch data until untouch and retouch. Try touching a zone and holding it. The software highlights and beeps, waits half a second, then removes the highlighting. You must untouch before it will recognize another touch. Contrast this screen with the Keyboard demo which maintains the highlighting and acts only on untouch.

While the use of untouch in the keyboard demo allows a higher density of touch zones, it does require training, although only a few seconds worth. With the public, you do not have any opportunity for training. Because Point Mode is natural to use, public-oriented applications should be written using it.

Touch Piano

Play the piano right on the screen.

You cannot touch more than one note at a time.

Touch Maze

Find your way through this maze.

Touch "Start" and slide your finger down the paths. If you hit the hedges, slide back to the center of the path and continue. As you move through the maze, you leave behind footprints.

Black Jack

This demonstration simulates casino-style black jack.

Touch the stacks of chips to place your bet, up to \$200. As you touch the chips, they form new stacks. You may touch these stacks to reduce your bet. Touch "DEAL".

After the cards are dealt, touch "Hit," "Stand," or "Double". Splits and insurance are not implemented.

Touch "Wager" to play again.

Touch X,Y

This screen outputs the coordinates of your touch and demonstrates some of the modes the Elo drivers make available to programmers.

As you slide your finger around, coordinates are displayed. Initially you are in Untranslated Mode, meaning the coordinates are displayed as they are received from the touchscreen controller. Note they are unscaled and uncalibrated and the origin is in the upper left or lower right corner. Touch "Untranslated" to switch the driver into Translated Mode. Now the coordinates are adjusted by the driver to match the screen resolution. A cursor appears which can be moved to 10,10.

Stream Mode outputs coordinates continuously as long as the screen is touched. Point Mode only outputs a point when the screen is first touched. Point Mode with

Untouch Mode outputs two points for each touch—once when first touched, and once on untouch.

For more information on programming, see the *DOS Programmer's Toolkit*, available separately from Elo.

Jigsaw Puzzle

Solve a jigsaw puzzle.

Slide each piece into place. An audio signal indicates it is locked into its correct position. You may slide pieces on top of each other if you wish. Pieces cannot be rotated.

Touch Windows

This demo shows how windowing software can be implemented using a touchscreen.

Touch any of the overlay activation zones, labeled "Ovly1 - Ovly10". Each causes an overlay to appear. Multiple overlays are stacked. When an overlay is "opened", its "icon" disappears. Overlays are removed and returned to icon form by pressing "HIDE".

Overlays can be moved by touching their "MOVE" zone and sliding. You can also move them by touching their left, right, or bottom edges and sliding.

Overlays underneath can be brought to the top of the stack by moving them until part of the "TOP" zone is visible, and then touching that zone.

Within the overlay, there are three zones which make different tones. Slide your finger up and down over these zones. The selection is made on untouch.

Although this screen is in text mode, a graphical version would work identically.

Home Control

Shows how a home can be controlled using a touchscreen.

The main menu displays the status of the Security, Lighting, Heating, and Sprinkler systems, along with the current day and time. The current state of the device is displayed in the "ON/OFF" field in real time. Touching this area manually overrides the device.

Touching the name of a device displays a screen with two analog clocks - one for the start time and one for the end time. Move the hands on the clock simply by

sliding them, as you would set the time on a grandfather clock. As you move the minute hand, the hour hand and AM/PM will change appropriately. You may also move the hour hand and touch "AM" or "PM" directly. Note the On Time selected is displayed. Next, toggle each day of the week you want the device to be activated. Finally, touch "Accept" or "Cancel".

Touch the clock on the main screen to set the time. (The system day and time are not affected). The clock is enlarged to facilitate the use of the techniques described above.

You may spin the hands of the clock quickly by circling close to the center point. To move the minute hand with the greatest precision, drag it at the outer edge of the clock, or even slide beyond the clock's perimeter.

If the minute hand is aligned with the hour hand, touching the hour hand selects it. Touching beyond its length selects the minute hand.

HOW ELODEMO WAS CREATED

ELODEMO was written in Borland Pascal. The graphics screens were developed with various painting programs. The Elo TouchUp touch zone definition utility was also used, which is included in the *DOS Programmer's Toolkit*, available separately from Elo.

DOS Touchscreen Driver and Calibration Utility

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- *Compatibility 26*
- *Installation 26*
- *ELODEV 27*
- *ELOCALIB 35*

INTRODUCTION

Included on the accompanying *DOS and Windows Driver Disk* are ELODEV™ and ELOCALIB, a touchscreen driver and calibration utility for DOS.

Who Should Use ELODEV and ELOCALIB

ELODEV makes all Elo touchscreens and controllers look the same to application programs or other drivers. ELODEV is required by the MonitorMouse for DOS, MonitorMouse for Windows, and TouchBack drivers. See Chapters 5, 6, and 7 respectively. In addition, some applications are specially written for direct interaction with ELODEV rather than using a mouse interface. Your application documentation should specify if only ELODEV is required.

The ELOCALIB utility is run automatically during the calibration step of the installation process. You may run it again as required. ELOCALIB is used only with DOS programs as MonitorMouse for Windows has its own calibration program.

Programmers: When developing new touchscreen applications, ELODEV is the most efficient driver to use when mouse emulation is not a requirement. *The DOS Programmer's Toolkit*, available separately from Elo, includes *the ELODEV Programmer's Reference* and *TouchUp User's Guide*. These manuals define the application programming interface (API) for the ELODEV driver and the touch zone definition utility. Sample source code is included in C, Pascal, BASIC, and assembly language.

COMPATIBILITY

The ELODEV touchscreen driver is compatible with all Elo touchscreens and controllers. See *Touchscreens and Controllers Supported*, page 4, for a complete list.

ELOCALIB supports calibration in text mode, CGA, EGA, VGA, and VESA-compatible SVGA graphics modes.

INSTALLATION

ELODEV.EXE and ELOCALIB.EXE are installed by the INSTALL program described in Chapter 2 if you choose DOS Express Installation, Windows Express Installation, or Selective Installation. They are typically copied to the \TOUCH directory.

The rest of this section describes the details of loading ELODEV and using ELOCALIB, including the command line structure and optional flags. Typically, you will not need to read this chapter. If you have problems with an ELODEV installation, see Appendix B—*Troubleshooting*.

ELODEV

Placement in AUTOEXEC.BAT

The ELODEV command line is placed in AUTOEXEC.BAT by the INSTALL program. ELODEV.EXE is a terminate-and-stay-resident (TSR) program and must be installed before any other Elo driver, including MonitorMouse for DOS (MONMOUSE.COM) and TouchBack (TCHBACK.EXE). ELODEV occupies about 6K of system RAM when loaded.

ELODEV Command Line

The ELODEV command line includes controller parameters and flags. These include the type of touchscreen controller, where/how it is connected, and the calibration values. A sample ELODEV command line is shown below:

```
C:\TOUCH\ELODEV 2201,280,5 -C722,3587,3319,841,1,15
```

By keeping these *hardware-dependent* parameters outside the application program, the application can be *hardware-independent* and therefore will work with any Elo touchscreen and controller configuration.

The INFO program (see page 108) can be used to easily display the current ELODEV parameters.

The controller parameters may be changed by running the SETUP program (see page 14), or use your system editor to manually make the changes.

The calibration values (-c flag) are initially placed on the ELODEV command line by ELOCALIB during the installation process. Recalibrating with ELOCALIB will update these values. Because the ELODEV command line includes calibration values, the touchscreen will not need to be calibrated each time the system is started.

ELODEV Command Syntax

ELODEV ignores spaces and tabs when scanning the command line. Flags consist of a hyphen and a letter, in upper or lower case. Multiple flags may be specified, separated by spaces. You may find it useful to include a comment at the end of the command line, preceded by a semicolon:

```
C:\TOUCH\ELODEV 2201,280,5 -C722,3587,3319,841,1,15 -I64 ;touchscreen driver
```

One of the following three command formats is used, depending on the type of controller.

Serial Controllers

Command format:

ELODEV <controller>,<COM port>,<baud rate>

where <controller> is:

2300 for the IntelliTouch E281-2300 controller.
4002 for the IntelliTouch E281{A}-4002 controller.
2210 for the AccuTouch E271-2210 controller.
2200 for the AccuTouch and DuraTouch E271-2200 controller.
140 for the AccuTouch E271-140 controller.
280 for the DuraTouch E261-280 controller.

<COM port> is 1 or 2, matching the COM port where the serial output of the touchscreen controller is connected.

<baud rate> matches the switch or jumper settings on the controller.

For example,

ELODEV 4002,1,9600

It is not necessary to use the DOS MODE command to configure the communications parameters of the COM port used by ELODEV.

NOTE

If you want to use ELODEV with a serial touchscreen controller installed on a serial port other than COM1 or COM2, you must supply custom code to do so. See the SetUserCom function in the ELODEV Programmer's Reference for more information. You may also consider using a PC-Bus controller.

PC-Bus Controllers

Command format:

ELODEV <controller>,<Base I/O Port (hex)>,<IRQ>

Where <controller> is:

4035 for the IntelliTouch E281-4035 controller.
4025 for the IntelliTouch E281{A}-4025 controller.
2201 for the AccuTouch and DuraTouch E271-2201 controller.
141 for the AccuTouch E271-141 or DuraTouch E271-142 controller.

<Base I/O Port> matches the jumper settings on the controller.

<IRQ> matches the interrupt jumper on the controller. (The IRQ for the E271-2201 controller is software selected by the ELODEV command line rather than with a jumper.)

For example,

```
ELODEV 2201,280,5
```

Micro Channel Controllers

Command format:

```
ELODEV <controller>
```

Where <controller> is:

2202 for the AccuTouch and DuraTouch E271-2202 controller.

The Base I/O Port and IRQ are software selected using the Reference Disk. See *Controller Installation*, page 90.

Command Line Flags

A number of flags can be specified on the ELODEV command line:

-c<xl,xh,yl,yh,zl,zh>	Calibration points.
-s<+/->	X,Y axes swapping.
-i<interrupt>	Software interrupt.
-w<ms>	Untouch wait time.
-p<+/->	Program the controller.
-h	Display quick reference information.

An additional flag allows you to remove ELODEV from memory if it is no longer needed:

-x	Extract ELODEV.
----	-----------------

Other flags may be required as described by the application program documentation.

Calibration Points Flag (-c)

This flag specifies the Calibration Points:

`-c<XLow,XHigh,YLow,YHigh,ZLow,ZHigh>`

The coordinates are specified in decimal.

Purpose

Calibration tells ELODEV the position and size of the video image in relation to the touchscreen. This relationship varies not only between monitors, but also with monitor adjustment. Only by knowing the position of the image can ELODEV and the application software locate the user's touch. The need for calibration is discussed at length in Chapter 2.

How the Calibration Points Are Determined

The ELOCALIB program is typically used to acquire the calibration points and place them on the ELODEV command line in AUTOEXEC.BAT. (Sometimes an application will include its own calibration program or procedure. See your application documentation for details.) ELODEV then uses these calibration points to map touch coordinates from the controller to screen coordinates. ELODEV or the application program further maps the screen coordinates into valid touch zones or on-screen buttons.

Hardware Axis Inversion

The calibration process used by ELOCALIB also forces the default origin to be the upper-left corner. Because the touchscreen typically has its origin in the lower-left corner, it is normal for ELOCALIB to indicate the Y (vertical) axis is being inverted. If the touchscreen is installed on the CRT face rotated 180°, ELOCALIB will indicate the X (horizontal) axis is being inverted.

Z-Axis Calibration

To insure compatibility, Z-Axis Calibration Points are required even for controllers that only operate in two dimensions. In this case, any values may be used for ZLow and ZHigh, such as 0,0 or 1,15.

When using an IntelliTouch controller, the Calibration Range for Z is actually a *sensitivity range*. Values of 1,15 or 1,255 are normally used for ZLow,ZHigh, since these ranges match the values returned by the controller.

This range can be decreased if the application requires fewer levels of Z. Before Z scaling occurs, the value of Z returned by the controller is pushed within the Calibration Points. For example, if ZHigh is reduced to 10, all touches harder than

10 will be reported as having a value of 10. Likewise, when ZLow is increased to 5, all lighter touches will be reported as having a value of 5.

X,Y Axes Swapping Flag (-s)

This flag can be used to swap the X and Y axes to correct touchscreens rotated 90° or with reversed cables:

`-s<+ / >`

where -s+ swaps X and Y, and -s- does not. Omitting the -s flag is the same as specifying -s-.

ELOCALIB automatically adds or removes the -s flag on the ELODEV command line in AUTOEXEC.BAT. The -s- flag should only be required with some DuraTouch controller installations.

Software Interrupt Flag (-i)

This flag specifies the software interrupt MonitorMouse for DOS, TouchBack, or your application program uses to access ELODEV functions:

`-i<n>`

where <n> is specified in hex. The default interrupt is 65. Any interrupt from 30 to FF inclusive may be specified. ELODEV does not check to insure that the vector is not in use.

All Elo software, including ELOCALIB, ELODEMO, INFO, MonitorMouse for DOS, and TouchBack, supports the -i flag. If no -i flag is specified, these programs check only interrupts 60-66 looking for ELODEV. These interrupts are recommended for most applications because DOS reserves them for user programs (see an IBM Technical Reference Manual).

If you suspect a conflict with another TSR program, you can try using the -i flag to specify another software interrupt for ELODEV, usually 60-66. Once ELODEV is installed, the software interrupt can be changed only by extracting ELODEV (see -x flag, page 33) and reinstalling it with a new interrupt specified.

Programmers: Avoid using -i60 with Turbo/Borland C, Pascal, and Debugger.

Untouch Wait Time Flag (-w)

This flag specifies the Untouch Wait Time (also called Wait Time):

`-w<n>`

where <n> is the time (in milliseconds) required before the program recognizes an *untouch* (lifting of the finger). The default Wait Time will vary depending on the controller.

When Required

The Wait Time flag is not normally required, since the default should be enough time for most applications. However, if the touchscreen is transmitting data at a slower than normal rate, the Wait Time may need to be increased to eliminate false untouches. You can test for this condition with the TOUCHES utility, see page 111.

Conditions which may require this flag include:

- Using 16 inch or larger IntelliTouch touchscreens if the controller firmware revision level is prior to 2.2. (The IntelliTouch firmware revision level is displayed when ELODEV is loaded, unless it is prior to 2.2). Try -w90.
- Using a serial controller at a baud rate slower than the one recommended on the controller data sheet in Appendix A.
- When the controller must perform extra samples due to an environment of extreme electrical noise.

In the latter three cases, display the default Wait Time with the INFO utility (see page 108), then increase it until TOUCHES no longer indicates false untouches.

Program the Controller Flag (-p)

This flag selects whether to query and/or program the controller with software setup information when ELODEV is loaded. This flag is ignored with controllers that do not use two-way communication. -p+ is the default.

`-p<+ / >`

If -p- is specified, ELODEV will not communicate with the controller during installation. The -p- flag is useful if there can only be one-way communication with the controller, as when all serial port output must be rerouted to another device, such as a display. It may also be required if the RS-232 handshaking lines are not connected.

Specifying `-p+` is useful only after ELODEV is installed. It uses the original ELODEV parameters to determine if and how the controller should be reprogrammed. Use the `-i` flag if ELODEV is not at the default software interrupt (65 hex). For example,

```
ELODEV -p+ -i62
```

The `-p+` flag will also re-display the controller firmware revision level and other information.

The `-p+` flag with an E261-280 controller also functions like the DURASET program from ELODEV versions before 1.4.

Extract Flag (-x)

Use the `-x` flag to extract ELODEV from memory if it is no longer needed:

```
ELODEV -x
```

Note that no controller information is specified.

If an error message indicates it cannot be extracted, a TSR loaded after ELODEV.EXE may be interfering with its extraction. Generally you should extract TSR's in the reverse order from which they were loaded.

If ELODEV is installed at a software interrupt other than the default (65 hex), include the `-i` flag:

```
ELODEV -x -i61
```

The `-i` flag is the only one that has any effect when used with the `-x` flag.

ELODEV can be extracted and reinstalled to change the `-i` flag.

Help Flag (-h)

At any time you may type:

```
ELODEV -h
```

or just:

```
ELODEV [Enter]
```

to display the ELODEV version number, command line syntax, and lists of supported controllers and flags.

Updating Flags

ELODEV may be re-run to modify the settings of a previously installed copy. For example:

```
ELODEV -w90
```

Note that no controller information is specified.

Only the -c, -s, -w, and -p flags can be changed using this method. To change the -i flag, extract and reinstall ELODEV as explained above.

If ELODEV is installed at a software interrupt other than the default, include the -i flag:

```
ELODEV -w90 -i61
```

You can use the INFO.EXE utility (typically in \TOUCH) to confirm the updated settings. See page 108.

Using Multiple Co-Resident Copies of ELODEV

Multiple copies of ELODEV are useful if the application program controls multiple touchscreens, or if the application is being tested with different controllers and/or configurations.

Install each copy of ELODEV using a different software interrupt flag (-i<n>, see page 31). Each copy of ELODEV must have its own calibration values. Use ELOCALIB -i<n> to calibrate a specific copy of ELODEV. ELOCALIB will correctly update calibration data in your AUTOEXEC.BAT file even if multiple copies of ELODEV are loaded there.

INFO, ELODEMO, MonitorMouse for DOS, and TouchBack all support the -i flag to specify the copy of ELODEV they should use. If you do not specify the -i flag, the first ELODEV found while scanning interrupts 60 66 (in that order) will be used.

ELOCALIB

ELOCALIB.EXE measures the touch coordinates of known points near the outside edges of the video image, and stores these calibration points for later use. If you elect to store these points in AUTOEXEC.BAT when so prompted, ELODEV uses them to automatically calibrate each time you reset the system.

To run ELOCALIB, type the following (typically from the \TOUCH directory):

```
ELOCALIB [Enter]
```

You will see a menu listing the video modes supported by your video card, such as shown in Figure 4-1. SVGA modes will only be listed if you have a VESA-compatible video card or video driver. Use the arrow keys to select the video mode used by your application. For example, if your application runs in 80x25 text mode, calibrate in 80x25 mode even if your system is capable of VGA graphics. Press [Enter].

The video will switch into the selected mode (unless it is not supported). Follow the on-screen instructions to calibrate the screen. When you return to the menu, the calibration points will be displayed. X or Y axis inversion is normal for most touchscreens. Press [S] to save the calibration points.

ELOCALIB 1.6 - Copyright 1987-1994 Elo TouchSystems, Inc.					
Mode	Description	Resolution	Colors	XLow XHi	YLow YHi ZLow Zhi
01	CGA Text	40 x 25	16 Colors		
03	CGA Text	80 x 25	16 Colors		
04	CGA Graphics	320 x 200	4 Colors		
06	EGA Graphics	640 x 200	2 Grays		
0D	EGA Graphics	320 x 200	16 Colors		
0E	EGA Graphics	640 x 200	16 Colors		
10	EGA Graphics	640 x 350	16 Colors		
11	VGA Graphics	640 x 480	2 Colors		
12	VGA Graphics	640 x 480	16 Colors		
13	VGA Graphics	320 x 200	256 Colors		
0100	VESA Graphics	640 x 400	256 Colors		
0101	VESA Graphics	640 x 480	256 Colors		
0102	VESA Graphics	800 x 600	16 Colors		
0103	VESA Graphics	800 x 600	256 Colors		
0104	VESA Graphics	1024 x 768	16 Colors		
0108	VESA Text	80 x 60	16 Colors		
0109	VESA Text	132 x 25	16 Colors		
010A	VESA Text	132 x 43	16 Colors		
Touchscreen orientation:					
Use [-][_] keys to select mode and [Enter] to calibrate.					
[S] to Save points in file or AUTOEXEC and quit ELOCALIB. [Esc] to abort.					

Figure 4-1. ELOCALIB Video Mode Menu

Calibrating in Multiple Video Modes (ELOGRAPH.CAL)

Most applications use only one video mode, and that is the mode you should calibrate in. If your application uses multiple video modes, the extremes of the display area may change with the mode switches. Some monitors allow the images to be aligned with separate adjustments for each mode. However, other monitors will require different calibration points for each mode.

Do the best you can with the available monitor controls. Try to make the video image as large as possible, and be sure to check the size and position of each mode again before calibrating in the modes you use. The most commonly used video mode should be calibrated last. The points for this mode will also be stored on the ELODEV command line with the -c flag.

ELOCALIB can store calibration points for multiple video modes in a file (typically ELOGRAPH.CAL). MonitorMouse for DOS will use ELOGRAPH.CAL to automatically stay in calibration with mode changes (see -d flag, page 49). Other applications must be specifically programmed to read ELOGRAPH.CAL, such as ELODEMO.

Command Line Flags

ELOCALIB supports several command line flags. Flags consist of a hyphen and a letter, in upper or lower case. Multiple flags may be specified, separated by spaces.

Video Mode(s) Flag (-m)

Use:

```
ELOCALIB -m<n1>[,<n2>...]
```

where <n1>,<n2> are video mode(s) to calibrate (in hex). If no -m flag is given, ELOCALIB provides a menu of modes to choose from.

Save Points in File Flag (-s)

Use:

```
ELOCALIB -s<+/->[,<FileName>]
```

to save (-s+) or not save (-s-) the calibration points in a file without prompting. If a <FileName> is not specified, the default is ELOGRAPH.CAL in the current directory.

Update AUTOEXEC Flag (-u)

Use:

ELOCALIB -u<+/->[,<FileName>]

to update (-u+) or not update (-u-) the ELODEV command line in AUTOEXEC.BAT with the calibration points (-c flag, page 30). Another batch file containing the ELODEV command line may be specified with <FileName>.

Quick Calibration Flag (-q)

Use:

ELOCALIB -q

in combination with the -s and -u flags to allow the whole calibration/ save/update process to be performed without any keystrokes.

Software Interrupt Flag (-i)

Use:

ELOCALIB -i<n>

where <n> specifies the software interrupt of ELODEV (in hex). This flag is particularly useful when multiple copies of ELODEV are loaded. See *Using Multiple Co-Resident Copies of ELODEV*, page 34. When ELOCALIB updates the AUTOEXEC file, it will update only the appropriate ELODEV command line.

If using a monochrome and color monitor on the same system, use the DOS MODE command (MODE MONO or MODE CO80) to switch to the appropriate monitor before calibrating.

Set Calibration From File Flag (-c)

Use:

ELOCALIB -c<n>[,<FileName>]

to calibrate a loaded ELODEV using calibration points from an existing calibration file. If <FileName> is not specified, ELOGRAPH.CAL in the current directory is assumed. <n> is the video mode in hex.

Language Flag (-L)

Same as INSTALL program, see page 11.

Help Flag (-h)

Type:

ELOCALIB -h

to display quick reference information on all flags and the current version of ELOCALIB.

Examples

ELOCALIB Provides a menu of video modes to calibrate in (see Figure 4-1, page 35). You are prompted to save the points in a calibration file and/or update your AUTOEXEC.BAT file.

ELOCALIB -m13 -s- -u- -q Calibrates ELODEV for video mode 13 hex only and does not save the points in a calibration file, does not update AUTOEXEC.BAT, and does not wait for a keypress before calibration begins.

ELOCALIB -m3,13 -s+ Calibrates in modes 3 and 13 hex and saves the points in ELOGRAPH.CAL in the current directory. ELODEV is calibrated in the last mode listed with the -m flag. You will be prompted to update AUTOEXEC.BAT.

ELOCALIB -c10 Calibrates a loaded ELODEV for video mode 10 hex with the points found in ELOGRAPH.CAL in the current directory.

Calibration Point Ordering

After the touchscreen has been calibrated, ELOCALIB displays the calibration points in the order XLow, XHigh, YLow, YHigh, ZLow, ZHigh. The Z values are constants defined in the ELOCALIB source code but may be manually changed to set a sensitivity range (see *Z-Axis Calibration*, page 30).

These six points are the same points required by the ELODEV -c flag. If the proper video mode is calibrated, these points will be consistent with MonitorMouse for Windows, MonitorMouse for OS/2, and MonitorMouse for Windows NT.

Point Extrapolation

You may have noticed ELOCALIB does not acquire its calibration points in the corners of the video image. The points are taken a little in from the edges, then extrapolated to achieve an estimated value at the edges. This is because the image on many monitors is not very linear, and usually least linear in the corners, due to the pin cushion effect. By acquiring calibration points near the edges instead of at the edges, more of the video will be closely calibrated with the touchscreen.

Third Point

The third calibration point is used strictly for detecting swapped axes. Your touch does not have to be as precise for this point.

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-

INTRODUCTION

Included on the accompanying *DOS and Windows Driver Disk* is MonitorMouse® for DOS, a touchscreen driver which emulates the Microsoft mouse driver under DOS. You will be able to run most existing DOS mouse-driven applications and off-the-shelf software without modification using an Elo touchscreen.

With MonitorMouse for DOS, the touchscreen may be used alone, or in conjunction with any mouse. Various *mouse button emulation modes* are supported providing options on how button clicks are simulated. You can choose the best mode for your application, and change between modes at any time.

MonitorMouse for DOS works with MonitorMouse for Windows to allow this same flexibility in Windows as well as DOS programs run from Windows. See Chapter 6 for information on MonitorMouse for Windows.

Who Should Use MonitorMouse for DOS

MonitorMouse for DOS is recommended when converting existing DOS mouse-driven applications to touch, and for applications that will support both a mouse and a touchscreen.

Programmers: MonitorMouse for DOS is not necessarily recommended for new DOS applications, unless they must also support a mouse. By emulating the mouse buttons, you may be adding extra complexity to your user interface, and sacrificing the naturalness and effectiveness possible with a pure touch interface. When writing new DOS applications, you may choose to call ELODEV directly for maximum efficiency, or use Elo's TouchBack keystroke emulation driver. See the *DOS Programmer's Toolkit*, available separately for more information.

COMPATIBILITY

Applications using only the left button will be the easiest to use with the touchscreen.

Because MonitorMouse for DOS uses ELODEV, the Elo touchscreen driver program, your application will be compatible with all Elo touchscreens and controllers. Because MonitorMouse for DOS can also use the mouse driver supplied with your mouse (MOUSE.COM or MOUSE.SYS), you will be able to use any brand of mouse in conjunction with the touchscreen.

Coordinates vs. Mickeys

All mouse-driven applications that ask the mouse driver for coordinates (*absolute position*) rather than mickeys (*relative motion*) will work with MonitorMouse for DOS. Most applications, including all Microsoft Windows applications, use coordinates and therefore will work immediately with the touchscreen.

The best way to know if your application will work with MonitorMouse for DOS is to try it. The cursor should jump to your fingertip with each touch as it does with the DOS 6.x EDIT program.

MonitorMouse for DOS does its best to emulate relative motion, but good results are not guaranteed. If your application moves the cursor or high-lighting without informing the mouse driver, MonitorMouse for DOS will not be able to determine the distance from a touch to the cursor. Knowing this distance is critical for simulating that motion with mickeys.

If your DOS application is relative motion-based, you will have to slide the cursor to the desired location (as you would with a mouse) rather than just touching the

desired area. Try choosing a mouse button emulation mode (-m flag) where the cursor can be slid before clicking (see page 47). Use in combination with the -j flag (see page 50). The cursor may not track with your finger because of the application's mickey-to-pixel ratio and/or acceleration or ballistic algorithms. The -r flag (see page 50) can be used to set a non-standard mickey-to-pixel ratio, but motion algorithms used by the application or driver are unknown and cannot be simulated. If the application does not move the cursor and it does not use any motion algorithm, it may then be possible to have the cursor jump to your fingertip with the -j+ flag.

Alternatively, find out from the developer if the application or library can also operate in an absolute mode. Sometimes a set-up parameter or flag can be used, or a different input device specified during installation which also emulates the mouse. Also, see the following section *Light Pen Emulation*.

Programmers: If you are the developer of the relative motion-based application, you may be able to modify it to use coordinates rather easily. Typically, mickeys are used only because properly scaled coordinates are not available in video modes unsupported by MOUSE.COM. However, if you use mouse functions 7 and 8, (see *Microsoft Mouse Programmer's Reference*), you can force both the mouse driver and MonitorMouse for DOS to scale to any resolution, such as 800x600. If you make this change to use absolute coordinates, you can discard the mickey-to-pixel conversion code in your application and let the mouse driver do it.

Light Pen Emulation

MonitorMouse for DOS can emulate BIOS light pen functions in text mode. Applications written for a light pen can be used with the touchscreen.

This feature may be useful even if you have never used a light pen. If your DOS application does not work well with MonitorMouse for DOS because the cursor does not stay under your finger, (the application uses the mouse in relative mode), and the application supports light pens as an input device, select "light pen" as the input device and try it again with MonitorMouse for DOS.

INSTALLATION

MonitorMouse for DOS is installed by the INSTALL program described in Chapter 2. Choose DOS Express Installation, Windows Express Installation, or Selective Installation.

The rest of this section describes the details of the installation. Typically you can skip to *Mouse Button Emulation Mode Flag (-m)*, page 47. If you have problems with a MonitorMouse for DOS installation, also see Appendix B—*Troubleshooting*.

Included Files

The following files are typically installed in the \TOUCH directory:

MONMOUSE.COM	MonitorMouse for DOS driver.
NOMOUSE.COM	Elo's MOUSE.COM-compatible driver for operation without a mouse.
PATCHMSE.EXE	Patches MOUSE.COM for operation without a mouse. Alternative to using NOMOUSE.COM.
TUTORIAL.EXE	Tutorial program for practicing with mouse button emulation modes.

Placement in AUTOEXEC.BAT

The MonitorMouse for DOS command line is placed in AUTOEXEC.BAT by the INSTALL program. MONMOUSE.COM is a terminate-and-stay-resident (TSR) program. A portion of a sample AUTOEXEC file is shown below:

```
MOUSE ; mouse driver
C:\TOUCH\ELODEV 2201,280,5 -C722,3587,3319,841,1,15 ; touchscreen driver
C:\TOUCH\MONMOUSE -M6 ; MonitorMouse for DOS
```

Your mouse driver and the ELODEV touchscreen driver must be loaded before MonitorMouse for DOS. MONMOUSE occupies about 4K of system RAM when loaded and ELODEV about 6K. MONMOUSE requires a loaded mouse driver.

If you do not have a mouse connected, NOMOUSE will be used in place of your mouse driver as in the following example. See the next section, *Using MonitorMouse Without a Mouse*, for more information.

```
C:\TOUCH\NOMOUSE ; NOMOUSE driver
C:\TOUCH\ELODEV 2201,280,5 -C722,3587,3319,841,1,15 ; touchscreen driver
C:\TOUCH\MONMOUSE -M6 ; MonitorMouse for DOS
```

Later, if you reconnect a mouse, replace NOMOUSE.COM with your original mouse driver.

If you will be connecting and disconnecting your mouse you can place MOUSE and NOMOUSE in your AUTOEXEC file. NOMOUSE will not load if it sees a mouse driver. A trick to prevent the warning message output by NOMOUSE is shown in the following example:

```

MOUSE                                     ; mouse driver
IF ERRORLEVEL 0 GOTO :OK                 ; if loaded OK, skip NOMOUSE
C:\TOUCH\NOMOUSE                          ; load NOMOUSE if no MOUSE
:OK
C:\TOUCH\ELODEV 2201,280,5 -C722,3587,3319,841,1,15 ; touchscreen driver
C:\TOUCH\MONMOUSE -M6                    ; MonitorMouse for DOS

```

NOTE

MonitorMouse for DOS will only be active while mouse-driven applications are running. Therefore, MonitorMouse for DOS will not conflict with touchscreen applications that do not use it. Because MonitorMouse for DOS takes over ELODEV when it becomes active, a single program should not make both mouse and ELODEV or TouchBack calls.

If you have both MonitorMouse for DOS and TouchBack loaded, TouchBack applications should call the ENABLE command at start-up, and DISABLE before exiting. MonitorMouse for DOS or TouchBack may also be extracted from memory when not in use.

Using MonitorMouse Without a Mouse

MonitorMouse for DOS requires a mouse driver to supplement some of its functions. Therefore, MONMOUSE.COM will not load unless it detects a loaded mouse driver. However, most mouse drivers will not load unless they detect a mouse.

There are two ways to load a mouse driver without a mouse connected.

Using NOMOUSE.COM

If a DOS mouse driver was not detected by the INSTALL program, NOMOUSE.COM was placed in your AUTOEXEC.BAT file. NOMOUSE.COM is a TSR program. It occupies only about 600 bytes of system RAM when loaded, as opposed to over 16K for most current mouse drivers, and does not affect the use of any serial ports or hardware interrupts.

NOMOUSE.COM does not contain code to display a mouse cursor. However, a cursor will still be displayed in Windows and when running DOS programs that draw their own cursor. With most dedicated touchscreen applications, a cursor is not required anyway. In fact, a cursor may distract the user because their eyes will be drawn to the cursor instead of focusing on the entire image.

If you require a cursor and one is not being displayed, see *Using PATCHMSE.EXE* below.

Command Line Flags

NOMOUSE.COM supports two command line flags. Flags consist of a hyphen and a letter, in upper or lower case:

```
NOMOUSE {-x | -h}
```

where:

```
-h    displays these flags  
-x    extracts NOMOUSE.COM from memory
```

If an error message is displayed when using the -x flag indicating NOMOUSE.COM cannot be extracted, a TSR loaded after it may be interfering with its extraction. Generally you should extract TSR's in the reverse order from which they were loaded.

Using PATCHMSE.EXE

You may also create your own version of NOMOUSE.COM by patching your MOUSE.COM so it will install without detecting a mouse. A patched mouse driver will display a mouse cursor in DOS programs.

To patch your mouse driver, use the PATCHMSE.EXE utility installed by the *DOS and Windows Driver Disk* INSTALL program. First, change into the directory where your MOUSE.COM is located, then run PATCHMSE specifying its path. For example,

```
\TOUCH\PATCHMSE
```

The program will list the versions of MOUSE.COM it knows how to patch. Select the version you have, or abort the program if your mouse driver is not listed. PATCHMSE will make a patched copy of the driver called NOMOUSE.COM. If the version of MOUSE.COM does not match the version you specified, the driver will not be patched.

Next, change your AUTOEXEC.BAT file to load the NOMOUSE.COM you just created instead of MOUSE.COM (or the NOMOUSE.COM used by the Elo INSTALL program).

NOTE

To find out the version of your mouse driver, install it and read its sign-on message. The company (e.g. Microsoft, Logitech) and version number are usually displayed.

If PATCHMSE does not list your version, try to locate a copy of one supported. MOUSE.COM may be found in the \MOUSE, \DOS, or \WINDOWS directory. It may also be found on the Microsoft Windows release disks, although it may be in a compressed form. See the README.MMW file for uncompressing instructions.

COMMAND LINE FLAGS

MonitorMouse for DOS supports several command line flags. Flags consist of a hyphen and a letter, in upper or lower case. Multiple flags may be specified, separated by spaces.

MONMOUSE [Flag(s)]

where [Flag(s)] are:

-m<mode>	Mouse button emulation mode 0-6.
-c<+/->	Mouse cursor on/off.
-b<+/->	Beeps on/off.
-d<directory>	Path where ELOGRAPH.CAL is found.
-r<x>,<y>	Default mickey/pixel ratio.
-j<+/->	Jump/don't jump to touch with mickeys.
-s<+/->	Emulation active/inactive in spawned programs.
-t<+/->	Emulation active/inactive after program terminations.
-i<interrupt>	Software interrupt of ELODEV (hex).
-x	Extract MonitorMouse for DOS from memory.
-h	Display quick reference information.

For example:

MONMOUSE -m6 -c-

No flags are required for use with MonitorMouse for Windows, as its options are set with the Touchscreen Control Panel. However, DOS programs run from Windows will use the defaults set by these flags.

Mouse Button Emulation Mode Flag (-m)

Four *mouse button emulation modes* are supported. (Three additional modes are available for backwards compatibility but are no longer documented). The modes

vary in the button actions they support (clicking, dragging, double-clicking). The modes are the same as in MonitorMouse for Windows and all other versions of MonitorMouse. You should choose the *simplest* mode that will work for your application. A Tutorial program is included for practicing with each mode (see page 53).

Mode 0 Left button clicking only. No dragging or right button is supported. Works with large targets. Recommended for public kiosk applications.

Moves the cursor to your point of touch and "clicks" the left button. A beep will confirm the click. The cursor will not move, nor will any other clicks be simulated until your finger is lifted and the screen retouched.

Mode 1 Left button clicking only. No dragging or right button is supported. Works with large and small targets.

The cursor follows your sliding finger and the left button is clicked at the point of *untouch* (lift-off).

Mode 5 Left button clicking and dragging. No right button is supported.

The left button is held down when you touch the screen, and it stays down until you untouch, dragging as you move.

Mode 6 Same as Mode 5, but supports double-clicking by tapping twice. Recommended for general use.

If the second touch occurs immediately after the first and is nearby, a double-click will be simulated at the exact point of the first touch. If you do not hear two beeps, you have tapped too fast.

Mode 0 is the default if no flag is specified. The INSTALL program adds the -m6 flag if MonitorMouse for Windows was also installed.

Cursor Flag (-c)

The mouse cursor can be turned on and off with the cursor flag (-c+ and -c- respectively). With most dedicated touchscreen applications, a cursor is not required. In fact, it may distract the user because their eyes will be drawn to the cursor instead of focusing on the entire image.

This flag will have no effect if the application draws its own cursor, uses a cursor bar or highlighting rather than a cursor, or in some windowed application environments, including Microsoft Windows. In Windows, use the Touchscreen

Control Panel to turn off the cursor (see page 61). The default for the cursor flag is on (-c+).

Beep Flag (-b)

Normally MonitorMouse for DOS gives a "click" sound for each touch. The beep flag may be used to disable the beeps (-b-).

Because the touchscreen does not have the tactile feedback of a mouse button, audible feedback helps to confirm your action. The default for the beep flag is on (-b+).

Calibration File Directory Flag (-d)

This flag specifies a path where the file ELOGRAPH.CAL is found. For example,

```
MONMOUSE -m6 -dC:\MYCAL
```

ELOGRAPH.CAL is produced by ELOCALIB.EXE, and contains a list of calibration points for each video mode used. MonitorMouse for DOS will automatically recalibrate itself using the values from ELOGRAPH.CAL as you switch video modes. When MonitorMouse for DOS is not active, the original calibration points are restored.

When MonitorMouse for DOS is installed, it looks for ELOGRAPH.CAL in the directory where MONMOUSE.COM is (typically \TOUCH), then the current directory, unless specified otherwise with the -d flag. If this flag is not specified, and ELOGRAPH.CAL is not found in the default directories, MonitorMouse for DOS uses ELODEV's calibration for all video modes. If ELOGRAPH.CAL is loaded, and your application uses a video mode not listed in the file, MonitorMouse for DOS will use the calibration values of the closest video mode, or the default calibration.

If you are using MonitorMouse for Windows, the Touchscreen Control Panel will allow calibration in the video mode used by Windows, even if the mode is not supported by ELOCALIB.

Mickey/Pixel Ratio Flag (-r)

This flag specifies the default "mickey-to-pixel ratio" for horizontal and vertical motion. A "mickey" is a unit of distance, typically 1/200 of an inch. Consequently, the mickey/pixel ratios specify how far the mouse must move for the cursor to move a given number of pixels. Because MonitorMouse for DOS uses absolute positioning rather than relative motion, your finger may appear out of calibration when using certain programs which use mickeys rather than coordinates. This flag can help you correct the pixel-to-mickey calibration.

The -r flag is required with some mickey-based (relative motion) programs. Specifically, it is needed only if *all* the conditions below are true:

- The program uses motion from the mouse driver rather than coordinates.
- The program draws its own cursor or cursor bar.
- The program performs its own mickey-to-pixel conversion, and changes the ratios without informing the mouse driver through mouse function 15.

If your application fits these criteria, adjusting the ratios through trial-and-error may keep the cursor in better calibration with your touch. Increase the value if the cursor falls behind your finger when sliding, or decrease it if the cursor speeds ahead of your finger.

The defaults for this flag are the same as they are for the mouse driver:

`-r 8,16`

namely 8 for X and 16 for Y.

Jump Flag (-j)

The -j flag is only of concern in programs which use mickeys (relative motion) rather than coordinates. With -j+, a new touch will emulate mickey motion to the new touch location from the point of last release, thus causing the cursor to jump to your fingertip. With -j-, a new touch will not simulate any motion to that point. The default is -j-.

Spawn Flag (-s)

Instructs MonitorMouse for DOS to remain active when an application *spawns* another program. This flag is required for some off-the-shelf software to run properly. Therefore, the default for the spawn flag is on (-s+).

Technically speaking, if the application sets up a mouse interrupt routine, then spawns another program which expects to receive mouse interrupts, MonitorMouse for DOS must remain active after the spawn.

If the -s- flag is specified, MonitorMouse for DOS will disable itself when the program spawns. If you spawn non-mouse-driven programs within a DOS shell, you may want to use the -s- flag to disable MonitorMouse for DOS while in the spawned programs. However, if a spawned program makes a mouse call, MonitorMouse for DOS will automatically re-enable itself.

Terminate Flag (-t)

Instructs MonitorMouse for DOS to remain active after a program *terminates*. This flag is required for some off-the-shelf software to run properly.

Normally, you will want MonitorMouse for DOS to disable itself when a program terminates. Therefore, the default for the terminate flag is off (-t-). This prevents beeps when you touch the screen at the DOS command level and in programs which do not use the mouse. MonitorMouse for DOS will always automatically re-enable itself if a program makes a mouse call.

The -t+ flag may be also required with some mouse-driven applications that do not respond at all to the touchscreen. See Appendix B—*Troubleshooting*.

Interrupt Flag (-i)

The -i<n> flag allows you to specify the software interrupt of ELODEV in hex. This flag is necessary if more than one copy of ELODEV is loaded, as when controlling two touchscreens. You will also need it if ELODEV is installed at a software interrupt other than 60 through 66 (hex). If the -i flag is not specified, the first ELODEV found when checking interrupts 60-66 will be used.

Extract Flag (-x)

Use the -x flag to extract MonitorMouse for DOS from memory if it is no longer needed. If an error message indicates it cannot be extracted, a TSR loaded after

MONMOUSE.COM may be interfering with its extraction. Generally you should extract TSR's in the reverse order from which they were loaded.

Help Flag (-h)

At anytime, type:

MONMOUSE -h

to display quick reference information on all flags and the current version of MonitorMouse for DOS.

Flag Defaults

The following summarizes the default values for each flag:

-m0	Mouse button emulation mode 0 - click on touch.
-c+	Cursor on.
-b+	Beep on.
-d<current directory>	ELOGRAPH.CAL in current directory.
-r8,16	Mickey/pixel ratios of 8 for horizontal motion and 16 for vertical motion.
-j-	Do not simulate mickey movement to new touches.
-s+	Active in spawned programs.
-t-	Not active after program terminations.
-i	Use the first copy of ELODEV found when scanning software interrupts 60 through 66 (hex) in that order.

Updating Flags

You may re-run MonitorMouse for DOS to update the flags of an installed copy. If a flag is not specified, it is left unchanged. You may also reconfigure MonitorMouse for DOS with a software command (see Appendix D).

NOTES

If you recalibrate, you will need to re-run MonitorMouse for DOS so it will recognize the new values.

Only the -i flag cannot be updated. Extract MonitorMouse for DOS and reload it with the new value.

RUNNING THE TUTORIAL PROGRAM

The *DOS and Windows Driver Disk* installation includes a tutorial program for practicing with the various mouse button emulation modes (see -m flag, page 47). It is also useful to verify the operation of the touchscreen and mouse hardware with MonitorMouse for DOS before trying your application. (The mouse will not work if NOMOUSE is loaded instead of a mouse driver.)

To run Tutorial type:

TUTORIAL

typically from the \TOUCH directory.

Command Line Flags

Two command line flags are recognized by Tutorial:

TUTORIAL M

The "M" flag causes the program to run in monochrome mode even if it detects a color adapter. This flag may be needed if you have a monochrome display, such as an LCD, and it is connected to a color card.

TUTORIAL L

The "L" flag tells Tutorial you are left-handed. This will place the exercise on the left side of the screen for easier reach.

Both flags may be specified, separated by a space. Flags may be in upper or lower case.

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INTRODUCTION

Included on the accompanying *DOS and Windows Driver Disk* is MonitorMouse® for Windows, a touchscreen driver which emulates the Microsoft mouse in Windows 3.1. You will be able to run all Windows programs immediately with an Elo touchscreen, in Standard or 386/Enhanced Mode. The touchscreen may also be used with DOS programs run from Windows.

As with MonitorMouse for DOS, the touchscreen may be used alone, or in conjunction with any mouse. Various *mouse button emulation modes* are supported providing options on how button clicks are simulated. You can choose the best mode for your application, and change between modes at any time.

COMPATIBILITY

MonitorMouse for Windows is compatible with all Windows 3.1 applications. Applications using only the left button will be the easiest to use with the touchscreen.

Because MonitorMouse for Windows works with ELODEV, it is compatible with all Elo touchscreens and controllers. Because the mouse driver from your mouse manufacturer can also be used, you will be able to use any brand of mouse along with the touchscreen in Windows.

INSTALLATION

MonitorMouse for Windows is installed by the INSTALL program described in Chapter 2. Choose Windows Express Installation or Selective Installation.

The rest of this section describes the details of the installation. Typically you can skip to *Using the Touchscreen Control Panel*, page 59. If you have problems with a MonitorMouse for Windows installation, also see Appendix B—*Troubleshooting*.

Included Files

MonitorMouse for Windows consists of the following files:

File	Typical Installed Path	Description
MONMOUSE.DRV	\WINDOWS\SYSTEM	MonitorMouse for Windows driver.
VMMD.386	\WINDOWS\SYSTEM	Virtual MonitorMouse driver for Enhanced Mode.
ELOCALW.CPL	\WINDOWS\SYSTEM	Touchscreen Control Panel for Windows 3.1.
ELOCALW.HLP	\WINDOWS\SYSTEM	Help file for ELOCALW.CPL
CURSOFF.EXE	\WINDOWS	Used by ELOCALW.CPL.
ZAXIS.EXE	\TOUCH	Demo of IntelliTouch Z-axis capabilities in Windows.
METER.DLL	\TOUCH	Used by ZAXIS.EXE.
ELO.BMP	\WINDOWS	Elo "wallpaper" for your Windows desktop.
OEMELO.INF	\WINDOWS\SYSTEM	Used by the Microsoft Windows Setup program.

These files are copied to your hard disk by the INSTALL program described in Chapter 2. ELOCALW.CPL and ELOCALW.HLP are included in English, French, Spanish, and German.

DOS Mouse Driver

A DOS mouse driver (MOUSE.COM, MOUSE.SYS or compatible) is required if you wish to use your mouse along with the touchscreen in Windows. While Windows does not typically require a DOS mouse driver for mouse operation, the MonitorMouse for Windows touchscreen driver requires it to allow any brand of mouse to be used along with the touchscreen. Later, if you change brands of mouse, you will not have to change your Windows setup, only load a different MOUSE.COM.

The DOS mouse driver must be compatible with the Microsoft mouse driver version 8.2 or later. A suitable MOUSE.COM from Microsoft may be found in your DOS directory. It may also be found on your Windows 3.1 disks, although in a compressed form. See the README.MMW file on the *DOS and Windows Driver Disk* for information on de-archiving this Microsoft driver.

Hardware Mouse Cursor

If you have a video board that has hardware mouse cursor capability, and are using a Microsoft Mouse driver version 7.03 or later, you must disable the hardware cursor since it is not supported by Windows. When loading MOUSE.COM, typically in AUTOEXEC.BAT, specify the /y option.

MonitorMouse for DOS

MonitorMouse for Windows requires that MonitorMouse for DOS is operating properly (see Chapter 5). The Tutorial program can be used to verify the operation of MonitorMouse for DOS (see page 53).

Windows Setup (SYSTEM.INI)

The Elo INSTALL program modifies the Windows driver settings in SYSTEM.INI, so running the Microsoft Windows Setup utility is not required.

Changes made by INSTALL to SYSTEM.INI are indicated by inserted comments. Typical changes are shown below:

```
[boot]
;Start of line(s) placed by Elo TouchSystems
mouse.drv=monmouse.drv
;End of line(s) placed by Elo TouchSystems
;Next line commented out by Elo TouchSystems
;mouse.drv=mouse.drv
:
[boot.description]
;Start of line(s) placed by Elo TouchSystems
mouse.drv=Elo MonitorMouse(R) 1.5 for Windows 3.1
;End of line(s) placed by Elo TouchSystems
;Next line commented out by Elo TouchSystems
;mouse.drv=Microsoft, or IBM PS/2
:
[386Enh]
;Start of line(s) placed by Elo TouchSystems
mouse=vmmd.386
;End of line(s) placed by Elo TouchSystems
;Next line commented out by Elo TouchSystems
;mouse=*vmd
```

Serial Mouse

If you have a serial mouse, moving it while Windows Enhanced Mode is loading can prevent the mouse from working. To fix this problem, the Elo INSTALL program may add the following command to the [386Enh] section of your Windows SYSTEM.INI file.

COMxBUFFER=0

where x is 1 or 2, specifying the COM port of your mouse.

Bus Controller on COM Port Interrupt

If you are using a bus touchscreen controller on a COM port interrupt (IRQ3 or IRQ4), and running Windows in Enhanced Mode, the INSTALL program may add two lines to your Windows SYSTEM.INI file. *Do not add these lines if you are using a serial touchscreen controller.*

You can tell which interrupt your bus controller is using by running the INFO utility found in the \TOUCH directory. You can also look at the third parameter in your ELODEV command.

If your touchscreen controller is configured for IRQ3, the following lines are added to the [386Enh] section of SYSTEM.INI:

```
COM2Base=0
COM2Irq= 1
```

If your touchscreen controller is configured for IRQ4, the following lines are added:

```
COM1Base=0
COM1Irq= 1
```

USING THE TOUCHSCREEN CONTROL PANEL

Run the Touchscreen Control Panel by double-clicking its icon with the mouse (the touchscreen may not be calibrated yet), or use the keyboard if you are using NOMOUSE.COM. The Touchscreen icon will be found in the Windows Control Panel, usually found in the Main program group.

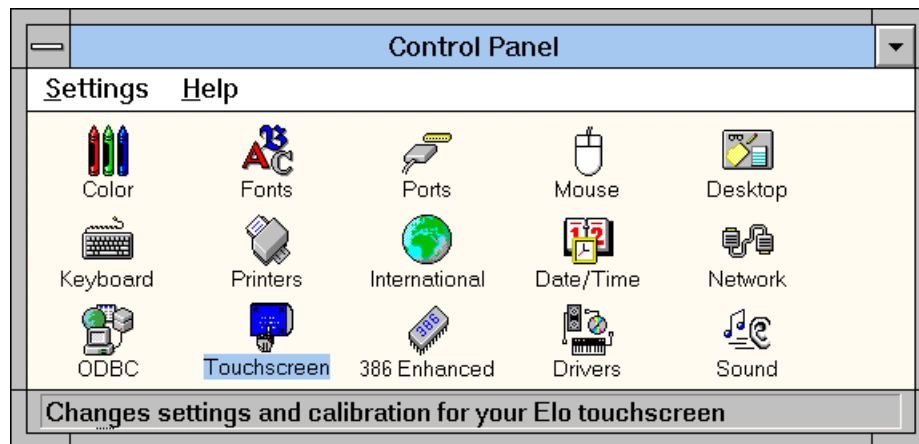


Figure 5-1. Windows 3.1 Control Panel with Touchscreen Icon

Calibrating MonitorMouse for Windows

The Touchscreen Control Panel is shown in Figure 5-2. Select Calibrate to initiate the calibration sequence. Follow the on-screen instructions. You will be given the opportunity to confirm the calibration points before they are stored in your WIN.INI file. Recalibration should only be necessary after moving or resizing the video image, or after changing either the touchscreen, controller, or monitor.

If the Calibrate button is dimmed, ELODEV.EXE is not loaded (see Appendix B—*Troubleshooting*).

NOTE

If the calibration is off when running DOS mouse-driven programs from Windows, you may need to use an ELOGRAPH.CAL file with MONMOUSE.COM. ELOGRAPH.CAL is created by ELOCALIB and should contain calibration points for each video mode you use in your DOS programs. See *Calibrating in Multiple Video Modes (ELOGRAPH.CAL)*, page 36, and the *Calibration File Directory Flag (-d)*, page 49.

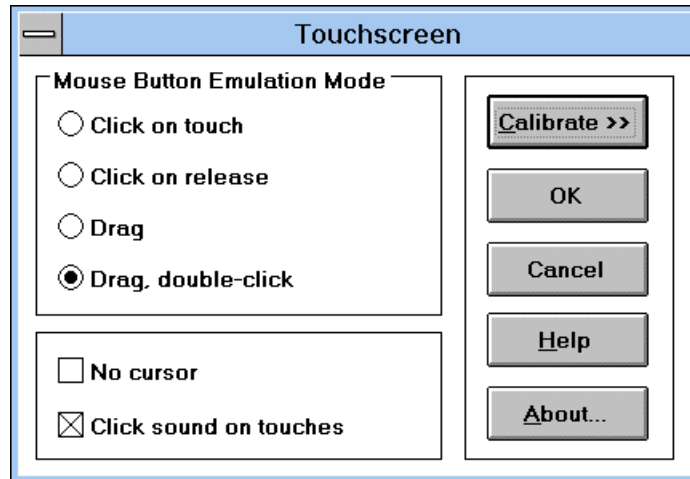


Figure 5-2. Touchscreen Control Panel

Mouse Button Emulation Mode

Four *mouse button emulation modes* are supported. (Three additional modes are available for backwards compatibility but are no longer documented). The modes vary in the button actions they support (clicking, dragging, double-clicking). The modes are the same as in MonitorMouse for DOS and all other versions of MonitorMouse. You should choose the *simplest* mode that will work for your application. The current mode is indicated in the Touchscreen Control Panel.

Mode 0 Left button clicking only. No dragging or right button is supported. Works with large targets. Recommended for public kiosk applications.

Moves the cursor to your point of touch and "clicks" the left button. A beep will confirm the click. The cursor will not move, nor will any other clicks be simulated until your finger is lifted and the screen retouched.

Mode 1 Left button clicking only. No dragging or right button is supported. Works with large and small targets.

The cursor follows your sliding finger and the left button is clicked at the point of *untouch* (lift-off).

Mode 5 Left button clicking and dragging. No right button is supported.

The left button is held down when you touch the screen, and it stays down until you untouch, dragging as you move.

Mode 6 Same as Mode 5, but supports double-clicking by tapping twice. Recommended for general use.

If the second touch occurs immediately after the first and is nearby, a double-click will be simulated at the exact point of the first touch. If you do not hear two beeps, you have tapped too fast.

If the mouse button emulation mode is dimmed, MONMOUSE.COM is not loaded. See *Installation*, page 44.

Click Sound on Touches

Checking this box enables a "click" sound for each touch. Because the touchscreen does not have the tactile feedback of a mouse button, audible feedback helps to confirm your action.

No Cursor

Checking this box disables the Windows mouse pointer (arrow cursor). With most dedicated touchscreen applications, a mouse pointer is not required. In fact, it may distract the user because their eyes will be drawn to the pointer instead of focusing on the entire image.

This option does not affect other cursors, such as the hourglass.

TIPS ON USING THE TOUCHSCREEN IN WINDOWS

The following are suggestions for using the touchscreen in Windows. Mouse button emulation mode 6 is assumed.

Double-Clicking

Double-clicking is common in the Windows environment, so MonitorMouse mouse button emulation mode 6 is recommended. If you are running a dedicated Windows application which does not use double-clicking, you may use Mode 5 instead.

If you are using an IntelliTouch touchscreen controller with revision 2.2 or later firmware (see *INFO*, page 108), or a SmartSet controller (E271-22xx or E281-23xx), you should be able to double-tap the touchscreen with the same speed as you would double-click the mouse.

If you do not hear two beeps when double-tapping with other touchscreen controllers, you are probably double-tapping too fast. Use the Windows Control Panel program to adjust the mouse double-click speed to a slower setting. Then use a relaxed pace when double-tapping.

Border Width

To make resizing windows with the touchscreen easier, increase the Border Width with the Windows Control Panel program. Select Desktop, then Border Width and enter the new value (17 is recommended for 640x480 video resolution, 26 for 1024x768). For other resolutions, pick a border width that visually matches the title bar width. Wide borders may look strange at first, but after awhile they will seem normal. See Figure 5-1, page 59, for an example of wide borders.

Menus

Menus are best navigated by sliding along the menu bar, then down a drop-down menu. Highlighting will follow your finger, indicating the position of touch. When you release, the highlighted item will be selected. This technique is easier than tapping an item on the menu bar, and then tapping an item within the drop-down menu.

Windows 3.1 has an option that can benefit right-handed users. Add the line:

```
MenuDropAlignment=1
```

to the [windows] section of the WIN.INI file. Drop-down menus will be shifted left so they will not appear under your hand.

Scrolling

Scrolling lists can be performed by touching the scroll bars, as you would with the mouse. Some lists can be scrolled more easily by touching the data area, sliding your finger to an edge, then continuing to slide outside the area. This technique works in drop-down lists too.

Maximizing Windows

To maximize a window, try double-tapping on the window's title bar, rather than tapping the Maximize button. Likewise, to restore a maximized window to its previous size, double-tap on its title bar instead of tapping the Restore button. You can also use the Control menu to maximize, minimize, and restore windows.

Using the Overscan Area

MonitorMouse for Windows pushes all touches in the display's overscan area within the screen image. This effectively enlarges the active touch area of zones on the edges of the image. You may touch the edges and corners of the CRT face to easily click on items displayed at the extremes of the image. For example, when a window is maximized, you may touch the upper-right corner to restore the window, touch the top to click on the window title, and double-tap the upper-left corner to close the window.

Option Buttons and Check Boxes

It is easier to select an option by touching the option name rather than the option button. The same is true with check boxes.

Choosing the Control-Menu, Minimize, Maximize, and Restore Buttons

Application windows can be maximized and restored easily by double-tapping the title bar as described above. The Minimize, Maximize, and Restore buttons, and the Control-menu box can be difficult to touch as they are quite small on high resolution screens. Since they all act on button release, you can slide among them before selecting as with the drop-down menus. You can also use the Control menu to easily maximize, minimize, restore, and close windows.

Elo Wallpaper

ELO.BMP can be used to display Elo "wallpaper" when giving demos of MonitorMouse for Windows. To load, click on Control Panel, select Desktop, Wallpaper, and enter ELO.BMP. Select Tile.

RUNNING DOS PROGRAMS FROM WINDOWS

DOS programs run from Windows may also use the touchscreen. However, the procedures are slightly different in Standard and Enhanced Modes.

If you are running Windows in Enhanced Mode, you may get warning messages when you run multiple DOS programs that use ELODEV or MonitorMouse for DOS, saying there is a contention over a LPT or COM port. To prevent these messages, run Control Panel, select 386 Enhanced, Device Contention, and select Never Warn for the contending device.

Running DOS Mouse-Driven Programs

MonitorMouse for DOS will automatically be enabled so you can use the touchscreen with DOS programs run from Windows that use MOUSE.COM. (See *Coordinates vs. Mickeys*, page 42, for restrictions.) An ELOGRAPH.CAL file can be used to keep the touchscreen calibrated in all video modes used by the DOS programs. See *Calibrating in Multiple Video Modes (ELOGRAPH.CAL)*, page 36, and the *Calibration File Directory Flag (-d)*, page 49.

In Enhanced Mode, each DOS session may use a different mouse button emulation mode (specified with the -m flag). In Standard Mode, changing the mouse button emulation mode affects all DOS mouse-driven programs.

Running DOS ELODEV-Based Programs

DOS programs that use ELODEV, such as ELODEMO, may be run from Windows. Even programs that use TouchBack may be run from Windows.

In Enhanced Mode, ELODEV-based programs may be run directly. In Standard Mode, another copy of ELODEV must first be loaded and calibrated within the DOS session. Otherwise you will get a message saying ELODEV was not found. MonitorMouse for Windows hides ELODEV in Standard Mode because ELODEV is not multi-tasking. By loading another copy in each DOS session that requires it, ELODEV-based programs and Windows programs can all share the touchscreen.

If you load a second copy of ELODEV in the DOS session, ignore the Windows message about TSR's when EXITing the session in Standard Mode. Extracting ELODEV before EXITing will not eliminate this message, because Windows cannot detect TSR extractions.

Calibrating ELODEV in one DOS session will not affect calibration in other sessions or Windows. In fact, any ELODEV parameter may be changed without affecting other sessions in both modes of Windows.

Running DOS Polled Touchscreen Programs

DOS programs that bypass ELODEV and directly poll Elo touchscreen controllers, such as the BUSSTAT utility, may be run from Windows in Standard and Enhanced Modes. However, these programs must not reconfigure the controller with software setup.

OTHER DRIVER CONFIGURATIONS

MonitorMouse for Windows requires three DOS drivers: MOUSE.COM, ELODEV.EXE, and MONMOUSE.COM. If one or more of these drivers are not loaded before entering Windows, operation can continue, although with the following limitations:

- **MONMOUSE.COM not loaded** - The mouse can still be used in Windows and with DOS programs run from Windows. The touchscreen will not operate as a mouse within Windows. Windows programs that directly call ELODEV can use the touchscreen. DOS ELODEV-based programs can be run from Windows. MONMOUSE.COM can be manually loaded in DOS sessions to use the touchscreen with DOS mouse-driven programs. The Touchscreen Control Panel can still be used to calibrate the touchscreen, but the mouse button emulation mode cannot be selected.
- **ELODEV.EXE and MONMOUSE.COM not loaded** - The mouse can still be used in Windows and with DOS programs run from Windows. The touchscreen will not operate as a mouse within Windows. ELODEV and MONMOUSE.COM can be manually loaded in DOS sessions to use the touchscreen with ELODEV-based and DOS mouse-driven programs. The Touchscreen Control Panel cannot calibrate the touchscreen nor select the mouse button emulation mode.
- **MOUSE.COM, ELODEV.EXE, and MONMOUSE.COM not loaded** -The mouse can still be used in Windows, although it must be hardware compatible with a Microsoft or IBM mouse. The touchscreen will not operate as a mouse within Windows. MOUSE.COM, ELODEV, and MONMOUSE.COM can be

manually loaded in DOS sessions to use the touchscreen with ELODEV-based and DOS mouse-driven programs. The Touchscreen Control Panel cannot calibrate the touchscreen nor select the mouse button emulation mode.

TouchBack

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 - *Compatibility* 67
 - *Installation* 68
 - *Options* 69
-

INTRODUCTION

Included on the accompanying *DOS and Windows Driver Disk* is TouchBack™, a touchscreen driver which emulates keystrokes for DOS keyboard-driven applications.

COMPATIBILITY

Applications must be specially written for use with TouchBack. Your application documentation should specify if TouchBack is required.

Because TouchBack works with the ELODEV touchscreen driver, it is compatible with all Elo touchscreens and controllers.

Programmers: The *DOS Programmer's Toolkit*, available separately from Elo, includes the *TouchBack Programmer's Reference* and the *TouchUp User's Guide*. The TouchBack manual defines the application programming interface (API) for

the TouchBack driver. The TouchUp manual describes the touch zone definition utility used when developing TouchBack-based programs. Sample source code is included in BASIC, dBase, Clipper, and many other languages.

INSTALLATION

TouchBack is installed by the INSTALL program described in Chapter 2. Choose DOS Express Installation or Selective Installation.

The rest of this chapter describes the details of the installation. If you have problems with a TouchBack installation, also see Appendix B—*Troubleshooting*.

Included Files

TouchBack consists of a single file, TCHBACK.EXE, typically located in the \TOUCH directory.

Placement in AUTOEXEC.BAT

The TouchBack command line is placed in AUTOEXEC.BAT by the INSTALL program. TCHBACK.EXE is a terminate-and-stay-resident (TSR) program. A portion of a sample AUTOEXEC file is shown below:

```
C:\TOUCH\ELODEV 2201,280,5 -C722,3587,3319,841,1,15 ; touchscreen driver
C:\TOUCH\TCHBACK ; TouchBack driver
```

The ELODEV touchscreen driver must be loaded before TouchBack. TouchBack occupies about 16K of system RAM when loaded and ELODEV about 6K.

There may be several flags on the TCHBACK command line. Flags are described in the next section.

TSR programs for keyboard enhancement (such as SuperKey or BUF128) must be installed *before* TouchBack. If you use SideKick, you must load it *after* TouchBack.

OPTIONS

TouchBack supports several environment variables and command line flags.

Environment Variables

TouchBack normally looks for application screen files (.PIC extension) and touch zone table files (.BIN extension) in the directory where the application is running. You can specify different directories with the following environment commands:

SET PICPATH=<pathname> Use the SET PICPATH command to specify the directory in which application screen files are located.

SET BINPATH=<pathname> Use the SET BINPATH command to specify the directory in which touch zone table files are located.

For example:

```
SET PICPATH=E:\SCREENS
```

These commands must be placed in the DOS environment with the DOS SET command *before* TouchBack is loaded. If you change an environment option after TouchBack is loaded, you must extract TouchBack (see -x flag, page 71) and reload it. Otherwise, TouchBack will not recognize the changed environment option.

If you are not familiar with environments or the SET command, consult a DOS manual.

An application program may override the default paths specified by these environment commands.

NOTE

If you have both MonitorMouse for DOS and TouchBack loaded, TouchBack applications should call the ENABLE command at start-up, and DISABLE before exiting. MonitorMouse for DOS or TouchBack may also be extracted from memory when not in use.

Command Line Flags

TouchBack command line flags enable you to change the command lead-in character, specify the number and size of buffers, remove TouchBack from memory, and display a list of available flags.

Flags consist of a hyphen and a letter, in upper or lower case. For example:

```
TCHBACK -c127
```

Multiple flags may be specified, separated by spaces.

Command Lead-in Character Flag (-c)

TouchBack uses rubout (ASCII 255) as its default command lead-in character. Your application documentation should specify if this flag is required. You can change the character to any code, printing or non printing with this command:

```
TCHBACK -c<code>
```

The code is a decimal ASCII code between 1 and 255 for the character you want to use. You can find ASCII codes in most books on DOS.

Number and Size of Buffers Flag (-b)

Buffers are areas in memory set aside for storing the .BIN file that holds the touch zone data. The format for this flag is:

```
TCHBACK -b<number of buffers>,<size of each in bytes>
```

If this flag is not specified, TouchBack defaults to one buffer that can hold a 2082 byte .BIN file, enough for 51 touch zones on a single screen. You may use the -b flag to specify a smaller or larger buffer size, but it must be at least as large as your largest .BIN file. (Use the DOS DIR command to display file sizes). The number of buffers required should be specified in your application documentation. The product of the number of buffers times the size must not exceed 52K.

NOTE

To change the number or size of the buffers, you must extract TouchBack from memory then reinstall it using the -b flag with the desired parameters. See -x flag, page 71.

Interrupt Flag (-i)

The -i flag allows you to specify the software interrupt of ELODEV:

```
TCHBACK -i<n>
```

where <n> is specified in hex. This flag is necessary if more than one copy of ELODEV is loaded, as when controlling two touchscreens. You will also need it if ELODEV is installed at a software interrupt other than 60 through 66 (hex). If the -i flag is not specified, the first ELODEV found when checking interrupts 60-66 will be used.

Extract Flag (-x)

Use the -x flag to extract TouchBack from memory if it is no longer needed:

```
TCHBACK -x
```

If an error message indicates it cannot be extracted, a TSR loaded after TCHBACK.EXE may be interfering with its extraction. Generally you should extract TSR's in the reverse order from which they were loaded.

Help Flag (-h)

At any time, type:

```
TCHBACK -h
```

to display quick reference information on all flags and the current version of TouchBack.

Updating Flags

You may re-run TouchBack to update the -c flag of an installed copy.

Appendix A

Configuring Your Controller

- *General Information 73*
 - *Controller Data Sheets 75*
-

GENERAL INFORMATION

This appendix explains how to configure your touchscreen controller's switch and/or jumper settings for use with the drivers on the *DOS and Windows Driver Disk*.

Your controller's switch and jumper settings can be found on one of the next few pages. Our recommendations should give you the best performance.

For information on physically setting the switches and jumpers to the listed settings, and controller installation instructions, see the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* as appropriate.

Emulation Modes

ELODEV will work with a touchscreen controller in an emulation mode if the emulated controller is specified. However, performance may be less than optimal and the power-on diagnostics and firmware revision level will not be displayed. See the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* for jumper settings.

Increasing the Untouch Wait Time

If you use a baud rate lower than the one recommended for certain serial controllers, you may have to increase the Untouch Wait Time (-w flag) when loading ELODEV.

If you are using a 16 inch or larger IntelliTouch touchscreen with controller firmware prior to revision 2.2, you must specify the -w90 flag to increase the Untouch Wait Time. The firmware revision level is displayed when ELODEV is loaded, unless it is prior to 2.2.

Non-standard Serial Ports

ELODEV supports serial touchscreen controllers installed on serial ports other than COM1 and COM2 if you write your own support code. The command syntax for installing ELODEV is slightly different under this circumstance. See the SetUserCom function in the *ELODEV Programmer's Reference* for more information.

Choosing an Interrupt (IRQ) for PC-Bus Controllers

ELODEV requires all PC-Bus controllers to be in Interrupt Mode. Choose the hardware interrupt (IRQ) carefully so it will not conflict with another device that is in use while the application program is running. The following table lists the devices normally assigned to each IRQ:

IRQ	XT	286/386/486 or later
2	IBM EGA, IBM network	Mapped to IRQ9
3	COM2	COM2
4	COM1	COM1
5	Hard disk controller	LPT2
6	Floppy disk controller	Floppy disk controller
7	LPT1	LPT1

Elo's recommendations on choosing an interrupt, in order of preference, are as follows. Skip the IRQ if a conflict may exist.

XT: 7,3,4,2,6,5

286/386/486 or later: 5,7,2,3,4,6

NOTE

When XT disk controllers are installed in AT type systems, IRQ5 is not available.

For 286/386/486's or later, IRQ5 (LPT2) is highly recommended. Since the BIOS does not use interrupts when outputting to a printer and most software uses the BIOS for printer output, you can jumper your PC-Bus touchscreen controller for IRQ5 without contending with LPT2. On XT-type systems, IRQ7, LPT1, is highly recommended for the same reasons.

If necessary, choose a COM port IRQ. ELODEV eliminates the interrupt conflict by disabling the interrupt line drivers of the COM ports while the touchscreen is in operation. A COM port can be used simultaneously only if the COM port is polled by the application or accessed strictly through the BIOS.

Programmers: If the selected IRQ contends with LPT1 or LPT2, ELODEV saves the state of the Interrupt Enable bit on the parallel port controller when OpenTouch is called. ELODEV then disables the parallel port interrupt and takes over the interrupt for the touchscreen controller. The original state of the bit and interrupt vector are restored when CloseTouch is called. The same technique works with a COM port. Applications may use a contending COM or LPT port simultaneously, but only in polled mode.

CONTROLLER DATA SHEETS

Data for each controller begins on a new page. The controllers are listed in the following order:

Controller	Page
IntelliTouch Serial Controller (E281-2300)	77
IntelliTouch Serial Controller (E281{A}-4002)	78
AccuTouch Serial Controller (E271-2210)	79
AccuTouch and DuraTouch Serial Controller (E271-2200)	80
AccuTouch Serial Controller (E271-140)	81
DuraTouch Serial Controller (E261-280)	82
IntelliTouch PC-Bus Controller (E281-4035)	83
IntelliTouch PC-Bus Controller (E281{A}-4025)	85
AccuTouch and DuraTouch PC-Bus Controller (E271-2201)	87
AccuTouch PC-Bus Controller (E271-141) and DuraTouch PC-Bus Controller (E271-142)	88
AccuTouch and DuraTouch Micro Channel Controller (E271-2202)	90

If you cannot identify your controller from the list above, see the cross-reference chart for obsolete part numbers on page 6.

NOTE

Switches may be labeled either OFF/ON or OPEN/CLOSE, depending on your controller. The data sheets tables always list switch positions as OFF (open) or ON (close).

IntelliTouch Serial Controller (E281-2300)

Verify the controller's jumper settings are as follows:

Baud Rate	(From Left)
9600 (recommended)	J0-N J1-N
4800	J0-Y J1-Y
2400	J0-Y J1-N
1200	J0-N J1-Y
19200	Cross-connect (connect jumper horizontally so the top pins of J0 and J1 are jumpered)
Binary Mode	J2-N
Hardware handshaking enabled	J3-N
Stream Mode	J4-N
Reserved	J5-N
Reserved	J6-N
Power-on settings from jumpers	J7-Y
Reserved	J8-N
Reserved	J9-N
Emulation mode	
None	J10-N J11-N

Jumpers cross-connected horizontally on the *bottom* pins of the jumper block have no effect and are available as extra jumpers.

9600 baud is recommended because it has the throughput necessary for many applications.

IntelliTouch Serial Controller (E281{A}-4002)

Verify the controller's switch settings are as follows:

For:	Set:
Stream Mode	SW0-OFF
Binary Mode	SW1-OFF
Z-axis enable	SW2-ON
9600 Baud (recommended)	SW3-ON, SW4-ON, SW5-ON
4800 Baud	SW3-ON, SW4-ON, SW5-OFF
2400 Baud	SW3-ON, SW4-OFF, SW5-ON
1200 Baud	SW3-ON, SW4-OFF, SW5-OFF
600 Baud	SW3-OFF, SW4-ON, SW5-ON
300 Baud	SW3-OFF, SW4-ON, SW5-OFF
150 Baud	SW3-OFF, SW4-OFF, SW5-ON
Reserved	SW6-ON
Reserved	SW7-ON

9600 baud is recommended because it has the throughput necessary for many applications.

AccuTouch Serial Controller (E271-2210)

The E271-2210 controller is a compact version of the E271-2200 controller.

Verify the controller's jumper settings are as follows:

Baud Rate	(From Left)
9600 (recommended)	J0-N J1-N
2400	J0-Y J1-N
1200	J0-N J1-Y
300	J0-Y J1-Y
19200	Cross-connect (connect jumper horizontally so the top pins of J0 and J1 are jumpered)
Binary Mode	J2-N
Hardware handshaking enabled	J3-N
Stream Mode	J4-N
Reserved	J5-N
Reserved	J6-N
Power-on settings from jumpers	J7-Y
Reserved	J8-N
Reserved	J9-N
Emulation mode	
None	J10-N J11-N

Jumpers cross-connected horizontally on the *bottom* pins of the jumper block have no effect and are available as extra jumpers.

9600 baud is recommended because it has the throughput necessary for many applications.

AccuTouch and DuraTouch Serial Controller (E271-2200)

Verify the controller's jumper settings are as follows:

	(From Top)
Default from jumpers	J7-Y
Reserved	J6-N
Touchscreen Type	
AccuTouch	J5-Y
DuraTouch	J5-N
Stream Mode	J4-N
Hardware handshaking enabled	J3-N
Binary Mode	J2-N
Baud Rate	
9600 (recommended)	J1-N
	J0-N
2400	J1-N
	J0-Y
1200	J1-Y
	J0-N
300	J1-Y
	J0-Y

J8 through J11 elsewhere on the controller should not be jumpered.

Jumpers cross-connected vertically on the *right* side of the jumper block have no effect and are available as extra jumpers.

9600 baud is recommended because it has the throughput necessary for many applications.

AccuTouch Serial Controller (E271-140)

Verify the controller's switch settings are as follows:

For:	Set:
9600 Baud	SW1-OFF SW2-OFF
4800 Baud	SW1-ON SW2-OFF
2400 Baud (recommended)	SW1-OFF SW2-ON
300 Baud	SW1-ON SW2-ON
8-bit Data	SW3-OFF
Binary Mode	SW4-ON
Filtered	SW5-ON
Stream Mode	SW6-OFF

2400 baud is recommended to limit the excessive amounts of data at higher baud rates.

Next, verify the Touchscreen Type jumpers. The controller is shipped with a jumper installed on the pins marked W1. This is the correct setting for E274 5-wire touchscreens. If you are using an older E270 3-wire touchscreen, install the jumper on W2 instead.

DuraTouch Serial Controller (E261-280)

Verify the controller's jumper settings are as follows:

For:	Jumper:
Binary Mode	E2 (requires 4.0 EPROM)
9600 Baud (recommended)	E5
300 Baud	E6
1200 Baud	Neither

If Elo has installed the controller inside your monitor, then E2 and E5 have already been jumpered. 9600 is recommended because it has the throughput necessary for many applications.

The E2 jumper is only supported by version 4.0 or later EPROMs. The controller is normally shipped with this jumper installed if it has a 4.0 EPROM. The E2 jumper causes the controller to power up compatible with ELODEV, so software setup is not necessary. This jumper is necessary if you can turn the E261 280 controller off independently from the computer; for example, when the controller is installed internally in a monitor. Contact Elo for an updated EPROM if necessary.

If your controller does not have EPROM version 4.0 or later and E2 is not jumpered, the controller must be configured by software setup to work with ELODEV. This setup is automatically performed by ELODEV upon installation. See the -p flag for more information, page 32.

IntelliTouch PC-Bus Controller (E281-4035)

The E281-4035 controller is a half-card version of the E281{A}-4025 controller.

Verify the controller's switch settings are as follows:

12-bit Mode	SW1-ON
Reserved	SW2-ON
Stream Mode	SW3-OFF
Reserved	SW4-ON
Z-axis enable	SW5-ON
Reserved	SW6-ON

Next, set the controller's Base I/O Port address with the W2 and W3 jumpers. W3 selects the high order address, and W2 the low order address. The values of the settings are shown in the following table.

W3		W2	
HI (100X)		LOW (10X)	
Position (from top)	Value (in hex)	Position (from top)	Value (in hex)
0	000	0	00
1	100	2	20
2 (recommended)	200	4	40
3	300	6	60
		8 (recommended)	80
		A	A0
		C	C0
		E	E0

To calculate the Base I/O Port address, add the values of the jumpered positions of W3 and W2. For example, the E281-4035 is shipped jumpered for a Base I/O Port address of 280 hexadecimal. W3 is jumpered in the third position (200), and W2 is jumpered in the fifth position (80). The address is the sum of 200 + 80, which is 280.

Next, install a jumper vertically at W1 to select the Interrupt (IRQ). The E281-4035 is shipped jumpered for IRQ5. See *Choosing an Interrupt (IRQ) for PC-Bus Controllers*, page 74. The jumper block positions are as follows:

Interrupt (IRQ)

W1

(from left)

2

3

4

5 (factory set)

6

7

Remember the Base I/O Port address and IRQ values. You will need them when running the INSTALL program.

IntelliTouch PC-Bus Controller (E281{A}-4025)

Verify the controller's switch settings are as follows:

12-bit Mode	SW1-ON
Reserved	SW2-ON
Stream Mode	SW3-OFF
Reserved	SW4-ON
Z-axis enable	SW5-ON
Reserved	SW6-ON
Reserved	SW7-ON
Reserved	SW8-ON

Next, set the controller's Base I/O Port address with the W2 and W3 jumpers. W3 selects the high order address, and W2 the low order address. The values of the settings are shown in the following table.

W3		W2	
Position (from top)	Value (in hex)	Position (from top)	Value (in hex)
4	300	8	E0
3 (recommended)	200	7	C0
2	100	6	A0
1	000	5 (recommended)	80
		4	60
		3	40
		2	20
		1	00

To calculate the Base I/O Port address, add the values of the jumpered positions of W3 and W2. For example, the E281{A}-4025 is usually shipped jumpered for a Base I/O Port address of 280 hexadecimal. W3 is jumpered in the third position (200), and W2 is jumpered in the fifth position (80). The address is the sum of 200 + 80, which is 280.

Next, install a jumper vertically at W1 to select the Interrupt (IRQ). A jumper is supplied, but may be found in a horizontal, inactive position. See *Choosing an Interrupt (IRQ) for PC-Bus Controllers*, page 74. The jumper block positions are as follows:

**W1 Position Interrupt (IRQ)
(from left)**

6	2
5	3
4	4
3	5 (factory set)
2	6
1	7

Remember the Base I/O Port address and IRQ values. You will need them when running the INSTALL program.

AccuTouch and DuraTouch PC-Bus Controller (E271-2201)

Verify the controller's jumper settings are as follows:

	(From Top)
Default from jumpers	J7-Y
Reserved	J6-N
Touchscreen Type	
AccuTouch	J5-Y
DuraTouch	J5-N
Stream Mode	J4-N
No Interrupt (software selected)	J3-N
	J2-N
Base I/O Port (in hex)	
280 (recommended)	J1-N
	J0-N
240	J1-N
	J0-Y
180	J1-Y
	J0-N
100	J1-Y
	J0-Y
2A0	Cross connect (connect jumper vertically so the left pins of J0 and J1 are jumpered)

J10 and J11 elsewhere on the controller should not be jumpered.

Jumpers cross-connected vertically on the *right* side of the jumper block have no effect and are available as extra jumpers.

AccuTouch PC-Bus Controller (E271-141) and DuraTouch PC-Bus Controller (E271-142)

Verify the controller's switch settings are as follows:

For:	Set:
12-bit Mode (recommended)	SW1-ON
8-bit Mode	SW1-OFF
No calibration data on reset	SW2-ON
Stream Mode	SW3-OFF
Filtered	SW4-ON

The 12-bit Mode is recommended, although if the resolution provided by a nominal 255x255 screen is adequate, then 8-bit Mode may be preferred because of its lower interrupt overhead. (The controllers deduct overscan and inaccessible areas, typically returning a range of 28 to 227, for example.)

Next, set the controller's Base I/O Port address with the W2 and W3 jumpers. W3 selects the high order address, and W2 the low order address. The values of the setting are shown in the following table:

W3		W2	
Position (from top)	Value (in hex)	Position (from left)	Value (in hex)
1	000	1	E0
2	100	2	C0
3 (recommended)	200	3	A0
4	300	4 (recommended)	80
		5	60
		6	40
		7	20
		8	00

To calculate the Base I/O Port address, add the values of jumpered positions W3 and W2. For example, the E271-141 is usually shipped jumpered for a Base I/O Port address of 280 hexadecimal. W3 is jumpered in the 3rd position (200), and W2 is jumpered in the 5th position (80). The address is the sum of 200 + 80, which is 280.

Next, install a jumper vertically at W1 to select the Interrupt (IRQ). A jumper is supplied, but may be found in a horizontal, inactive position. See *Choosing an Interrupt (IRQ) for PC-Bus Controllers*, page 74. The jumper block positions are as follows:

Position (from left)	Interrupt (IRQ)
1	2
2	3
3	4
4	5 (factory set)
5	6
6	7

Remember the Base I/O Port address and IRQ values. You will need them when running the INSTALL program.

Touchscreen Type Jumpers (for AccuTouch E271-141 Only)

Verify the Touchscreen Type jumpers on the AccuTouch E271-141 Controller only. The controller is shipped with a jumper installed on the pins marked W4. This is the correct setting for E274 5-wire touchscreens. If you are using an older E270 3-wire touchscreen, install the jumper on W5 instead.

AccuTouch and DuraTouch Micro Channel Controller (E271-2202)

Verify the controller's jumper settings are as follows:

	(From Top)
Default from jumpers	J7-Y
Reserved	J6-N
Touchscreen Type	
AccuTouch	J5-Y
DuraTouch	J5-N
Stream Mode	J4-N
Reserved	J3-N
Reserved	J2-N
Reserved	J1-N
Reserved	J0-N

Jumpers cross-connected vertically on the *right* side of the jumper block have no effect and are available as extra jumpers.

Controller Installation

Several additional steps are required when installing controllers in a Micro Channel computer. Proceed in order as follows.

Copy the file @6253.ADF from the *DOS and Windows Driver Disk* to your Backup Copy of your "IBM PS/2 Reference Disk." If you do not have a backup of your Reference Disk, boot with the Reference Disk in drive A and follow the on screen instructions to create one.

Follow the "Installing an Adapter" instructions in *your IBM Personal System/2 Quick Reference*. The controller (adapter) may be installed in any available slot.

Power up with your backup copy of the Reference Disk in drive A. Error 165 -- Adapter Configuration Error -- will appear because you just installed a new adapter. Press [Enter] on the logo screen, then follow the on screen instructions to "Automatically configure the system".

Next, follow the on screen instructions to "View Configuration" and verify that the E271-2202 controller was detected. You should see installed in a slot the "Elo E271-2202 Touchscreen Controller". The Base I/O Port and selected Interrupt (IRQ) will also be shown. Later, if you have problems, you can "Change Configuration" of the controller's Base I/O Port and Interrupt.

Quit the program, remove the Reference Disk, and restart the computer. The system should now boot without any error messages. Continue the software installation as you would with other controllers.

Note that the Base I/O Port and Interrupt (IRQ) are not specified because they were determined by the configuration programs on the Reference Disk, the ADF file, and other adapters present in your system.

After the software is installed, you can run the INFO utility to display and verify the chosen Base I/O Port and Interrupt for the E271-2202 controller. See page 108.

Appendix B

Troubleshooting

- *General Information* 93
 - *Diagnostic Utilities* 103
-

GENERAL INFORMATION

Should you experience operational difficulties with the touchscreen system either during or after installation, this appendix should help you determine the source of the problem.

The first step in troubleshooting a touchscreen system is to determine whether the problem is due to the hardware, driver software, or application software.

Display Problems

If you are experiencing a display problem, (such as no video, horizontal and vertical synchronization, raster non-linearities, etc.), realize that the video function of the display and the Elo touchscreen installed on the display are entirely separate systems. Therefore, problems with the display should be treated as display problems, not touchscreen problems. Diagnostic procedures and possible corrections for display problems should be performed using the troubleshooting procedures outlined in your display manual.

The touchscreen is powered from its controller. Usually the display and touchscreen controller have separate power supplies and operate independently. Thus it is possible for the touchscreen to interact with the computer even if the

display is powered off. Internal serial controllers are usually powered by a supply that is separate from the display's power supply, but controlled through the display's power switch. In this case, even if display problems exist, the touchscreen system will probably function if the display power switch is on.

Peeling Back the Layers

The secret to troubleshooting is to first identify at what level the problem exists. For example, if your application uses MonitorMouse for DOS, there are several layers of software and drivers involved. The problem could be with your application, MonitorMouse for DOS, ELODEV, your mouse driver, the touchscreen hardware, or a conflict with other software. The problem could even be at a lower level such as a conflict with other hardware, or even the computer.

The best approach to troubleshooting is to remove the layers one by one until the problem disappears. If the problem exists after all software has been removed, then hardware troubleshooting is in order.

Calibration Problems

Calibration problems can appear at any level. If the touchscreen hardware is responding and is linear, (see *COMDUMP*, *BUSSTAT*, and *TOUCHES* later in this appendix), but a touch does not activate the appropriate zone, check the calibration. Other symptoms of improper calibration are when a cursor does not move at the same pace as a sliding finger, or when it moves in the opposite direction. A cursor should always move in the same axis as your finger.

Calibration problems are usually due to calibrating in the wrong video mode. Even though you may have a VGA monitor, for example, your application may be running in text mode, so calibrate in text mode rather than graphics mode.

If using MonitorMouse for DOS with a DOS application, apparent calibration problems may actually be due to a relative mode application. See *Coordinates vs. Mickeys*, page 42, and *MonitorMouse for DOS* later in this appendix for help on identifying this situation.

If you have a calibration problem, try erasing ELOGRAPH.CAL and re-running DEMOCAL or ELOCALIB. Only ELODEMO and MonitorMouse for DOS use ELOGRAPH.CAL. TouchBack does not.

Besides the remainder of this appendix, see the following sections for more information on calibration:

Section	Page
Step 4 - Calibrating the Touchscreen	12
Calibration Points Flag (-c)	30
ELOCALIB	35
Calibrating in Multiple Video Modes (ELOGRAPH.CAL)	36
Calibration File Directory Flag (-d)	49
Calibrating MonitorMouse for Windows	59
Running DOS Mouse-Driven Programs (from Windows)	64

Where to Go From Here

The remainder of this appendix discusses troubleshooting the MonitorMouse for Windows, MonitorMouse for DOS, TouchBack, and ELODEV drivers, as well as the ELODEMO and ELOCALIB programs. For each, the layers are diagrammed with specific tests given to try at each level. The appendix ends with descriptions of the diagnostic utilities installed from the *DOS and Windows Driver Disk* (typically in \TOUCH).

There are still other sources for troubleshooting information. See the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* for hardware troubleshooting tips. See the *DOS Programmer's Toolkit* when troubleshooting application problems. Remember to check the README files from the *DOS and Windows Driver Disk* for other suggestions and known incompatibilities that may have been identified after the printing of this manual. Of course, Elo Technical Support is also available to assist you.

MonitorMouse for Windows

The layers for MonitorMouse for Windows are as follows:

Windows Enhanced Mode Driver (VMMD.386)
Windows Standard Mode Driver (MONMOUSE.DRV)
Windows
MonitorMouse for DOS (MONMOUSE.COM)
ELODEV.EXE
Your mouse driver (MOUSE.COM/.SYS, etc.)

Try these procedures:

- Run Windows Setup and verify that MonitorMouse for Windows is selected as your mouse driver. If it is not, click on Options/Change System Settings, and select MonitorMouse for Windows. If it is not listed, exit Windows and run INSTALL from the *DOS and Windows Driver Disk*.
- Make sure the touchscreen and mouse work with the MonitorMouse for DOS Tutorial program (see page 99).
- Check your SYSTEM.INI file to be sure the changes INSTALL made are still there (see page 58).
- See if the problem is only with Windows Enhanced Mode. Try Standard Mode by invoking Windows with the /S flag. Double-check the [386Enh] section of SYSTEM.INI (see page 58).
- Check the dates of the MONMOUSE.DRV and VMMD.386 files in your WINDOWS\SYSTEM directory. They should match those on the *DOS and Windows Driver Disk*. If not, reinstall the *DOS and Windows Driver Disk*.
- Check the version of your mouse driver. Some old or clone mouse drivers do not work very well with Windows, or when returning to Windows from DOS sessions. Try temporarily loading NOMOUSE.COM and see if the problem is resolved. (Your mouse won't work at this point.) Many mice are Microsoft or Logitech hardware compatible. Try the latest Microsoft or Logitech mouse driver with your mouse.
- Run the Windows Setup program from the \WINDOWS directory and reinstall your mouse driver. Check that Windows works with your mouse (the touchscreen will not work). If the mouse does not work, check for conflict with other drivers and/or re-install Windows. Once Windows works with your mouse, re-run Windows Setup, reinstalling MonitorMouse for Windows.
- Check that your mouse and touchscreen are not using the same hardware interrupt (IRQ). See the procedure under MonitorMouse for DOS, page 99.

The mouse IRQ is important in Windows Enhanced Mode even if you are using NOMOUSE.COM. See if NOMOUSE.COM is the same as the version on the *DOS and Windows Driver Disk*. If not, try that version.

If NOMOUSE.COM was created with PATCHMSE from Microsoft MOUSE.COM version 7.04, the IRQ will be 2. Earlier versions may be 5. The patches for Microsoft 8.x or later drivers do not use an interrupt, so using one of these patched drivers is recommended.

- Try removing all unnecessary TSR's and device drivers from AUTOEXEC.BAT and CONFIG.SYS. Conflicts may show up only in Windows. Check for interrupt contention with other devices. Remove other devices and drivers to see if they may be contending with the touchscreen controller or drivers.
- If you are using a bus touchscreen controller on a COM port interrupt (IRQ4 or IRQ3), see *Bus Controller on COM Port Interrupt*, page 58.
- If you have a serial mouse, and it does not work after it was moved while Windows Enhanced Mode was loaded, see *Serial Mouse*, page 58.
- If you get a warning message saying there is a contention over a LPT or COM port when you run multiple DOS programs that use ELODEV or MonitorMouse for DOS, see *Running DOS Programs from Windows*, page 64, to prevent these messages.
- If your calibration is off only while in Windows, try recalibrating with the Touchscreen Control Panel.
- If your calibration is off when running DOS mouse or touchscreen-driven programs from Windows, make sure MonitorMouse for DOS is loading an ELOGRAPH.CAL file. See *Calibration File Directory Flag (-d)*, page 49. Also make sure ELOGRAPH.CAL contains correct calibration points by recalibrating with ELOCALIB in each video mode you use. You must reboot before MONMOUSE.COM will recognize the new calibration points.
- If double-clicking is difficult, check that you are using Mode 6. Also see *Double-Clicking*, page 62.
- If you get a message when Windows is started saying MOUSE.DRV is not version 8.20 or later, delete POINTER.EXE from the LOAD= line in WIN.INI.

Touchscreen Control Panel

- If the mouse button emulation mode is dimmed, MONMOUSE.COM is not loaded. See Chapter 5.
- If the Calibrate button is dimmed, ELODEV.EXE is not loaded. See Chapter 4.

MonitorMouse for DOS

The layers for MonitorMouse for DOS applications are as follows:

Your application
MonitorMouse for DOS (MONMOUSE.COM)
ELODEV.EXE
Your mouse driver (MOUSE.COM/.SYS, etc.)

Try these procedures:

- Reboot and check to see if MONMOUSE.COM is installing without an error message. See page 118 for a description of each message or Chapter 5 for installation instructions.
- See if the problem is only with your application. Try the TUTORIAL program included with MonitorMouse for DOS (typically in \TOUCH). You can also try DOS EDIT. The touchscreen and mouse should both work (unless NOMOUSE.COM is being used). If the touchscreen does not work, see *ELODEV*, page 102. If the mouse does not work, check that the latest DOS mouse driver from your mouse manufacturer is being loaded.
- If the touchscreen works with TUTORIAL or EDIT but the cursor does not jump to your finger in your application, you may have a relative mode program. See *Coordinates vs. Mickeys*, page 42.
- If the touchscreen works fine with TUTORIAL or EDIT but there is no beep on touch in your application, (and the -b- flag is not used), try adding the -t+ flag to the MONMOUSE command line and reboot (see page 51). If there is still no response in your application, try adding a second "MONMOUSE -t+" command to your AUTOEXEC file. This will force the touchscreen to initialize even with applications that are not properly initializing the mouse driver. At this point you should hear beeps on touch at the DOS prompt even before you run your application.
- If calibration is off in your application and it is not a relative mode application, re-run DEMOCAL, or run ELOCALIB if the video mode used by your application is not addressed by DEMOCAL. With ELOCALIB, save the points in ELOGRAPH.CAL and AUTOEXEC.BAT. Reboot and check that ELOGRAPH.CAL is being read when MONMOUSE.COM is loaded. See -d flag, page 49.
- Check that your mouse and touchscreen are not using the same hardware interrupt (IRQ). The IRQ's used by serial ports are IRQ4 for COM1 and IRQ3 for COM2.

To determine the interrupt for bus touchscreen controllers, run the INFO utility (typically in \TOUCH). See page 108.

To determine the interrupt for a non-serial mouse, check your mouse documentation. You may also use the DOS DEBUG utility as in the following example. Keystrokes are in **bold**.

```
C:\>debug
-a
2018:0100 mov ax,24
2018:0103 int 33
2018:0105 int 3
2018:0106 [Enter]
-g
AX=0024 BX=0704 CX=0105 DX=0000 SP=FFEE BP=0000 SI=0000 DI=0000
DS=2018 ES=2018 SS=2018 CS=2018 IP=0105 NV UP EI PL NZ NA PO NC
2018:0105 CC INT 3
-q
C:\>
```

In this example the CX register is 0105. The last digit, 5, is the IRQ.

The mouse IRQ is important even if you are using NOMOUSE.COM. The NOMOUSE.COM on the *DOS and Windows Driver Disk* does not use an IRQ. Use this version if possible.

If NOMOUSE.COM was created with PATCHMSE, the above procedure can be used to determine the IRQ.

- Try removing all unnecessary TSR's and device drivers from AUTOEXEC.BAT and CONFIG.SYS. Check for interrupt contention with other devices. Remove other devices and drivers to see if they may be contending with the touchscreen controller or drivers.

TouchBack

The layers for TouchBack applications are as follows:

Your application
TouchBack (TCHBACK.EXE)
ELODEV.EXE

Try these procedures:

- Reboot and check to see if TCHBACK.EXE is installing without an error message. See page 121 for a description of each message or Chapter 7 for installation instructions.
- If you are getting beep codes when your application runs, see page 123 for a description of each beep code.
- See if the problem is only with your TouchBack-based application. See the following section, *ELODEV*.
- If calibration is off in your TouchBack-based application, run ELOCALIB and calibrate in the video mode used by your application. Save the points in AUTOEXEC.BAT. TouchBack does not use ELOGRAPH.CAL. Reboot and try your application again.
- **Programmers:** Try a version of TBTEST included with the *DOS Programmer's Toolkit*.

ELODEV

The layers for ELODEV applications are as follows:

Your application
ELODEV.EXE
Hardware

Try these procedures:

- Reboot and check to see if ELODEV.EXE is installing without an error message. See page 114 for a description of each message or Chapter 4 for installation instructions.

If you have an IntelliTouch touchscreen controller with revision 2.2 or later firmware, or a SmartSet controller (E271-22xx or E281-23xx), the firmware revision level and power-on diagnostic results will be displayed when ELODEV is loaded. See the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* as appropriate if the power-on diagnostics are non-zero.

- See if the problem is only with your application. Try the ELODEMO program (typically in \TOUCH). If it does not work, try the TOUCHES program (see page 111). If TOUCHES does not display any coordinates when the touchscreen is touched, use COMDUMP (page 106) or BUSSTAT (page 104) to determine if data is reaching the computer from the touchscreen controller.
- Check the ELODEV command line parameters. They must match your hardware configuration. See Appendix A—*Configuring Your Controller*.
- Try removing all unnecessary TSR's and device drivers from AUTOEXEC.BAT and CONFIG.SYS. Check for interrupt contention with other devices. Remove other devices and drivers to see if they may be contending with the touchscreen controller or drivers. Try the -i flag to change the software interrupt of ELODEV (see page 31).
- If calibration is off in your ELODEV-based application, run ELOCALIB and calibrate in the video mode used by your application. Save the points in AUTOEXEC.BAT. ELODEV applications do not typically use ELOGRAPH.CAL.

ELODEMO

- If ELODEMO does not work, or only works in some screens, press [Esc] to abort. Try recalibrating with DEMOCAL.
- If it still does not work, try the TOUCHES program (see page 111). If TOUCHES does not display any coordinates when the touchscreen is touched, use COMDUMP (page 106) or BUSSTAT (page 104) to determine if data is reaching the computer from the touchscreen controller.
- Check the ELODEV command line parameters. They must match your hardware configuration. See Appendix A—*Configuring Your Controller*.
- See page 113 for a list of ELODEMO error messages.

ELOCALIB

- If nothing happens when you touch the screen to calibrate, press [Esc] to abort.
- Try the TOUCHES program (see page 111). If TOUCHES does not display any coordinates when the touchscreen is touched, use COMDUMP (page 106) or BUSSTAT (page 104) to determine if data is reaching the computer from the touchscreen controller.
- Check the ELODEV command line parameters. They must match your hardware configuration. See Appendix A—*Configuring Your Controller*.

DIAGNOSTIC UTILITIES

The following pages detail the use of the diagnostic utilities (typically found in the \TOUCH directory).

BUSSTAT

BUSSTAT.EXE allows you to test any Elo PC-Bus or Micro Channel controller (E281-4035, E281{A}-4025, E271-2201, E271-2202, E271-141, or E271-142) with or without ELODEV installed. The utility displays the controller's switch or jumper settings, then displays the touch coordinates as they are received. BUSSTAT polls the controller directly rather than being interrupt-driven. This can help determine if a problem is interrupt related.

If on installation, ELODEV reports an error message that the controller cannot be found, has incorrect switch settings, or ELOCALIB simply does not work, run BUSSTAT from the DOS prompt as follows:

```
BUSSTAT [Enter]
```

The program will prompt you for the controller type and Base I/O Port (except with the E271-2202). Initially, it should not be necessary to remove the Interrupt (IRQ) jumper.

Compare the displayed switch or jumper settings to those listed in Appendix A—*Configuring Your Controller*. A common problem results from inverting all the switch settings.

Next, touch the touchscreen and see the raw (untranslated) coordinates. Normally, data is displayed at a constant rate only when the touchscreen is touched. If no data is displayed on touch, or if data is displayed when the touchscreen is not touched (either continuously or intermittently), you may have a hardware problem.

It is possible that non-linearity or other problems may exist even if data is being reported to the computer. From the coordinate display, you can determine which corner is the origin and watch both X and Y increase steadily as you slide your finger to the diagonally opposite corner. Check the other two corners to make sure their coordinates look correct and the touchscreen appears linear in each axis. If the coordinates appear to be meaningless, try changing the Base I/O Port address of the controller. Another device may be contending for the same I/O address.

See the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* for hardware troubleshooting information. Contact Elo Technical Support if you believe you have a hardware problem.

To check for interrupt contention with another device, turn off the computer and remove the Interrupt (IRQ) jumper from the controller (the E271-2201 and E271-2202 should not have an interrupt jumpered). Power on and run BUSSTAT without installing or calibrating ELODEV. If the controller works, you probably have interrupt contention with another device. If you are using a controller other than E271-2201 or E271-2202, it is also possible that the interrupt specified for

ELODEV did not match your jumper placement. Try selecting another interrupt and double-check your jumper placement.

With the E271-2201 controller, you may simply change the interrupt specified on the ELODEV command line—it is not necessary to change jumpers (except when in E271-141 emulation mode). Likewise, with the E271-2202, use the configuration program on your Reference Disk to change the interrupt. Also see *Choosing an Interrupt (IRQ) for PC-Bus Controllers*, page 74.

COMDUMP

COMDUMP.EXE allows you to test any Elo serial controller (E281-2300, E281{A}-4002, E271-2210, E271-2200, E271-140, or E261-280) with or without ELODEV installed. COMDUMP directly reads the system's serial ports and displays any received data. This can determine if a problem is hardware or software related.

COMDUMP can be used to determine the controller type, data mode and baud rate of a controller. COMDUMP gives you a way to verify switch and jumper settings if the controller is installed inside a cabinet and not easily accessible. Also use COMDUMP to check that a controller/touchscreen/ cable combination is working correctly, which indicates that ELODEV installation is the problem.

To run COMDUMP, type the following at the DOS prompt:

```
COMDUMP <port 1 or 2> <baud rate>
```

The baud rate is optional. The default is 9600.

For example:

```
COMDUMP 2 2400
```

For instructions on how to format the command line and display the version number of COMDUMP, just type:

```
COMDUMP [Enter]
```

Once in COMDUMP, the raw (untranslated) data received from the controller is displayed. Normally, data is displayed at a constant rate only when the touchscreen is touched.

The baud rate can be changed by pressing [SPACE]. This cycles through all available baud rates. Change the baud rate until *something* displays. You can press the [M] key to toggle Hex and ASCII display modes. Try different combinations of [SPACE] and [M] until the data is recognizable. If you are not familiar with your controller, Elo Technical Support can help you interpret the displays. The *IntelliTouch Product Manual*, *AccuTouch Product Manual*, and the controller technical reference manuals also detail the data formats.

ELODEV requires that the controllers transmit in binary mode. Check your controller's switch and/or jumper settings (see Appendix A—*Configuring Your Controller*).

If no data is transmitted on touch, or if data is transmitted when the touchscreen is not touched (either continuously or intermittently), you may have a hardware

problem. See the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* for hardware troubleshooting information. Contact Elo Technical Support if you believe you have a hardware problem.

INFO

INFO.EXE allows you to confirm ELODEV settings. To run INFO, type the following at the DOS prompt:

INFO [Enter]

A sample output is shown below:

```
Controller:      2210 Rev: 1.3-0.0 Diags: 00-00 ID: EloInc.
Base Port:      03F8H
Interrupt (IRQ): 4
COM Port:       1
Baud Rate:      9600
Data Bits:      8
Stop Bits:      1
Parity:         N
Wait Time:      30
ELODEV Version: 1.7
Software Interrupt: 65H
Buffer Size:    5
Calibration Points: X= 666.. 3438 Y= 3350.. 809 Z= 1.. 255
Scaling Range:  X= 1.. 80 Y= 1.. 25 Z= 1.. 15
XY Swap Flag:   0
Mode:           0007H = buffered/untouch/stream/untranslated
Open Flag:      0
Enable Flag:    0
Error Flag:     0000H
Zone Table:     0000:0000H
User ISR:       0000:0000H
TSRLockFlag:   1
```

The Controller number will be 400 for the E281{A}-4002 controller. It will be 401 for the E281{A}-4025 and E281-4035 controllers.

If you have an IntelliTouch touchscreen controller with revision 2.2 or later firmware, or a SmartSet controller (E271-22xx or E281-23xx), the firmware revision level and power-on diagnostic results will be displayed after the Controller number. See the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* as appropriate if the power-on diagnostics are non-zero.

Programmers: INFO can be used when debugging an application program. Run INFO from a debugger or after breaking out of your program. As you can see above, you can use INFO to check the Open and Enable flags, the Mode, the Calibration, and the Translation Range. INFO also indicates any error conditions such as buffer overflow. See the *ELODEV Programmer's Reference* for more information.

Interrupt Flag (-i)

The -i flag allows you to specify the software interrupt of ELODEV. Syntax:

INFO [-i<n>]

where <n> is the software interrupt of ELODEV in hex. This flag is necessary if more than one copy of ELODEV is loaded, as when controlling two touchscreens. You will also need it if ELODEV is installed at a software interrupt other than 60 through 66 (hex). If the -i flag is not specified, the first ELODEV found when checking interrupts 60-66 will be used.

Help Flag (-h)

Type:

INFO -h

to display quick reference information on all flags and the current version of INFO.

SAWDUMP

SAWDUMP.EXE displays the firmware revision level, results of power-on diagnostics, signal gain values, and can capture further signal information into a .SWV file for analysis by Elo Technical Support. SAWDUMP works only with IntelliTouch controllers with 2.2 firmware or later (E281-2300, E281A-4002, E281-4035, or E281A-4025). If you are uncertain as to the firmware revision level, run INFO (see page 108).

To run SAWDUMP, type the following at the DOS prompt:

```
SAWDUMP [Enter]
```

and follow the on-screen instructions.

TOUCHES

TOUCHES.EXE allows you to confirm that ELODEV is communicating properly with the controller and to check touchscreen linearity.

To run TOUCHES, type the following at the DOS prompt:

```
TOUCHES [Enter]
```

Touch the screen and the program will display the X and Y coordinates of your touch, the Z value if the controller determines one, and a single "TRUE" only when you lift your finger (untouch). The coordinates should stream as described under the discussions of COMDUMP and BUSSTAT. Press any key to quit.

If TOUCHES does not display any data, but COMDUMP or BUSSTAT works, your ELODEV command line is incorrect, or you have an interrupt contention with another device.

If TOUCHES does not display coordinates at a steady rate with serial controllers, the baud rate may be incorrect. Check the ELODEV command line and Appendix A.

If TOUCHES does not display coordinates at a steady rate with IntelliTouch controllers, see the *IntelliTouch Product Manual* for hardware troubleshooting steps, or contact Elo Technical Support.

If TOUCHES indicates "TRUE", or a series of "TRUE"/"FALSE" when you have not lifted your finger, try increasing the Untouch Wait Time with the -w flag as a temporary solution (see page 32). Contact Elo Technical Support.

TOUCHES can also be used to perform a linearity check of the touchscreen. (BUSSTAT can also perform this check with bus controllers). If TOUCHES is run without calibrating ELODEV, TOUCHES will display the untranslated (raw) coordinates of your touch. Make sure ELODEV is loaded without the -c calibration flag and without running ELOCALIB. From the coordinate display, you can determine which corner is the origin and watch both X and Y increase steadily as you slide your finger to the diagonally opposite corner. Check the other two corners to make sure their coordinates look correct and the touchscreen appears linear in each axis.

Appendix C

Error Messages

- *ELODEMO Error Messages* 113
- *ELODEV Error Messages* 114
- *MonitorMouse for DOS Error Messages* 118
- *TouchBack Error Conditions* 121

ELODEMO ERROR MESSAGES

If ELODEMO aborts with error codes 202 or 203 (not enough memory), remove any TSR programs you can and re-run ELODEMO. A system with at least 400K of available RAM is recommended.

If ELODEMO says "ELOGRAPH.CAL not correct format", erase ELOGRAPH.CAL, recalibrate with DEMOCAL, and run ELODEMO again. You have a calibration file from a previous version of ELODEV.

ELODEV ERROR MESSAGES

This section lists the error messages that can be displayed by ELODEV upon installation, with a brief explanation where necessary. No error messages are ever output by an installed copy of ELODEV.

ELODEV returns an *exit code*, sometimes called an "error level" code, that can allow DOS batch files to process fatal errors with the ERRORLEVEL command. If the ELODEV command works normally, the returned code is 0; otherwise it's 1.

Cannot output to controller.

A COM port error was detected when trying to set up the controller. You may have a defective COM port.

COM port not installed.

Self-explanatory.

Controller not detected.

If using the **E271-2210** or **E271-2200** serial controller, ELODEV did not detect the DSR RS-232 line from the controller. Make sure your cable provides the DTR, DSR, RTS, and CTS handshaking lines when using this controller, or use the -p- flag (see page 32). Also check that the controller is not in an emulation mode.

If using the **E271-2201** PC-Bus controller, ELODEV did not detect the controller at the Base I/O Port specified. Make sure the jumpered Base I/O Port matches the ELODEV command line, or try changing both to another address. Also check that the controller is not in an emulation mode.

If using the **E271-2202** Micro Channel controller, make sure you used your IBM PS/2 Reference Disk to define the adapter to the system.

Controller not found at Base I/O Port address or has incorrect mode switches.

Self-explanatory. Double-check the switches and Base I/O Port jumpers.

Controller not found at Base I/O Port address or is not in 12-bit/Z mode.

For the E281{A}-4025 controller to transmit Z data, its switches must be set for 12-bit and Z-axis modes.

Controller not responding.

Controller is not responding to the software setup sequence. Check the cabling and the baud rate of the controller.

Controller not responding correctly.

Controller is responding, but not correctly, to the software setup sequence. Check the controller's baud rate.

ELODEV already installed.

You tried to install ELODEV when it is already present. To install multiple copies of ELODEV, specify a different software interrupt (-i flag) for each copy. To update the flags of an installed copy, specify only the flags on the command line. Do not specify the controller information.

ELODEV cannot be extracted.

Another program loaded after ELODEV is preventing its extraction. Try extracting TSR's loaded after ELODEV first.

ELODEV not installed.

You tried to extract ELODEV from memory, or to update its flags. You may have specified an incorrect software interrupt if ELODEV is installed at an interrupt other than the default.

ELODEV in use.

You tried to extract ELODEV, but another TSR loaded after ELODEV is still using it. Try extracting the other TSR first (such as MONMOUSE.COM).

Flags not updated.

You tried to update a flag that cannot be updated. Extract ELODEV and reinstall it with the new flag.

Invalid baud rate.

The baud rate must be 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19,200, or 38,400. ELODEV will accept a baud rate from this list even if the specified controller does not support it, allowing the use of compatible controllers which do support the baud rate.

Invalid buffer size flag.

The buffer size (-b flag) must be between 3 and 1000 (decimal) inclusive.

Invalid calibration range.

Six unsigned decimal values must be specified (-c flag).

Invalid COM port.

The COM port is normally 1 or 2. For controllers connected to other COM ports, software must be supplied for ELODEV to access the port (see the SetUserCom function in the *ELODEV Programmer's Reference* for more information). For all of these ports, the COM port is specified as 0, and no baud rate included.

Invalid controller.

The controller number must be 140, 141, 280, 400, 401, 2200, 2201, 2202, 2210, 2300, 4002, 4025, or 4035. Other controllers can only be installed by specifying the emulated controller.

Invalid flag.

Display ELODEV's available flags by typing:

ELODEV [Enter]

Invalid I/O port.

The Base I/O Port for PC-Bus controllers must be specified in hexadecimal, and must be a multiple of 8 or 32 (20 hex), depending on the controller.

Invalid interrupt (IRQ).

The Interrupt (IRQ) for PC-Bus controllers must be between 2 and 7.

Invalid mode flag.

The mode (-m flag) cannot be larger than FF (hex).

Invalid software interrupt flag.

The software interrupt (-i flag) must be between 30 and FF (hex) inclusive. Note that most software only checks for ELODEV at interrupts 60 through 66.

Invalid syntax.

An argument on the command line was missing or not as expected. Usually a comma was expected. If you specified a COM port of 0, no baud rate should be specified. If using a Micro Channel controller, you should not specify a Base I/O Port or Interrupt (IRQ).

Invalid translation range.

Six signed decimal values must be specified (-r flag).

Invalid wait time flag.

The Untouch Wait Time (-w flag) must be less than 500 (decimal).

Invalid XY swap flag.

The swap flag (-s) must be + or -.

System does not have a Micro Channel bus.

You have specified a Micro Channel controller on a system that is not a PS/2 or compatible with a Micro Channel bus.

System does not have a PC-Bus.

You have specified a PC-Bus controller on a system that has a Micro Channel bus.

Touchscreen fault -- controller is transmitting continuously.

The controller should be transmitting only when you touch the touchscreen. You have a hardware problem. See the *IntelliTouch Product Manual* or the *AccuTouch Product Manual* as appropriate for additional troubleshooting information.

MONITORMOUSE FOR DOS ERROR MESSAGES

This section lists the error messages that can be displayed by MONMOUSE.COM upon installation, along with a brief explanation where necessary. No error messages are ever output by an installed copy of MonitorMouse for DOS.

MONMOUSE.COM returns an *exit code*, sometimes called an "error level" code, that can allow DOS batch files to process fatal errors with the ERRORLEVEL command. If the MonitorMouse for DOS command works normally, the returned code is 0; otherwise it's 1.

Cannot read ELOGRAPH.CAL.

An error occurred while trying to open the file ELOGRAPH.CAL, possibly due to lack of available file handles or access privileges.

Conflicting TSR.

Another TSR is using the same multiplex interrupt ID value. Try installing MonitorMouse for DOS with each TSR separately to identify the contending TSR.

DOS memory deallocation error.

You tried to extract MonitorMouse for DOS, but something has corrupted your system RAM. Reset your system.

ELODEV not calibrated.

The -c flag was not specified when you loaded ELODEV, or you failed to run ELOCALIB or DEMOCAL after ELODEV was loaded. See Chapter 4.

ELODEV not installed.

ELODEV must be installed before loading MonitorMouse for DOS (see page 44). Look for an error message while the system is booting. If you are using ELODEV's -i flag, make sure the interrupt is between 60 and 66 (hex), or use MONMOUSE's -i flag.

ELODEV not version x.x or later.

Copy the latest version from your distribution disk into the correct directory, or contact Elo for the updated version. Check your AUTOEXEC.BAT file, if any, to see where it looks for ELODEV. To find out the version, type:

ELODEV [Enter]

ELOGRAPH.CAL not correct format.

Either your ELOGRAPH.CAL file is damaged, or it was created with ELOCALIB from a version of ELODEV before ELODEV 1.3a. Erase the .CAL file, and recalibrate in the video modes you will be using with a current version of ELOCALIB.

ELOGRAPH.CAL not found in specified directory.

ELOGRAPH.CAL was not found in the directory specified with the -d flag.

-i flag cannot be updated. Extract and reload.

Self-explanatory.

Invalid beep flag.

The beep flag (-b) must be either + or -.

Invalid cursor flag.

The cursor flag (-c) must be either + or -.

Invalid directory flag.

The directory path given with the -d flag for ELOGRAPH.CAL is invalid. Check that the path specification is correct and the directory exists.

Invalid flag.

Display the available flags by typing:

MONMOUSE -h

Invalid interrupt flag.

The interrupt flag (-i) must specify the software interrupt of ELODEV in hex.

Invalid jump flag.

The jump flag (-j) must be either + or -.

Invalid mickey/pixel ratio.

The mickey-to-pixel ratios (-r flag) must be specified as two decimal numbers for X and Y, separated by a comma.

Invalid mode.

The mode (-m flag) must be between 0 and 6 inclusive.

Invalid spawn flag.

The spawn flag (-s) must be either + or -.

Invalid terminate flag.

The terminate flag (-t) must be either + or -.

MonitorMouse for DOS cannot be extracted.

Another program or TSR loaded after MonitorMouse for DOS has changed interrupt vectors affecting MonitorMouse. If you can extract these other TSR's, do so in the reverse order from which they were loaded and then try extracting MonitorMouse for DOS.

MonitorMouse for DOS not installed.

You tried to extract MonitorMouse for DOS, but it has not been previously loaded.

MonitorMouse for DOS requires DOS 2.0 or later.

Self-explanatory.

MOUSE driver not installed.

MOUSE.COM or MOUSE.SYS must be installed before loading MonitorMouse for DOS. See *Installation*, page 44.

PRINT.COM version 2.0 or less.

DOS's PRINT.COM program is resident and it will not allow other TSR's such as MonitorMouse for DOS to use the multiplex interrupt. Get a more recent version of PRINT.COM, or update your version of DOS.

TOUCHBACK ERROR CONDITIONS

TouchBack may output an error message as it is loaded. Once loaded, run-time error conditions are indicated with beep codes rather than error messages. Error messages and beep codes are listed in the following sections.

Error Messages

TouchBack may display any of the following error messages as it is loaded.

TouchBack also returns an *exit code*, sometimes called an "error level" code, that can allow DOS batch files to process fatal errors with the ERRORLEVEL command. The exit code that corresponds to each error message appears in parentheses following the message. Exit code 0 indicates no error. See a DOS manual for information on writing batch files which check the ERRORLEVEL code.

-b flag cannot be updated. (4)

Reminds you that TouchBack's buffers cannot be changed with the -b command after TouchBack has been loaded. Extract TouchBack using the -x flag, then reinstall it with the desired -b flag. See page 71.

Buffer too large. (9)

You have specified buffers that occupy more space than is available. The product of the number of buffers times the buffer size of each may not be greater than 52K.

Can't install TouchBack -- conflicting TSR. (11)

Another TSR program is using the same multiplex interrupt ID value. Try installing TouchBack with each TSR separately to identify the conflicting TSR.

ELODEV not calibrated. (3)

The -c flag was not specified when you loaded ELODEV, or you failed to run ELOCALIB after ELODEV was loaded. See Chapter 4.

ELODEV not installed. (1)

ELODEV must be installed before loading TouchBack (see page 68). Look for an error message while the system is booting. If you are using ELODEV's -i flag, make sure the interrupt is between 60 and 66 (hex), or use TCHBACK's -i flag.

ELODEV not version x.x or later. (2)

Copy the latest version from your distribution disk into the correct directory. Check AUTOEXEC.BAT or the batch file that loads ELODEV to see where it looks for ELODEV. To find out the version, type:

ELODEV [Enter]

Insufficient memory. (9)

Your system does not have enough memory available for TouchBack to stay resident with the specified (or default) buffer size. Try removing TSR's. You may have tried to load TouchBack from a DOS shell.

Invalid buffer flag. (8)

The buffer flag must be specified in the following format:

-b<buffercount>,<buffersize>

Both numbers must be decimal. Buffercount must be between 1 and 20 inclusive. Buffersize must be 50 or larger.

Invalid flag. (8)

Display TouchBack's available flags by typing:

TCHBACK -h

Invalid lead-in character flag. (8)

The ASCII code for the lead-in character must be a decimal number between 1 and 255, specified in the following format:

-c<code>

SET BINPATH subdirectory not found. (10)

TouchBack can't find the subdirectory specified in a SET BINPATH command. Check the batch file that loads TouchBack and modify the SET BINPATH command to specify a valid directory.

SET PICPATH subdirectory not found. (10)

TouchBack can't find the subdirectory specified in a SET PICPATH command. Check the batch file that loads TouchBack and modify the SET PICPATH command to specify a valid directory.

TouchBack already installed. (4)

Reminds you that TouchBack was already loaded when you gave the command. All TouchBack flags except -b may be used after TouchBack is loaded.

TouchBack cannot be extracted. (7)

Another program or TSR loaded after TouchBack has changed interrupt vectors affecting TouchBack. If you can extract these other TSR's, do so in the reverse order from which they were loaded and then try extracting TouchBack.

TouchBack not installed. (5)

You tried to extract TouchBack, but it has not been previously loaded.

TouchBack requires DOS 3.1 or later. (6)

Self-explanatory.

Beep Codes

The following error conditions are indicated by the number of repeated beeps shown at left. The beep has a different sound than the beep indicating valid touches. Error conditions marked with an asterisk (*) must be corrected within the application code.

1. *Invalid command.**

Check your syntax.

2. *Cannot display PIC file.*

One of the following conditions occurred:

- The file was not found (check the path and the SET PICPATH in your environment, page 69).
- A disk error occurred while reading the file.
- The file cannot be displayed because of an incorrect ID byte, an unsupported version number, or an invalid video mode.
- The file cannot be displayed because your hardware is insufficient for viewing (e.g. an EGA screen and you have only CGA). If the image is 640x480 on an EGA+, add

TUFLAGS=480 to your DOS environment with the SET command.

3. *Cannot find BIN file.*

Check the path and the SET BINPATH in your environment. See page 69.

4. *Cannot load BIN file.*

One of the following conditions occurred:

- A disk error occurred while reading the file.
- The file did not have the correct version number.
- The file was for an overlay.
- The file has been corrupted.

5. *Not enough memory for BIN file.*

The buffer size (-b flag) will not allow the specified BIN file. Increase your buffer size. See page 70.

6. *TOUCH SCREEN command called without first calling SET TARGETS TO.*

The buffer number specified when calling the TOUCH SCREEN command was never filled with the SET TARGETS TO COMMAND. This error will typically follow error codes 3 and 4. If it occurs by itself, the problem must be corrected within the application code.

7. *Invalid stuff string.**

The string to be stuffed in the keyboard buffer, either from a touched zone or the KEY FAKE command, is not syntactically correct.

8. *Invalid buffer number.*

A buffer number specified by the application program is not valid. Try increasing the number of buffers with the -b flag. See page 70.

Appendix D

MonitorMouse for DOS Programming Information

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INTRODUCTION

MonitorMouse for DOS supports a special mouse function number (65 hex) with three subfunctions:

- 0 Get MonitorMouse for DOS mode and options.
- 1 Set MonitorMouse for DOS mode and options.
- 2 Wait for untouch if screen is being touched.

SUBFUNCTION 0 - GET MODE AND OPTIONS

Subfunction 0 is used to get the current mode, flags, and version number of MonitorMouse for DOS. In the style of Microsoft mouse programmer's documentation:

INPUT	OUTPUT
M1%=&H65	M2%=&H65
M2%=0	M3%=flags/mode
	M4%=version number

(For other languages, the AX register is M1%, BX is M2%, CX is M3%, and DX is M4%. The mouse driver is called with an INT 33H instruction.)

On input, M1% is the MonitorMouse for DOS special function number (65 hex), and M2% is the subfunction number.

On return, the high byte of M4% will contain the major version number and the low byte the minor version number. The low byte of M3% will contain the current mode (see -m flag, page 47). The high byte of M3% will have the current flag settings as follows:

bit 8	&H0100	1 if cursor-on (-c+), 0 otherwise
bit 9	&H0200	1 if beep-on (-b+), 0 otherwise
bit 10	&H0400	1 if active in spawned programs (-s+), 0 otherwise
bit 11	&H0800	1 if active after program terminations (-t+), 0 otherwise
bit 12	&H1000	1 if jump-on (-j+), 0 otherwise

If the subfunction is successful, 65 (hex) is returned in M2%. This can be used to detect if MonitorMouse for DOS is installed. If only MOUSE.COM is installed, M2% will not change.

SUBFUNCTION 1 - SET MODE AND OPTIONS

Subfunction 1 is used to set the mode and flags. M3% must contain the mode in the low byte and the flags in the high byte as above.

INPUT	OUTPUT
M1%=&H65	M2%=&H65
M2%=1	
M3%=mode/options	

As in subfunction 0, if this subfunction is successful, 65 (hex) is returned in M2%. This can be used to detect if MonitorMouse for DOS is installed. The following is an example in BASIC:

```
100 M1%=&H65          ' MonitorMouse special function
200 M2%=1              ' subfunction 1
300 M3%=&H302          ' set -c+, -b+, -s-, -t-, -m2
400 CALL MOUSE(M1%, M2%, M3%, M4%)
500 IF M2%<>M1% THEN PRINT "MonitorMouse not installed."
```

Here's the same code in C:

```
regs.x.ax = 0x65; regs.x.bx = 1; regs.x.cx = 0x302;
int86(0x33,&regs,&regs);
if (regs.x.bx != regs.x.ax)
    puts("MonitorMouse not installed.");
```

SUBFUNCTION 2 - WAIT FOR UNTOUCH

Subfunction 2 will wait for an untouch if the screen is being touched. This is normally called before changing modes with subfunction 1.

INPUT	OUTPUT
M1%=&H65	M2%=&H65
M2%=2	

Appendix E

MonitorMouse for Windows Programming Information

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Z-AXIS CAPABILITY

Windows 3.1 programmers can take advantage of IntelliTouch Z axis capabilities. For a demo, select File/Run from Program Manager and enter ZAXIS.EXE (typically found in the \TOUCH directory).

The following information describes how to obtain Z data. For a complete example, see the source code, ZAXIS.C, available on the Elo BBS and CompuServe (see page 7).

First verify that MonitorMouse for Windows is installed as the mouse driver by looking for the string "mouse.drv=monmouse.drv" in the [boot] section of SYSTEM.INI. Use the function:

```
GetPrivateProfileString("boot", "mouse.drv", "nomouse", buffer, 80, "system.ini");
```

Be aware that the string returned after "mouse.driv=" may be in upper or lower case.

Then, use the GetMessageExtraInfo() function to receive additional information about your input device (mouse, tablet, touchscreen, etc.). MonitorMouse for Windows returns a 32-bit field containing additional information on touch and mouse events, as well as controller capabilities.

The bit definitions are as follows:

Low Word

bit 0: 1 = touch, 0 = mouse
bit 1: 1 = controller has Z-axis capabilities, 0 = No Z

High Word

bits 0 7: Z-axis data (0-255)

The following code fragment demonstrates how to obtain Z data.

```
ULONG TouchInfo;  
TouchInfo = GetMessageExtraInfo();  
// If we had a touch, this if statement will not be executed.  
// If there was a mouse event, set TouchInfo to indicate this.  
if (!(LOWORD(TouchInfo) & 1))  
    TouchInfo = 0x00ff0000;                   /* mouse Z is 255 (100%) */  
// Send the Z value to the meter control to be displayed  
SendDlgItemMessage(hDLG, ID_METER, MM_SETPARTSCOMPLETE, HIWORD(TouchInfo), 0);
```

See a Windows SDK manual for more information on Windows function calls.

LAUNCHING THE TOUCHSCREEN CONTROL PANEL

It is possible to launch the Touchscreen Control Panel directly from a Windows 3.1 application using the following code:

```
handle = WinExec("control elocalw.cpl", SW_SHOWNORMAL);
```

CALIBRATING FROM WITHIN YOUR PROGRAM

You may also call the calibration procedure of the Touchscreen Control Panel directly from your program with the exported function CalibrateScreen(). It takes two arguments—your window handle and a timeout value in seconds (0 = no timeout).

The following code fragment demonstrates how to call this function. For a complete example, see the source code, CALIB.C, available on the Elo BBS and CompuServe (see page 7).

```
WORD Timeout;
HWND hWnd; // window handle
FARPROC lpfnCalibrateScreen; // pointer to Calibrate function
HANDLE hLibrary; // ELOCALW.CPL library handle
// Load the Control Panel applet
hLibrary = LoadLibrary("ELOCALW.CPL");
if (hLibrary < (HANDLE)32) {
    MessageBox(NULL, "Could not load Calibration Library.", "NoLoad", MB_OK);
    break;
}
// Get address of CalibrateScreen function
lpfnCalibrateScreen = GetProcAddress(hLibrary, MAKEINTRESOURCE(4));
// timeout in 5 minutes
Timeout = 300;
// Call CalibrateScreen function
(*lpfnCalibrateScreen)(hWnd, Timeout);
FreeLibrary(hLibrary);
```

TOUCH ICONS

Several touch-related icons are available for your own programs. Select the icon for your program in Program Manager. Choose File/Properties/Change Icon and enter ZAXIS.EXE with its path as the File Name. Select one of the displayed icons.

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