MICROCOMPUTING MICE

Mice demystified

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The mouse is invading! In programs ranging from drafting (AutoCAD, AutoSketch) to drawing (Dr. Halo, PC Paintbrush), from spreadsheet (Excel) to word processor (Word)—not to mention operating environments (DESQview, Windows)—they're everywhere! More than half a dozen manufacturers are hawking their wares, and several more are hawking alternate technologies that in some way hope to alleviate one or more weak points of the mouse. In this article, we'll examine the basics of how mice work, and then examine some popular devices.

Types of mice

There are three basic mouse types: mechanical, optical, and wheel. The most common is the mechanical, shown in Fig. 1. It has a roller ball that drives two pressure rollers mounted at right angles to one another, one each corresponding to the X and Y dimensions.

The pressure rollers in turn drive two encoder wheels. In a purely mechanical mouse, the encoder wheels have contact points around the circumference that serve to make and break an electric circuit. In an opto-mechanical mouse, slits in the encoder wheel make and break an optical circuit (i.e., an LED/photodetector pair). In either case, signal-shaping circuitry cleans up the signals and converts them to a form digestible by a computer.

The wheel mouse is quite similar to the mechanical mouse, except that there is no wheel. Instead, the shafts from the encoder wheels terminate in small wheels that contact the table directly.

The distinguishing feature of the optical mouse is that it has no moving parts. Instead, a pair of LED's shine through the case of the mouse. Their beams are reflected by a specially lined pad and are then detected by photodetectors in the mouse. As with the mechanical mouse, those raw signals are then cleaned up and converted for computer use. Because they have no moving parts, optical mice are more reliable and easier to maintain.

As for alternate devices, the most popular is the trackball, which can be viewed as just a mouse lying on its back. Instead of contacting a table, the ball contacts your hand. Internally, either mechanical or opto-mechanical technology can be used to decode motion.

Digitizing tablets can also emulate mice, through a combination of both hardware and software. For example, Keytronic's KB5153 keyboard contains what amounts to a miniature high-resolution digitizing tablet. Output from the keypad is transmitted along with the usual scan codes from the keyboard; a special software driver separates keyboard codes from tablet codes, and can translate the latter into equivalent mouse codes if desired.
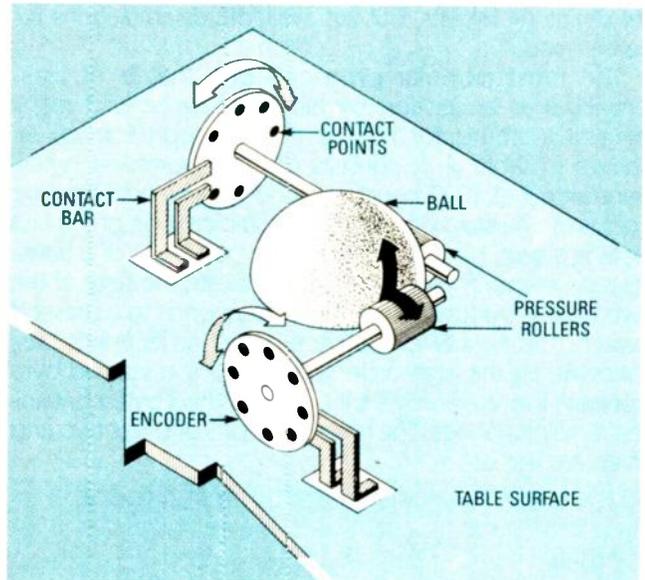

FIG. 1—Inside a mechanical mouse. The roller ball drives two pressure rollers mounted at right angles to each other.

Number of buttons

Among human-interface designers, discussions of the optimum number of buttons on a mouse is akin to arguing about the number of angels that can fit on the head of a pin. The arguments become heated, but most real-world software is written to use only one button (occasionally two). For example, even though the Microsoft mouse has two buttons, Windows uses only one. A few mice have three buttons, but there is almost no commercial software that uses all three.

Interface hardware

Whatever the underlying technology, the mouse must have a way to get signals to your PC. There are two basic interface techniques: serial and bus. A serial mouse connects directly to any standard RS-232 port; a bus mouse has its own interface card. (Trackballs are generally serial devices.)

It is claimed that a bus mouse provides better response, but unless you're in the habit of racing your mouse across your desk at full speed, you're not likely to notice any difference. So choose the type of mouse depending on whether you have a free serial port or a free slot. The only other thing to keep in mind is that, when installing a bus mouse, you'll have to select an interrupt level that is not used by other devices in your PC.

Microsoft has an additional mouse interface, called the

InPort. The InPort is a special type of serial interface that is available on Microsoft's Mach 10 and PC Technologies' Rainbow Plus accelerator cards, and a few others. The InPort connector is non-standard, so you cannot plug an InPort mouse into a standard serial-port connector.

Interface software

Several protocols exist by which a mouse may communicate with the host PC, including Summagraphics Bit Pad One (binary and ASCII protocols), Retrographics RG-512, three-byte relative, Houston Instruments HiPad, five-byte relative (Mouse Systems), Tektronics Plot 10, Microsoft, USI OptoMouse, Hitachi Tiger, and others. As the names suggest, some of those protocols were originally developed for digitizing tablets, but are available as emulations for some mice.

The most popular protocol, one that is at least provided as an option by almost all mice and many digitizing tablets for PC's, is the Microsoft format. As shown in Table. 1, it consists of three seven-bit bytes, transmitted at 1200 baud, with no parity, and with one start and one stop bit. The most-significant bit of the first byte is a sync bit that indicates the beginning of a transmission frame. The next two bits indicate the state of the two mouse buttons; a zero bit corresponds to a pressed switch. The next two bits are the high-order Y-axis bits, followed by the high-order X-axis bits. The second byte contains the remaining X bits, and the third byte contains the remaining Y bits. The high-order bits of bytes two and three are not used.

TABLE 1—MICROSOFT MOUSE PROTOCOL

Byte Bit	6	5	4	3	2	1	0
1	1	S1	S2	Y7	Y6	X7	X6
2	0	X5	X4	X3	X2	X1	X0
3	0	Y5	Y4	Y3	Y2	Y1	Y0

Normally, you needn't concern yourself with the software interface protocol. Name-brand mice (Microsoft, of course, as well as Logitech and Mouse Systems) are supported directly in their own format by most major software packages; almost invariably they include Microsoft emulation modes as well. You should be safe buying an off-brand mouse (or an alternate device), assuming it can emulate the Microsoft protocol competently.

Utility software

Using a mouse with Windows or AutoCAD is a snap—but what about all the other programs that don't know mice from lice? Many mice now include special programs that let you build your own mouse interface for your favorite application program.

To generate a mouse-based menu interface, you write a program using your favorite ASCII text editor, compile it, and then run it before running your application. In the application, special menus pop up depending on which buttons you push, what's displayed on the screen, etc. With careful thought, you can add a complete menu interface to just about any program that operates in text mode. The menu-programming language is simple to use, easy to master, and easy to experiment with. Microsoft's menu language is something of a standard; compilers made by other companies (Logitech for one) can compile Microsoft menu files directly.

Maintenance

Unless you are a total slob, mouse maintenance is minimal or non-existent. One claimed advantage of optical over mechanical mice is that no cleaning is ever required. That may be true, but cleaning a mechanical mouse is a 30-second procedure that must be performed only a few times a year.

Product evaluations

What follows are our experiences installing and using more than half a dozen different mice and other devices. Although there are differences among them, and we certainly have our favorites, not one has serious defects, and every one is well built. Features are summarized in Table 2. A serial version of each device was installed on an IBM PC XT with a 12-MHz BreakThru 286 accelerator card (made by PCSG) and tested with the following software: Microsoft Windows 2.0, DesqView 2.0, Auto-

TABLE 2—FEATURE COMPARISON CHART

	Fulcrum Trackball Plus	Numonics Manager Mouse Cordless	Logitech Mouse	Microsoft Mouse	Keytronic KB5153	PC Mouse
Length (inches)	4.5	3.6	4.8	4.0	3.5	3.8
Width (inches)	5.8	2.4	2.8	2.1	3.5	2.6
Height (inches)	1.8	1.1	1.0	1.2	1.3	1.0
External power	Y	Y	N	N	N	N
Battery	Y	Y	N	N	N	N
Microsoft emulation	Y	Y	Y	Y	Y	N
Total emulations	10	3	3	1	1	1
Cable length (inches)	48	40*	72	90	72	60
Technology	O	M	OM	M	M	O
Number of buttons	6	3	3	2	2	3
Menu software	N	N	Y	N	N	Y
Other utility software	N	Y	Y	Y	Y	Y
RAM used by basic driver (K)	8	8	10	10	6	7
Software version tested	6.02	6.11	3.41	6.11	3.0	5.03
Price	$95	$199	$119	$150	$249	$149

*With charging cable

Sketch, and Dr. Halo. Except as noted, all devices performed adequately with each program. Reviews are presented alphabetically by manufacturer.

Fulcrum

To some, a big disadvantage of the mouse is that you must maintain a flat, fairly clean area on your desk in which to operate the device. The trackball overcomes that problem; you can set the trackball's housing on just about anything (including your lap) and still obtain acceptable results. In addition, sometimes you run off the edge of the desk when using a mouse, after which you must pick it up, set it down, and then continue working. That never happens with a trackball.

Fulcrum's Trackball Plus (shown in Fig. 2) has six buttons and emulates nearly all standard protocols (including Microsoft). You can set the emulation protocol using either a software driver or by pressing various combinations of buttons.

There is a potential problem with "dragging," the process of pressing a button while moving a mouse. Because of the mechanical arrangement, dragging can be difficult or impossible with a trackball. Fulcrum solves the problem by dedicating the fourth button to initiating a drag. First press it, followed by the desired button. The trackball will continue responding as if that button is depressed until you press another button.

The fifth button is a dedicated "alternate cursor" switch, useful in AutoCAD for getting at the menus without actually moving the drawing cursor from its current position.
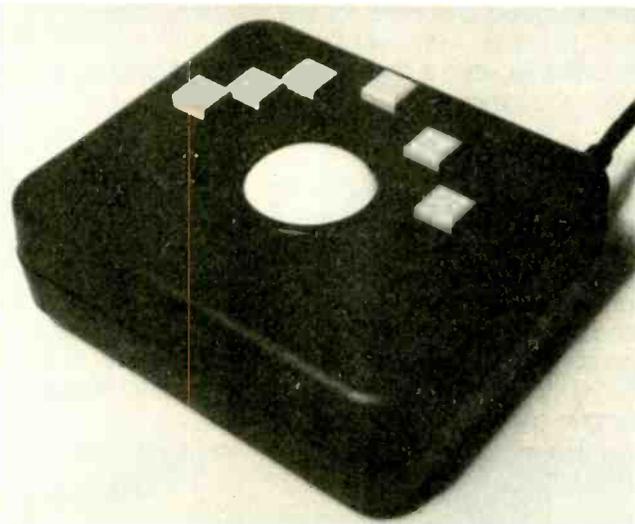

FIG. 2—The Fulcrum Trackball Plus

The trackball itself has a very nice feel. But because of the height of the enclosure, there is no support for your wrist, so your arm may get tired. The buttons generate a nice click when pressed, and they have a stiff feel that is almost too stiff. The interface cable is somewhat short, and due to the non-symmetric layout of the six buttons, the device is definitely biased toward right-handed users. But you needn't maintain a clear space on your desk to use the Trackball Plus, and the trackball itself allows very precise cursor positioning.

Keytronic

The KB5153 keyboard was originally reviewed in the July 1987 issue, where we concentrated on its function as a keyboard. Since then, Keytronic has released new software for the keyboard that provides better support for graphics programs.

The keyboard itself is laid out in the AT style, with the Escape key appearing in the numeric keypad. Next to the numeric keys is the pad itself (shown in Fig. 3), which measures about 3½ inches on a side. The pad has a resolution of about .001", about five to ten times that of most mice.
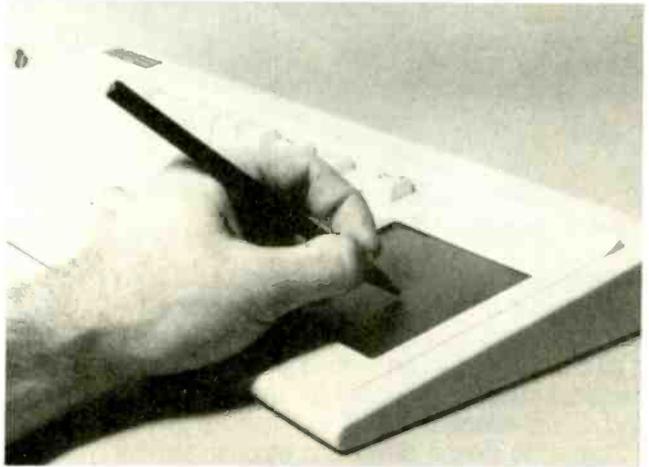

FIG. 3—The Keytronic KB5153

The pad is programmable and may be used in several modes, including Function (wherein areas of the pad function as keys that are user-programmable), Cursor (wherein the pad functions like the cursor keys), Mouse (wherein the pad emulates a Microsoft mouse), Graphics (wherein the pad emulates a digitizing tablet), and various combinations of the above.

Separate programs are supplied to use the pad as a mouse under DOS and under Windows. Installing the Windows driver is slightly difficult, because the installation instructions refer to an old version of the program (1.0), and because Windows itself is "cantankerous." After getting through the installation, however, the pad works well. Special drivers and plastic overlays are available for use with PageMaker and Ventura Publisher. By touching the plastic stylus to various parts of the pad, you can open and save files and perform other common functions. Other parts of the pad function (simultaneously) as a "drawing" area for mouse emulation.

Mouse emulation works fairly well, but, depending on your software, you may need to experiment with some of the emulation settings (in consultation with Keytronics' technical support personnel, who are available by toll-free telephone). The only oddity is that you must get used to working with both hands, because the mouse buttons are simulated by pressing keyboard keys.

Since our original review, Keytronic has decreased the price and increased the functionality of the KB5153. It needs neither a slot nor a serial port, so in its present incarnation, it's a winner. Left-handers watch out, though; the pad is contained in the right side of the keyboard.

Logitech

Although boxy looking (as shown in Fig. 4), Logitech's mouse has an excellent feel, good emulation, and good utility software. It is available in serial, bus, and PS/2