

PC Focus: TurboPuck, a Precision Pointing Device

By Richard A. McGrath, Contributing Editor

TurboPuck, from the KA Design Group (Oakland, CA), is a 2-D pointing device that is somewhat like a mouse, joystick and digitizing tablet—all rolled into single package capable of delivering 16,385 × 16,385 resolution. A complete \$159.59 TurboPuck system includes the opto-electronics package, an RS-232 connector cable and documentation. If needed, an external power supply is available for an additional \$20.

The user's interface is a motion handle which can be moved within a 1.5" rectangular area. Optical sensors measure the position of the handle to the nearest 0.010", with a maximum resolution of one part in 16,385 per axis of motion. There are three buttons on the housing that can function like those on a mouse, and an optical switch is built into the motion handle. When the handle is pushed down, the TurboPuck senses this change.

Several modes of operation allow you to change TurboPuck's resolution and type of motion. You can switch from ASCII to binary output under program control or by changing DIP switches. The Delta Binary output mode emulates mouse output and an Absolute Binary output mode is like that provided by small digitizing tablets.

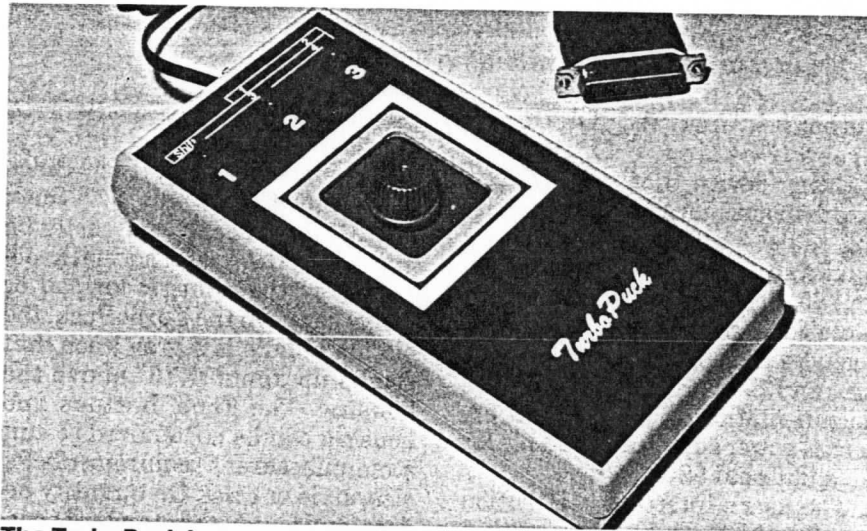
The device includes a module with an opto-mechanical motion assembly (Puck Pointer Component) mounted on a small printed circuit board. The board contains digital driver circuitry, a bank of eight DIP switches, and a microprocessor. In addition, there are three microswitches plus connectors for power and the serial cable.

Similar modules are available to OEM's for installation into keyboards or instrumentation. Since this component is only 0.5" thick and 3.25" square, it can easily be fitted into the space normally occupied by the numeric keypad or arrow keys. On the TurboPuck, the motion handle is a gray knob that sticks up about 0.75" above the housing. The knob, buttons and housing can be customized to suit a manufacturer's requirements for size, style or color. On quantity orders, any four of the standard spectrum of baud rates can be provided, up to 19,200 baud.

This pointing device is not limited to cursor movement on personal computers. Applications to medical scanning equipment and micropositioners are already being used in the field. The Puck Pointer Component costs \$25 and the module, including driver circuitry, is priced at \$100.

Distinguishing Features

Several software features distinguish the TurboPuck from other pointing devices. With the help of an on-board microprocessor, computing overhead is removed from the host as different commands are used to change the device's characteristics. For example: automatic cursor positioning permits multiple cursor and window manipulation; a Z command provides full control of x, y, and z axes; the SPACE command changes the working space in the range of 10 × 10 to 16,384 × 16,384; and the STEP command changes binary or ASCII step size in the range of 1 to 127.



The TurboPuck buttons numbered 1, 2 and 3 are analogous to mouse control buttons. The knob is a motion handle that provides 2-axis positioning and an additional optical switch.

TurboPuck Specifications

Item	Values or Characteristics
Model	TurboPuck 2-D/3-D Position Control
Resolution Range	1 Part in 10 variable through 1 part in 16,384
External Interface	RS-232
Baud Rate	300, 1,200, 9,600, 19,200
Power Consumption	1W @ 5.0V (or from pin 11 on RS-232 connector)
Dimensions	7.5" x 4" x 1"
Weight	12 oz.
Switches	3 push buttons, 1 optical switch in handle
Controlled Areas	x, y, z or theta axes
Price	\$159.95 (plus optional power supply for \$20)

The TurboPuck's optical technology is totally enclosed, and touted as being impervious to dirt, electrical noise, liquids, bright light, vibration, or the need for external adjustment or calibration. Since there are moving mechanical parts elsewhere in the Puck Pointer Component, however, you should not expect the advantages of a completely sealed or encapsulated electronic assembly.

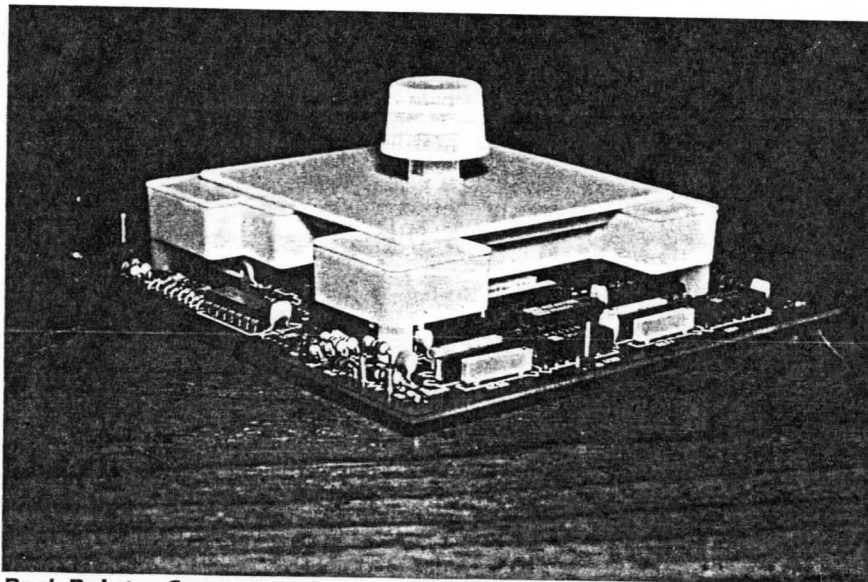
Besides having environmental advantages over most mice and joysticks, the TurboPuck boasts friendly characteristics that promote ease of use. Its motion handle has a built-in tracking bias that tends to keep the cursor moving horizontally. When the handle is pressed down, the tracking bias disappears to allow easier free-hand sketching or positioning.

Another noteworthy feature is the potential for 3-D use. By using the software Z command, any two axes can be manipulated simultaneously and the third axis can be frozen in its last position. Instructions are provided for assigning the Z function to the motion handle's optical switch. In this configuration, the z (or theta) axis can be used when the motion handle is pressed down and either the x or y axis is frozen in its last position. Thus, x-y and either y-z or y-theta positioning can be controlled from the motion handle. Under these conditions, the z axis can also have a resolution of 10 to 16,384 units.

Programming versatility is assured in TurboPuck's design. In the bit-pad tablet mode, each of the three push buttons can have combined actions as well as on/off action. Both two-at-a-time and shifted modes are possible. In combination with the optical switch in the motion handle, a total of 16 switching actions are possible under software control.

System Installation

Eight DIP switches at one end of the housing provide for setting various modes and baud rate. You simply plug in a 5V power supply and RS-232 connector, then look in the User's Guide to find the proper positions for setting the DIP switches. Calibration is done by moving the



Puck Pointer Component, the heart of the positioning device, for OEM custom installations.

motion handle around the limits of its rectangle. That's all there is to it. Different software commands can be entered at the keyboard to take advantage of TurboPuck's versatility. A dumb terminal or terminal program on a PC can be used to check proper operation by setting the TurboPuck in ASCII format via DIP switches and by pressing buttons and moving the motion handle. The output appears on the screen as readable characters.

Using TurboPuck

I tested TurboPuck with a NOVA MS-DOS computer and Tecmar's Graphics Master display adaptor at 640×400 resolution (see PC Focus, June 1985). Software packages included AutoDesk's AutoCAD-2 vector-based drafting program (see PC Focus, July 1985) and PC-Paintbrush, a raster-based paint program from IMSI.

TurboPuck was configured to emulate a Mouse Systems Mouse operating at 1,200 baud. No installation problems were encountered with either software package. The SPACE and STEP commands were used at factory settings, which results in about a $2'' \times 3''$ screen window that reflects the TurboPuck's drawing area. When the cursor reaches an edge of the window, the active area moves or "rates" to a new position where drawing can continue.

In a second set of tests, TurboPuck was connected to a Liberty 50 dumb terminal and the DIP switches were set in ASCII mode. As the motion handle is moved, coordinate values appear on the screen. TurboPuck responds to various input commands by displaying different sets of output coordinates as the handle is moved.

TurboPuck works smoothly and

easily. The knob on the motion handle turns to receive finger pressure from the controlling movements. A device with this level of accuracy takes some getting used to. However, TurboPuck is an innovative design for precision positioning, and the Puck Pointer Component is an excellent alternative to arrow keys.

Summary

TurboPuck is a 2-D or 3-D precision pointing device that can achieve resolutions far in excess of the capabilities of most of today's graphics systems, and works as advertised without any problems or disappointments. Resolution can be varied via software commands from 10×10 to $16,385 \times 16,385$, and step size can be set anywhere from 1 to 127. Two of the x, y and z (or theta) axes can be used simultaneously, and the software allows for switching to a different pair of axes and locking a previous axis position. Binary and ASCII output modes are possible, and baud rates of 300, 1,200, 9,600 and 19,200 can be set by DIP switches. The TurboPuck's Puck Pointer Component is available to OEM's for installation in computer keyboards, industrial instrumentation, or applications with medical equipment. Both TurboPuck and the Puck Pointer Component operate from 5V and use an RS-232 interface. ■

Acknowledgment

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Richard McGrath owns and manages Studio 7 Technical Documentation, a technical writing, graphics and consulting business specializing in hardware/software user's guides.

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