GUIDING LIGHTS

Are you in the dark about lightpens? In the first of a two-part series Chris Drage compares four models

EVERYONE who purchases a micro is immediately aware that the standard device for inputting data into the system is the keyboard. The range of different input devices though, is quite considerable. They include joysticks, graphics pads/plotters, voice input systems, direct sensors, touch-pads and lightpens. The primary purpose of lightpens is for inputting two-dimensional visual data. In a way it reverses the usual flow of information in a computer system. Instead of using the monitor screen as an output to the user, the lightpen enables it to be used as an input device returning data to the computer.

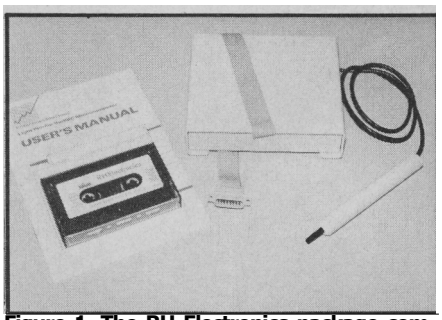

Figure 1. The RH Electronics package comprising lightpen, interface unit, introductory software and user's manual

Typically, a lightpen is a cylindrical object similar to a felt tip pen. From one end of the tubular body emerges a lead which connects the lightpen to the A/D socket on the computer. Housed in the tapered end of the lightpen is a light sensitive transistor, its sole purpose to sense lit screen pixels. Within the barrel of the pen is circuitry which organises and shapes the signals received by the light sensor.

Because the BBC micro has a 6845 cathode ray tube controller (CRTC chip) built into it, the lightpen is able to behave in a far more sophisticated manner than the norm for many computers. No longer a mere sensor of lit and unlit portions of the screen, the 6845 IC allows the lightpen to register the exact position at which it is pointing on the screen. This opens the way for a number of useful applications.

The four lightpens described here represent a range available for the BBC micro from the middle to the top end of the market. Unfortunately, few software houses supply versions of their packages that work with a light-pen. A peripheral such as this relies heavily upon support from its manufacturer, and the pens in this article were chosen because each manufacturer provides very good software support.

SUPPLIERS AND SPECIFICATIONS

Product	Colour Light Pen
Manufacturer	RH Electronics
Interface box	Yes
Dimensions	Pen: 123mm x 15mm Interface box: 145 x 127 x 40mm
Switch type	Probe with microswitch + LED indicator
Cable length	Pen: 880mm Interface box: 420mm
Price	£45.95 inc VAT
Software supplied	Five utilities, two games, one sketch program
Review copy obtained from	RH Electronics (sales) Ltd, Chesterton Mill, Frenchs Road, Cambridge CB4 3NP

Product	Stack Light Pen
Manufacturer	Stack Computer Services
Interface box	Yes, complete with 15-way D plug
Dimensions	Pen: 135mm × 9mm Interface box: 65 × 45 × 18mm
Switch type	Touch contact rings
Cable length	900mm (working length)
Price	£28.00 inc VAT
Software supplied	Nine games plus Litewriter program
Review copy obtained from	Stack Computer Services, 290-298 Derby Road, Bootle, Merseyside L20 8LN

Product	Robin Educational Light Pen
Manufacturer	Educational Software Co
Interface box	None
Dimensions	130mm × 11mm
Switch type	Finger touch contact-rings
Cable length	900mm (working length)
Price	£41.40 inc VAT
Software supplied	'Paint Brush' program
Review copy obtained from	The Educational Software Co (Southport), 108 Parthenon Drive, Liverpool L11 7AQ

Product	Datapen Light Pen
Manufacturer	Datapen Microtechnology
Interface box	None
Dimensions	135 × 15 x 23mm
Switch type	Thumb switch plus LED lamp
Cable length	1050mm
Price	£25.00 inc VAT & pp
Software supplied	Two graphics programs
Review copy obtained from	Datapen Microtechnology, Kingsclere Road, Overton, Hampshire RG25 3JB

The RH Electronics Colour Light Pen is the only one actually approved by Acorn Computers for use with the BBC micro. It is rather different in characteristics from the other three pens. The RH Electronics package consists of a lightpen, an interface unit, introductory software and a substantial user's manual (figure 1).

The pen comprises a stout off-white aluminium tube with a black plastic probe at one end. At the other end a screw plug provides a solid anchorage for the screened cable and red status LED indicator. Inside is a neat and narrow printed circuit board containing circuitry that organises the signals. An extremely fine micro-switch allows the push tip to signal the user's decisions to the computer.

The pen is linked to the cream metal interface box by a screened cable. The interface circuitry controls the switch and video pulse latches. It is also responsible for converting the analogue video pulse into TTL levels. The computer sends bytes to the interface unit where they are stored. The various latches are then set for the different modes. The interface box is connected to the BBC micro via a 420mm ribbon cable and 15-way analogue connector. Each element in the system is well made and the overall impression is one of quality and robustness.

The software supplied with the lightpen comes on cassette and comprises a machine code driver routine, utilities and three demonstration programs in Basic: ' Draughts', 'Kwartet' and 'Draw'.

`Driver', 'LPDrive' and 'Reloc' are machine code loader and relocator programs plus the driver routine, which allow programmers to interface the pen with programs of their own devising. My only criticism is that the driver routine resides at &E00 and resets PAGE. Being protected, there is no easy way you can relocate it and thus not lose valuable memory. SETUP is a utility that enables adjustments to be made to the TV/monitor's brightness and contrast thus enabling the pen to detect video pulses correctly. The second utility TRIM, is included to enable the offset to be adjusted. This calculates and plots a point on the screen relative to the physical position of the pen probe. These utilities ensure that you are able to set up your RH Light Pen to its greatest accuracy.

The three demonstration programs are just that. As applications software they are very limited indeed but by listing each one and examining the light-pen related procedures a great deal can be learnt. I do feel however, that for £45.95 one piece of serious applications software should have been included to put the pen to some real work.

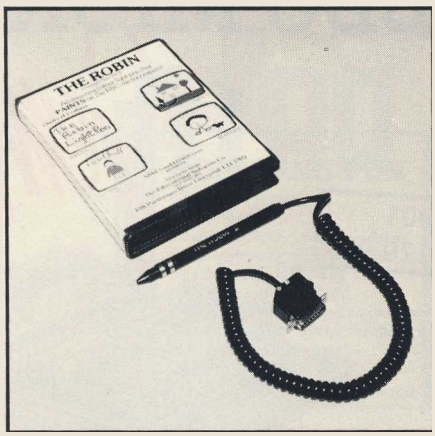

Figure 2. Lightpen, information cards and software cassette which make up the Robin Educational Light Pen package

Figure 3. The Robin lightpen and its 'Paint Brush' program allow children to get down to creative work without delay

Documentation in the form of a 20-page user's manual is excellent. Eight pages alone are devoted to using the procedures, and it is most helpful in the construction of lightpen software. Details are also given about the demonstration programs and there is plenty of technical information on how the pen works.

Without a doubt the RH Electronics Colour Light Pen is outstanding. It is extremely well-designed and constructed, pleasant to hold and very strong. I used the pen with groups of 10-year-olds over a period of three weeks during which it worked faultlessly. Its instantaneous response was a joy. The narrow probe tip was excellent, ensuring good visibility round the operating area. However, attention should be given to keeping a clean screen as classroom 'dirt' tended to clog the probe's fine aperture. The probe's optics concentrate and guide the light, enabling the pen to be used for very accurate work. Two features I particularly like are the positive push-tip method of switching and the bright, sensitive LED. They combine to give the user total control over the pen.

If you have £45.95 and require an instrument of the highest quality, with advanced control, sensitivity and accuracy then I wholeheartedly recommend the RH Electronics Colour Light Pen.

The Robin Educational Light Pen marketed by the Educational Software Co (Southport) is aimed directly at the educational market. This package com-

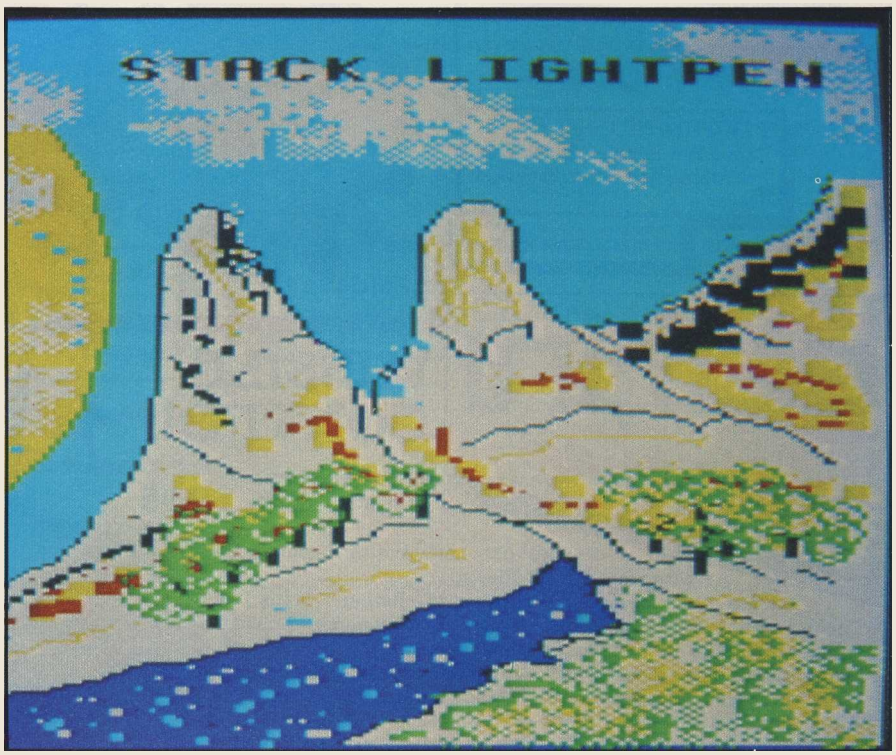

Figure 4. The Stack lightpen is aimed at the entertainment and games market, and has a facility for pictures to be saved and loaded

prises the lightpen, information cards and a cassette software (figure 2). The pen is black and cased like a felt tip pen. The barrel has a detachable tip which enables the sensor to be placed closer to the screen to increase its sensitivity. The pen is connected to the Beeb's analogue port by way of a twisted, telephone-style cable which can be stretched to a suitable operational length. The lead terminates in a

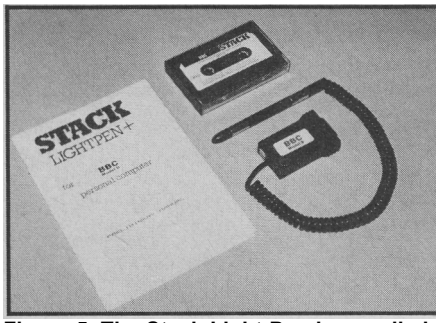

Figure 5. The Stack Light Pen is supplied with a preliminary manual and a cassette of games software

standard 15-way 'D' connector, and it's refreshing to have a classroom peripheral with a decent sized lead.

Internally, there are few surprises. The pen contains the photo sensor and the necessary amplification circuits that detect and amplify the current passing from the sensor and pass a suitable signal to the CRTC chip. Near the tip of the pen are two chrome rings which serve as a finger-touch switch that causes the pen to react or not to react to light. This provides the pen with a switching device. It operates in a manner similar to the fire button on a joystick, and in use proved a very reliable means of switching the pen. No adult or child found the method difficult to use mainly because the chrome rings are sited at just the right point on the pen barrel.

As the Robin pen is so strong, sturdy and simple to use, I decided this should be my class's introduction to the use of lightpens. It was a smash hit right away, due in no small part to the excellent ' Paint Brush' program that accompanies the pen. Comments like 'incredible, amazing ...' were soon superseded by gasps as the children came to realise that the screen had been transformed into a 'canvas' and they really were painting and drawing, only this time, with light.

It's a real treat to discover that a program as useful as 'Paint Brush' is included as part of the package. Its success is entirely due to its simplicity, enabling pupils (and teachers!) to get down to work creating vivid screen images almost immediately. A simple menu is presented down the left-hand side of a white (mode 2) screen. Seven colours plus a 'rub-out' (background) colour are offered. Each time you wish to create a new image you pick a colour, place the pen at the required position and touch the chrome contacts. By use of a command key BRUSH may be made to draw lines, triangles, rectangles and filled or unfilled circles of all sizes. Text can be input on the screen, and freehand drawing/painting is also supported. All these effects are possible using single letter commands with a bit of point fixing using the space bar. It is so simple that Joanna, using a lightpen for the very first time, created the park scene (figure 3).

Saving and Loading pictures is also possible by single key commands. Beware though if you are using discs, as each picture is saved under the same file name, thus over-writing existing picture files, as we learnt to our cost. Rubbing out is a natural form of deletion for young children, and with 'Paint Brush' they really appreciated the power of being able to create and rub out images at a stroke.

Disappointingly, the accompanying documentation is rather sparse. Just two small cards are provided, the first giving the operating instructions for the

'The Robin was a smash hit right away'

'Paint Brush' program, the other a brief description of a pen routine to enable programmers to develop lightpen software for themselves. The 20-line pen routine listed is really only just enough to get started with. This excellent little package is really let down by lack of sufficient documentation.

The Robin Educational Light Pen is a ruggedly constructed, yet sensitive pen ideal for classroom use. It appears overpriced at £36 plus VAT yet, as we shall see next month, with this lightpen you have a tool far more versatile than just an electronic paint brush. For teachers and parents who wish their charges to use a tool ideal for creating and discovering on-screen images, look no further than this.

Stack Computer Services has aimed its lightpen well and truly at the games/entertainment end of the market. The package comprises a lightpen, a preliminary manual and a comprehensive selection of games software on cassette (figure 5).

The lightpen has a long, thin black barrel, with two 20mm chrome bands situated at the top and bottom thirds along its length. The barrel houses a photo diode specially developed for Stack in Japan, and the circuitry that accomplishes various timing conversions and senses when the two touch contacts have been made. A twisted, telephone-type cable terminates in what looks to be a large, black plastic analogue 'D' connector. Its best working length is about one metre. The large 34-way connector houses a video speed comparator and amplifier which increases the intensity and shape of the signal so that it may be presented to the computer more effectively.

Perhaps the most obvious features of the Stack Light Pen are the touch contacts which allow the user to choose when the computer is to control the lightpen registers. Without this the pen could 'see' the screen each time it is approached thus making it very awkward to control. In practice however, the touch contacts proved rather difficult to master, as the pen must be held further back along the barrel than an ordinary one. With the upper contact cradled between the thumb and forefinger, another finger must be extended to touch the lower contact, so often contact was made inadvertently because the fingers slip towards the pen tip. The touch sensitivity, however, is very good.

Accompanying the package are nine games and a graphics program on cassette. Most are rather sedate versions of popular games converted for use with the lightpen, including *Othello, Shuffler, Simon, Go, Draughts, Seek & Destroy, Crossword Twister, Life* and *Labyrinth.* The most interesting by far is

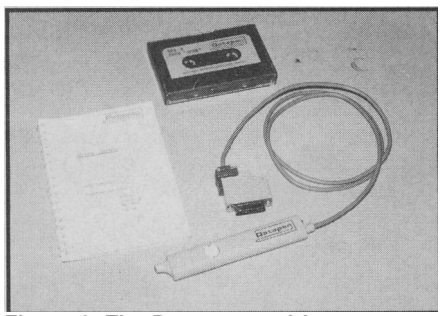

Figure 6. The Datapen, oval in cross-section, comes in a package with software on cassette, 15-page handbook, printed listing sheet and two rubber probe inserts

'Litewriter', a versatile little program including some very good features. Written in mode 2 using eight colours (white is the background and erase colour), it is entirely menu driven. Both a colours menu and a brush menu are provided, the latter giving eight different brush strokes. Lines, rectangles, circles, text input and freehand drawing are all supported. A simple fill routine is also included. Pictures may be saved and loaded (figure 4). The code

is written in a structured way and Stack invites you to experiment with it.

Documentation comprises a seven-page duplicated stapled booklet marked *Preliminary Manual.* Although it appears to be hastily put together it is quite good. The introduction discusses raster scans and pixel character construction. It explains how a lightpen sees the screen, and a section on the state of the registers and how to set up a lightpen for individual TVs/monitors is most useful. The manual includes an 18-line program to type in, intended to illustrate how the lightpen routines work so programmers can include them in their own programs. There is not quite enough guidance given and beginners would benefit from more detail on how to implement the routines. Hopefully, Stack will have extended this section by the time the full manual is published.

For the games enthusiast, the Stack Light Pen at £28 represents value for money. The company seems keen to back up its product by publishing further lightpen-oriented games software. However, for the dedicated arcade fiend the Stack Light Rifle at £29 must be number one on the list. Shooting 'em down a full two metres from the screen really has to be experienced! By comparison keyboard based shoot'em-and-zap-'em games seem sedate indeed.

The Datapen from Datapen Micro-technology is physically different in design from the other pens reviewed. This package includes a Datapen, software on cassette, a small 15-page handbook, printed listing sheet and a packet of two rubber probe inserts (figure 6).

The pen is oval in cross-section with an offset probe at one end which houses the light sensor and a large status indicator LED and cable at the other. The screened cable terminates at a standard 15-way, 'D' connector at the BBC end. A very good working length of cable is provided. The Data-pen is provided with a thumb switch on its left-hand side towards the probe end of the barrel. The switch allows the user to control when the computer is to read the lightpen registers of the CRTC chip. Like the Robin pen, it functions as a joystick fire button. The body of the pen contains circuitry to amplify the signal from the sensor, passing it through a highpass filter to give good reaction to local lighting conditions. The resulting signal provides a fast positive strobe for the video interface chips.

At first I thought the Datapen was for right-handed people only, but by inverting it so that the thumb switch is on the right, left-handed operation proved no problem. The rubber probe insert did help the performance on a standard resolution monitor but had to be removed for use on a high resolution Kaga monitor as it cut down the amount of light reaching the phototransistor. I found the LED's output rather disappointing compared with the RH Electronics pen but the Datapen's overall performance was good.

The software provided on cassette, includes three programs: 'Intro', 'Sketch' and 'Shape'. The former program is a very good interactive demonstration of how the Datapen works. 'Sketch' is a mode 4, line-drawing program with save and load facilities. 'Shape' is a very good character definer program: using the Datapen to fill an 8 x 8 grid, characters may be defined and saved, their VDU23 parameters being noted from the screen. The programs are accessible and much can be learnt from listing them.

The accompanying documentation discusses how lightpens work, followed by a brief circuit description and how the switch and the X & Y positions of the pen are read. Unfortunately, much of the booklet is taken up with information relating to the CBM 64, Vic and Dragon computers, but there is sufficient help when read in conjunction with the 'Intro' program. A separate sheet describes the 'Sketch' and 'Shape' programs and lists three useful procedures to include in your own software.

This is a good lightpen at the right price. It aims at a wide market and can be especially recommended for beginners who wish to 'shine a light'.

Choosing a lightpen depends very much on personal circumstances. Each pen reviewed here is well-constructed, has worked satisfactorily over a period of time and comes with routines to enable you to write or adapt your own programs for lightpen use. But how many people are prepared to burn the candle at both ends converting their software? Not too many I suspect, and it is highly unlikely that schools will embark on such a time consuming activity.

If people are to make the most of their lightpens then they need a supply of quality applications software. RH Electronics, the Educational Software Co, Datapen Microtechnology and Stack each provides substantial software support for their products and in some cases enable the user to do something really worthwhile with their new acquisition, which is an important consideration when choosing your lightpen.

Next month in part two, Chris Drage tests the software available to support the lightpens.

HOW THEY SCORE

	RH COLOUR LIGHT PEN	ROBIN EDUCATIONAL	STACK LIGHT PEN	DATAPEN
Design	5	4	3	4
Construction	5	5	4	4
Switching	5	4	2	4
Cable length	4	4	4	4
Handling characteristics	5	4	3	4
Ease of use	5	5	2	4
Software provided	3	4	4	4
Documentation	5	2	3	4
Insensitivity to ambient light	5	5	5	5
Colour monitors* it works best on	All types	All types †	Standard medium res.	Standard medium res.
Range of applications	Wide range	Education, home use	Games, home use	Education, home use

** Monitors used in this review were: Microvitec (standard), Novex (medium), Kaga Vision III (high).*

† Works well with hi-res, when tip removed.

KEY: *5 EXCELLENT, 4 GOOD, 3 SATISFACTORY, 2 POOR, 1 VERY BAD*