Pen Gantry
The gantry can be positioned at any point across the page (the X axis) and the pen holder is then moved into position along its length (the Y axis).
Combinations of left to right and up and down motions allow any point on the page to be reached

programming is often a little more complicated in that, instead of just sending the results of a program to be printed, information about the way the results are to be presented must also be sent. This is generally done in much the same way as a diagram would be built up on the screen.

Because of the complicated way in which plotters build up their output they are usually 'intelligent'. This means they have built-in microprocessors that convert the characters and instructions from the computer into a series of coordinates, which the plotter then draws. Many of the more sophisticated plotters also allow complicated shapes such as circles and curves to be drawn by simply supplying the starting points — the plotter does the rest. The labelling of graphs

and diagrams and the colouring-in of pie charts and bar graphs are often automatic processes, making the programming much simpler.

Many plotters come complete with software that allows them to be used directly from within a program rather like a paper copy of the screen. If this type of program is not provided, the user will have to work out the necessary routines to translate screen information into the appropriate codes in order to drive the plotter. Some plotters don't feature built-in character sets, so even the codes for the letters and numbers will have to be created. This does at least allow the user to design his own characters and typefaces. Once a shape has been generated, it can be plotted at any position and in any orientation or size, so a library of shapes can be built up for repeated use. Routines to plot circles and curves and shapes in sections of graphs are often very useful, especially in the field of business graphics and these may also have to be created. However, the principles of creating a drawing from coordinates on the screen are just the same as those required to create the shape on paper, so the programming is usually quite simple.

Stepper Motors
These motors turn through a few degrees for every electrical pulse applied. With suitable gearing they provide the fine movement of the pen and gantry

Circuit Board
Plotters are usually 'intelligent' devices – they can be given a high-level command such as 'draw a circle with specified radius and centre', and the plotter works out how to move the pen. The circuit board contains its own microprocessor, ROM and RAM

DAVID WEEKS

Interface Connection
Plotters connect to the computer by means of a standard interface such as RS232 (serial) or Centronics (parallel). To the computer it appears just like a printer, though different commands will be needed to drive it

ERROR

Pen Lift Control
This allows the pen to be manually placed in contact or lifted off the paper

Pen Motion Controls
The pen can be manually positioned on the page by these controls

The Four-Pen Plotter/ Printer

This mechanism captured the attention of the micro industry when it first appeared in the Sharp CE-150 printer. Its bigger brothers in the form of Tandy's CGP-115 and the Oric MCP-40 have helped bring low-cost colour printing to the home computer user.

Like all good ideas the system is amazingly simple in concept. A roll of paper is pulled through the mechanism by a spiked roller. The paper is moved both backwards and forwards in very precise steps while a pen carrier holding four miniature ballpoint pens moves across the surface from left to right and vice versa.
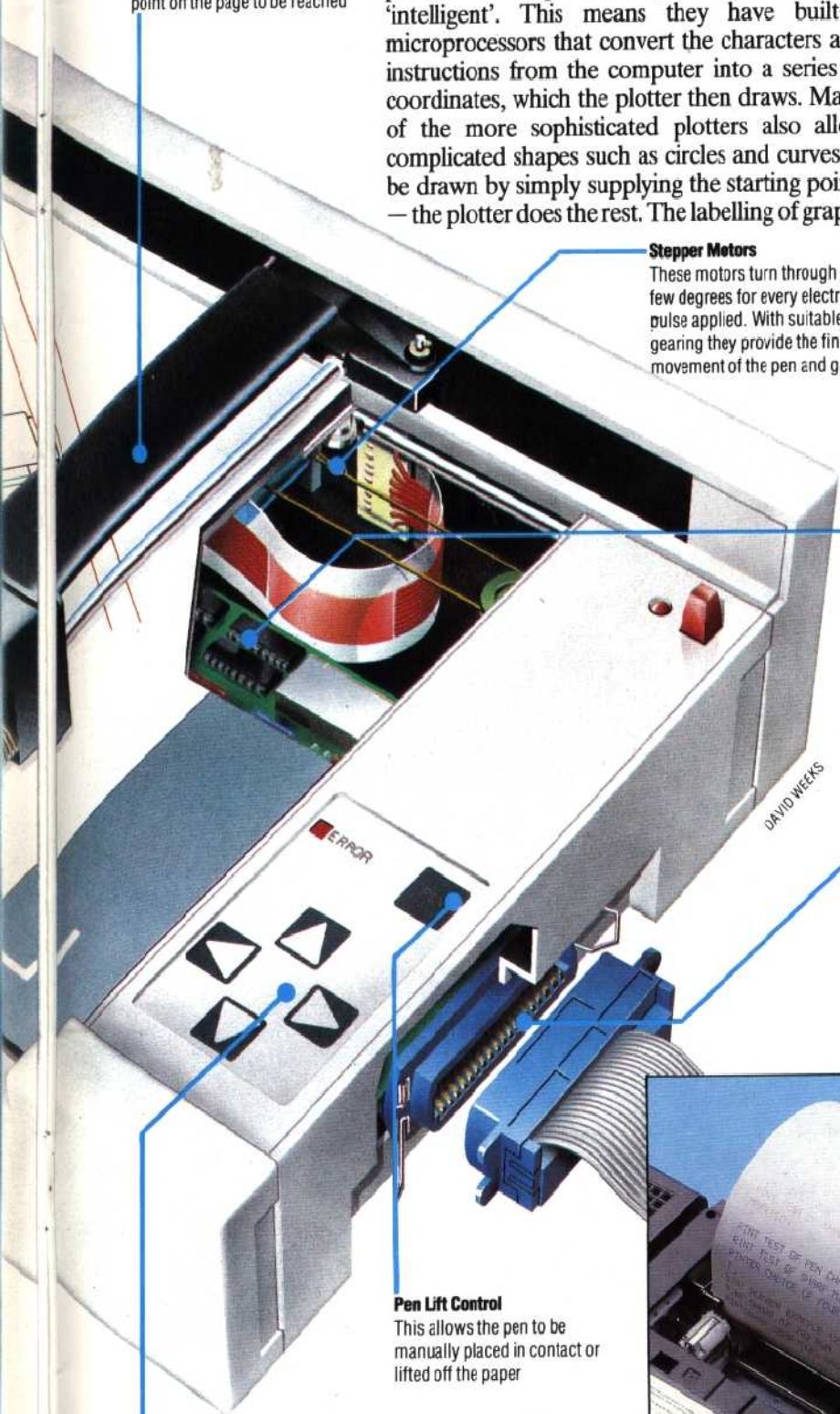
To create the output, which can be text or graphical, the pen carrier is rotated until the correct colour is in position and then the pen is pressed against the paper. Horizontal lines are created by the pen moving while the paper is stationary, vertical lines use the movement of the paper with the pen fixed in place. Combinations of the two movements produce diagonals and curves. The quality of the printing is very high, although the restricted paper width makes it unsuitable for word processing and other serious uses

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