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NASA TECH BRIEF

Circuit Board Hole Coordinate Locator Concept

The problem:

To accurately determine, in a desirable sequence, the location of the x-y coordinates of the holes in a printed circuit board pattern (template) so that accurate and repeatable drilling may be achieved in the production circuit boards. The x-y coordinate information would be desirable either for the operation of numerically controlled drill presses or reformatting by computer technology to produce a tape to operate tape-driven drill presses.

The solution:

A conceptual system that uses a fixed light source to register the x and y coordinates of holes in a fixed opaque template. A first surface parabolic mirror and a set of photocells are used to detect the passage of light through the individual holes.

How it's done:

A smooth, opaque, stationary primary surface is equipped with a narrow slit centrally located in the x direction and extending completely across in the y direction. The light source is mounted above and extends across the slit while the mirror is mounted directly below the slit with its focal point located at its farthest point from the primary surface. The template (pattern) from which the hole coordinates are to be determined is mounted beneath the primary surface on a table that is free to move from left to right.

As the table and template move from left to right and a hole is traversed, light strikes the parabolic mirror and is reflected to its focal point where an x-coordinate photocell is located. Peak voltage output of this photocell locates the centerline of the hole in the x direction and the movable table is stopped. A y-coordinate photocell with a pinhole aperture is mounted in the narrow slit of the primary surface in such a way that it can be moved freely between the top and bottom of the slit. As the y-coordinate photocell moves, light is received as soon as the leading edge of the hole is crossed and until the trailing edge is passed. Here again, the peak photocell output locates the centerline of the hole, this time in the y direction. Should there be more than one hole in the x direction, continual movement of the y photocell will establish their respective coordinates.

Following the above operation, the movable table is again moved in the x-direction until the parabolic mirror/x-coordinate photocell system indicates another hole or holes and the operation is repeated to obtain peak output from the x and y photocells. In this way all holes in the template are located and their x and y coordinates established.

Notes:

1. If constructed as described and linked to appropriate support electronics, this concept could be used to drive a numerically controlled drill press directly or could be used to produce a tape for the same purpose.
2. This development is in conceptual stage only, and, as of date of publication of this Tech Brief, neither a model nor prototype has been constructed. No further documentation is available.

Patent status:

No patent action is contemplated by NASA.

Source: Lyndon Willis Samuel of
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Marshall Space Flight Center
(MFS-14737)

Category 01