

Automated X-ray Inspection Top Side Reference Details

Problem: PCA manufacturers get their blank PCBs at different times and from different suppliers. The boards are not always made from exactly the same material and sometimes colors and translucence will vary. Solder resist and FR4 (fiberglass substrate) thickness will vary, as well (see DRAWING 1 at the end of this paper). The laser used for surface mapping may penetrate to different levels under these varying conditions. This can cause a delta Z error large enough that some views will not be in proper focus. Delta-Z in this case refers to the difference between where the laser finds the board surface and where the user defines the top surface. Until now, the only way to avoid this problem was to put all surface map points on traces, consistent ground planes, fiducials, or other guaranteed Z height targets. The limited locations for possible map points if this is attempted generally lead to poor map point triangles which may cause other surface map problems. Sometimes it is impossible to find suitable locations in certain areas of the board.

“**Top Side Reference**” is the mechanism designed to compensate for this “*delta – delta Z*” (or the differential between the laser-found Z height on one type of board versus the same point on another.) The idea is to put one *single reference point* on a known surface feature such as a trace, surface plane, or fiducial. This feature should not be tinned. Then, surround that point with three other

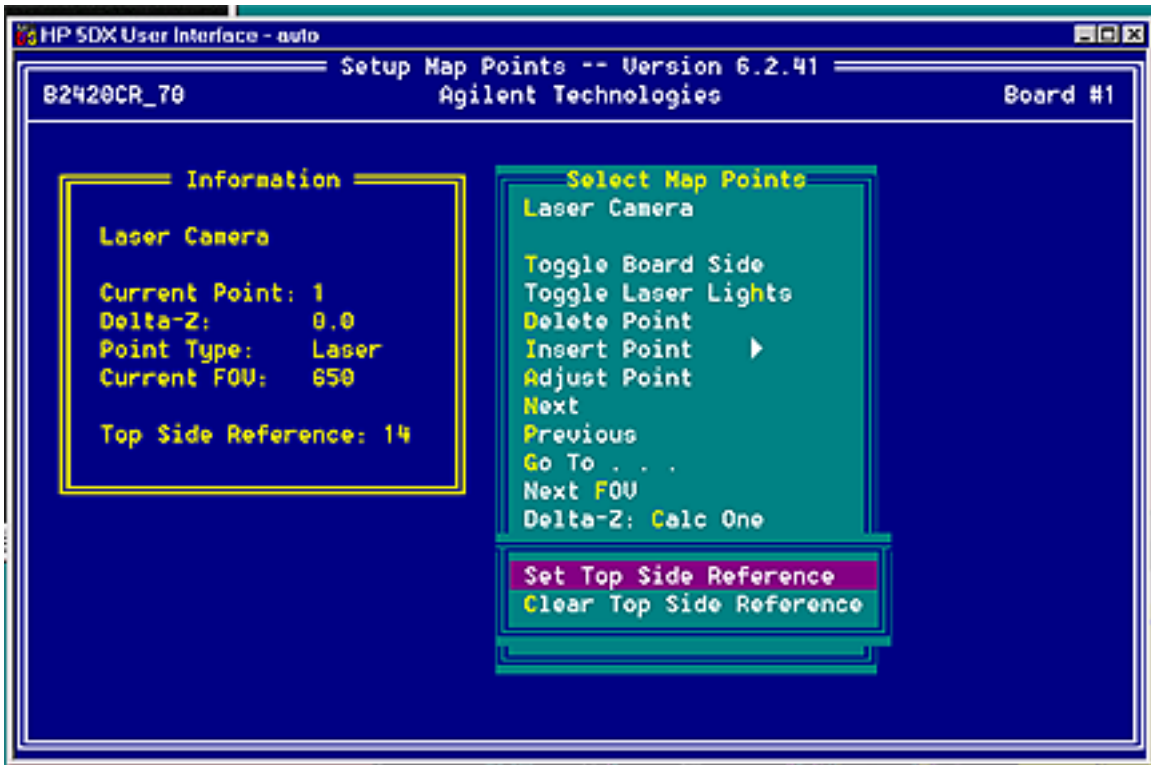
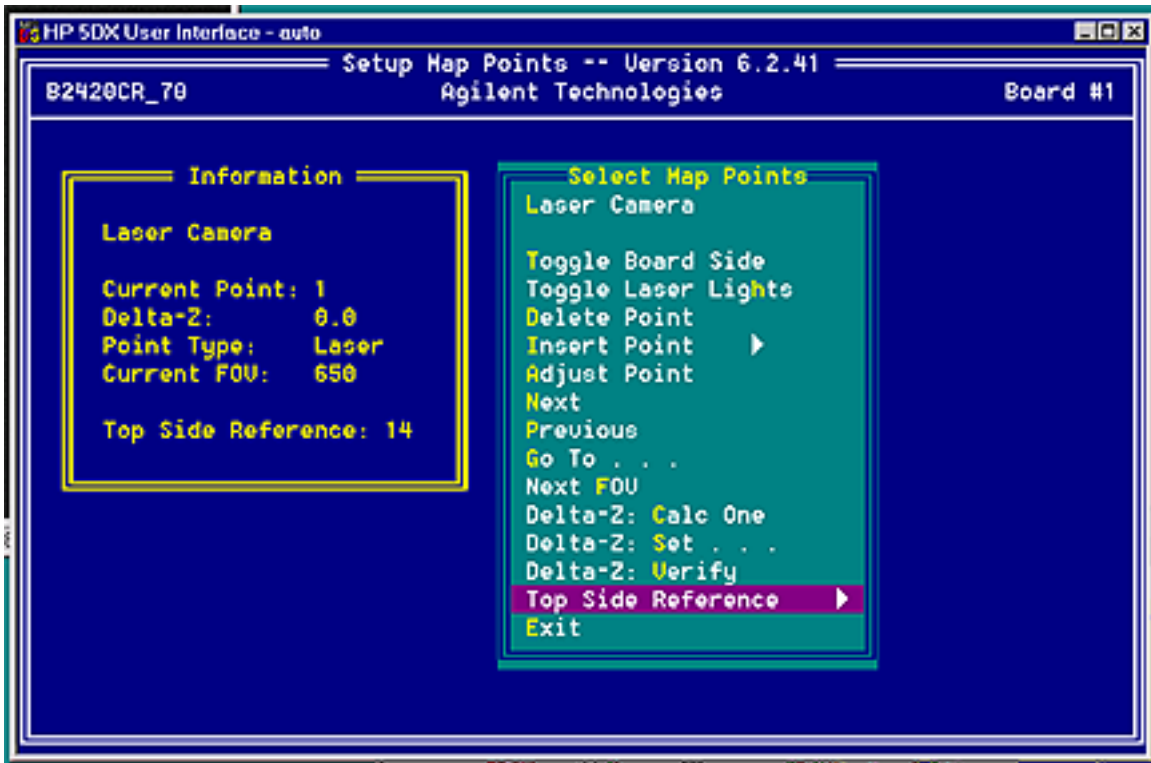
surface map points very nearby (not more than one inch away, and the closer the better). These nearby points must be on the common mapping surface, such as a ground plane used by other surface map points. The Z distance between the *reference point* and these nearby points is measured during surface mapping. The Z height for the plane that the laser is reflecting off of for normal points is calculated based on the readings of the 3 nearby points and the difference between that and the height measured for the Top Side Reference Point is added to the delta Z for all of the other points.

Ideally, all other surface map points on the panel are on the same reflective surface as the close reference points. In fact, the only way to make this feature work well is if all other points vary the same amount when the board reflectance changes. If some points are on other targets and not affected by board color, the same top-side reference will be applied to them as well as the ground plane points. This could cause views using these points to be out of focus. If other points must be placed so they reflect off of other surfaces, check that focus is acceptable with all bare board varieties that are available.

Setup:

You define the *reference point* in Surface Map Setup. There is a menu selection called Top Side Reference.





There are two choices, *set* and *clear*.

First, use the Goto menu selection to move to the desired surface map point. Then select Top Side Reference / set. No other setup is required.

You do not have to Goto the reference point to clear it. Clear Top Side Reference will clear the reference point no matter what the current point is.

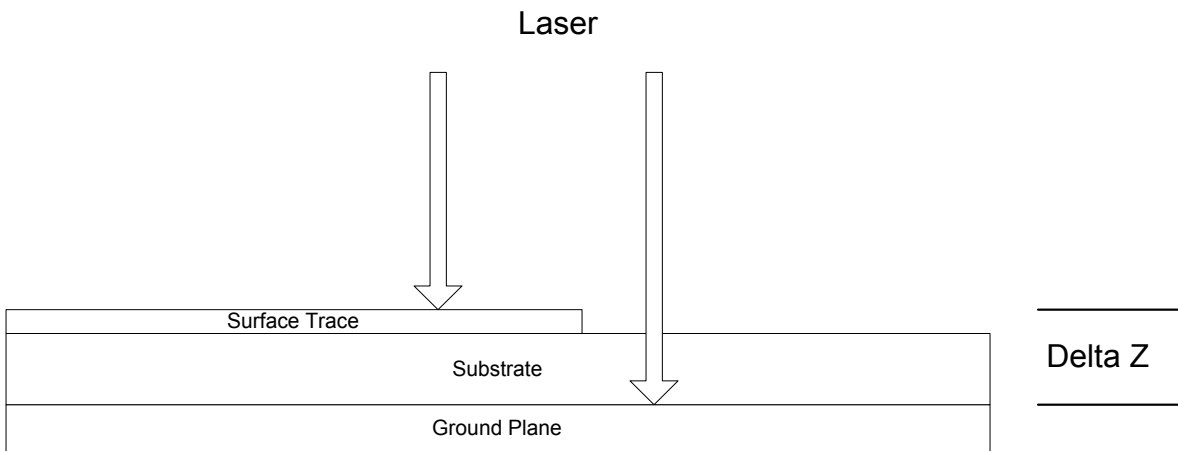
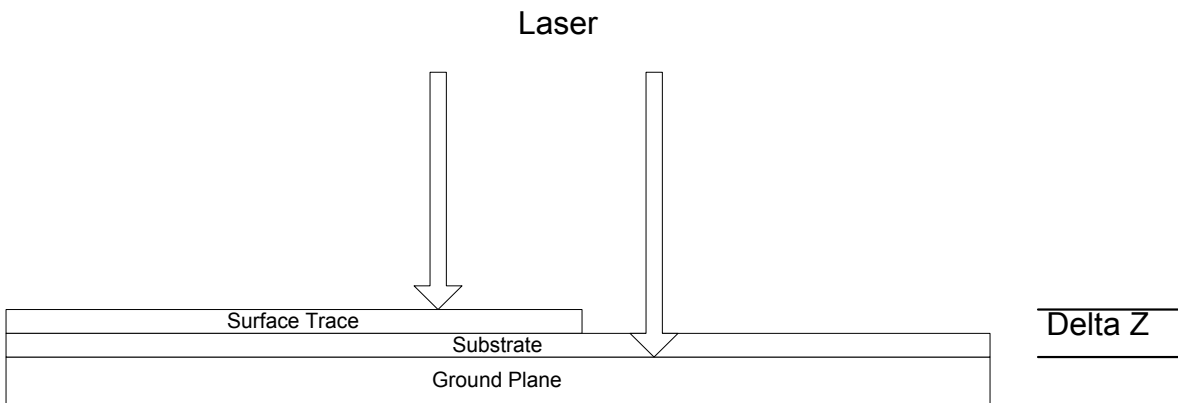
Set Top Side Reference requires the current surface map point to be the one you wish to use. If we use the screen shot above as an example, you could clear the current reference point (number 14) but you cannot set one. There is already a point set. If one was not set, Set Top Side Reference would set point 1 as the reference because point 1 is current.

There are some rules about what the reference point can be.

The point must be on the top side of the board as it is tested in the 5DX. It can be either a laser or an x-ray point. Laser points are easier to use and probably more accurate.

You cannot use "Calc One" and "Verify" when a reference point is defined. It is assumed the reference point is on the top surface. The reference point and the regular map points can have a non-zero delta-z. This represents the distance between the laser height and the height used to test normal surface mount components (usually defined as TOP). You must compile after you set or clear a reference point before the change takes effect.

Top Side Reference - Drawing 1



This information is subject to change without notice.
Agilent Technologies, Inc. 2004
December 2, 2004