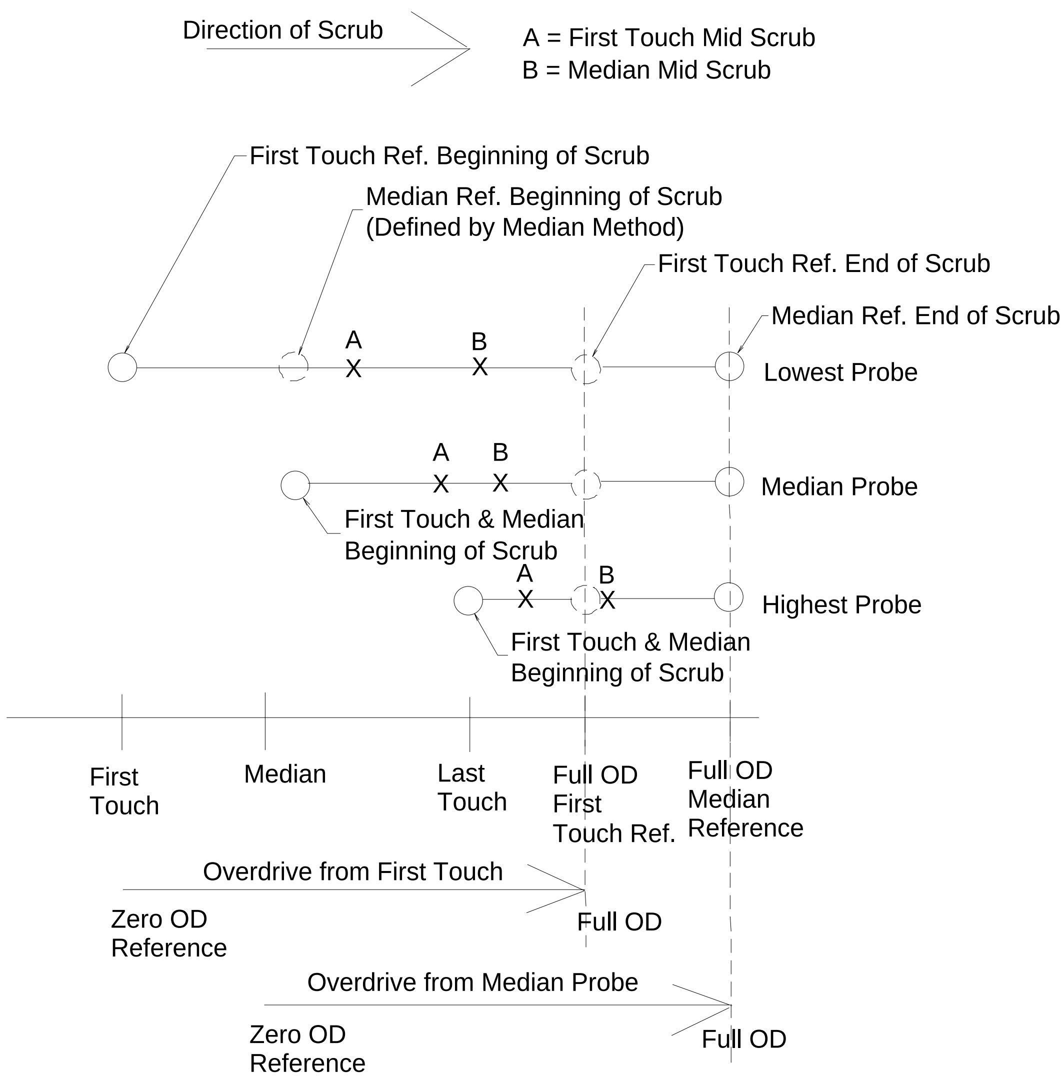
PROBE CARD REPAIR TECHNIQUES

PROBILT PB1200 REPAIR SYSTEM

The Probilt PB1200 Probe Card Repair System is designed for efficient repair of epoxy ring probe cards. It is not the same as a probe card analyzer system and is optimized for use with an analyzer system. The analyzer provides the optimized test capability and PB1200 provides the optimized repair capability. Test results from the analyzer may be imported directly into the PB1200 and used for the repair operation. A fast test or retest of alignment may be performed on all pins. A fast retest of planarity of a single pin may be performed on the system, but it is not optimized for a full planarity test since it must test a single pin a time like the bus probe test on a typical analyzer. The tradeoff is that the PB1200 does not require expensive motherboards. It uses inexpensive probe card holders which short all pins together and allow the single pin planarity test to be performed.

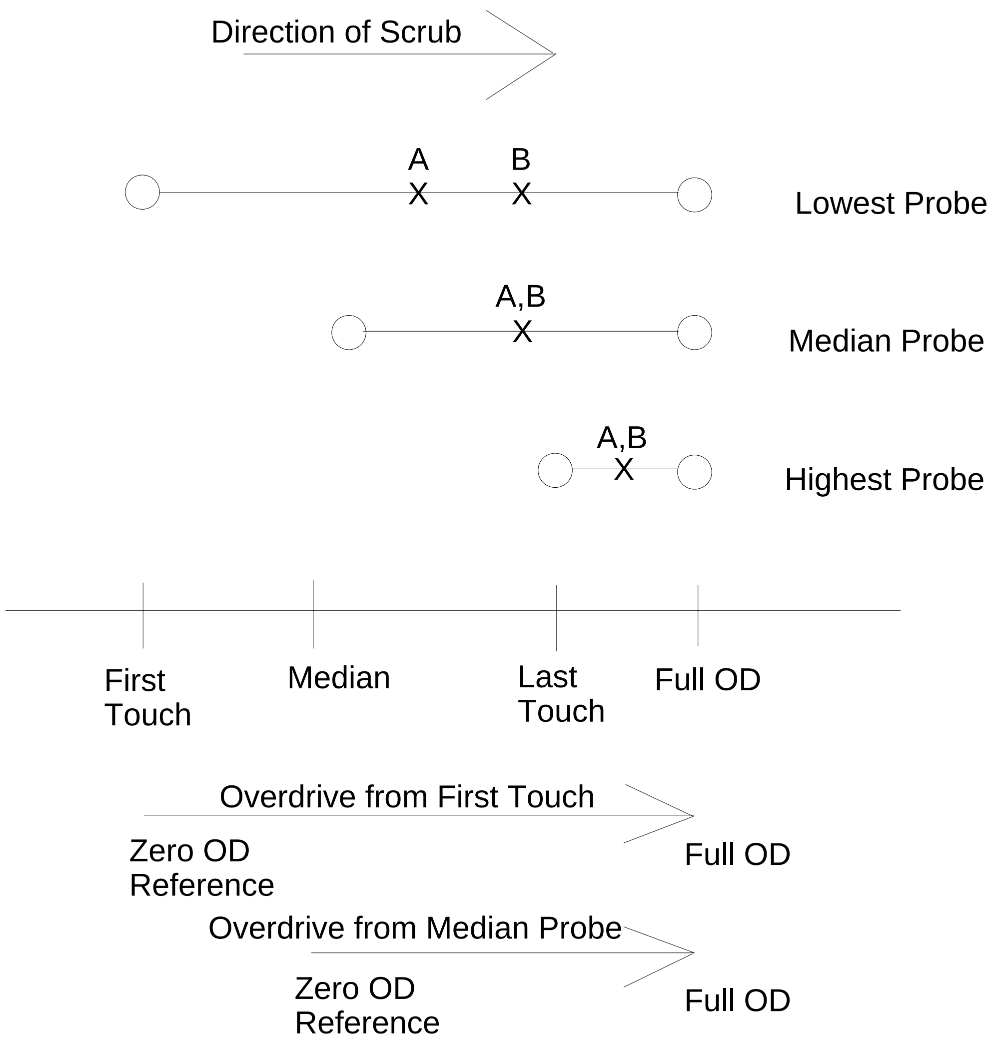
One of the areas which is not well understood regarding probe card analyzers and the PB1200 Repair Station is the overdrive reference for alignment. In general, there are two distinct methods for the overdrive reference or zero point. These are First Touch and Median. In the First Touch method, the zero point for overdrive is the electrical touch point of the lowest probe, i.e., the “first touch” probe. The Median overdrive method considers the zero point for overdrive as the median or middle probe in the planarity distribution of probes. These two methods will not give the same alignment results for any given card. If the planar window is small, the two methods will be closer together, but they will still be different.

Case 1 below illustrates the difference between the First Touch and Median methods when the same amount of overdrive is used for each. The effect of the different methods is shown for 3 representative probes, the lowest or first touch probe, the median probe and highest or last touch probe. If we assume the location of the probe is specified by the “mid-scrub” point, this will be the point one half way between the captured zero overdrive position and the full overdrive position of the probe. These points will be different for the two methods. The First Touch overdrive method positions are represented by A on the diagram and the Median overdrive method positions are represented by B. Note that the beginning of the scrub is different for probes below the median and the same for probes at or above the median. The end of scrub is different in all cases. The larger the planar window (difference from lowest to highest probe), the larger the difference in the reported probe position between the First Touch method and Median method of overdrive.



CASE 1 - First Touch Overdrive = Median Overdrive

Case 2 below shows the effect of changing the amount of overdrive to cause the maximum or "end of scrub" overdrive to be the same for both the First Touch and Median methods. Notice how the A and B locations are exactly the same for all probes above the median probe. If the planar window is small, this technique will give very similar results for both methods.



CASE 2 - First Touch Overdrive Increased to end
at same point as Median

The important questions are "How much difference will these two different methods make in the reported alignment position and how does it affect alignment in the alignment repair process?". We can partially answer these questions with an example using typical planar windows and alignment overdrives. If we assume an overdrive specification of 75 microns and a planar window of 20 microns with the median probe approximately at the middle of the window, then we assume a scrub length of 25% of the applied overdrive, we can find the relative positions of the probes for the two cases.

For Case 1, the lowest (first touch) probe will start and end its scrub 10 microns of overdrive before the median probe. The median probe and all probes above it will start their scrub at the same time for both methods but end their scrub 10 microns of overdrive later for the median method. The alignment position of the lowest probe will be 10 microns different, the median and higher probes will be 5 microns different (20% of the 10 microns extra overdrive for median).

For Case 2, the lowest probe will have 10 microns different position in alignment just as in Case 1 but the median and all higher probes will have the same positions. Since this 10 micron difference is still significant in the alignment we need to determine how it affects the repair process.

Regardless of the test method, all probes are adjusted from the non-deflected or free air position. In most cases today they are adjusted from a "tips up" position. On a standard analyzer such as the Probilt PB3500 this is done by flipping the probe card to the tips up position, counting probes to find the correct probe to adjust and moving it by an amount the operator feels is correct to adjust the alignment. This is very much a developed skill on the part of the operator since there is no reference to know how far to move the probe.

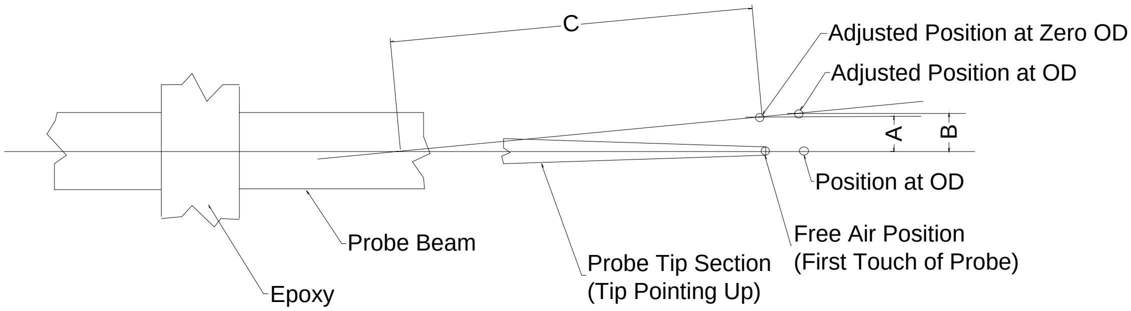
Figure 1 represents a single probe to be adjusted for alignment. If we assume the probe will be adjusted either in the direction of the scrub mark or perpendicular to the scrub mark, we can estimate the amount of error from using the non-overdriven position. If the probe is to be adjusted in the direction of the scrub (+ or -) there is no error. If the adjustment is perpendicular to the scrub, we must estimate where the probe will bend in order to calculate the error. If the bend length is shown as C, the difference between the overdriven and non-overdriven points A and B is a very small percentage of the overall bend length. Assuming C=0.5" (12500 microns) and a scrub length of 20 microns, we can calculate the difference in the mid-scrub position adjustment versus the non-overdriven (free space0 adjustment using simple trigonometry. If the desired adjustment to position B is 10 microns and ½ the scrub length is 10 microns, we can calculate the error if we instead move position by 10 microns.

$\text{TAN } \theta = A/C = B/(C+10u)$

$A/12500 = B/12500+10$

$A/B = 12500/12510 = 0.999$

Therefore if B = 10u, A = 9.99u or nearly zero error.



Probe Repair Position - Zero OD versus Overdriven Position

Figure 1