Application Note

How It Works – Surface Plate Lapping Quick-Check

System Recommendation

L-703SP Surface Plate Calibration System

One of the annoying parts of using electronic levels when re-surfacing a surface plate is you have to shoot the entire plate for flatness to see how the lapping process is going. This is a waste of time! With the L-703SP Surface Plate Calibration Systems, you can do quick-checks of a single line segment in about 5 minutes to see how much the flatness error has been reduced. Typically, you'll pick the line segment with the highest flatness error and focus on it as you lap the plate.

Here is the procedure to do a quick-check of a line segment for flatness after you have finished the lapping and cleaned the plate.

***Note** - you don't really need to clean the entire plate but just the area that you will measure.*

Step 1 - Set Up Laser Line & A-703SP-LM

Select the line segment you want to measure and select the matching length for the A-703SP-SE Straight Edge ruler. Use the corner/midpoint locating tool to set up the straight edge as shown in Plane6 Software Manual on pages 35, 41 or 42.

Then place the L-703SP-LM Laser Fixture on the straight edge as shown above.

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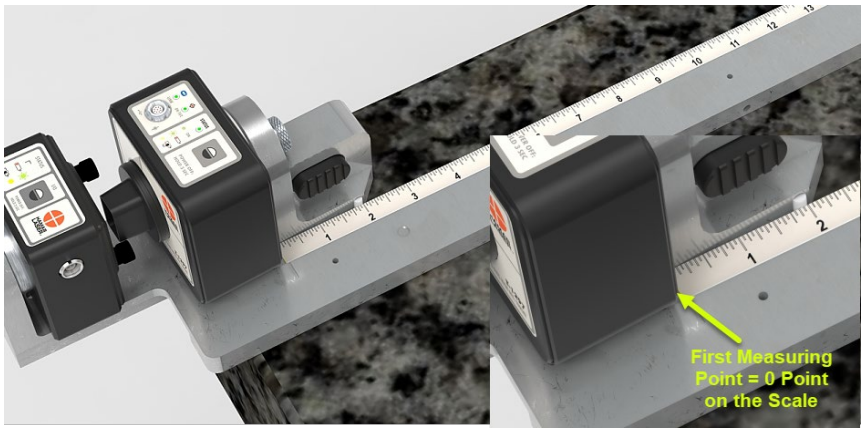
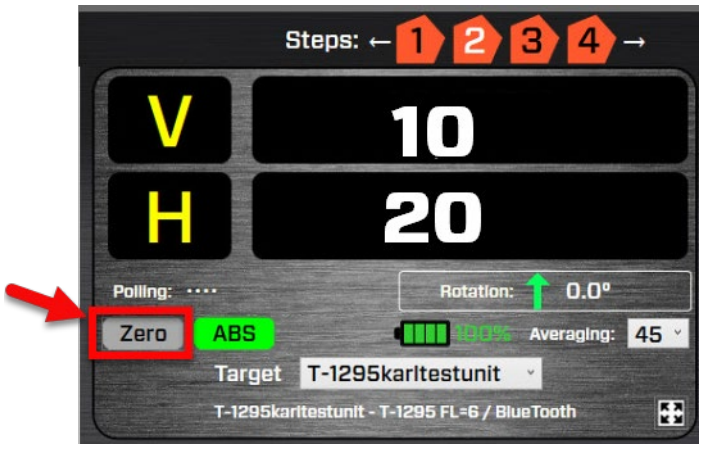
Step 2 - Set Up Laser Line

Bring the T-1297 Target and A-1297-SP Target-Measuring Base to the first measuring point as you did above. Zero the display by clicking on the **Zero** button.



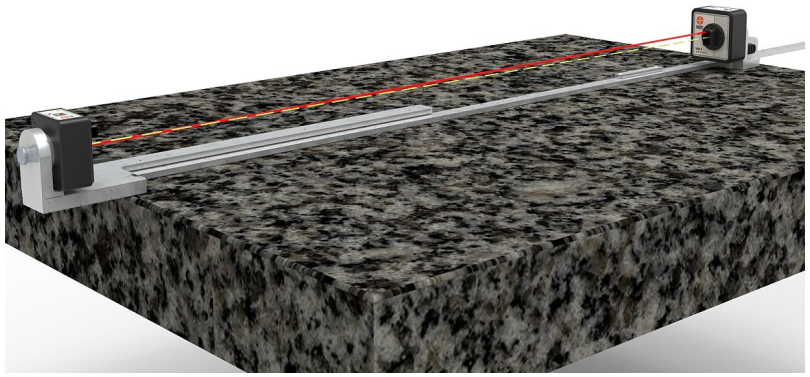
Due the extremely high resolution, it's expected that the value won't be exactly zero due to some measurement noise but they will be close.



Step 3 - Move Target to Far Point and Adjust Laser's Pitch/Yaw

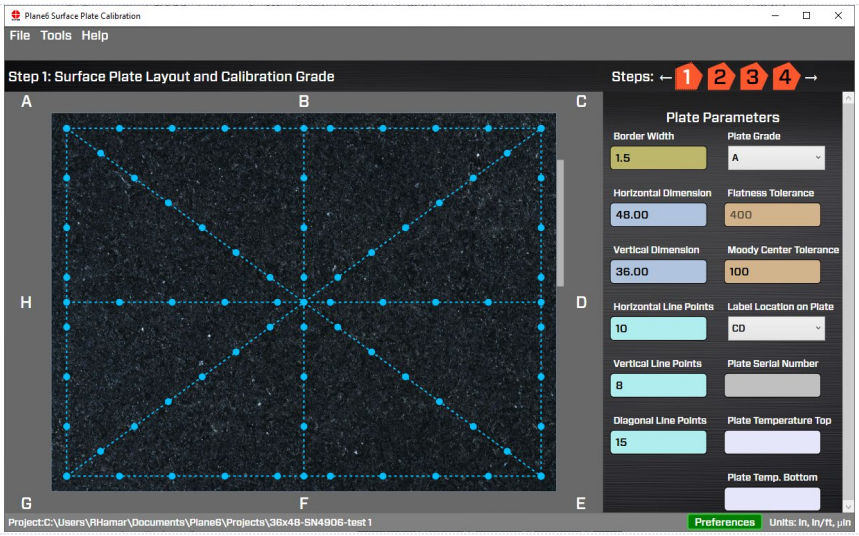
Move T-1297/A-1297-SP Base to the far end of the straight edge. Adjust the Pitch and Yaw knobs on the laser until you get as close to zero as you can go. Again due to very high resolution and the limited angular adjustment resolution, it will be hard to get all the way to zero with the adjustments. This ok because the sampling will remove dampen out most of the noise.

Go back to Point #1 and check to see if you have the nearly same values as when you zeroed it. If not, re-zero the target and repeat Step 3. You want to get the end values to be nearly the same. Maybe within 70-100 µin (1.5-2.5 µm).



Step 4 – Setup Test Project

Set up a new project with the line length you want and the number of points you want to use to measure the line segment.



Step 4 – Record the Values

Go to Step 2 and select the line segment you want to record. Record the data for that line segment. You can then go to Step 3 and see the data in the table for that line segment. Note there won't be any calculations unless you have all the data recorded.

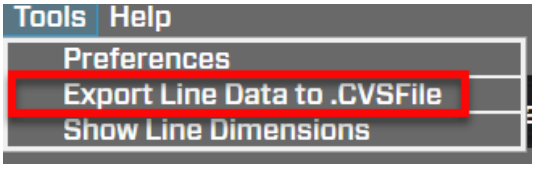
Note – you can easily export this data to a CSV file to open in Excel by clicking the Export Line menu item under the Tools menu.

You can then roughly estimate the flatness or do the math in an Excel file as shown below.

To roughly estimate the flatness, average the 2 end points and then subtract that value from each point. The highest (or most negative) value is the rough flatness error. Make sure to keep track of the signs!

Line GC

Point #	Collected	Zero Line Ends	Zero at Center	Zero Low Point
1	-310	N/A	N/A	N/A
2	-430	N/A	N/A	N/A
3	-510	N/A	N/A	N/A
4	-550	N/A	N/A	N/A
5	-590	N/A	N/A	N/A
6	-590	N/A	N/A	N/A
7	-630	N/A	N/A	N/A
8	-670	N/A	N/A	N/A
9	-670	N/A	N/A	N/A
10	-590	N/A	N/A	N/A
11	-510	N/A	N/A	N/A
12	-430	N/A	N/A	N/A
13	-310	N/A	N/A	N/A
14	-160	N/A	N/A	N/A
15	0	N/A	N/A	N/A



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Raw Values (µin)	-310	-430	-510	-550	-590	-590	-630	-670	-670	-590	-510	-430	-310	-160	0
Average of End Points	-155														
Raw values - Average		-275	-355	-395	-435	-435	-475	-515	-515	-435	-355	-275	-155	-5	
Max Corr. Val. = Flatness	**-5**														
Min Corr. Val. = Flatness	**-515**														

To get the true flatness, see the next page for the math calculations using Excel.

An example on how to do the Math to get the exact flatness values:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Raw Values (µin)	-310	-430	-510	-550	-590	-590	-630	-670	-670	-590	-510	-430	-310	-160	0
Distance (in.)	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56
Zero out end point	0	-120	-200	-240	-280	-280	-320	-360	-360	-280	-200	-120	0	150	310
Slope Calc*	5.54														
Slope Correction**	0	22	44	66	89	111	133	155	177	199	221	244	266	288	310
Corrected Flatness Value (µin)	0	-142	-244	-306	-369	-391	-453	-515	-537	-479	-421	-364	-266	-138	0
Max Corr. Val. = Flatness	**0**														
Min Corr. Val. = Flatness	**-537**														
* Slope Calc = (Far Point-Zero Point)/Total Distance															
** Slope Correction = Distance * Slope Cacl															