RapiTrim Case Study #2

High density thick film circuit requires 3 passes

The Setup

The customer for this case study is a manufacturer of thick film hybrid circuits targeting the automotive industry.

The circuit consisted of a total of 48 thick-film resistors, laid out on an area approximately 60 x 70 mm. Resistors were of varying size and orientation on the substrate. A variety of trim types was required from single- and double-plunge to L-cut and U-cut.

The customer chose this circuit as a good test case for them because it required three passes through their current machine with different probe cards to both access the complex array of test points and leave a path for the laser to access the resistor trim regions.

The customer's current system was set to process 22 resistors in Pass A, 23 resistors in Pass B and 3 resistors in Pass C.

The Analysis

The customer performed an analysis of their current process steps to understand whether the fixtureless RapiTrim-C would be worth purchasing to satisfy an increased demand for their products. That analysis is below, with any specific product identification removed.

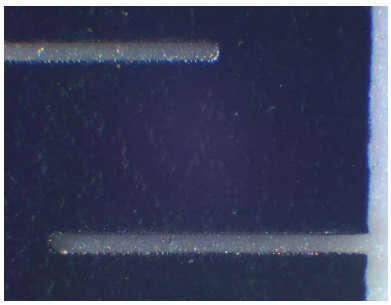
The customer broke out the work involved into three main categories:

1. **Laser Process Time.** The actual process time of the RapiTrim-C is nearly identical to the total of the process times for all three passes of the probe card system. This is not surprising since both techniques are trimming the same number of resistors and to the same tolerances, with identical cut types.

2. **Setup and Preparation.** The customer's thorough analysis also included the setup and preparation tasks, of which there are many for the probe card system and for which the customer had data for a baseline comparison. Basing calculations on a batch of 4000 circuits, the customer knows that their probe card system would take 77 hours (74 processing and 3 overhead) but only 68 hours (67 processing plus one overhead) with the RapiTrim. That saving of 9 hours a week (assuming 2-shift operation to complete the batch in a week) times 50 weeks is a saving of 450 hours for the year.

3. **Probe Cards and Job Creation.** This customer builds their own probe cards, and so knows the time required. An individual customer can decide whether to build probe cards and assign a different time, or buy probe cards and so transfer this time (cost of operation in labour hours) to a purchase cost. Regardless of the mechanism, this significant cost should not be ignored if a valid comparison of times and costs is to be made.

Writing or modifying a program however, is not an optional step, and typically this is a significant expense for probe card systems since it needs a high-skill, high-cost process engineer or similar. With the RapiTrim's DXF auto-import function, the job creation step on the RapiTrim is greatly streamlined compared to writing code for a probe card system. Depending on the number of new jobs required, this can rapidly become a huge cost saving with the RapiTrim. The customer's data shows they will be saving about 20 hours per new product setup. This would save 400 hours in a year with 20 new products to build.



Portion of a serpentine trim in a thick film resistor. Kerf width approximately 30µm.

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The Result

The total time saved (let alone the cost for the probe cards) in this scenario could easily be 500-800 hours per year with the RapiTrim system. This higher efficiency means lower cost (fewer hours needed for the same amount of product trimmed) or higher revenue (time benefit used to increase production for the year in the same number of hours that would have been needed by the probe card system). An ROI should take these factors into consideration.

Tasks - Current Systems	Time(sec)	Notes
A Pass Trim	25	
B Pass Trim	27	
C Pass Trim	15	
Total Trim Time	**67**	* 1 minute 7 seconds
Part Setup/Preperation Tasks	Avg Time(sec)	
Clean Probe Card and Check for Shorts	1200	
Load Program and Attach Correct Bearings/Adjust Theta	1425	
Line Up Probes on Correct Pads and Make Sure They Read	1950	
Adjust Starting Point of Each Cut	1200	
Validate All Cuts are Good and Then Measure Resistance	1725	
Clean Probe Cards During Each 3-Hour Validation Cycle	300	
Adjusting Probes During Run (If needed)	825	
Replacing Split or Broken Probes	3000	
Total Avg Setup Time	**11625**	*3.22 Hours
New Product Tasks	Avg Time(sec)	
Build Probe Cards	57600	*Can take up to 16 hours to build a probe card
Write New Program or Modify Old Program	21600	*This time depends on if we are modifying an old program or creating a new one.
Current Systems		
Total New Product Setup Time	**79200**	*22 Hours

Tasks - PPI RapiTrim-C-IR	Time(sec)	Notes
PPI Trim single pass with 60um spot	60	
Total Trim Time	**60**	* 1 minute
Part Setup/Preperation Tasks	Avg Time(sec)	
Automated System Calibration Routine	4800	This number is assuming a calibration once per shift, or every 8 hours Assuming a 67 hour run of 4000 parts, this means 8 calibrations of approximately 10min
Total Avg Setup Time	**4800**	*1.33 hours
New Product Tasks	Avg Time(sec)	
Write New Program	7200	This number is highly dependant on the input data being used If a fully detailed dxf is created, including resistor names, targets, test points etc. this process could take as little as 5min For manual creation using a dxf and the job creation GUI somewhere closer to 2 hours is likely for a 50 component job
PPI RapiTrim-C-IR		
Total New Prod Setup Time	**7200**	*2 hours

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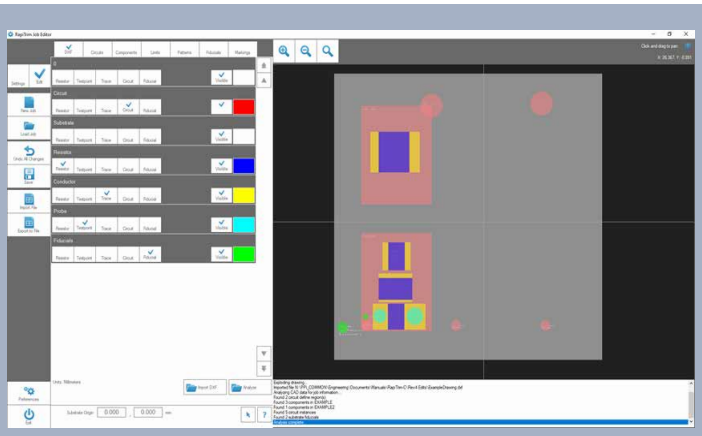
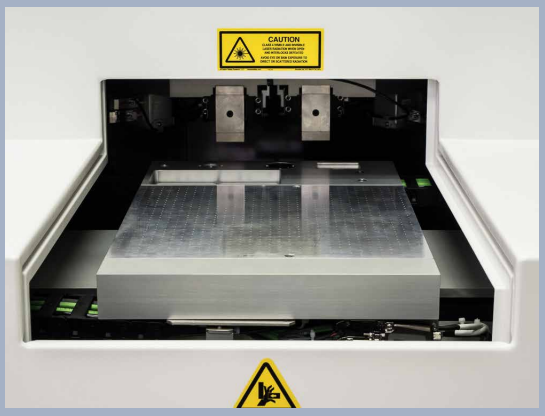
Pickup head for the optional stack loader.



Streamlined job editing with the DXF auto-import function.



Standard flat vacuum chuck on the left and a custom fixture on the right for a 3x3 array of substrates.

PPI Comments

As shown in this example, the fixtureless technology in the RapiTrim uses four independent flying probes, allowing dense, complex circuit layouts to be trimmed as easily as simple designs. Any component location, size, orientation and layout can be accommodated and there is no longer a requirement for multiple probe card passes for dense designs.

A complete family of RapiTrim products is available with different wavelengths. Optional hardware includes stack loaders, custom fixturing, the SM200 switching matrix, external instrument support, bar-code readers and process sequence customization.

PPI can provide turnkey solutions for all trimming needs, from standard component and circuit trim to complex active-trim scenarios with custom fixturing.

RapiTrim - ***The Future of Resistor Trimming™***