

June 2002



### Los Angeles/Orange County Chapter

*"The Surface Mount Technology Association membership is a network of professionals who build skills by sharing practical experiences and developing solutions in electronic assembly technologies and related business operations."*

#### DATE

June 12th, 2002

#### AGENDA

5:30 PM, Presentation / Dinner  
PLEXUS Tour Immediately Following Presentation

#### MEETING FEES

\$20, Members  
\$25, Nonmembers

#### MENU

TBD

#### LOCATION

Plexus Inc. 14118 Stowe Drive,  
Poway, Ca, 92064.

#### RESERVATIONS

Limited to 120 Attendees.

RSVP Now!

Frank Crockett with Tri-Cal  
Technologies Via  
phone: (760) 533-0195  
or  
e-mail: tfcroc@aol.com

#### DIRECTIONS

Take I-15 North to Scripps Poway Parkway exit, Go East on Scripps Poway Parkway to Stowe Drive, Turn Right onto Stowe drive, Second building on left hand side.

#### NO SHOWS WILL BE INVOICED.

If you can not attend, please cancel your reservation by 12 Noon on Wednesday, prior to the meeting.  
See you there!

### JUNE 2002 Dinner / Presentation / Tour

#### San Diego & LA/OC SMTA COMBINED Chapter Meeting & Plant Tour

##### PCB Fabrication Presentation & Plexus, Inc. of Poway, Ca. Tour

The LA/OC SMTA chapter is pleased to join the San Diego SMTA Chapter this year for a combined chapter meeting & plant tour. Plexus Inc. in Poway, Ca. will host a tour of their facility immediately following the PCB Fabrication presentation.

The PCB Fabrication presentation will be presented by speaker Brad Harline, Director of Sales with South Coast Circuits in Santa Ana, Ca. Brad will be assisted by: Dave Peterson- Sales Manager and Bob Neisus- Process Engineering Manager.

The Presenters will provide an in-depth review of the 35(approx.) manufacturing steps required for producing a Multi-layer PCB. From inputting the Gerber files from the OEM (Original Equipment Manufacturer), Drilling( holes sizes vs.cost ), Photo tooling for LPI, Desmear/Etch Back, Lamination, Black Oxide, AOI, Electrolytic Copper, and many other PCB manufacturing steps, to the final inspection of the finished PCB.

PCB Manufacturing samples will be available for attendees to view during the Printed Circuit Board Fabrication presentation, and you will be given the opportunity to discuss some of the various multilayer PCB fabrication steps that you have learned.

## MESSAGE FROM THE PRESIDENT

By: Riki Brown

Our last months meeting was with Dr. Bill Messina of Boeing. We all learned more about SPC as it relates to Pick and Place process control and we want to thank Dr. Messina again for his fine presentation.

This month of June has been LA/OC tour month. We have been contacting companies since the beginning of the year to get a tour locally but have had no luck. Several companies said yes but than canceled on us. We tried to join AMAPS for their tour but theirs canceled on them also. So to hold to tradition we are joining the San Diego Chapter for their tour of Plexus. We wish to thank the Pres. Barry Guest on behalf of San Diego SMTA for allowing us the opportunity to join them. The technical presentation is on PWB fab, but Plexus is a CM and we will tour their facility in Poway.

We will have no meeting in July, and Aug. will be the Golf Tournament...which we hope will be a big success. Frank Kurisu has put in a lot of work to make this happen in concert with CCA and the board really appreciates the hard work Frank has done. We are still in need of more sponsors so call Frank (714-842-1987) or e-mail him (fkurisu@msn.com) if your company can help. The tournament is Aug. 8 at the California Country Club in Whittier.

The LAOC SMTA web site is now up so visit us at [www.laocsmta.org](http://www.laocsmta.org). We are looking for suggestions and comments about our site so after you have checked us out, e-mail any of the board members and let us know what you think.

## Wayne Koh

**Wayne Koh, PhD, ChE is a graduate of Cornell University. He is the Director of Manufacturing at Kingston Technologies. He has been the Director for the past 2 years.**

**Wayne is married with 2 daughters: 20 and 16 years old. The family enjoys traveling, which is also Wayne's hobby. Every year they pick a place they would like to visit. This year they will be vacationing in Italy.**

**Let's all give Wayne a warm "SMTA" welcome into the LA/OC Chapter!**

**Hope to see you at a future meeting!**

## New Member Profile

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*Written by, Atul Mehta*

### *LA/OC chapter SMTA meeting for the month of May was held on the 16th at the Embassy Suites in Anaheim.*

*Dr. Bill Messina from Boeing Space Satellite Division in El Segundo conducted the presentation on "Implementing Statistical Process Control for component placement equipment."*

Bill began with..."The application of SPC to component placement equipment presents some unique challenges to the data sleuth. Due to the nature of the problem, we are usually dealing with a situation in which we want to develop a control chart scheme that must function in a low ppm defect level. This is the first time we have discussed a need to implement a control scheme for this type of environment."

He went on to explain that most component placement equipment are designed with it's own internal inspection system that assures that it can place parts on the board in the designated place. It will attempt several times using different parts until it correctly places the part on the board. On the surface, this sounds like a great idea and doesn't look like we need an SPC system to monitor this process.

Some of the shortcomings of implementing this system are that: (1) Machine rejected parts are often scrapped. (2) Increased Cycle Time. Since it takes time away from production to find up to say 5 parts to fix the internal problem it can add from 10 to 25% increased cycle time. This is clearly unacceptable from a production standpoint. (3) Machine downtime. The operator is acting in a reactive mode. No intervention is taking place to fix the machine as errors are occurring. We would like to develop a predictive maintenance scheme, which allow us to prevent problems from occurring in the first place. (4) Lack of specific problem information. Under this type of scheme, maintenance does not receive any information on the root cause of problems since the scheme is self-correcting.

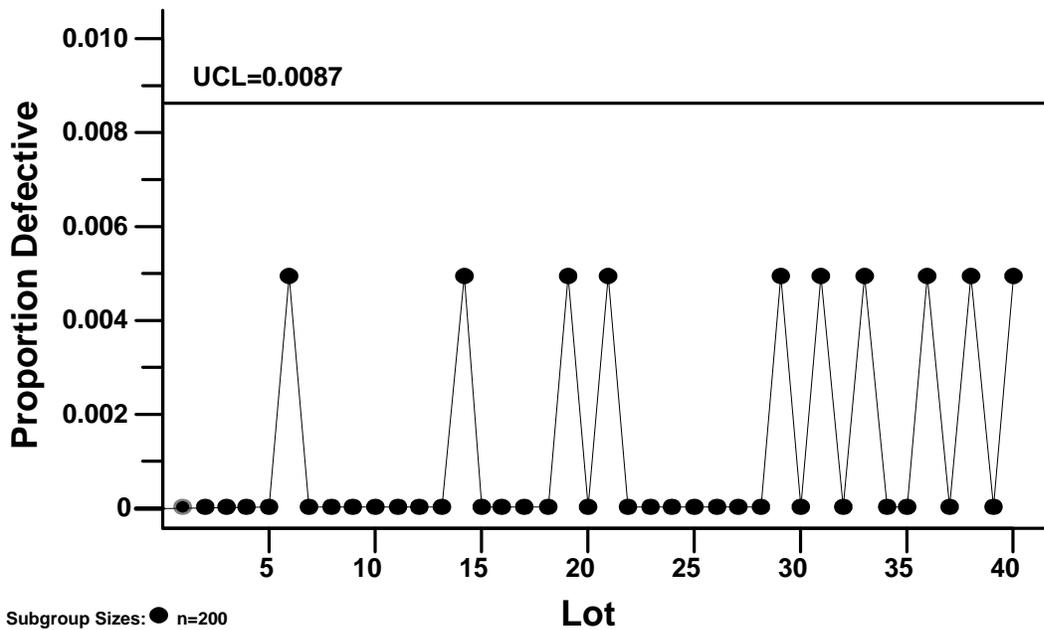
Under these circumstances, it is important to develop a scheme that can detect a problem quickly and implement an appropriate Out of Control (OCAP) scheme to eliminate the root cause.

Example 1 will be examined to see how effective this method is. Example 1: A component placement operation was observed in which a P chart was implemented. The number of defects for each subgroup of size 200 were monitored. A total of 8000 insertions (40 subgroups) were studied. Table: 1 shows the results of this study.

Figure: 2 show the P chart for this data. Form this chart, a few observations can be made: (1) 17 out of the first 20 points are plotted at 0. In practice, this is not a good idea from a manufacturing perspective. If the operator looks at a chart or worse has to plot a chart say every 1hour, he or she will be plotting mostly zeros on the chart and will lose interest. (2) The chart shows a saw tooth pattern due to the fact that so many points are 0. The pattern appears to be a dichotomy, since each point is either defective or not. So it appears that the P chart is not the correct chart to apply in this situation due to the low defect level.

**TABLE: 1 DATA FOR PCHART FOR COMPONENT PLACEMENT EQUIPMENT**

SUBGROUP NUMBER	NUMBER DEFECTIVE	PROPORTION DEFECTIVE	SUBGROUP NUMBER	NUMBER DEFECTIVE	PROPORTION DEFECTIVE
1	0	0.00	21	1	0.05
2	0	0.00	22	0	0.00
3	0	0.00	23	0	0.00
4	0	0.00	24	0	0.00
5	0	0.00	25	0	0.00
6	1	0.05	26	0	0.00
7	0	0.00	27	0	0.00
8	0	0.00	28	1	0.05
9	0	0.00	29	0	0.00
10	0	0.00	30	0	0.00
11	0	0.00	31	1	0.05
12	0	0.00	32	0	0.00
13	0	0.00	33	1	0.05
14	1	0.05	34	0	0.00
15	0	0.00	35	0	0.00
16	0	0.00	36	1	0.05
17	0	0.00	37	0	0.00
18	0	0.00	38	1	0.05
19	1	0.05	39	0	0.00
20	0	0.00	40	1	0.05



**Figure 2**

## TIME-BETWEEN EVENT (TBE) CUSUM APPROACH

A new approach is required, which allows modeling the process when the defect level reaches the low ppm levels that we strive to attain in practice. The new approach is called TBE CUSUM. This approach does not arbitrarily make subgroups of the data and plots some statistics based on these subgroups on a control chart. Instead, in this approach the data dictates the sub grouping method. In this case, we count the number of component placements between errors. The number of insertions between errors is the statistic that the CUSUM control chart will be developed around. Table 2 presents the data from example 1 in a TBE format.

**TABLE: 2 DATA FOR TBE CUSUM CHART**

INSERTION ERROR NUMBER	$Y_i$	$S_H (i)$
1	1450	0
2	1300	100
3	1425	75
4	1200	275
5	1000	675
6	500	1575
7	400	2575
8	150	3825
9	100	5125
10	475	6050

The data for  $Y_i$  is obtained from the machine itself. Next, determine the values of H and K.

First we need to determine the Acceptable ( $U_a$ ) and Unacceptable Defect level of the machine ( $U_b$ ). The acceptable level of the machine is usually set at the design requirement of the machine. The unacceptable level of the machine is generally based on historical data from the process.

In this case, the acceptable level of the machine is set at: 500 PPM and the unacceptable level is set at 1000 PPM. From this we can calculate the value of  $K_t$  – the intermediate value of K and the value of K.

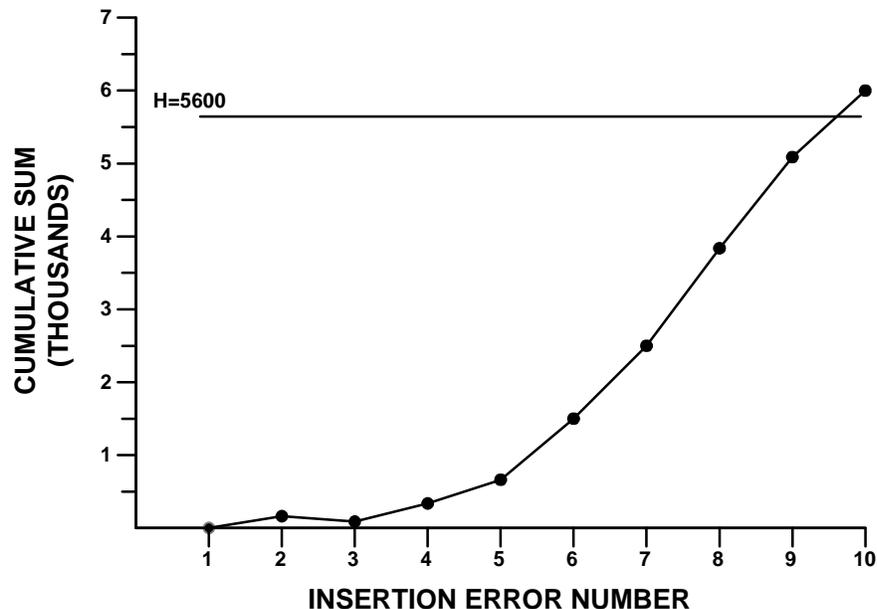
$$K_t = \frac{\ln(U_b / U_a)}{(U_b / U_a) - 1} = \frac{\ln(1000 / 500)}{(1000 / 500) - 1} = \ln 2 \approx 0.7$$

$$K = \frac{K_t}{U_a} = \frac{0.7}{500 / 10^6} = 1400$$

$$H = \frac{H_t}{U_a} = \frac{2.8}{500 / 10^6} = 5600$$

The value of H is calculated as follows:

Value of  $H_t$  is chosen to be 2.8 since we wanted to have an in control run length of 110 insertions before a signal is given when the process is performing at the 500 PPM level. We wanted the CUSUM scheme to signal quickly when the process is out-of-control at the determined level of 1000 PPM, so an out of control run length of 12.9 is picked. Therefore, the  $H_t$  of 2.8 is chosen. As can be seen from the table, many other combinations are possible. It depends on the economics of the tradeoff of detecting an error quicker or waiting longer before signaling when the process is performing at the in control PPM level. Each case warrants its own combination. Figure 3 shows the TBE control chart for the component placement data.



**FIGURE 3** TBE CUSUM For Component Placement Errors

From Figure 3, we see a different picture of the process than that presented by the P Chart. This chart signals that the process goes out of control at the 10<sup>th</sup> error. Instead of plotting 40 subgroups worth of data, we have plotted 10 subgroups of data. The data plotted is meaningful because it relates to the 10 insertion errors in the process. Whereas, 30 of the 40 groups plotted weren't meaningful, since all that was plotted was 0 and provided no information on the process.

*Another important aspect of the TBE data is that it provides information on the development of predictive maintenance procedures. Then a predictive maintenance scheme could be set-up based on a counter hooked up to the machine to signal the maintenance personnel to replace the feeder after 900 parts have been placed, so that the machine would never signal an out-of-control condition for feeders.*

In SUMMARY this case study has demonstrated the need for alternative SPC methods when low PPM is desired, and Bill has shown how to effectively employ the TBE CUSUM control chart to achieve this objective. The study was also able to demonstrate that his proposal to use box plots (to set the out-of-control defect level) and other strategies on how to reduce this level was effective in achieving the stated goal. The LA/OC SMTA Chapter would like to thank Dr. Messina for sharing his knowledge and an excellent presentation!

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Further details on the Chapter Training coming soon...**

## **LA/OC SMTA Chapter Goes Live with new Web Site!]**

Your local LA/OC SMTA chapter board members have completed the chapter web site, and are pleased to announce that is now up and running for your viewing pleasure.

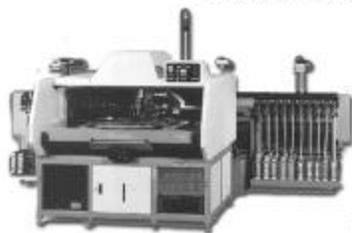
The web site ([www.laocsmta.org](http://www.laocsmta.org)) offers a message board for members (and non-members) to post questions and share technical ideas. If you have not already done so, be sure to go sign up and become part of the new LA/OC SMTA technical forum.

In addition to running ADS in the News Letter, the ADS will also be posted on the web site for the same duration the AD is ran in the News Letter. An Archive link is available for viewing all of the previous news letters, and of course a Corporate Sponsors link posting all of our wonderful corporate sponsors!

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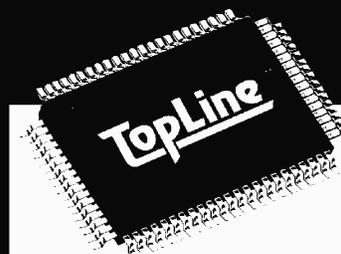
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