Making Electronics with the TM-240A Pick-and-place Machine

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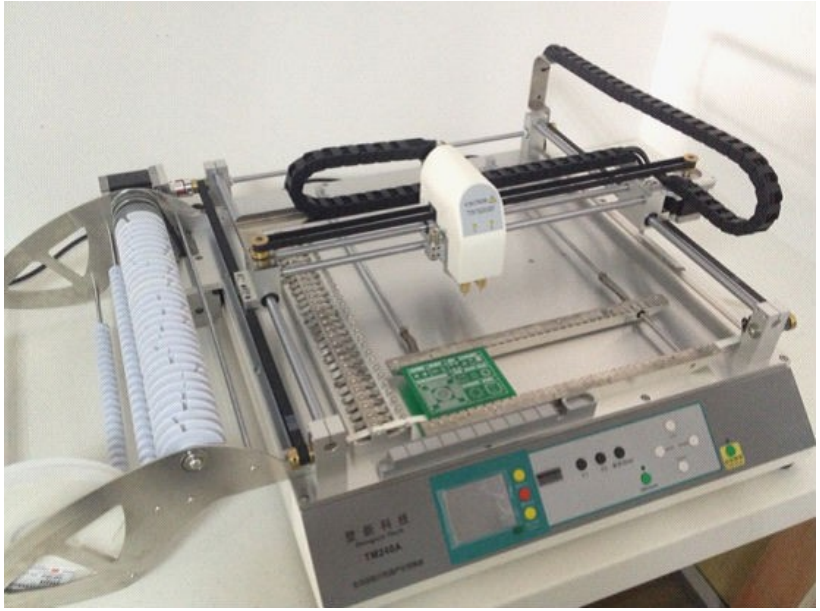


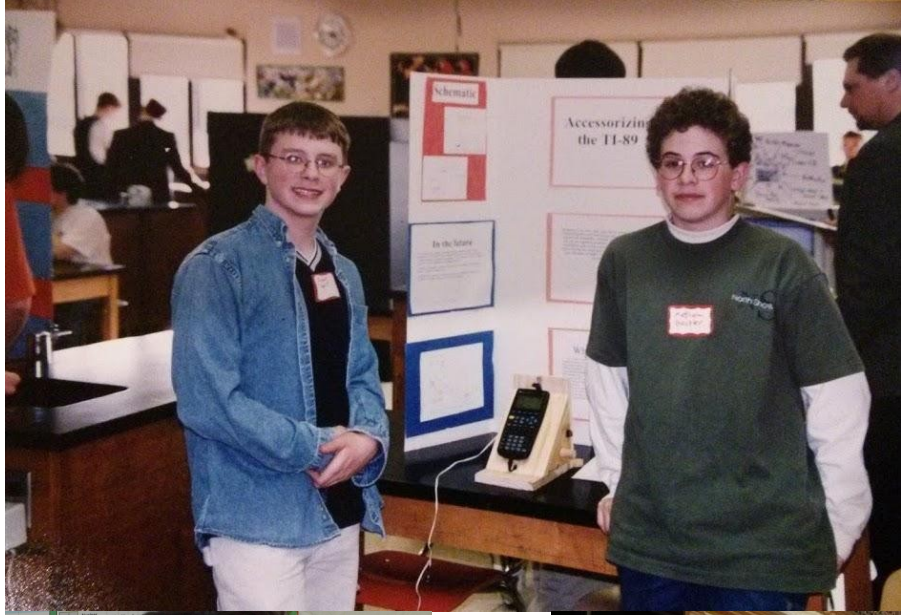
Wayne and Layne, LLC

Wayne and Layne

~4 years old

Open source hardware electronics kits

Museum installations



OSHW Kitbiz: 5 years ago VS today

Bigger market

Demand for soldering kits slowing

Demand for pre-assembled modules increasing

Developing Electronics, design

Order parts

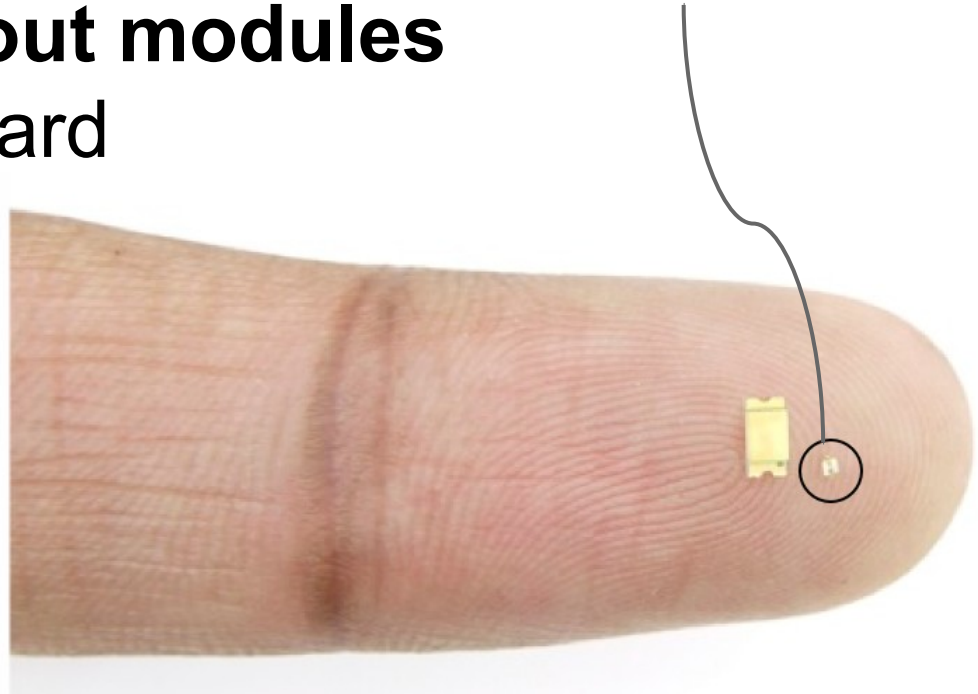
Connect on a breadboard
Iterate
Make a printed circuit board (PCB)
Solder parts to PCB
Test

Developing Electronics, production

Order parts & PCBs in bulk
Kit them together
$$$

Developing w/SMT Electronics, design

Order *itsy bitsy* “surface mount” (SMT) parts
Solder to little breakout modules
Connect on a breadboard
Iterate
Make a PCB
Solder parts to PCB
Test



Developing w/SMT Electronics, scale-up

- Work with a contract manufacturer (CM)
  - Sample boards
  - Bill of Materials wrangling
  - Leftover parts?
  - Test plan with language, timezone issues

Seeed Studio is the best CM we've worked with

and we love them!

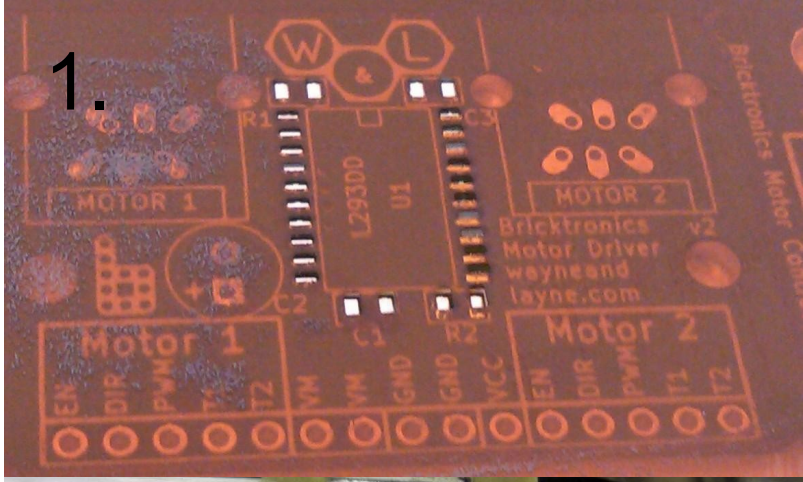
… but it still isn't fast!

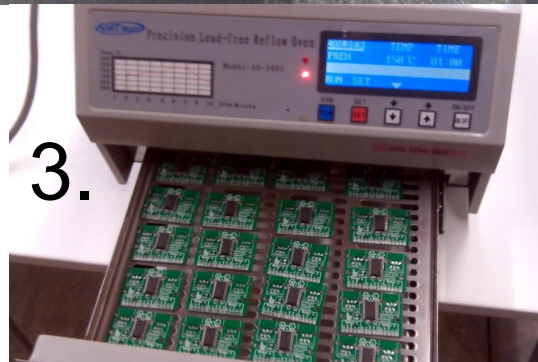
What if we made just one step faster?

Order itsy bitsy parts
Solder to little breakout modules
Connect on a breadboard
Iterate
Make a PCB
Solder parts to PCB
Test

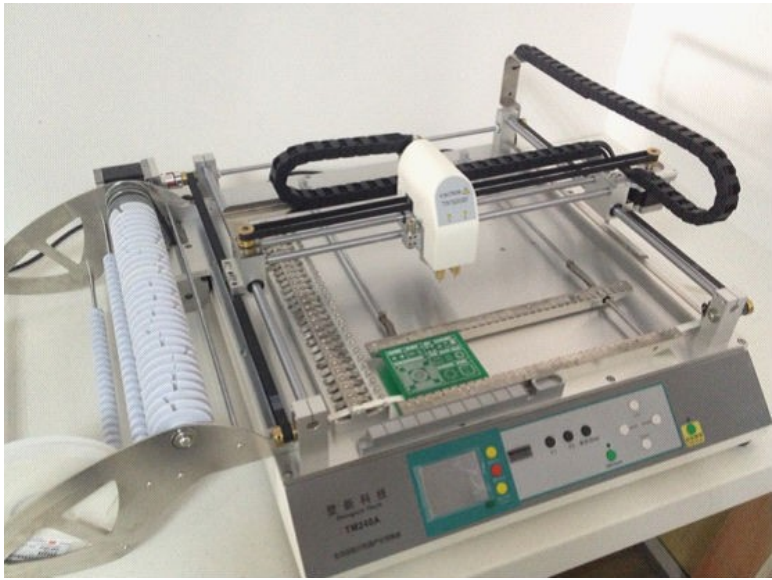
Solder parts to PCB

1. Use stencil to apply solder paste to PCB where the solder should go
2. Use a robot to take the tiny parts from reels and place them where they should go
3. Heat up everything in a little oven





The robot is called a “pick and place” machine



Large range in features, price
(http://lowpowerlab.com/blog/2014/07/14/pick-and-place-commercial-options)

Number of parts that can be loaded in machine at one time, accuracy of placement

For most of their history, they’ve been aimed at large production runs

Oh, have you heard about the open source pick and place that isn’t out yet but will be soon?

Our first “reel” run of our machine

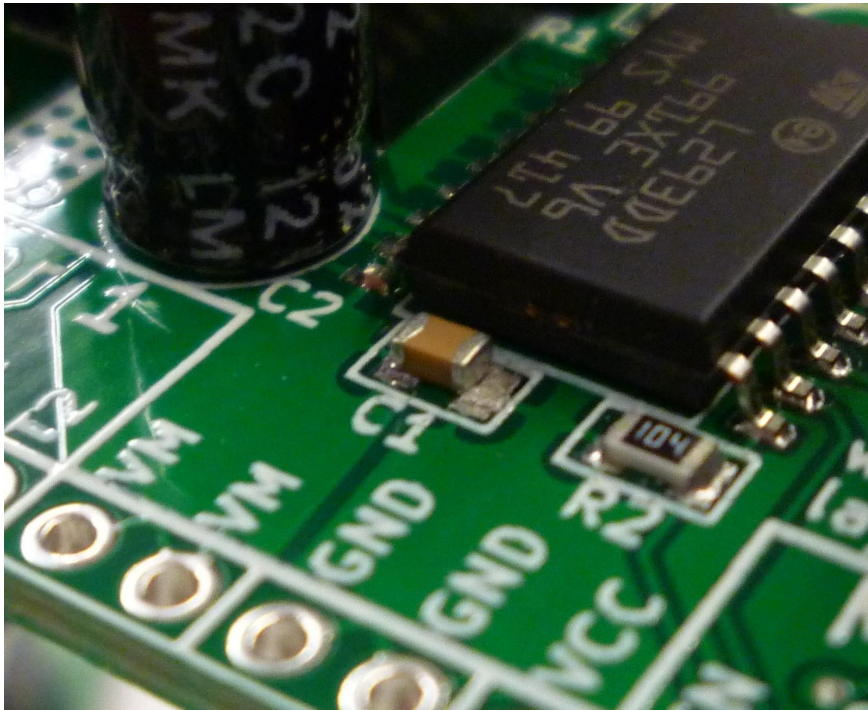
New Fubarinos for our pal Brian Schmalz
20 boards, 23 parts
4 hours tweaking output from Eagle,
loading reels into machine
No rework necessary on anything but the IC,
and that was removing bridges with solder wick
One board had an IC placement issue… this was also the first time we used cut tape!

Our second run of our machine

A new W&L product:
Bricktronics Motor Driver

105 boards with 5 SMT parts in 4 hours total, start to finish

No IC rework required, but 5 out of 400+ passives didn’t reflow



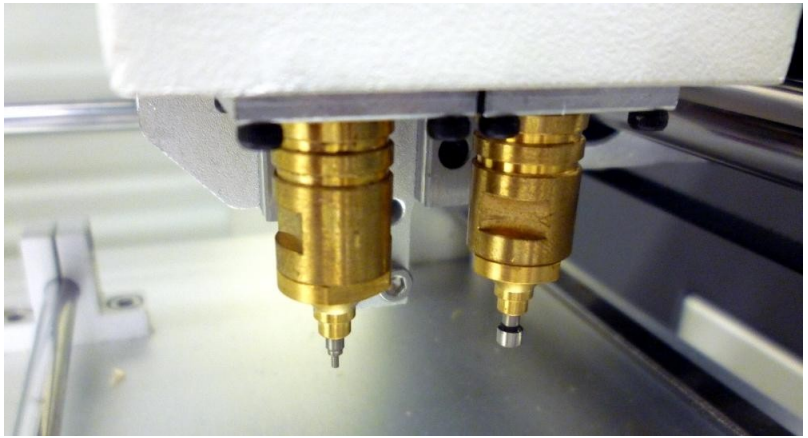
Neoden TM-240A

27 feeders + front tray
Small! ~ (38” x 26” x 12”)
PCB area ~ 15” x 14”

0402, 0603, 0805, 1206, 1812, 2010, 2512, SOT-23, LED (3528, 5050, etc.), SOT89, SOP-8, SOP-14, SOP-16, SOT-223, SOT-252

Neoden TM-240A

No vision, no centering



No solder paste dispensing

Two heads, but no automatic nozzle changer

27 reel/cut tape feeders, 1 front tray

Purchasing and arrival

~$5,000

Arrived at my house in a crate in less than 1 week

No calibration required

2 hours between uncrating and placing parts

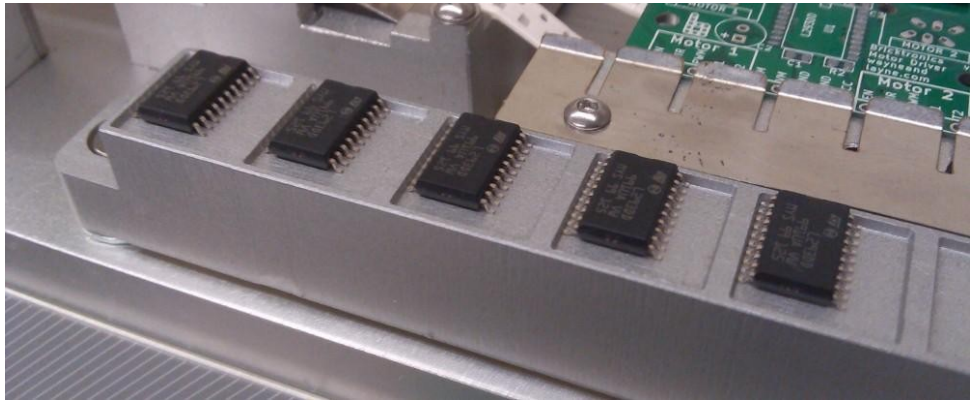
Honest abilities

Good at placing passives, SOICs and thereabouts

Not super great at placing fine-pitch TQFP or smaller ICs

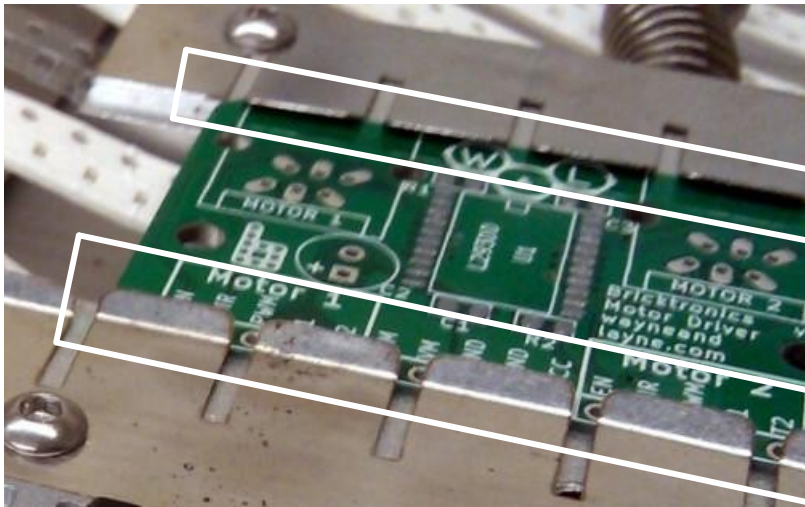
TQFP

Tips and tricks!



Front tray is too low,
fix with a pair of washers
Front tray accuracy is lower
(fix with custom jig?)

Remember the PCB clips
when placing parts on PCB



Tips and tricks!

Use sacrificial reel + Scotch tape for cut tape film, but you need an extra inch of cut tape
Use double sided tape to test placement
Table stability is important
Use our software if you want to parse, manipulate the PnP placement CSV files

PnP placement files

https://commons.wikimedia.org/wiki/File:SanDisk_SD_Card_8GB.jpg

Simple CSV format
Read from SD card
Dangerous Prototypes has an Eagle ULP script

Wayne and Layne (that's us!) are releasing a Kicad importer and Python library today!

KiCad

This pick and place machine helps us prototype SMT electronics faster.

We can rework or hand-place the one or two fine pitch ICs we use per board, and we have found the setup + placement time to be quicker than manual placement of passives.