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07-28-2007, 12:42 PM #1

Rhodan
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Join Date: Jul 2003
Location: Canada
Posts: 142

Wolfgang Engineering TB-350 spindle review

After using my K2CNC 2514 with the Porter Cable router and DA collet to try and cut traces on a PCB (miserable failure - 0.0005 deep cut with a 90 degree V bit gave me a 0.020 wide cut!), I decided I needed something with a HELL of a lot less runout if I was to reach my goal of making PCBs with 0.010 wide traces.

After searching around and finding mostly $10,000 air driven high-speed spindles, I stumbled across Wolfgang Engineering on Ebay stores. I settled on the TB-350 spindle with mounting bracket and AC motor for just under $200 as the maker claims typical runout of 0.0001" and max 0.0004".

Right off the bat I was pleasantly amused when I received an email from the maker apologizing for not being able to ship the spindle on the weekend (I ordered on a friday afternoon) and that he'd ship on monday. I received the spindle within a few days (I think it was about 4 working days from the order date). Events conspired against me and I didn't actually mount the spindle and start cutting until about three months later.

Right off the bat I had a problem: the motor pulley spun freely on the motor shaft. Funny thing was that I had the unit running when I first received it and it seemed fine then... I thought perhaps I'd lost a part or something so I emailed the maker. He apologized and said that they were supposed to be press-fitted but he discovered that a few had been messed up. He suggested a dab of epoxy (JB weld or equivilent) but I went with locktite blue (in case I ever want to remove it). I'm guessing the tool he used to bore (or ream) the holes was creating a small burr that gave the illusion of a tight press-fit. With some use the burr smoothed off and the pulley would spin freely.

Anyway, a drop of "the blue" did the trick perfectly so I got everything set up and then pulled out my dial micrometer to see if the runout claims were accurate.

WELL! Was I in for a shock. I chucked up the aformentioned 90 degree V-bit (longest 1/8th shank bit I have) and gave it a few spins while watching the dial closely. Not a wiggle.. Absolutely no movement at all! Whatever the runout is on this spindle, I cannot measure it with my dial micrometer.

Low speed accuracy is all well and fine but how was the runout at the advertised 25,000 RPM? I checked that by using a V-bit and manually cut some lines on copper board with the tip just barely cutting into the copper. The lines were miniscule! I should mention that the spindle uses a drawbar, not a setscrew, to tighten the collet. This accounts for the high speed accuracy as there is nothing throwing the spindle off-balance.

The first time I chucked up a bit I was dismayed to find that I couldn't get much of a grip on the spindle to tighten the drawbar. I thought for sure the bits would stall and spin in the collet as soon as they hit copper. That didn't happen! In fact, I find it takes very little tightening to hold bits securely.

Next I pulled out a PCB file I'd been working on and cut it using a 30 degree V-bit - the PCB being held down with my home-made vacuum table (dust collector hooked to an MDF table with a gazillion holes in it). I experimented with different depths and found 0.003 deep the most reliable (no shorts). I used Visual Mill 5.0 engraving set to "to condition" and "outside" and the results were amazing. Or at least, they were amazing until I forgot to plug in the spindle before starting a cut - the V-Bit stabbed into the copper board then dragged across,

snapping off the point. And, of course, I had only ONE 30 degree bit.

So, I pulled out a 45 degree bit and I've been working with that (haven't forgotten to plug in the spindle since!). The cuts are a bit wider but at 0.003 deep its not a gigantic difference.

This spindle is impressive for its accuracy, especially considering the price. What it lacks is power. While it works great at 40IPM with Vbits and tiny drill bits, I stalled the unit with a 1/8th drill bit at that speed. Not a huge deal really, the K2 2514 Z axis deflects slightly when plunging at that speed anyway so I slowed it down to 5IPM for drilling at that size (PCBs are 1/16th or 1/32nd thick so it still takes no time at all).

Where the lack of power really hurts is in cutting out the board. Using a 1/8th "chip breaker" router requires dropping to 2IPM and even a smallish board at 5x6 takes quite a while to route out. I actually gave up on routing the board out and cut it on my tablesaw instead. I'll reserve the routing method for smaller boards that are too dangerous to do on the tablesaw.

Yesterday I cut my first "real" board. Traces at 0.010 wide and it was bloody perfect. Initial inspection with a multimeter showed some shorts but a quick brushing fixed that - it was just copper dust that compressed air hadn't blown away.

So, the only real issue with this spindle is a lack of torque delivered to the bits. Its belt drive (O-Ring really) so thats not a big suprise. If this were a $10,000 spindle then I'd be all upset but at <$200 I'm finding the spindle's performance to be nothing short of awesome!

If I had a camera that could focus up close, I'd post a picture of the PCB. Unfortunately, my ancient AGFA CL20 just isn't up to it. It needs to be about 2 feet away and the traces just don't show up at that distance (yeah, THAT small

Quote

07-29-2007, 01:23 AM #2

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Turns out my brother had a camera that could do a better job - though it still can't focus up close. I had to zoom in quite a bit and use a mega-high rez. No stand also meant a bit of the shakies so the pic is still a tad blurry.

The first pic is 0.010 traces which metered out perfectly. Between glare, shakies, and lack of a real macro camera it appears like the upper traces have been rubbed out but in fact they're just as good as the lower traces. You might notice that the bottom left hole is a bit off - it is! My fault totally, I went and re-zeroed to cut the SMD after just doing the engraving. Had to manually find zero again for drilling.

The second picture shows the pattern for an Atmel Mega8 QFP and a DS1307 SOP. Again, it appears like some of the pads aren't fully cut out but in fact they are. I probably should have sanded a bit to take the burrs off before taking the photos - they aren't big but I think the light reflecting off them messes up the picture.

I have a 0.005 endmill that I've been too chicken to try cutting with up until now. I think I might just have to buck up and try it next! I could cut two traces between 0.060 DIP pads! Or, I might just

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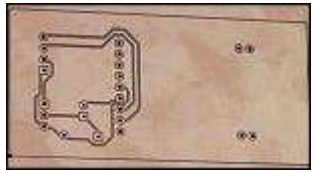
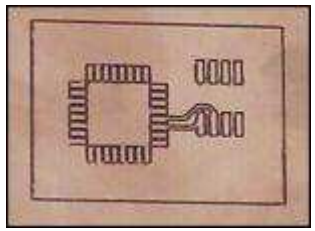

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