

## TIP 113 — Acorn Retrofit on a Denford/Sherline Microturn Lathe/Friolator

### About the Denford/Sherline CNC Microturn Lathe

We started our CNC line by building CNC-Ready machines for Denford and a few other companies. Denford sold Sherline mini-lathes and milling machines in the UK as Microturn and Micromill CNC student learning machines. The CNC machines were installed in an enclosure for student safety.

The following text is from Friolator's original post on the Centroid Community CNC Support Forum. [CLICK HERE](#) to see the original post.

### Gutting and Converting a Denford/Sherline Microturn Lathe to Run on Centroid Acorn by Friolator

I've posted a few threads here and there over the past couple months, but here's the official build thread. I'm just about done with it at this point and I'm down to dialing stuff in.

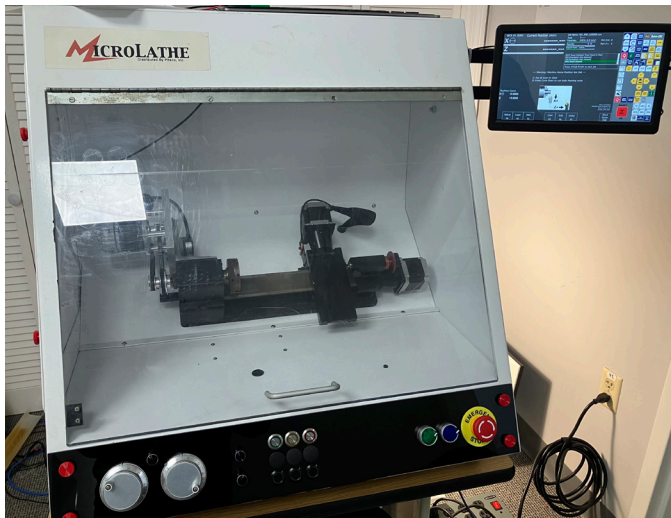


FIGURE 1—The Sherline CNC MicroLathe for Acorn in its converted Denford enclosure. Click the following URL link to view a photo album of the Denford Microturn CNC lathe conversion to run on Centroid Acorn: <https://flic.kr/s/aHBqjBiFta>. The album includes photos and videos.

I bought a used Denford CNC Lathe a couple months ago for our office. I have a manual lathe but nowhere to set it up in our new space, so I needed something self contained and small. We are a motion picture film scanning and restoration service. When I was in film school I was always into visiting the small shops around town that did film related work but also had their own in-house machine shops. Even in the 90s, it was getting harder and harder to get parts for cameras and related

equipment, so there were a handful of places that just made them themselves. 30 years later, I own a company that deals with archival film and the situation is worse. A lot of the hardware we use is from the 70s and 80s, plus we're now confronted with film that's so old it's shrinking and can't be run on traditional hardware with sprocket wheels. Sprocketed drive systems can completely destroying shrunken film.

Over the past several years I've built a completely sprocketless film scanner for 35mm through IMAX film, but primarily for some really old film (110 years old) that one of our clients wants us to scan. That machine is nearly done, we're down to the software at this point. Almost all of that was custom made to my design, but farmed out to third party machine shops to manufacture. Now that we're done, and we're considering building a second one, I am looking to bring some of that in house. Specifically, the rollers we use for film and the hubs for the particle transfer rollers that make up the transport of the film scanner. And, we've had several people ask about getting rollers made for their machines, so it may turn into a small side hustle for us, if the numbers make sense.

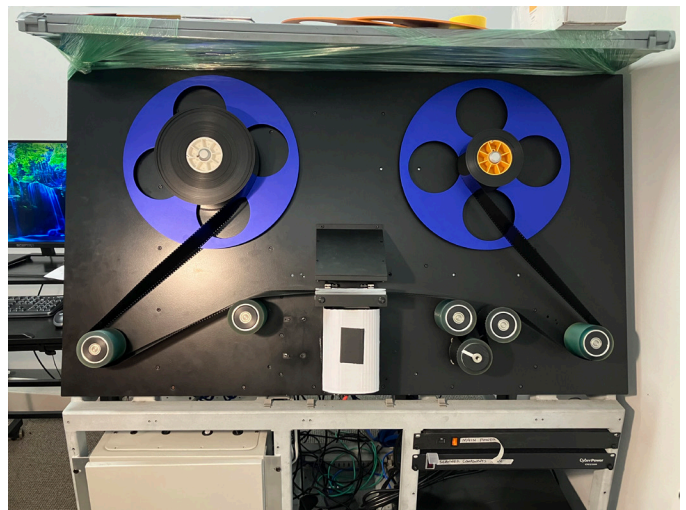


FIGURE 2—IMAX film scanner.

In any case, the Denford is basically a student lathe for teaching CNC, and it's built around a Sherline 4000. It's small and completely self-contained. The hardest material we will ever mill on this will probably be aluminum, but most parts will be made out of Delrin. My goal is to have a machine that's basically completely

self contained using conversational programming to turn these simple shapes with good repeatability and minimal babysitting. But I also want basic manual functionality, which we're going to be able to do with the USB-BOB board.

I removed all of the original Denford CNC controller hardware, the open-loop Z and X steppers, and the spindle motor. The original seller said that the motor made a weird buzzing noise, and I already have a couple spare Teknic Clearpath MCPV and MCVC motors from the film scanner project, so I decided to replace it with that.

The Teknic motor takes PWM, so I use a 0-10V -> PWM converter board to convert the VFD analog out on the Acorn board to PWM. The Sherline has a 9/16" shaft, and I had a heck of a time finding a pulley for the motor with that bore diameter. In fact, I couldn't. So I ended up drilling it out on my drill press, and it's less than ideal - super wobbly. But once I'm done dialing things in, the first project will be to fix that on the lathe, boring out a new pulley, so it turns more smoothly. I've added a spindle encoder as well, so that I can eventually do threading and maybe even rigid tapping if the machine can handle it.

The stepper motors were going to be closed-loop motors I already had, but it turns out the Sherline shaft coupler didn't match the shaft diameter of those motors and the coupler isn't a standard one that I can easily replace\*. So I had to buy new closed loop steppers with 1/4" shafts. Not expensive, just another delay.

**\*NOTE:** Other sizes are available from Sherline upon request.

I was able to re-use the homing switches but that's pretty much the only electronic/electrical part left from the original setup.

The PC is a GMKTek Mini PC I got on Amazon for about \$130 with Windows 11 Pro preinstalled. It passes the Centroid PC test, and seems to be just fine. What I like about it is that it's absolutely tiny, and it has two ethernet connections. Wifi doesn't work so well when it's inside a closed steel box, so having the ability to plug into our wired network is great. I picked up a small touchscreen as well for about \$100 on Amazon - 1920x1080 but small, to match the form factor of the machine. It's mounted on the side with a swing-arm VESA mount.

I'm using the USB-BOB board as well, for the control panel on the front, which has separate MPG wheels for

the two axes, a 1x/10x/100x selector for those MPGs, feed and spindle speed override knobs, buttons for cycle Start and stop, feed hold, MPG enable/disable, speed override enable/disable, and some cabinet lights. There's room on the panel for a couple more buttons if I decide I need them. The USB BOB has been really easy to set up, but I did end up reconfiguring where I put it to cut down on the amount of wiring. It now lives underneath the machine, which is not ideal, but as long as I don't need to rewire things it's fine. I don't expect to have to add any more to this than I'm already using.

I'm at the point now where the motors are all working, I'm able to home the axes, and some of the control panel is set up. I'm working on dialing in the motors now.

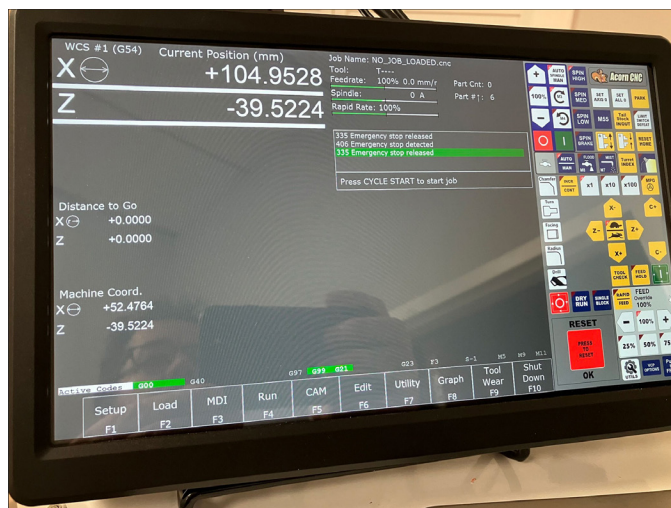


FIGURE 3—Closeup of the Acorn CNC interface.