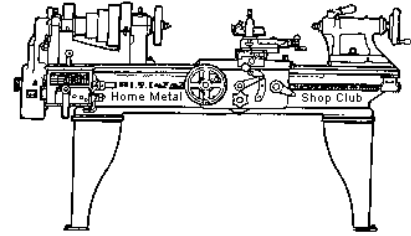




January 2017
Newsletter

Volume 22 - Number 01



<http://www.homemetalshopclub.org/>

The Home Metal Shop Club has brought together metal workers from all over the Southeast Texas area since its founding by John Korman in 1996.

Our members' interests include Model Engineering, Casting, Blacksmithing, Gunsmithing, Sheet Metal Fabrication, Robotics, CNC, Welding, Metal Art, and others. Members enjoy getting together and talking about their craft and shops. Shops range from full machine shops to those limited to a bench vise and hacksaw.

If you like to make things, run metal working machines, or just talk about tools, this is your place. Meetings generally consist of **general announcements**, an **extended presentation** with Q&A, a **safety moment**, **show and tell** where attendees share their work and experiences, and **problems and solutions** where attendees can get answers to their questions or describe how they approached a problem. The meeting ends with **free discussion** and a **novice group** activity, where metal working techniques are demonstrated on a small lathe, grinders, and other metal shop equipment.

President <i>Brian Alley</i>	Vice President <i>Ray Thompson</i>	Secretary <i>Joe Sybille</i>	Treasurer <i>Emmett Carstens</i>	Librarian <i>Ray Thompson</i>
Webmaster/Editor <i>Dick Kostelnicek</i>	Photographer <i>Jan Rowland</i>	CNC SIG <i>Martin Kennedy</i>	Casting SIG <i>Tom Moore</i>	Novice SIG <i>John Cooper</i>

This newsletter is available as an electronic subscription from the front page of our [website](#). We currently have 1078 subscribers as of this printing located all over the world.

About the Upcoming 11 February 2017 Meeting

The next general meeting will be held on 11 February at 12:00 P.M. (Noon) at the South Houston Library, located at 607 Avenue A, South Houston, TX 77587 ([Map](#)). *Dick Kostelnicek* will give a presentation about Microprocessor One-Axis CNC.

Visit our [website](#) for up-to-the-minute details, date, location maps, and presentation topic for the next meeting

General Announcements

[Videos of recent meetings](#) can be viewed on the HMSC website.

The HMSC has a large library of metal shop related books and videos available for members to check out at each meeting. These books can be quite costly and are not usually available at local public libraries. Access to the library is one of the many benefits of club membership. The club has funds to purchase new books for the library. If you have suggestions, contact the [Librarian Ray Thompson](#).

We need more articles for the monthly newsletter! If you would like to write an article, or would like to discuss writing an article, please contact the [Webmaster Dick Kostelnicek](#). Think about your last project. Was it a success, with perhaps a few 'uh ohs' along the way? If so, others would like to read about it. And, as a reward for providing an article, you'll receive a free year's membership the next renewal cycle!

Ideas for programs at our monthly meeting are always welcomed. If you have an idea for a meeting topic, or if you know someone that could make a presentation, please contact [Vice-President Ray Thompson](#).

Recap of the 14 January 2017 General Meeting

By Joe Sybille, with photos by Jan Rowland



Twenty-four (24) members and one visitor, Tina Alley, attended the 12:00 P.M. (Noon) meeting at the Parker Williams Library located at 607 Ave, South Houston, TX 77587. There was one new member, Jon Gaynor. Welcome to the club Jon. There are thirty (30) members in good standing with the club. President *Brian Alley* led the

meeting (right photo).



Presentation

There were two presentations today. Club member Vance Burns gave an overview of how he built his CNC router table. Club member Martin Kennedy discussed the conversion of his lathe to CNC while maintaining his ability to operate the lathe manually. We shall begin with Martin explaining the advantages

and disadvantages of CNC.

The advantages of CNC include:

- Easily make complex parts
- Easy to manufacture a number of identical parts
- Fast machining when compared to manual operations
- High precision and repeatability – calculation errors are eliminated

The disadvantages of CNC include:

- Requires more time for simple one-off parts due to programming time
- Steep learning curve
- Cost and complexity of support software required (CAD/CAM/control)
- Cost and complexity of hardware required
- Somewhat complicated to build and debug

An understanding of the overall CNC process is necessary. From the inception of an idea, one must reduce the idea to a computer aided drawing/design (CAD) file. A computer aided manufacturing (CAM) file follows, then command codes (G-code), then on to a controller, and finally to the machine shaping the material. Major components of CNC include a computer display, stepper or servo motors, and the electronics to control the machine movements and direction of shaping tools.

Vance began by describing his nine foot long by five foot wide router table. The frame is made of sections of extruded aluminum. A gantry straddles the five foot width and is also made from sections of extruded aluminum. He chose rack and pinion drive for the gantry. Vance considered ACME screw thread for the drive, but since the drive travel is greater than 48 inches, he chose rack and pinion. ACME screw lengths greater than 48 inches are susceptible to an off-axis motion that worsens the faster a screw rotates. This phenomenon is known as 'screw whip'. NEMA 23 stepper motors provide the motive force for the gantry. The spindle motor is three phase and is driven via a MODBUS 485 controlled variable frequency drive (VFD).

LinuxCNC is the controller software of choice for Vance's router table. Between the PC with the Linux software and the motor are the breakout board and the driver. The breakout board serves two major purposes: signal distribution and circuit protection. The driver takes signals from the breakout board and translates them into something understood by the stepper motor.

LinuxCNC is free on-line and has a large community support forum. If one is entering the CNC field, one should consider using LinuxCNC.



About four years ago, Martin acquired and refurbished a 1943 vintage Monarch lathe. Of late, he wanted to improve the accuracy of making both imperial threads and tapers on the lathe. Also, since his lathe had no feature to make metric threads, he wanted to add a metric threading capability to the lathe. A conversion to CNC could solve all three concerns. With on-hand electronics and familiarity with programming his CNC mill and another's CNC lathe, Martin set out to convert his lathe to CNC. In doing so, he wanted to retain the ability to use his lathe in manual mode, for he envisions most of

his lathe work will be done in the manual mode.

Experienced using Mach3 control CNC software, Martin wanted to use LinuxCNC to control his lathe. Significant features he wanted to incorporate included a pendant for wireless control of his lathe, a tool setter for precise tool setting from each of four directions, touch screen interface, and versatile threading.

As part of the conversion, Martin sought to avoid removal of or extensive modification to original equipment and to retain a previously installed digital readout (DRO). He replaced the cross feed screw and nut due to excessive backlash. The carriage lead screw suffers from backlash, too. Future plans include replacement of the carriage lead screw and split nut, but until that is done, all cuts must be made in the same direction.

Two spindle encoders were installed to provide both RPM readout and synchronized motion detection for threading. Martin added a proximity switch to detect the lock ring teeth on the lathe spindle. This detector generates 10 pulses per revolution. Additionally, a Hall Effect detector with magnet is installed and produces 1 pulse per revolution.

Control electronics include three power supplies, a motion controller – Mesa 7192, four stepper driver cards – Pacific Scientific 6410 (two for future use), and two breakout boards, all housed in a stainless steel enclosure. An Elo 1520L touch screen monitor, Intel NUC5CPYH computer, and a ShumaTech DRO are included as well. Although originally developed for Mach3, Martin adapted the wireless pendant, XHC HB04, for use with LinuxCNC. He uses the pendant to control two axes, run and stop the lathe, and to home the lathe.

The operating system Martin uses is Linux – Debian “Jessie” version 8.6 32-bit. Uspace version 2.7.8 is the LinuxCNC. A few comments about LinuxCNC are in order. Extensive tweaking may be necessary to get computer latency acceptable. The software runs well on certain legacy computers. Stability is best on a 32 bit system and Debian “Wheezy” version 7.11 circa 2013 and real time kernel 3.2. Prepackaged ISO or FANUC programming language is easy to install with the Debian OS and LinuxCNC. As noted supra, the OS and LinuxCNC work well on legacy computer hardware, for they do not support modern chipsets, Wi-Fi, Bluetooth, network, video, et cetera. Using the parallel port to facilitate system software offers the easiest path to successful configuration. One must generate .ini and .hal files to configure the software with the hardware. Automatic generators are available, but note that some hardware and software configurations are not compatible for automatic generators. In that case, one must generate the .ini and .hal files manually.

Lastly, LinuxCNC can be customized extensively. Several different inter-active displays are available depending on the machine used and the preferences of the user.

Vance and Martin’s slide presentation may be [viewed at this link](#).

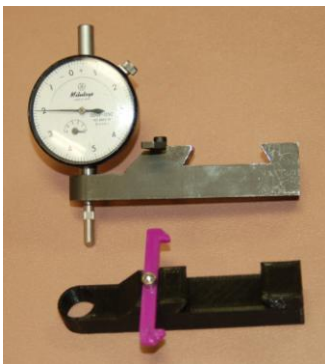
Safety Moment

Brian Alley showed a video on unsafe safety practices at both the workplace and home. Notable among the unsafe practices was the misuse of ladders. A quick review of portable ladder safety is available at [this link](#).

Show and Tell

John Cooper showed a copy of Make Magazine and extolled its benefits. Also, he mentioned the auction of machinery and other items at Dresser Rand Corp. on the north side of Houston.

Joe Scott showed a brochure of a pecan shelling machine made by Meyer Machine Co. of San Antonio, TX.



Martin Kennedy exhibited a dial indicator holder and copy of it that he made on a recently acquired 3D printer (photo at left).

Joe Miller displayed examples of wood plaques with intricate detailing he made using a CNC router controlled by Aspire software (photo at right).



Dick Kostelnicek indicated the rationale of the NEMA stepper motor numbering system. For example: the side of the square base and body diameter of a NEMA 23 motor is about 2.3 inches square. A NEMA 17 is 1.7 inches and so on. With this information, one can visualize the size of the stepper motor when the model number is mentioned.



Norm Berls showed a jig that he made to set his tool post at the angle of his choice (photo at left). Also, Norm told the group about a steam powered machine shop in operation today. The machine shop, found on YouTube, is owned by David Richards



Richard Douglas exhibited a lathe face plate that he made from malleable cast iron (photo at right).

Problems and Solutions

A member sought recommendations on a local jeweler who is good at resizing rings. Another member recommended Accu-Tyme on College Avenue for the resizing work.

Articles

Prototyping with a 3D printer

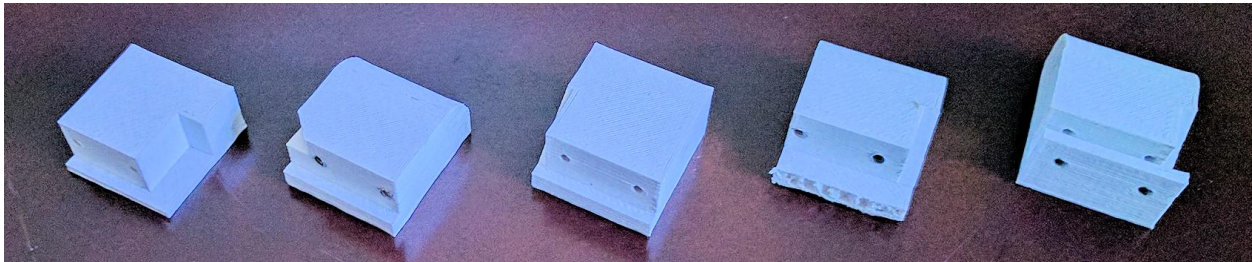
By Martin Kennedy

I've been having some trouble with the Z limit switch on my mill. It was cheaply made – it was not even a real switch, just a piece of bare wire. It tended to flag a limit when it should not have been during machining when it got some swarf on it.

I looked for a place to put the switch. The best location was within the Z axis indicator enclosure on my mill drill. There was no good place to mount it, and I would need to build a bracket to hold the switch. The place I wanted it was hard to get to and very hard to accurately measure. It would likely be an iterative process to get it to fit correctly.

I recently acquired a 3D printer. I realized that instead of machining a part, trying the fit, and then re-machining another part that I could 3D print the part with a minimum of effort. I could test fit it, and then quickly print another part with any changes necessary.

I eventually printed six versions of the bracket. Shown below are the first five. The various cutouts on the sides were to allow the bracket to be mounted near gussets in my mill. Each of these versions had slightly different dimensions.



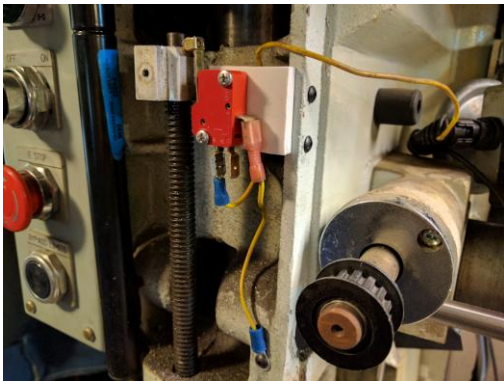
After the test installation of the first print, I found that the switch didn't actuate because it needed to be about 0.030" closer to the part the switch was to contact at the limit. I also had to move the switch about 0.050" farther away from the mill. I printed the second version, and continued to tweak the design until it was just right. (Yes, I know that I could have designed the bracket to have some play to accomplish the same thing. But it was more fun this way.)

Another challenge I had was to locate the mounting holes I needed to drill through the mill. I would be unable to drill from the side where the bracket was to be mounted. I thought about making some pointed pins to fit in the mounting holes and then using them to make marks. I realized there was an easier solution with the 3D printer! I printed a special version of the bracket that wrapped around the mounting flange and had aligned holes on both sides. I couldn't use it for the final version, because it would interfere with replacing a cover plate. Another benefit of this wrap around design was that I could install the switch assembly and easily move it up or down to get it in just the right place. The bracket is shown on the mill in the right photo.



I used the holes on the right to precisely align the drill for the hand drilling operation. It worked great!

I considered making the final design of the part in steel or aluminum but I found that the ABS plastic threaded easily, and had plenty of strength for this application.



Here's the final design shown in the left photo. A cover plate fits over the front of the mill and only leaves a slot in the middle open to show the Z axis position. There's also a bracket removed from the right that supports the stepper motor.

LED Lamp Electrical Noise

By Dick Kostelnicek

I've installed a number of LED flood lamps on my stationary machine tools since they have high brightness, draw low electrical power, produce negligible heating, and are rather inexpensive. For example, search Amazon for "LED Work Light Spot Lamp". The lamps operate on 10 - 30 Volts DC. They can get away with this wide voltage range while maintaining near constant brightness because the LEDs are driven with an internal '*bucking switching power supply*' circuit that maintains constant voltage, and therefore, constant current to the LEDs.

This is all fine for the work lamps, but the LED lamp's electric switching noise plays the devil with sensitive electronics using the same other power source connected to the same AC electrical mains. In my case, I powered both a LED lamp and a Hall effect digital RPM meter from the same 12 volt power supply for use on my variable speed drill press. The switching transients in the KHz frequency range from the LED bucking regulator were inductively coupled from the 12V power line to the Hall sensor line running along side of it for about 2 feet. This caused multiple transitions at the 50% digital switch point of the Hall sensor that translated into erratic readings of the electronic RPM meter.



I solved this problem in two steps. First, I placed a 100 microfarad capacitor across the 12V power supply at the electrical input to the LED lamp. Second, I placed a clamp-on ferrite filter core (Left photo) using several wraps of both the 12 Volt power and Hall sensor lines going to the RPM indicator.

These measures squelched the false triggering of the Hall sensor. Moral, a cheap lamp, however great as a lamp, can cause all sorts of weird electronic problems to nearby electronic devices.