DIY Dial Gauge Flat Contact
By Loring Chien
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This article describes how I made a flat contact for an AGD dial gauge.

These are AGD dial gauges, Harbor Freight model 33675 and 623 respectively. They and similar models sell for between $7 and $14 at HF (often on sale) and for $20 to $50 at industrial supply houses like W.W.Graingers (www.grainger.com), Enco (www.use-enco.com), and Master Specialty (www.mscdirect.com). AGD stands for American Gauge Design, apparently the original design for this type and therefore the standard for probe and lug dimensions. I totally find the HF versions completely satisfactory for woodworking usage, a good bargain.

It's a very versatile instrument for making height and depth and displacement measurements. This particular type is usually available with 0-1" travel and .001" resolution and accuracy. The probe shaft at the bottom travels vertically and is lightly spring loaded to keep it against the point being measured. Some units have up to 2" travel. There are two dials, one small dial counts revolutions of the big dial. The big dial measures 0.1" in 100 increments of .001". The second dial counts up to ten revolutions of the bigger dial. The actual travel is the sum of the two. A rotating, lockable (lock knob at 2:00 on the case) bezel allows setting zero point for relative (differential) measurements and a couple of sliding pointers on the bezel can set upper and lower go/no-go limit points.

Typical use is attached to a rigid stand and overhead arm. There is a backplate with a vertical lug with a hole in it to attach to the stands. When used vertically you can slip items between the probe and a flat reference surface such as a granite table and measure the thickness of the item. By setting the zero reference point and the height of the gauge off the table you can accommodate items of any size and make differential or absolute measurements of up to 1". Setting the gauge horizontally is also useful for measuring runout on drill presses, table saws and other rotation machinery (use with the machines off, please!).

My favorite use of the dial gauge is for measuring cutter height in woodworking. I have made various jigs for measuring the height of table saw blades and dado blades, and router bits, and for setting jointer blades. One of the nice things is that the spring-loaded probe follows the blade or bit as you raise and lower the bit. A couple of my jigs are illustrated below:


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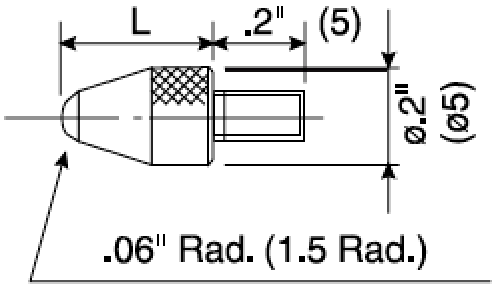
The common design goal of my jigs is to maintain the accuracy of the gauge by holding it perpendicular to the measuring surface (table or bed).

The AGD dial gauge has a ***contact point*** that is removable and interchangeable. The probe from the gauge is 0.2" in diameter and is threaded with a relatively rare 4-48 fine pitch thread. A typical contact point is available with a round point as illustrated below:



But contact points are available with needle points, flat points and round points to suit various measuring applications.

In general, flat points are used when measuring round surfaces such as rods, cylinders and spheres. Rounded points are used when measuring flat surfaces. If contours need to be indicated, then a contact point with a ball tip should be used. Thin chisel points and needle points are used for grooves and slots. A special rolling wheel is used when measuring stock.

For measuring the tippy top of router bits, table saw blades and jointer blades, it would be hard to keep a round point at the very top of the blade edge. Thus, a flat contact is needed for my jigs, that allows you to place the contact against the tip or edge of the bit or blade and get the same reading anywhere across the contact point making the placement easy and quick.

I have found a source of flat contact points www.use-enco.com catalog #325-1380 but they cost about $4-something each and also there's a $5 shipping cost involved. That makes a $9+ point for a $7 gauge. This is the flat point:

It has a 0.625” diameter (5/8”) and is also available in smaller diameters, but I find the wider ones easier to line up. It is made of black oxide steel so as not to wear with repeated use, and has the 4-48 threaded stud to mate with the probe. I’m pretty sure it is designed to be very “square” with the thread to the flat.

I have found a reasonable way to make a flat contact that works well for the jobs I do. The biggest issues were

1. finding a way to attach to the 4-48 threaded hole, and
2. making a very flat surface
3. making the flat surface very square to the thread.

The #1 item is difficult, because while I can get 4-40 threads, taps and dies easily, I could not locate 4-48 and if I did, it would surely defeat my low cost goal. Nor could I find any threaded rod, studs, or screws to fit.

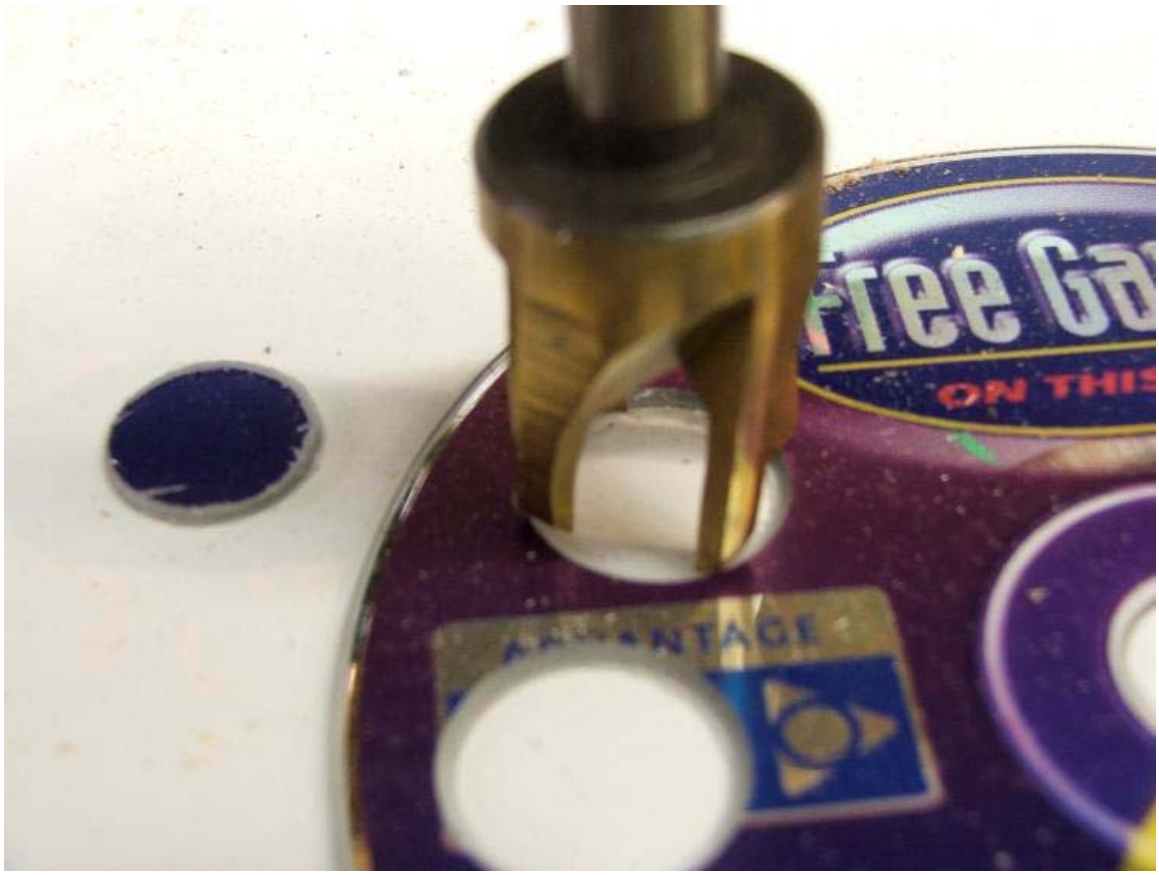
The #2 item is important, because a ridge or burr would throw the measurement off as we set the reference point (table top) to the burr or ridge and then measured a saw blade tip in a valley.

The #3 item is important, because if the flat is tilted 0.5° off level then the outside edges of the contact will be up or down by ~.002” meaning the measurements would be sensitive to where on the flat it was measured. Obviously you want to be able to hit the flat anywhere with the tip of your cutting edge and have it read the same. By the way, this also means you should have drilled your dial gauge holder so its absolutely perpendicular to the bottom – the only way I know of is to use a properly tuned drill press.

My solutions:

First I needed a flat disk – very flat if possible. I considered using washers, coins, etc. but in the end I did this: I took old discarded CDs, which are very flat (probably optically flat) on the recorded side, and about .055” thick. I chucked up a 5/8” (1/2” would probably work fine, too) woodworking plug cutter in the drill press and proceeded to cut a number of disks out of one CD. If you don’t have an old CD to destroy, Best

Buy still gives away free AOL CDs at the checkout lane. Use a very slow a speed on the DP to prevent the edges of the cutout disk from melting, and keep the recorded side down on the table.



I then polished the cutout disk on a piece of sandpaper to remove any burrs from the bottom, burrs on the top are of only aesthetic concern. You will want to secure sandpaper to a flat surface and push the disk around with your fingertip. Don't over sand or you risk bevelling off one of the sides. When you cannot feel any burr on the bottom as you drag a fingernail across the edge, then you are OK, the bottom is pretty flat at this point. Minute scratches won't matter. Cracks are bad, if it cracks, make a new one.

Next, to solve the fastener problem, I decided I could use the original round-point contact that came with the dial indicator, I already had it and it has the requisite threading. I would simply glue it to the disk.

Finally, how to make sure I glue it absolutely square? It was simple, my jig was drilled with a drill press so that the gauge probe would be square with the bottom of the jig. If I mounted the dial gauge and placed the jig on a flat surface (like my jointer bed) then a disk placed on the bed would also be square to the probe.

So it was simple matter of

1. Make sure the table top (jointer bed) is absolutely clean and flat – a piece of sawdust in the wrong place can lead to non-parallel disk and errors.
2. Mount the dial gauge in the jig, with the round point mounted and allowed to touch the table.
3. Place the flat cutout disk with the flat side (the original recorded side) on the table.
4. Drop a generous drop of CA (cyanoacrylate) "super glue" in the center of the cutout disk, the more viscous gels work well.
5. Lift the probe, place the cutout disk underneath.
6. Then let the probe and contact point drop into the center of the glue and disk, centered by eye is good enough. Push a little on the top of the probe to make sure it presses the disk into solid contact with the table surface.

7. Allow to cure.

When you are done, you can unscrew the new flat contact from the dial gauge to remove it from the dial gauge if you need to.

Testing the Flat disk contact:
Once you have made this, you will want to test if it is OK.

The way I decided to test mine was to use a setup bar, of say 0.250" (1/4") under 3 or four points on the disk and see what the variation was. Place just the end of the bar under an edge at four compass points of the disk. Use a jointer bed, it's probably about the flattest surface you have around.

I first did this on the commercially bought flat contacts and I got readings of 0.254" on three sides and 0.252" on the fourth side. The bar actually calipered at .254 with a separate set of dial calipers so one edge was .002" high.

With the DIY flat contacts I measured very similar performance, so although I did not achieve .001" parallelness across the disk, I did equal the commercially-made version.

Using the Flat Contact Disk:

When using a router, place it over the highest point on the bit since this will determine the cutting depth. When you lock the router, it may move a few thousandths of an inch. If you observe this you can usually figure out the compensation before you lock it and of course, the measurement after being locked is the depth it will cut.

When using a table saw, you need to measure a tip on the blade that's the highest point and therefore theoretically need to rotate the blade so that one tip is "straight up". However in practice it's not that critical. If you simply go for the eyeballed highest point without moving the blade, the teeth on a 36-tooth or 40-tooth blade will be closely spaced enough so that the second highest tooth will not be more than .005" lower than the top. On the BT3000 saw, there's an opening next to the throat place for the flat arbor wrench. If you measure a tooth inside this region, then you will be +0, -.005" of the cutting depth. This should work for 10" blades, I did not do the math for smaller 6" dado blade so you might want to center a tooth for that.

When setting a jointer using a jointer jig, I cantilever the gauge off one end of a block referenced to the outfeed table, I do not span the blade like I do with my TS/router height gauge. The theoretical target here is to have all three blades at a height equal to the outfeed table, across the blade.

The only potential problem I can see is that the plastic disk contact does not have the stability and longevity of hardened steel or carbide. But for casual use in woodworking machine setup vs. production testing, I think that the plastic will do OK.