Digital Height Gauge

Project:

I recently built a device for measuring the height of my router bit and showed it (the prototype) to a few members of the SJFWA. They expressed some interest in building one for themselves as well as some description of how to build it.

The project is to build a digital height gauge which is capable of measuring heights up to about six inches and accurate to about .001". It will read in decimal inches, millimeters and fractions. This gauge is based on the Rockler height gauge which retails for about $55.00 or on sale for about $39.00. This project costs about $15.00 in material.

This gauge has a few advantages over the Rockler device other than cost. The base of the unit is wider, longer and more stable than the Rockler unit. The wider base makes it easier to set cutter heights. There is a pair of magnets in the base which improves stability but also makes it easy to store on any steel surface such as your table saw. In addition to setting the router bit height, you can also use this device to set your table saw blade height which is especially useful in making dado cuts. If you have a sliding panel for your table saw, you can measure the height of the table saw blade above the panel or you can measure the height of the panel and reset the height gauge to zero. The advantage of this method is that you don't have to measure from the panel; you can use the saw table. One final advantage of this unit is that when the MDF shows signs of wear, you can resurface the base with thin materials such as 1/8" MDF, hardened Masonite, or plastic.

This was a fun project and should take about two hours **plus** drying time for the glue. With some ingenuity and slight modification, this device could also be used to measure the height of your chop saw, radial arm saw, band saw distance from blade to fence, and planer height.

Specifications:

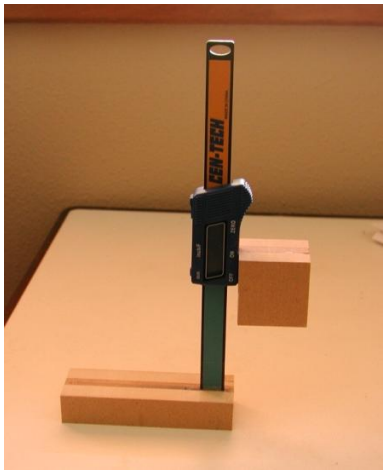


Figure 1

Overall Length:	6 3/16"
Base:	4 7/16" L x 1 3/8" W x 13/16 H
Sliding Block:	1 13/16" L x 1 3/8" H x 1 13/16" H
LCD:	Display in inches, MM, Fractions
Accuracy:	.001"
Maximum Height:	6"
Standard Battery:	A76 or Equivalent
Readout Zero:	Zero Set at any point

Digital Height Gauge

Operation

Accurate height setting of the router bit is important and can be accurately done with the height gauge but table saw height is not generally important in making cuts except when making dado cuts and this is where the height gauge becomes a very useful tool.

A. Setting router bit or table saw height

Figure 2

Figure 3

- Refer to Figure 2. Set the height unit on a flat surface with the base and sliding block flat to the surface and zero the reading on the dial. The table saw surface is an ideal flat surface.
- Refer to Figure 3. Move the sliding block up to the desired height measurement and position the sliding block over the router bit or table saw blade.
- Adjust the router or table saw so that the tip of the cutter barely touches the bottom of the height block. On the table saw, rotate the blade to be sure that the peak height of the blade is touching the height block.
- Recheck the gauge measurement and check blade again.

B. Setting the table saw height when using a panel sled. Refer to Figure 4.

Figure 4

- The difference between this procedure and the previous procedure is that you will need to adjust for the difference in height between the panel and the surface of the table saw.

Digital Height Gauge

- Set the base of the unit on the surface of the table saw and position the sliding block on top of the panel sled. Zero the reading of the height gauge.
- Move the sled out of the way and adjust the height block to the desired cutting height and position the block over the table saw blade.
- Adjust the table saw blade height until the blade barely touches the block, recheck the height measurement and recheck blade height.

Digital Height Gauge

Construction

A. Safety

- As with any shop project, standard precautions must be adhered to in order to prevent damage to the project, your fingers, relatives, and friends but not necessarily in that order.
- This project requires several cuts on small parts for which you will need a feather board and a push block and an accurately adjusted fence for the table saw.
- If the table saw fence is not parallel to the blade, you could experience kick back or an inaccurate cut.

B. Parts List

- Digital Caliper from Harbor Freight Item number 99639 with Inches, millimeters, and fractions.
- MDF Stock ¾” x 6” x 8”. The actual thickness of the MDF may not be exactly ¾" but should be close. We'll refer to it as ¾" MDF throughout this process.
- Epoxy Glue, preferably quick set
- Wood Glue, Tight Bond I, II or III or equivalent
- Rare Earth Magnets 3/8” or 5/8”available at Michaels or Joanne Fabric
- Small finishing nails 1 1/2”, to be used as pins
- Masking tape
- Fine Sawdust to be used as filler in epoxy for larger gaps

C: Tools

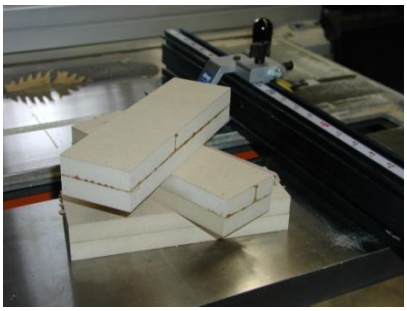
- Table Saw
- Band Saw or Thin kerf hand saw
- Drill Press
- Jointer (Optional)
- Forstner bit 3/8" or 5/8"
- Drill Bit 1/16"
- Clamps
- Small Right Angle block approximately 3” x 3” (used as an offset to trim caliper)

D: Process

In general, the process starts with making a glue-up which will be trimmed at different stages of development. The finished size dimensions are shown in Specifications but could be trimmed further if desired. The actual time necessary to make measurements and cuts is less than two hours but gluing is done in several stages in order to achieve maximum accuracy. The notes inserted at certain steps provide additional information about the step.

Digital Height Gauge

Figure 5



- Refer to Figure 5. Cut two pieces of ¾" MDF into 2 ½" x 8" and glue them together to form a glue-up of 1 1/2 " x 2 ½" x 8". Clamp the two pieces to be sure that they fit tightly together and flush along the glue line.

  Note: Don't let any glue get on the face sides of the glue-up.

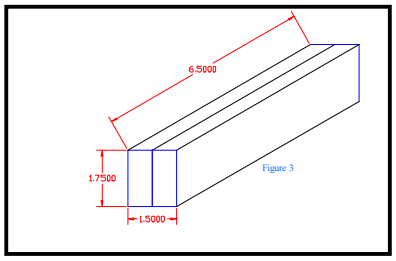


Figure 6

- Scrape away most of the excess glue and if you have a jointer, joint one side to establish one flat side otherwise, use the table saw.
- Cut the opposite side for a parallel side to 1 ¾". Trim one end for a clean end and cut the other end off to a length of 6 ½".
- You should now have a rectangular block 1 ½" x 1 ¾" x 6 ½". (Re: Figure 6)

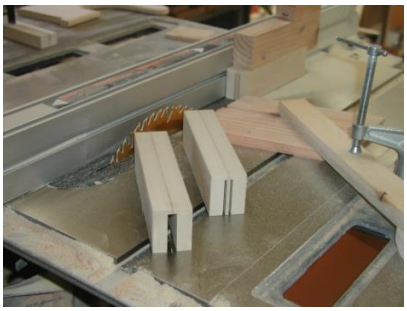


Figure 7

- Refer to Figure 7. Cut a dado the length of the block 1 9/16" deep and centered leaving a very thin 3/16" of material at the bottom.

  Note: Depending on the width of your table saw blade, you will need to make at least two cuts so that the dado is three tenths of an inch wide and centered on the block. This is a small block and the cut is deep so for safety, use a feather board and push block.

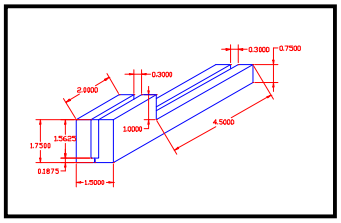


Figure 8

- A full size drawing of Figure 8 is attached at the end.
- Use the band saw to remove material as shown in Figure 8. The block dimensions should be as shown.
- The block as shown will remain one piece until the caliper is glued and sealed into position.
- The next step is to modify the digital caliper

Digital Height Gauge

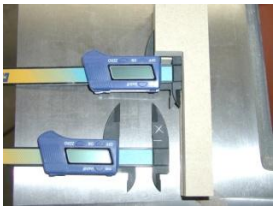


Figure 9

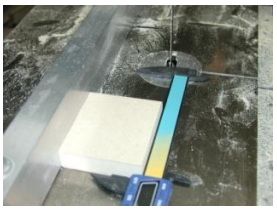


Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

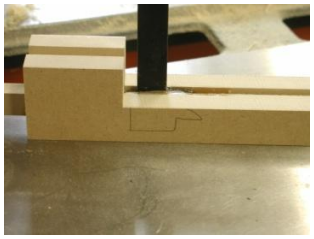


Figure 15

- Figure 9 shows the first part to be removed marked with an "X". This part can be removed with a band saw or a thin kerf saw. If you are using a band saw, (Refer to Figure 10) use a 3" x 3" block (with right angles) to make the straight cut. Cut as close as possible to the caliper support bar.
- Figures 11 and 12 show the second part to be removed. The part marked with an "X" is part of the caliper slide and needs to be cut off. For this cut, you will need a thin kerf saw as shown in Figure 13. Cut the part off as close to the caliper slide as possible.
- Figure 14 shows the caliper with both parts removed.
- Next step is to make some spacers and get the caliper ready to be mounted in the MDF block.
- Refer to Figure 15 and mark the outline of the caliper part on the block. After the caliper is glued into position this will help locate the installation of the pins.

Digital Height Gauge

Figure 16

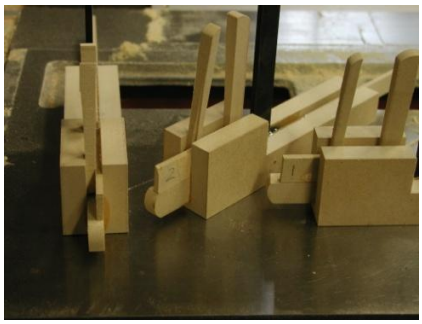


Figure 17

Figure 18

- Three spacers are required for two reasons. First to hold the digital caliper in position until the glue sets and the device is pinned. Second, the spacers take up space which would otherwise need to be filled with epoxy.
- Figure 16 shows the caliper in position and a spacer in the dado holding the caliper. At this point, this is a dry fit until the spacers are all cut. This spacer should extend forward and past the caliper. The other end of the spacer can extend to the right and beyond the block. Both ends of the spacer will be cut off later.
- The height of the spacer should be below the level of the top of the block by about 1/16" or maybe a bit more.
- Figure 17 shows the two spacers needed for the block which will eventually become the sliding block. The bottom spacer is wide enough to fill the width of the block and low enough so that the sliding part of the caliper can go to the lowest point of the caliper.
- In Figure 17 also note the top spacer which takes up some space also and is fitted between the caliper and the wall of the MDF block.

  Note: The fitting of this spacer that goes between the caliper and the MDF block is critical. It must be loose. If it puts stress on the caliper part, it will act like a spring when you sever the block from the base. Loose fit and no stress is Good.

- Do a dry fit to prove that the spacer is flush to the side, lower than the base top and is snug when fitted with the caliper base part. Move the caliper slide up and down and it should be as close as possible but not touching what will eventually be the moving block. The shaft of the caliper should be perpendicular to the base and can be checked as shown in Figure 18. Note the caliper and spacer in position.
- Refer to Figure 18 and glue the spacer in position with wood glue. At this point, mask the top of the base with masking tape to keep the base clean. After the glue is set, glue the caliper in position using Epoxy. Be sure to check the position, and angle of the caliper shaft and be sure that the caliper slide can move up and down freely. The wedges hold the spacers in position until the glue dries.
- The caliper is made of a composite plastic material that epoxy will not bond to permanently. The epoxy is used to hold parts in position until pins are inserted. When the final epoxy fill is added, the epoxy will hold the parts in tight.

Digital Height Gauge

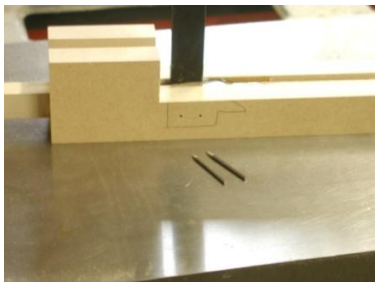


Figure 19

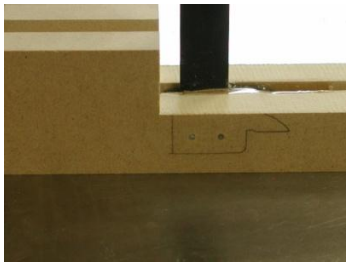


Figure 20

- Refer to Figure 19. After the epoxy is dry, drill two holes so that they line up going through the base of the caliper. Use a drill bit slightly smaller than the finishing nail. Use a drill 1/16" drill bit with a finishing nail slightly larger.
- Refer to Figure 20. Remove the nail head and drill hole **almost** all the way through and cut the nail to about 1 ¼". You can counter sink the nail and later fill the divot.
- Sharpening the nail will make it easier to drive the pin through the MDF
- The markings can be sanded off later.
- The next step is to glue the caliper slide into the block.

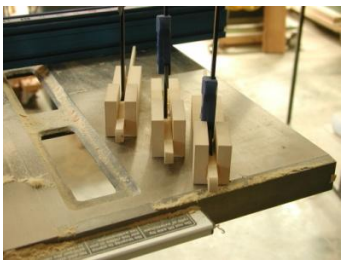


Figure 21

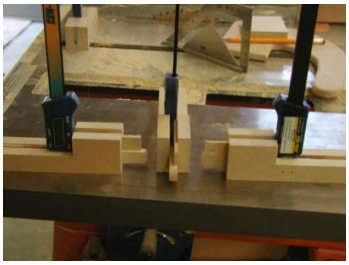


Figure 22

- Refer to Figure 21. Dry fit the caliper slide in position with the two spacers. Be sure the caliper slide goes all the way to the bottom. If all is well, glue the two spacers into position in the block with wood glue.
- Slide the caliper slide down all the way and if there is any glue blocking the caliper from going all the way down, remove the obstruction.
- Make another spacer to fit between the caliper and the inside wall of the dado. It is important that this space is just slightly touching the caliper so that there is NO stress on the caliper. Any stress on the caliper will cause bending of the slide after you cut the MDF slide away from the base.
- Mix enough epoxy to cover the plastic end of the caliper and insert the epoxy. Be sure that no epoxy gets behind the caliper slide. You can fill the gaps after this part dries. At this point, tilt the unit forward to prevent epoxy from seeping in behind the caliper..
- After the glue is dry, pin the caliper slide as before with the base part.

Digital Height Gauge

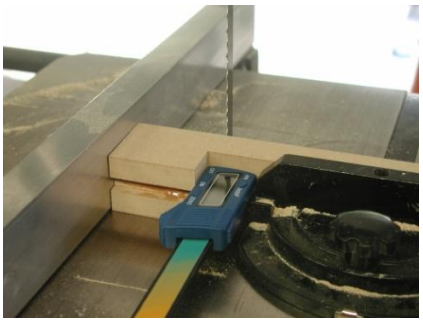


Figure 23

- Refer to Figure 23. Use the band saw or thin kerf saw to cut through the base of the unit until the slide can move up.
- Now for the finishing touches.
- Mask off the two ends of the slide and both ends of the base and fill with epoxy to form slight bead over the top. The epoxy can be mixed with some fine sawdust to form a thick paste. The paste mix will be opaque and hide the spacers. After it is dry, remove the masking tape sand the tops smooth.

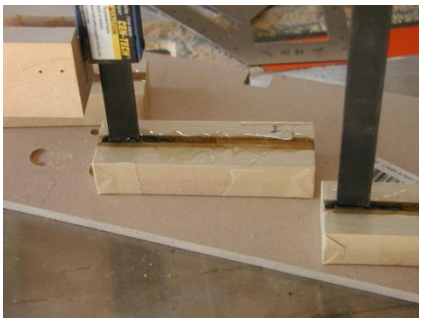


Figure 24

- Refer to Figure 24. When the epoxy is dry, sand the tops smooth.
- Trim the ends of the block base and the sliding block to the dimensions listed in the specifications.
- You can change the final dimensions if you wish, however, please consider that the base helps to maintain stability.

Figure 25

- Refer to Figure 25. Mark the bottom of the base to locate the center point for the magnets. The magnets should be on center line. The center point for the rear magnet should be about 1 ½" inch from the end and the forward magnet center should be about ¾" from the sliding block.
- Turn the unit over and use the Forstner bit to make the recess for the magnets you selected. Epoxy the magnets in place and if desired, fill the pin holes with filler and sand smooth

Digital Height Gauge

Conclusion:

So far I have made four of these units and you can see the last three in the photos. The actual time it takes to do the cutting, drilling and sanding is about two hours or maybe less. The glue drying process is what takes time. Hopefully the instructions are clear enough and hopefully don't put you to sleep. So, good luck.

Digital Height Gauge

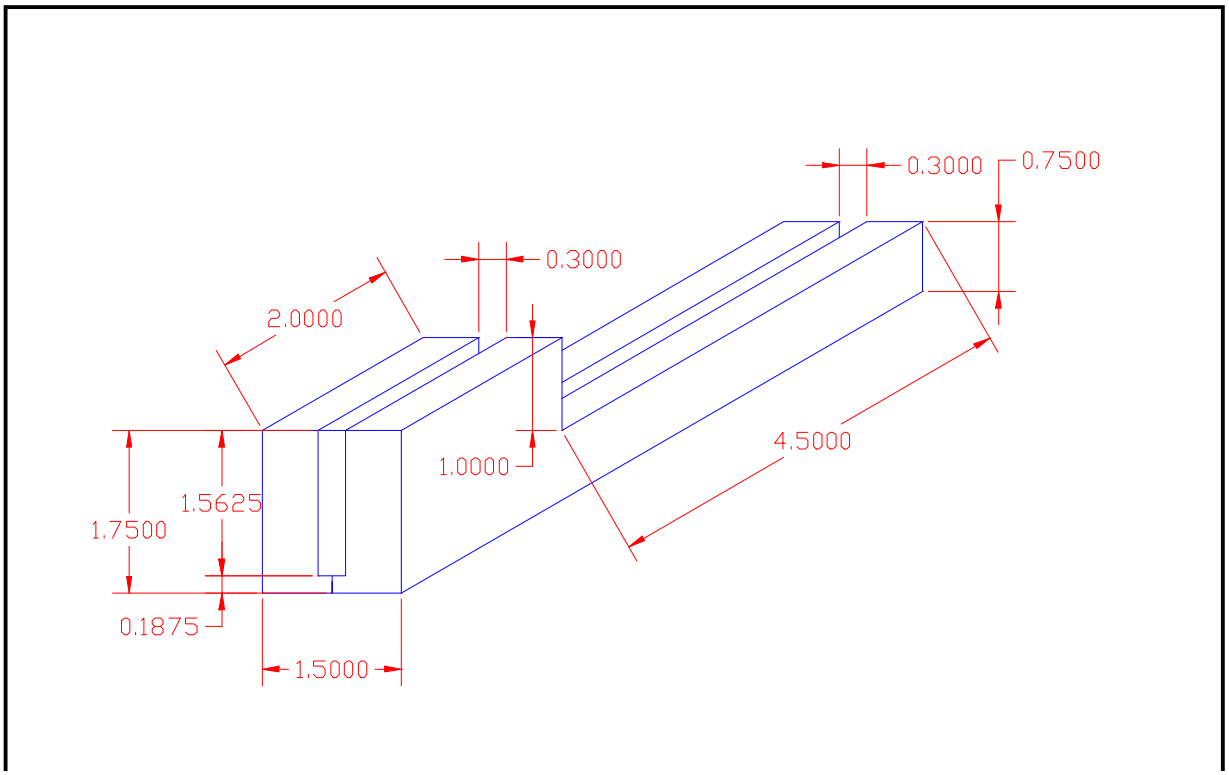


Figure 8