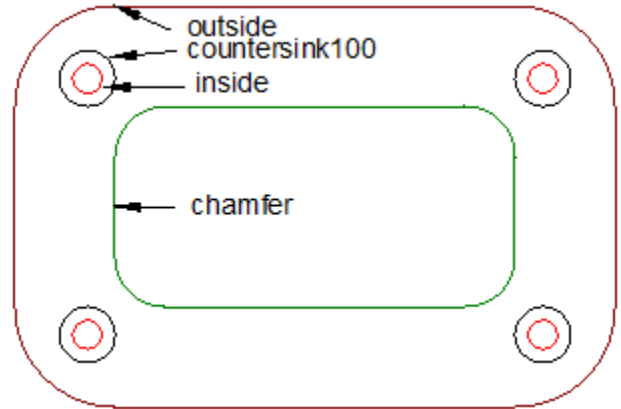


## Chamfer and countersink with the Panel Pro

The Panel Pro is capable of cutting countersinks using the standard 1/8" flat end mill. It is also capable of cutting chamfers using a chamfer mill.

This paper describes the techniques.

To cut a countersink we use a special layer where the maximum diameter of the countersink is drawn as a circle on the layer named countersink with the angle in whole degrees appended. I.E. the layer named countersink100.



A normal circle is also drawn on your inside layer that is cut through the material as a normal hole. When AvCAM encounters the countersink circle, it cuts one circle at the maximum diameter at z zero. Then it cuts successive circles .005" lower than the previous one with the diameter calculated at the angle (100 degrees) until the circle is equal to or smaller than the end mill.

Note that this leaves .005 circular grooves that may not be acceptable in a structural part, but is easily smoothed with a hand operated countersink reamer.

The chamfer is not a special AvCAM layer. AvCAM will generate a tool path that is inside a closed figure when layers are selected that do not have the name of an AvCAM special layer such the layer named outside.

The approach here is that we will cut the inside holes and countersinks with the inside cuts, change to the chamfer mill, and cut the chamfer, then change back to the 1/8" end mill to cut the outside. The reason for the chamfer layer is that we can select layers inside and chamfer to cut the holes. Then when cutting the chamfer, select only the chamfer layer.

The material must be level and well supported for countersinks and chamfers. One way to verify level is to use our Z dial indicator. Jog to the place you want to reference z zero. This does not necessarily need to be xy work zero.

Lower the z till the indicator is on 0. set zero on the dial indicator, as well as z zero in AvCAM.

Raise to retract and move to different areas, hit 0 and note the dial indicator reading. Shim as required so that no area is more than .005 from any other area. Paper makes a great single use shim.



Once the surface is level it is time to cut.

In AvCAM, select layers inside, countersink100, and chamfer, but do not select the outside layer for cutting at this time.

Insert a 1/8" end mill in the router.

Set work zero

Set z zero.

Check other settings as required and cut.

All of the inside holes and countersinks will cut.



Remove the 1/8" flat end mill and insert the 1/4" chamfer mill.

In AvCAM Verify auto tool path mode is selected.

Select ONLY the chamfer layer.

Set the end mill diameter to .0625.

Simulate. The simulation will show a 1/16 end mill tool path inside of the chamfer layer entities.

settings, set .0625 as the end mill. Set the cut depth to -.0625. See the illustration to the right. We have told AvCAM that a .0625 end mill is installed. AvCAM will create a tool path that is .03125 from the hole edge. Setting a cut depth of -.0625 will create the chamfer shown. If Desired, set it a bit lower and cut it again.

.25

.090 material

The cut depth in the picture below was set at -.07



Once you are happy with the chamfer, remove the chamfer mill and reinstall the 1/8" normal end mill.

Select layer outside.

Set end mill diameter to 1/8"

Set cut depth as desired.

Set z zero.

Cut the outside.

While doing these operations, it is imperative that the material being cut is not disturbed. It is not likely that it could be repositioned accurately enough for a chamfer operation.

A question might arise, "Can I cut the chamfer first the cut all the rest with the 1/8" mill"?

Generally no. The center of the chamfer mill has no SFM (surface feet / minute) and will exert a lot of down force pushing the material away from the cutter. Feel free to experiment, but We don't recommend it.

### **Cut the chamfer and countersink using Z calibration.**

Z calibration uses the Measure Pro to measure the z level at a spot chosen by the user. Then it takes a measurement on each circle or vertex of a polyline and assigns a correction value to that entity.

The z calibration takes place After simulation and before cutting.

Load the drawing into AvCAM.

Make any setting changes needed, particularly cutter diameter.

The first operation on this drawing will be to cut the inside holes and countersinks.

Select layers Inside, countersink100, chamfer.

Simulate.

Remove the router, install the Measure Pro. It is not necessary to set z zero as the Z Calibration routine will automatically do that for the Measure Pro.

Jog to an area that will not be cut. This could be work zero, but does not have to be. It just needs to be an area that wont be cut out.

After simulation, the Text “Perform Z Calibration” will appear under the “cut the file” button.

Click it.

AvCAM will check the Z elevation at the current location of the ZY axis. It then takes measurements at each circle and vertex of a polyline. Note that the drawing can be made with arcs and lines that AvCAM will turn into a closed polyline.

When this is complete, the XY axis will return to the initial position.

Remove the Measure Pro, Install the router.

Set z zero at the current position.

Caution! Do not reload the file or make any setting changes except setting z zero for the router.

Making any setting changes or reload the file as that will erase the z calibrations. The z corrections (zcor) can be seen on the entity list – TP (tool path)

Cut the file. This will cut the inside cutouts and the countersinks.

We also intend to cut the chamfer.

Go to layer Layer management and select only layer chamfer.

Set the end mill diameter to .0625. The actual diameter of our chamfer mill is .25”, however we will not be cutting on the maximum diameter, but a portion of the 90 degree nose. Setting the end mill size to .0625 caused AvCAM to create a tool path that is .03125 inside of the lines on the chamfer layer.

Simulate. AvCAM does not know it is going to be chamfering, it thinks we are cutting a hole using a 1/16” end mill.

Install the Measure Pro.

Again move the x/y to a location where solid material is available to check z zero.

Click “perform z calibration”

Remove the Measure Pro, Install the router with the chamfer mill.

Set Z zero at the present location which should be the same location as the reference location for the Measure Pro.

Set cut depth to -.0625. Note that a cut depth of -.03125 would theoretically just touch the square edge.

Cut using a 90 degree chamfer mill.

Look at the results. Adjust cut depth and cut again to make it deeper.

**Limitations:** A circle cannot change z while cutting. The measurement is made at the zero degree location. If the material is not level, that will show up to the maximum effect at the 180 degree position. A polyline is checked at each vertex. However AvCAM will change a circular polyline into a circle.