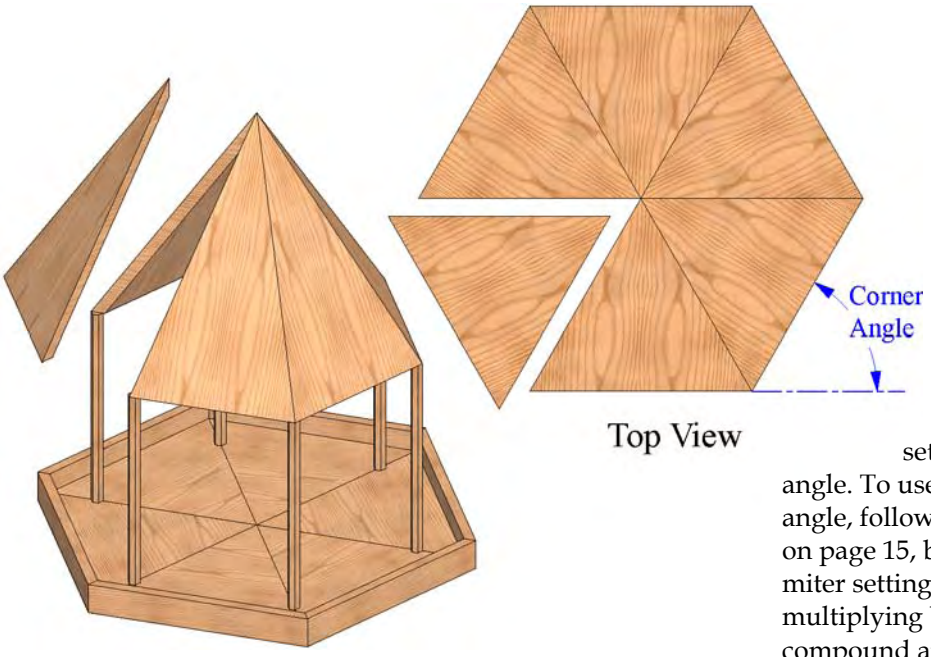
This blank page is inserted here just in case you want to view the procedure pages side-by-side. These procedure pages appear in the actual manual on facing pages, as they do below.

Compound Miter Cuts

Compound miter cuts are where the saw is both in a miter position and a bevel position at the same time. There are several applications for compound miter cuts, but cutting crown moulding and sloped miters are common examples. The example below shows a very simple birdfeeder roof.



The greatest challenge with compound miters is determining the proper saw settings to achieve the desired miter angle. These saw settings can be found in look-up tables for standard mouldings, but for non-standard angles, determining the proper saw settings requires mathematical calculation.

Note that there are several methods for accurately cutting crown moulding depending on the circumstances. Make sure to review the methods described in the applicable section on page 19.

Calculating compound miter settings requires two parameters from the desired joint: the **corner angle** and the **slope**.

Corner Angle

The corner angle is the angle between the two pieces, when viewed looking straight down on the joint. The corner angle is relatively easy to determine, but it is also the value that can cause the greatest amount of confusion for many woodworkers. That's because most woodworkers view angles differently than a mathematician will. A woodworker typically considers both inside and outside corners as 90 degrees (with a 45 degree miter) even though a mathematician would make the distinction that one corner is 90 degrees and the other is 270 degrees. To be consistent with mitersaw settings, the corner angle is measured from a straight line between the two pieces, as shown above.

Slope

The Slope angle is the angle that each piece makes with respect to the base of the corner, such as the ceiling or floor in the examples provided here. For a roof-like structure, this would be the pitch of the roof. For crown moulding, this would be the "Spring Angle" of the moulding. Common spring angles for mouldings are 38/52 and 45/45.

Determining the Corner Angle of Polygons

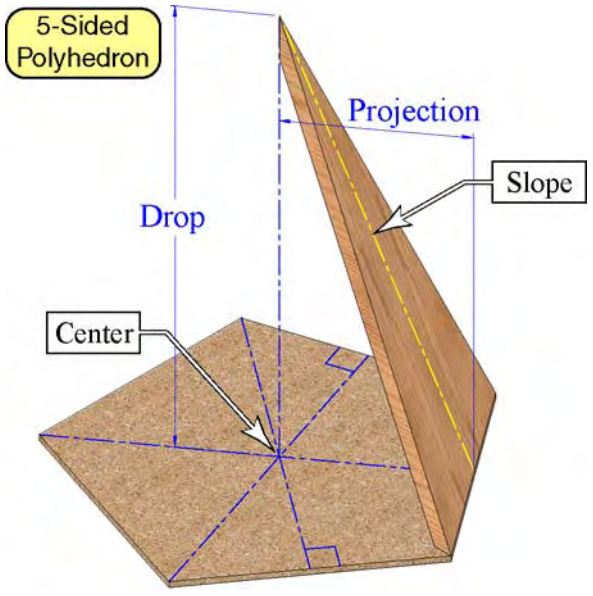
The corner angle for standard polygons is shown in the table on page 17.

Using the Miter Setting Tool to Find a Corner Angle

For non-standard corner angles, such as a room that is slightly out of square, the miter setting tool can be used to determine the corner angle. To use the miter setting tool to measure the corner angle, follow the "Using the Miter Setting Tool" procedure on page 15, but instead of making the cut, record the saw's miter setting angle. This angle is ½ the corner angle, so multiplying by 2 will give you the corner angle. (The compound angle calculator on page 19 also has an option for letting you enter this angle directly without needing to double it.)

Determining the Slope of a Pyramid (Polyhedron)

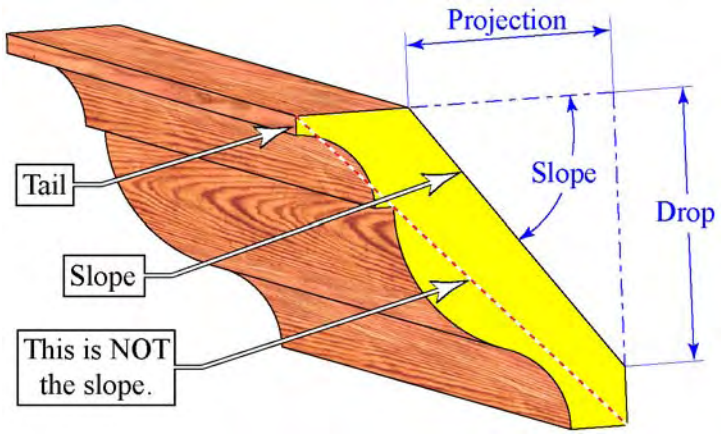
A polyhedron is a pyramid that can have any number of sides. The easiest method for determining the slope of the polyhedron is by measuring the **Drop** and **Projection** of one face. These are the distances from the center-to-the-edge, and the base-to-the-point of the pyramid. Note that with a polyhedron with an odd number of sides, the center is found by drawing bisecting lines as shown in the image below.



Determining the Slope of Crown Moulding

As was mentioned previously, the slope of a crown moulding is also called its" Spring Angle". The two common spring angles of crown moulding are 38/52 and 45/45. The reason why these angles are given by dual numbers is because the actual spring angle depends on which direction the moulding is oriented. For example, turned one way, the spring angle is 38 degrees, but turned the other way, the spring angle is 52 degrees. Note that the sum of these two angles is always 90 degrees.

For mouldings that are not the standard 38/52 or 45/45, you will need to measure the moulding to determine its spring angle. This is very similar to measuring the **Drop** and **Projection** of a pyramid, but more care needs to be taken to ensure the measurements are taken from the correct locations. **Important:** The spring angle of a moulding does not necessarily coincide with the "points" or "Tails" of the moulding. The spring angle is measured from the **back-side** of the moulding, regardless how long the tails of the moulding may extend (see image below).



Calculating Compound Angles

There are two separate equations for calculating a compound angle. One equation is for calculating the miter setting of the saw, and the other equation is for calculating the bevel setting of the saw.

$$\textbf{Miter} = \text{ArcTan}\left[\text{Tan}\left(\frac{CornerAngle}{2}\right)\times\text{Cos}(Slope)\right]$$

$$\textbf{Bevel} = \text{ArcSin}\left[\text{Sin}\left(\frac{CornerAngle}{2}\right)\times\text{Sin}(Slope)\right]$$

If you don't know the **slope** angle, but you know the **Drop** and **Projection**, then use the following to calculate the slope:

$$\textbf{Slope} = \text{ArcTan}\left[\frac{Drop}{Projection}\right]$$

The most common error in calculating compound angles is using the wrong **Corner Angle**. As a double-check to your calculations, for nearly all cases, the Corner Angle should be less than 100°. The only time the angle should be significantly larger than 90° is either for a 3-sided box, or a wall corner with a sharp edge.

Compound Angle Calculator

A compound angle calculator has been built into this Adobe® Acrobat® PDF file. If you do not have an original electronic version of this manual, visit the http://www.festoolusa.com/ website to download a copy.

Slope Angle Options

◉ Slope Angle	38.0	○ Drop	
		Projection	

Corner Angle Options

◉ Corner Angle	90.0	○ Miter Setting Tool Angle	45.0

Results

Miter Setting	38.2
Bevel Setting	25.8

Calculate

Note: If you are unsure about the corner angle you have entered, check the calculated "Miter Setting Tool Angle" value. This number should be no more than 60 degrees for sharp corners, but otherwise, it should always be less than 45 degrees.

If it is significantly greater than 45 degrees, then you probably have the wrong "Corner Angle"

Calibration and Adjustment

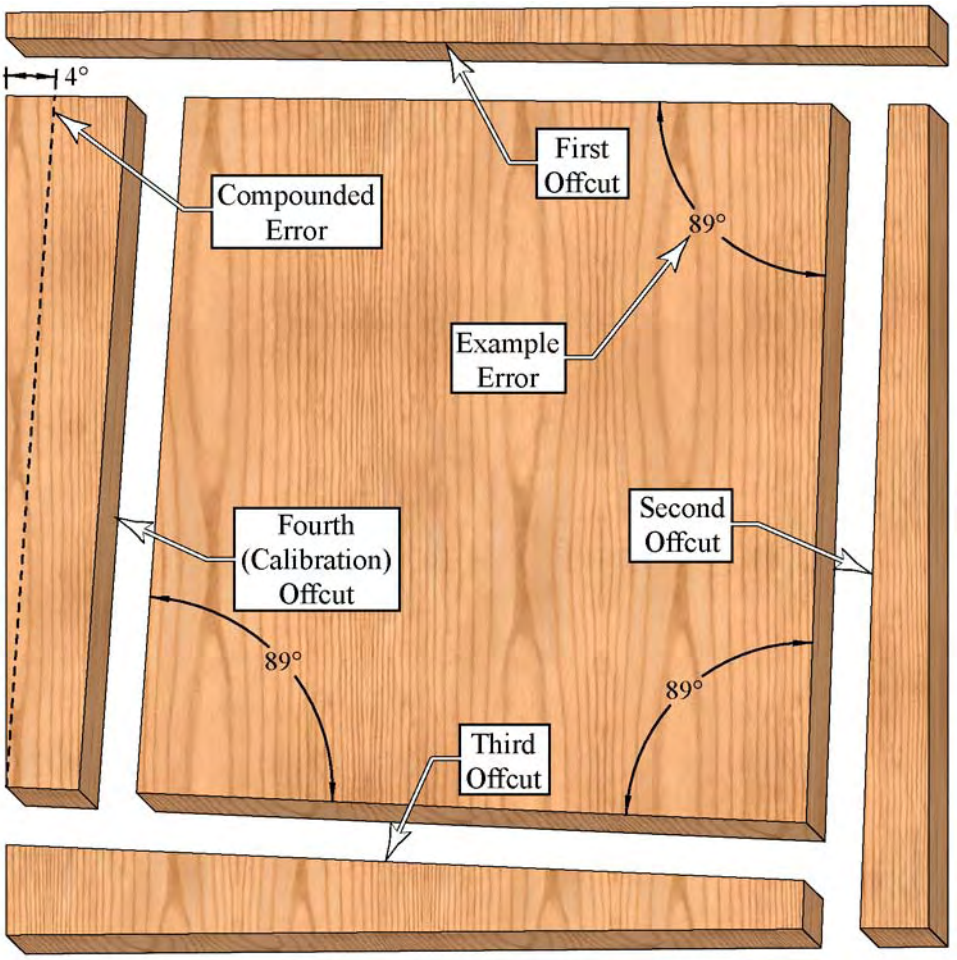
The Festool Kapex miter saw comes fully calibrated from the factory and should not require calibration under normal use. If your saw is found to be out of calibration when new, it is recommended that you contact your Festool representative for service before completing any calibration procedure. Use these procedures only when your saw needs service.

Calibrating the Miter Angle

The calibration method described here is based on compounding an error by a factor of four. This makes it easier to detect extremely small calibration errors. However, care should be taken in over using this calibration procedure because it has such a fine accuracy that it could be easy to get carried away and try to over-calibrate the saw. The factory calibration threshold is ±0.16°, but this calibration procedure is capable of measuring errors as low as ±0.001°, which is nearly impossible to obtain in actual practice.

The basis for this procedure is to make four successive cuts, where each new cut references from the previous cut. As a result, any angular error in the miter angle will propagate and be compounded with each cut. The final cutting error will have 4-times the actual error of the saw. In the diagram to the right, you can see that each successive offcut has a slightly larger angle than the previous offcut.

You may have heard of this method referred to as the "5-cut Calibration Method", but as long as you start out with a straight edge on the board, only 4-cuts are required. Furthermore, any additional cuts made after the fourth cut will not increase the accuracy, and it will remain at 4-times the original error.



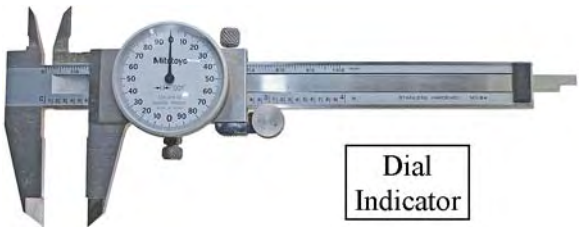
Getting Started

You will need a piece of scrap wood that is between 6 and 12 inches on a side. The scrap does not need to be perfectly square, but at least the first edge must be straight. The larger the piece, the more accurate your final measurement will be.

The material can be anything, but Medium Density Fiberboard (MDF) will give you the cleanest cuts, and therefore, the easiest to measure.

- High density plywood, such as Baltic birch, will also give very accurate results.
- Low-grade plywood may have rough edges, depending on the quality, and therefore, may provide the lowest accuracy.
- Solid wood can also be used, but you may experience burning on the rip-cuts if you are using a fine-tooth blade.

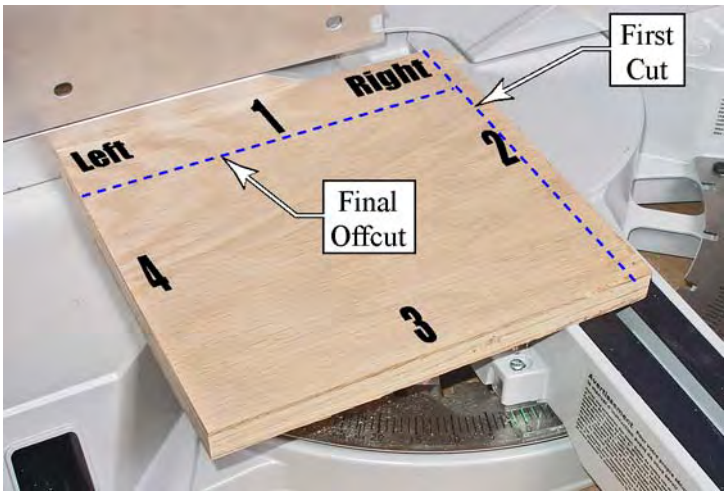
You will need a ruler to measure the length of the final offcut, and optionally, a dial indicator to accurately measure the difference in the width of the offcut at both ends. This width measurement is the most critical, so a dial indicator is recommended.



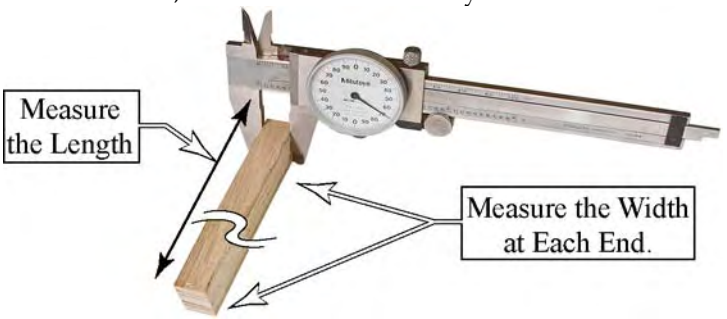
Measuring the Error

Before adjusting the saw, you first need to measure whether it is accurately calibrated to begin with. As was stated previously, the factory calibration threshold is ±0.16°. If you attempt to exceed this calibration threshold, you may end up actually making the saw less accurate, so it is highly recommended that you not perform this calibration procedure on a new saw.

1. Number the sides of the scrap piece of wood from 1 to 4, starting with the best edge.
   - If you cut the wood on the left side of the blade (as shown in this example), then number the sides in a clockwise direction (as shown below).
   - If you cut the wood on the right side of the blade, then number the sides in a counterclockwise direction.
2. On the #1 side, which will eventually become the final calibration offcut, label it "Left" and "Right" as shown. Do this regardless whether the cut is made on the left or right side of the sawblade.
3. Place the scrap on the saw with the number "1" against the fence.
4. Cut approximately 1/4-inch off the board, so that there is at least a 1/8-inch offcut. This offcut ensures that the sawblade will be stable because there is wood on both sides of the blade during the entire cut.



5. Rotate the board with side #2 against the fence and repeat the same cut. Note that the side previously cut is now against the fence for each of the four cuts described below.
6. Rotate the board to side #3 against the fence and repeat the same cut.
7. Rotate the board to side #4 against the fence, but this time, make the cut a little wider, so that the offcut is large enough to handle without breaking it (approximately 1/4 to 1/2 inch wide).
8. Discard the first three offcuts, but the fourth offcut is the calibration offcut.
9. Measure the length of the fourth offcut. The accuracy of this measurement is not critical, so a standard tape measure or ruler will suffice.
10. Measure the width of the fourth offcut at both ends (as labeled "Right" and "Left"). These two measurements are critical, so use the best method you can.



Calculating the Error

The equation for calculating the error is:

$$Error = \frac{1}{4} \times Arc\sin\left[\frac{WidthLeft - WidthRight}{Length}\right]$$

If the answer is a negative number (Right side wider than Left side), then your saw is cutting too much to the left of center. If the answer is positive, your saw is cutting too much to the right of center.

Width Left	**0.500**	Width Right	**0.500**
Length	**8.0**	**Calc Error**	**0.000**

Adjusting the Saw

1. With the miter handle out of the way, loosen only the middle screw on the miter gauge, and then move the miter handle back to zero.
2. Engage the miter lock by pressing down on the lock handle (see page 12). This locks the miter gauge to the miter handle, and prevents the gauge from moving until you are ready to move it.
3. Loosen the remaining two screws on the miter gauge, and gently tap sideways on the miter handle to move the gauge.
4. Retighten all three screws.
5. Repeat the calibration procedure to verify the results.

