

The Poor Man's Angle Set

An accessory for TS-Aligner



User's Manual

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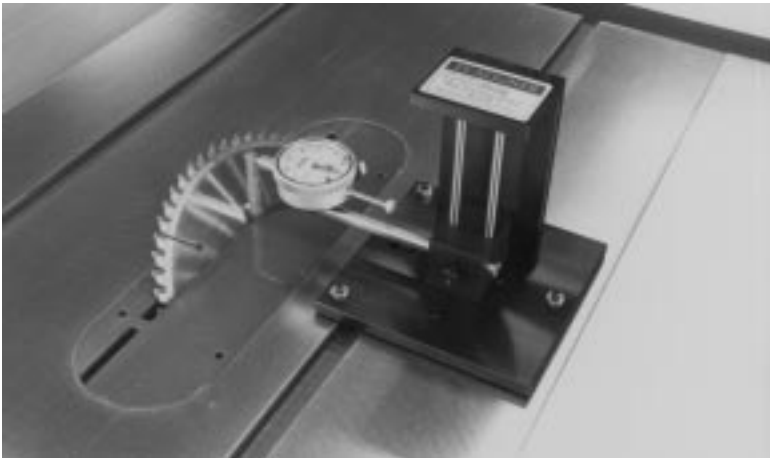
Basic Measurement Procedures:

A. Blade Tilt

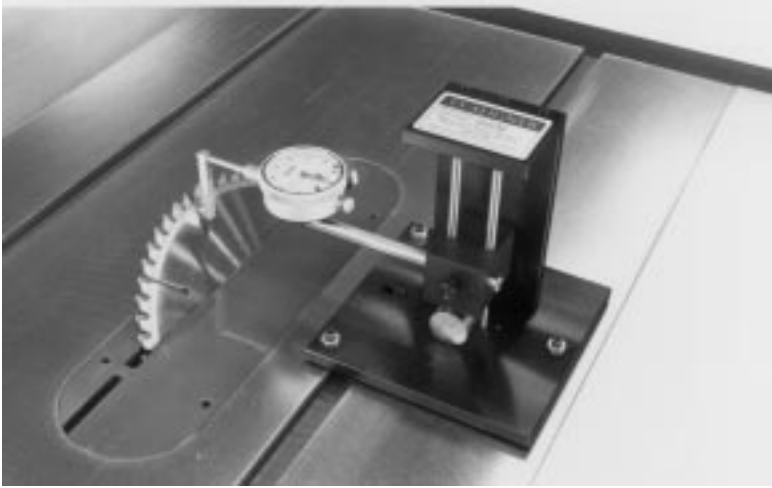
Tilt your blade to the approximate desired angle using the scale on your table saw as a guide. Place TS-Aligner in a miter slot so that the blade tilts away from it (see the drawing below).

Perform the following steps:

1. Adjust the dial indicator rod so that the stylus is up against the tilted blade and the plunger is pushed in almost all the way. The small hand on the dial indicator will make one complete revolution, and the large hand will rotate several times around. Make sure both hands are pointing exactly at zero (rotate the dial indicator scale if necessary). This is your reference point.



2. Carefully lift the block assembly and place the precision ground rod segment under it. Lower the block on top of the rod segment and tap on the block a couple of times to make sure it is firmly seated. This is your measurement point. Any saw dust or dirt under the rod segment will cause inaccuracy so make sure it's clean.
3. Make note of how much change in distance was measured by the dial indicator between the reference point and the measurement point. Each revolution of the large hand is one tenth of an inch. Each major division on the scale is one hundredth of



an inch. Each small division on the scale is a thousandth of an inch. Use the small numbers on the scale to help you see how far the hands have moved. Compare this measurement to number in the tangent table for the angle you want.

4. Adjust the tilt mechanism on the saw until the reading on the dial indicator matches the number found in the tangent table.
5. Remove the rod segment and lower the block assembly back to the bottom of its travel. You will notice that your reference point has shifted. You may have to repeat steps 1 thru 4 a few times to get to the correct angle but this method of "successive approximations" is the easiest and fastest way to make the adjustment. When the distance between the reference point and the measurement point is equal to the number in the tangent table, you are done.

B. Miter Gauge

Place a square against the miter gauge as described by "Adjusting the miter gauge for squareness" in the TS-Aligner manual. Adjust the miter gauge to the approximate angle using the scale as your guide. Clamp a block in the miter gauge slot and slide the miter gauge bar up against the block. Place TS-Aligner in the opposite slot facing the edge of the square.

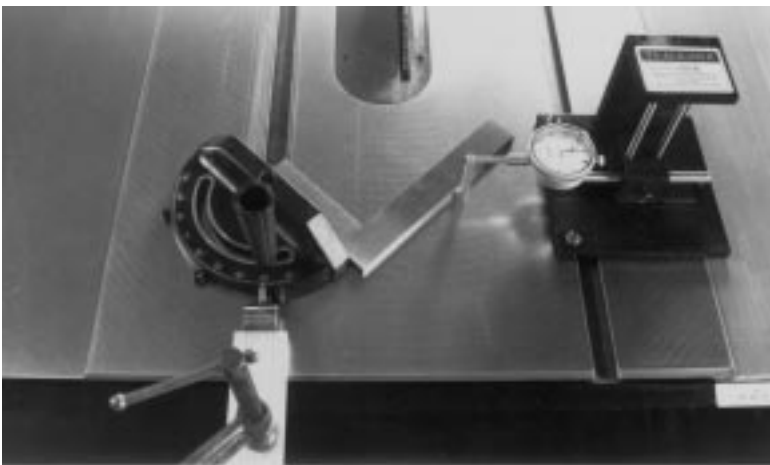
Perform the following steps:

1. Establish a reference point on the edge of the square by placing the stylus of the dial indicator on the edge of the square so

that the plunger is almost all the way in and both the large and small hands point to zero. You will probably want to clamp the square to the miter gauge to prevent it from sliding around.



2. Slide the miter gauge forward, place the precision ground rod segment between the miter gauge bar and the block clamped in the miter slot. Slide the miter gauge back against the



precision ground rod segment. This is your measurement point.

3. Compare the distance between your measurement point and your reference point with the number in the tangent table. If they are different, adjust the miter gauge so that the dial indicator reads the correct value.
4. Remove the precision ground rod segment and slide the miter gauge bar back against the clamped block. You will notice that your reference point has changed. Repeat steps 1 thru 4 until no further adjustment is necessary.

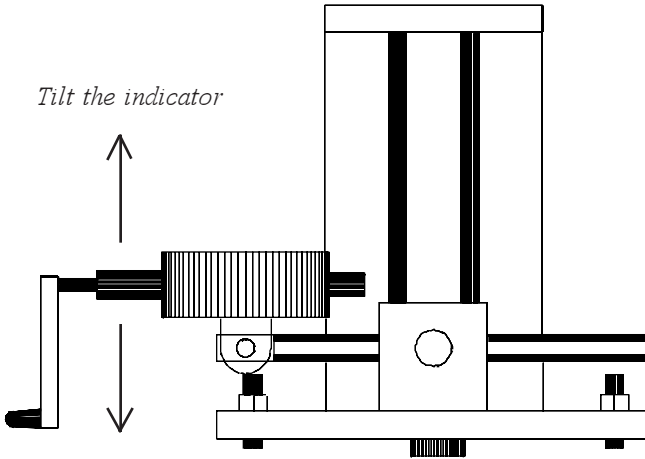
Additional Calibration Instructions:

The Poor Man's Angle Set relies upon basic right triangle trigonometry to help you set angles on your saw. There are two adjustments that are absolutely critical to your success in achieving accurate measurements. The first is the calibration procedure outlined in the TS-Aligner user's manual. The second adjustment involves making sure that the dial indicator is exactly parallel to the table surface. When the dial indicator is not parallel to the table surface, the right triangle trigonometry that is used to measure angles will be subject to what is called "cosine" errors. That is, the error in your angle settings will be equal to the cosine of the tilt of the dial indicator.

Adjusting the dial indicator parallel to the table surface is best accomplished by comparing the distance between the reference and measurement points with the number in the tangent table when measuring a known angle.

1. Set your blade tilt to 45 degrees exactly. We recommend that you use an accurate angle block with the TS-Aligner to make this setting. You can also try using the head of an accurate combination square. If you prefer, you may arrive at this setting by trial and error. The accuracy of your setting will determine the accuracy of your calibration.
2. Establish your reference point in the same way you would if you were going to set an angle. Extend the dial indicator rod until the dial indicator plunger is pushed almost all the way in. Both hands must be pointing at zero. Rotate the scale if necessary to make sure that the large hand is pointing at zero.

- Carefully raise the block assembly and place the precision ground rod segment under it. Lower the block on top of the rod segment and tap it a couple of times to make sure it is firmly seated. This is your measurement point.
- Compare the distance between your reference point and your measurement point. It should be exactly 1.000 inches. If it is not, slightly loosen the bolt that holds the dial indicator onto the rod and slowly tilt the entire dial indicator until the reading is exactly 1.000 inches.

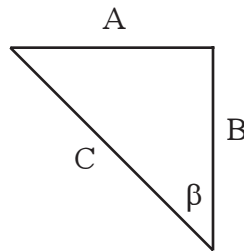


- Remove the rod segment and lower the block back to the bottom of its travel. You will notice that your reference point has changed. Go back and repeat steps 2 thru 5 to re-establish the reference point and re-check the tilt of the dial indicator. It will probably take a few times before you zero in on the correct setting but this is the fastest way. TS-Aligner is properly calibrated when the distance between your reference point and your measurement point is exactly 1.000 inches.

Theory of Operation

When the length of two sides of a right triangle are known, the length and angles of the third side can be calculated using basic trigonometry. When you use an accurate angle block, the trig. has already been done for you by the machinist who made it. He figured out what size gauge blocks to put under his sine bar to obtain the correct angle under his surface grinder. You benefit greatly because his gauge blocks, sine bar, and surface grinder are many times more accurate than TS-Aligner and a dial indicator.

If, however, you don't have one of these angle blocks, you can use TS-Aligner and the precision ground rod segment (substituting for the gauge blocks) to set your saw blade or miter gauge creating the imaginary triangle pictured below:



The precision ground rod segment defines the length of the side of the triangle labeled "B". The length of side "A" is going to be measured by the dial indicator. Side "C" is represented by the saw blade and " β " is the angle that the blade is tilted. Since you know that "B" is one inch, and you can measure "A", then you can figure out the blade tilt angle with the formula: $\beta = \text{Arc Tan}(A/B)$. Most of the time, you know what angle you want and so you must find out what length "A" should be. This can be easily calculated with the formula $A = B * \text{Tan}(\beta)$. That's what the tangent table on the back cover lists. If you want more accuracy in your angle settings, create a bigger triangle. By increasing "B" (the diameter of your rod segment) you will increase your accuracy. The MTB angle set offered as an accessory is accurate to 1/60 of a degree because it is long enough (3.44 inches) so that if "A" is .001 inches (the smallest increment on the dial indicator), the formula: $\text{Arc Tan}(.001/3.44)$ will yield .0166 (or 1/60).

Tangent Table

If you wish, you can use a calculator to determine the tangent of the angle you desire. Just make sure that your calculator is giving you your answers in degrees, not radians. The formula is: $1 * \text{Tan}(\text{angle})$

<i>Angle</i>	<i>Reading</i>	<i>Angle</i>	<i>Reading</i>	<i>Angle</i>	<i>Reading</i>
0.5	0.009	15.5	0.277	30.5	0.589
1.0	0.017	16.0	0.287	31.0	0.601
1.5	0.026	16.5	0.296	31.5	0.613
2.0	0.035	17.0	0.306	32.0	0.625
2.5	0.044	17.5	0.315	32.5	0.637
3.0	0.052	18.0	0.325	33.0	0.649
3.5	0.061	18.5	0.335	33.5	0.662
4.0	0.070	19.0	0.344	34.0	0.675
4.5	0.079	19.5	0.354	34.5	0.687
5.0	0.087	20.0	0.364	35.0	0.700
5.5	0.096	20.5	0.374	35.5	0.713
6.0	0.105	21.0	0.384	36.0	0.727
6.5	0.114	21.5	0.394	36.5	0.740
7.0	0.123	22.0	0.404	37.0	0.754
7.5	0.132	22.5	0.414	37.5	0.767
8.0	0.141	23.0	0.424	38.0	0.781
8.5	0.149	23.5	0.435	38.5	0.795
9.0	0.158	24.0	0.445	39.0	0.810
9.5	0.167	24.5	0.456	39.5	0.824
10.0	0.176	25.0	0.466	40.0	0.839
10.5	0.185	25.5	0.477	40.5	0.854
11.0	0.194	26.0	0.488	41.0	0.869
11.5	0.203	26.5	0.499	41.5	0.885
12.0	0.213	27.0	0.510	42.0	0.900
12.5	0.222	27.5	0.521	42.5	0.916
13.0	0.231	28.0	0.532	43.0	0.933
13.5	0.240	28.5	0.543	43.5	0.949
14.0	0.249	29.0	0.554	44.0	0.966
14.5	0.259	29.5	0.566	44.5	0.983
15.0	0.268	30.0	0.577	45.0	1.000