TS-ALIGNER JR.

Owner's Manual

Contents

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1. Introduction

Thank you for purchasing TS-Aligner Jr. I hope you find it to exceed your expectations of quality and value. A great deal of time and effort have gone into its development to ensure that you will receive excellent performance for a long, long time. This performance depends partly on your careful attention concerning use and maintenance. TS-Aligner Jr. is a delicate instrument and needs to be treated as such. This manual will outline its proper use and maintenance. Please read it carefully. If any point is not clear, or you have further questions, feel free to call me at (800) 333-4994. I try to be available during normal business hours as much as possible and often after hours as well. However, if you should get the answering machine, please leave a message with your name and number and I'll call you back as soon as possible. I am committed to your success in using TS-Aligner Jr.

Ed Bennett

2. Safety Rules

It never hurts to state the obvious and could save someone from a serious injury.

1. **Always unplug or otherwise disconnect power from the table saw before aligning it. TS-Aligner Jr. should NEVER be used with power applied to the saw.**

2. Do not use TS-Aligner Jr. as a hammer, screwdriver, pry bar, or anything else that you can imagine. It is a measurement instrument, not a cutting or impact tool.

3. Do not use TS-Aligner Jr. as a projectile. Serious bodily injury can be inflicted as TS-Aligner Jr. is made from solid Aluminum.

Seriously, woodworking is a VERY dangerous and EXTREMELY hazardous activity. TS-Aligner Jr. is not very dangerous in itself. However, that table saw is. Please take every precaution to avoid an accident. We cannot help you or take any responsibility for what might happen if you are careless.

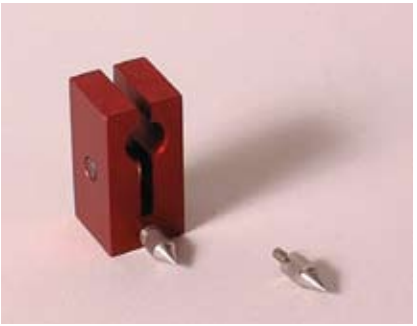
3. Unpacking and assembly

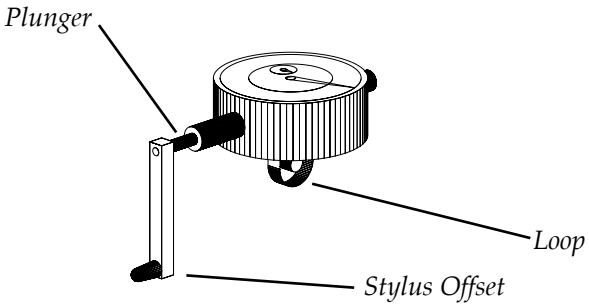
You've probably located the manual and you can probably guess what the big red metal thing is. That's your TS-Aligner Jr. Notice that there are two main parts: the Base and the Cross Bar. The Cross Bar is attached with one thumbscrew in the center.

You'll also find another red metal piece called the Upright Bar. It includes a socket head cap screw and a nut for mounting the dial indicator. There's also a machined metal rod called the Spindle Rod.

There should be a box that contains a Dial Indicator. The stylus of the dial indicator has been removed and a #4-48 socket head cap screw has been put in it's place. Also in this box is the Stylus Offset (a piece of 1/4" aluminum with a dial indicator stylus screwed into one end).

Finally, you'll also find the Angle Attachment Gage (a small red piece of 3/4" aluminum with a pointed stylus screwed itno it) and another identical pointed stylus. This will be used on the dial indicator to measure angles.





To assemble, attach the stylus offset to the plunger on the dial indicator by first removing the screw that is already on the end of the plunger. Place this screw thorough the hole in the stylus offset and screw it back into the plunger.

<u>DO NOT OVERTIGHTEN THIS SCREW!</u> The plunger on the dial indicator is not designed to take radial forces and <u>THE INTERNAL MECHANISM CAN BE EASILY DAMAGED</u>. Tighten the screw only tight enough to keep the stylus offset bar in place. Due to differences between each dial indicator, this screw may not go in far enough to clamp down on stylus offset. if this happens, just file or grind down the screw until it fits. <u>UNDER NO CIRCUMSTANCES SHOULD YOU EVER TRY TO FORCE THE SCREW.</u>

Adjust the stylus offset so that it is roughly square with the dial indicator body before tightening.

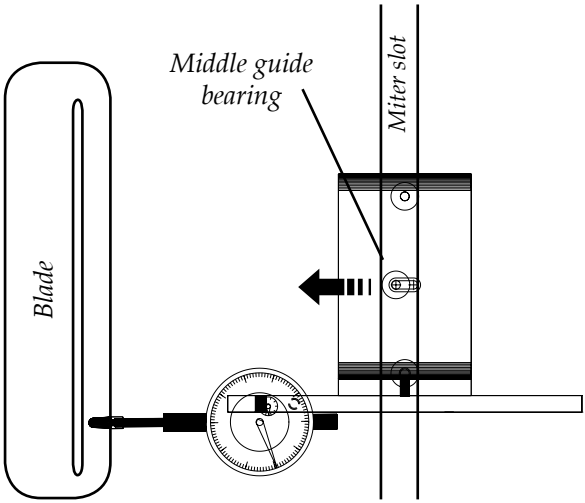
Remove the screw that is already in the cross bar. Place the screw through the loop on the indicator and replace the screw through the hole in the cross bar and back into the nut in the channel as shown in the photo below.

The dial indicator should be tilted so that it rests against the setscrew on the top of the cross bar. Each dial indicator is slightly different and sometimes the bottom of the stylus offset will drag on your table surface. If this is the case, just file the bottom of the stylus offset bar until it no longer drags. **DO NOT ADJUST THE SET SCREW ON THE CROSS B AR UNDERNEATH THE DIAL INDICATOR**. This screw controls calibration for angle measurement.

Next, adjust the middle guide bearing for your saws slot width as shown in the drawing. This can be done by placing TS-Aligner Jr. in the table slot, loosening the Allen nut that secures the middle bearing, sliding the bearing up against the wall of the slot and retightening it. Your TS-ALIGNER JR. is now ready to go!

4. Theory of operation

If you're fairly familiar with dial indicators and standard measurement techniques, you may wish to skip this section. If not, read on. Most of the questions we receive from new owners find their answers in this section.



4.1 Dial Indicators

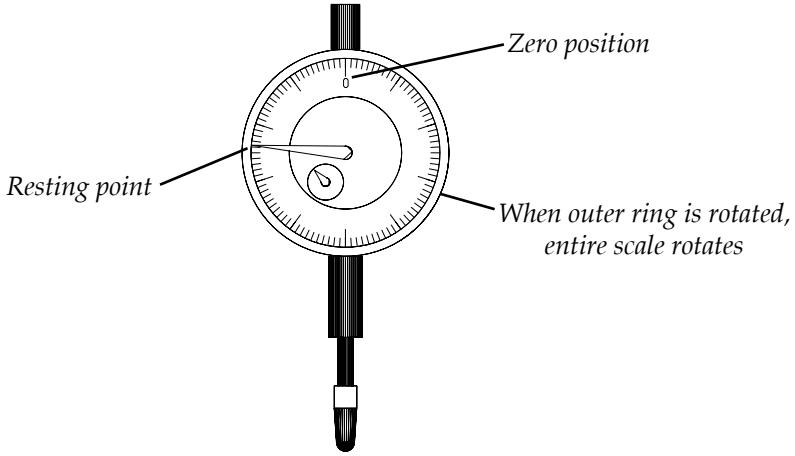
Understanding how the dial indicator works will help you to get the most out of this simple but very accurate tool. If you were to open up your dial indicator (not necessarily recommended) you would find a simple rack and pinion gear system. The rack is connected to the plunger. The pinion gear is connected (through a series of other gears) to the hands that you see from the top.

The spring loading on the plunger is part of a mechanism that counteracts play and backlash in this gearing system. This mechanism is not effective at the travel limits of the plunger. Indicators of any quality at all place those travel limits outside of the specified measurement range. Therefore, from the rest position of the plunger to the "zero" position there is always some small amount of travel. There is also some travel left in the plunger after you push the plunger to the specified measurement limit. Measurements made from the resting point of the plunger are not protected by the anti-backlash mechanism and are therefore not accurate. The same is true for measurements that end at the full travel limit.

The drawing below shows the resting point and the "zero" position. If you push the plunger in so that the large hand points to the "zero" position, the small hand will also point at it's "zero" position. As you pass this "zero" position each time the large hand rotates around the dial, the small hand will increment by one count. The small hand is keeping track of each revolution of the large hand. This corresponds

to one tenth (0.100) of an inch. The large dial is divided by 100 equally spaced marks. Each of these marks corresponds to one thousandth (0.001) of an inch.

The small knob on the side of the dial indicator holds a clamp that locks the large dial (usually referred to as the "scale") in place. If you loosen



this small knob, you will be able to rotate the scale freely so that the zero point can be placed at any position that the large hand sweeps.

Dial indicators are almost never used to measure extended distances. Most often they are used to measure small changes in distance. By placing the stylus of the dial indicator against an object and rotating the scale so that the large hand points at zero you establish a reference point. If you move the object or the indicator, you will be able to watch the large hand move from that reference point "indicating" the change in distance. Most of the measurements you make with TS-Aligner Jr. will be the result of moving the dial indicator in very controlled ways. Some measurements (like checking blade flatness) require you to move the object being measured (the blade).

4.2 Reference points on the table saw

Whenever you are going to make a measurement you must pick a reference point to base that measurement on. The reference point must not change during the measurement process or you will not have an accurate measurement. If your reference point changes, then the adjustments you make based on your measurements will be completely inaccurate.

There is also an element of reality that creeps into your measurements. Let's face it, nothing is perfect and things change constantly. Saw tables

are not always flat. They change shape over time due to thermal stresses. But they change less than anything else on a table saw. Therefore, the saw table will supply the references from which all other measurements are made. The surface of the table defines the first reference: a plane. The miter slot in the table defines the second reference: a line. Together, these two references will dictate the measurements that direct every adjustment you make to your saw.

Table saws that have severely warped tables or crooked miter slots are defective and potentially dangerous. They cannot be aligned. The defects must be corrected before alignment can take place. TS-Aligner Jr. can help you determine if you have a problem. If you suspect your table is not flat, it can be re-ground by a qualified machine shop. Several customers have called to tell us that they have successfully had this done at a very reasonable cost. It is also possible to re-mill the table slots if necessary.

4.3 Angle measurements

TS-Aligner Jr. provides you the ability to measure objects that are parallel to the miter slot and at any angle between 45 and 90 degrees with respect to the table surface. The Angle Attachment Gage uses simple high school trigonometry to accomplish angle measurements. It fits directly on the dial indicator stem and replaces the Stylus Offset. The accuracy of these measurements is dependent on the accuracy of the calibration. In theory, the Angle Attachment Gage can resolve angles to within 0.057 degrees. When greater accuracy is needed, machinist's angle blocks can be used.

5. Calibration

We carefully calibrated your TS-Aligner Jr. at the factory before shipping it. So, there should be no need to re-calibrate your new unit for quite some time. However, calibrating TS-Aligner Jr. is very easy and will ensure that you are getting excellent angle measurements.

First, remove the Stylus Offset and place the Angle Attachment Gage over the dial indicator stem. Place the pointed stylus tip on the end of the dial indicator plunger (**FINGER TIGHT ONLY!**). **WARNING: The pointed stylus tips are sharp so be careful. Attach them after the Angle Attachment Gage is on the stem to avoid a puncture wound if you should slip.** The Angle Attachment Gage is designed to fit very snugly on the dial indicator stem. Don't be surprised if it takes some force. Make sure that the locking screw is loose to avoid any

damage to the dial indicator as you push the Angle Attachment Gage onto the stem.

When you attach the dial indicator to the cross bar, hold it upside down and press on the bottom of the angle attachment gage as shown in the following photo.

This ensures that the dial indicator is firmly resting against the calibration set screw.

Your TS-Aligner Jr. designed to be much more accurate than is possible for typical woodworking. This gives you the advantage of being able to measure and adjust your equipment with full assurance and knowledge. Be careful of the following so that you maintain that advantage:

1. Make sure the table saw surface is clean. Sawdust or other particles can influence the accuracy of your calibration.

2. Always place both TS-Aligner Jr. and the square or angle block on the same segment or surface. Don't put one on an attached wing or let one hang over an edge or the table insert. The flatness of the surface that is used for calibration will greatly influence the outcome.

3. Use an accurate square. In spite of their price tags, many squares promoted in the woodworking market claim to be accurate and are not. Your calibration will be no better than the square you use. Look for the following in a good quality square:

a. Made from hardened steel. Brass and wood are beautiful but they don't make for an accurate square. Many customers have called me to say that their expensive rosewood handled brass square now has its place in the display cabinet, not in the shop.

b. Look for a rating or accuracy specification. "Machinist" or "Shop grade" is barely adequate. We recommend one that conforms to at least Accuracy Class II which is commonly referred to as "Toolroom grade" (error of 0.00080 + L/100,000). It's important to know that squares are always specified according to how much the they deviate from perfect 90 degrees over a given distance. "L" in the above equation is the length of the square in inches. Therefore, a typical six inch Class II square will be allowed at most 0.00086 inches of error over its entire length (0.0008 + 6/100,000).

c. It also makes it easy if the square has a thick blade. It's hard to balance the stylus of TS-Aligner Jr. on a thin blade. (We offer one as an accessory that is ideal for this purpose or you can purchase one from any machine shop supplier.)

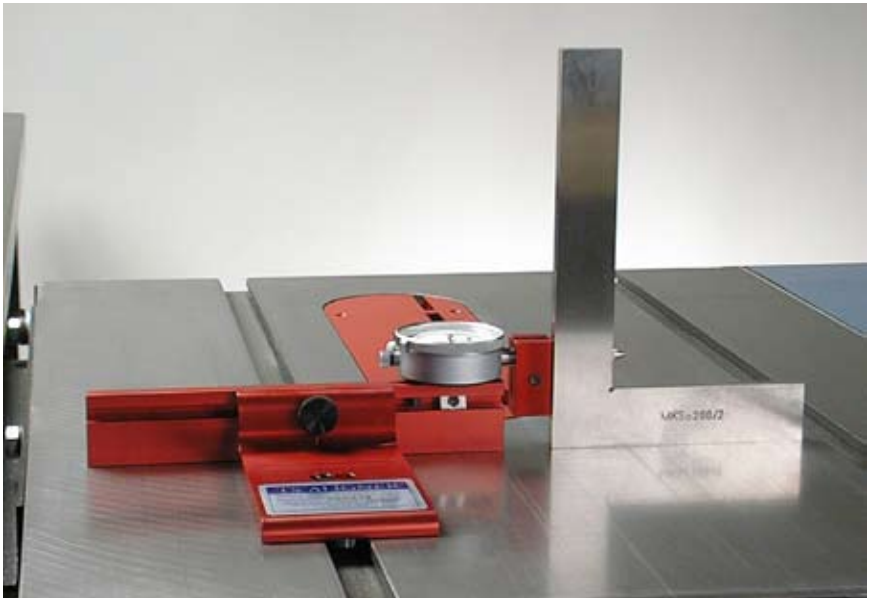
4. Make sure that the square won't slide around. Clamp it down if possible.

In order for angle measurements to be accurate, the travel of the plunger on the dial indicator must be parallel to the surface of the table and the Angle Attachment Gage must be square with the table surface. To make this adjustment easier, the sides of the Angle Attachment Gage have been machined flat and square. Using an accurate square against these sides will provide you with a fairly close calibration.

5.1 Approximate calibration

This procedure is desinged to get you close but is no substitute for Precise Calibration (Section 5.2) using an accurate 45 degree angle block. Very often, the results from Precise Calibration do not agree with those from Approximate Calibration. **So, do not be concerned if your factory calibrated Jr. does not pass this test.**

First, place a square on the table surface so that the blade is against the front of the Angle Attachment Gage as shown in the photo. Adjust the tilt of the dial indicator so that the edge of the Angle Attachment Gage is square with the table surface. Make sure that the Cross Bar remains flat on the table surface. When you are satisfied, lock down the screw that holds the dial indicator to the Cross Bar.



Next, place the blade of the square against the side of the Angle Attachment Gage. Rotate the Angle Attachment Gage on the dial indicator stem until it is square with the table surface as shown in the following photo.

Finally, place the blade of the square against the upper stylus point (the one attached to the plunger on the dial indicator) and push it in

until the bottom point is against the blade of the square as shown in the following photo.

Set the **One Inch Point** on the dial indicator by rotating the scale so that the large hand points to zero. If the lower point won't come in contact with the blade of the square, then the Angle Attachment Gage is installed too far on the dial indicator stem. You will need to pull it forward until both points are in contact with the blade of the square. Recheck that the Angle Attachment Gage is square in both directions before you set the **One Inch Point**. Ideally, both hands will be pointing away from the square when calibration is correct.

You will notice a set screw located on the Cross Bar just under the dial indicator. This is the Tilt Adjustment Set Screw. It uses a nylon locking patch and will be fairly stiff but will stay in place once adjusted. Adjust it so that it comes in contact with the bottom of the dial indicator. This gives you a reference if you ever need to remove and replace the dial indicator. It is also used during precise calibration to change the dial indicator tilt in minute increments.

5.2 Precise Calibration

When the Angle Attachment Gage is correctly calibrated, measurement of a square object will push the plunger to the **One Inch Point** (both hands pointing to zero with the plunger almost all the way pushed in) and measuring a 45 degree object will bring the dial indicator to

the **Zero Point** (both hands pointing to zero when the plunger is only slightly pushed in).

For this final calibration, you will need a good reference for 45 degrees. You can attempt to arrive at a 45 degree blade tilt on your table saw by trial and error or you can purchase a machinist's 45 degree angle block like the one we offer as an accessory. The following photo shows the angle block being used to check the **Zero Point** on the dial indicator.

First, check the **One Inch Point** by using a square as described in the previous section. Make sure that the dial indicator is resting firmly on the Tilt Adjustment Set Screw (the dial indicator is tilted all the way back). Adjust the position of the Angle Attachment Gage on the dial indicator stem so that both hands point to zero when both stylus points are against the edge of the square.

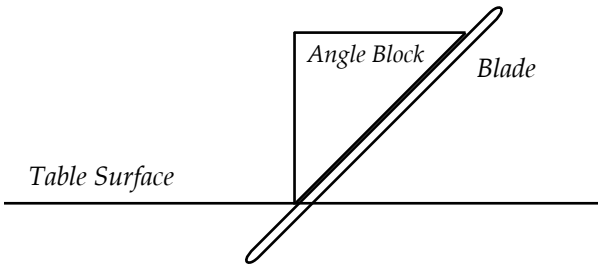
Next, use your 45 degree reference to check the tilt of the dial indicator. As you can see from the photo, both stylus points are against the edge of the angle block. Adjust the tilt of the dial indicator by turning the Tilt Adjustment Set Screw in or out from the bottom of the Cross Bar. The Tilt Adjustment Set Screw has a nylon locking patch that will hold it firmly in place between adjustments. Each time you do this, loosen the dial indicator, make sure it's tilted against the Tilt Adjustment Set Screw, and retighten the dial indicator. When the tilt is correct, both hands of the dial indicator will point to zero when both stylus points are against the edge of the angle block. The plunger will be just barely pressed in. This is the **Zero Point**.

Adjusting the tilt of the dial indicator will affect the **One Inch Point** calibration. So, you must go back and readjust the position of the Angle Attachment Gage on the stem to restore calibration. You will need to alternately check and adjust both the **One Inch** and the **Zero Points** until they are both correct at the same time (should only take a few iterations). When both points are correct, tighten the screw on the Angle Attachment Gage to lock it in place.

5.3 Using angle blocks to avoid setting the zero point

You can achieve greater accuracy and save yourself the trouble of setting the **Zero Point** by using angle blocks. When an angle block is placed against a tilted object (like a blade) the opposite edge of the angle block will be perfectly square with the table surface when the tilted object is at the correct angle. This is illustrated in the following drawing.

So, if the **One Inch Point** is accurately set (using a square) the Angle Attachment Gage will be able to tell you when the edge of the angle block is square with the table surface.



6. Aligning and testing your table saw

Whenever you make adjustments or test your saw, there are just a few things to keep in mind.

1. **Make sure the power is disconnected or disabled. TS-Aligner Jr. was not intended to be used under any circumstances where power is applied to the saw. This is dangerous and may lead to severe injury and possibly death.**
2. Make sure the table surface is clean and free of sawdust or other contaminants. This will ensure accurate setups and also preserve

the life of your TS-Aligner Jr. (dial indicators and bearings are sensitive to dust contamination and can be easily damaged by it).

3. Table saws are not perfect. Some saws, because of table flatness, blade warp, arbor runout, bearing play, and a host of other variables will never be aligned better than ±0.010". That's not bad when you consider the stability of wood. However, TS-Aligner Jr. can tend to make the ±0.010" mole hill look like a mountain. That error of ±0.010" spans 20 divisions on the dial indicator! Rest assured, most quality saws can easily be aligned to within a few thousandths of an inch.

4. Your table saw owner's manual is an invaluable resource to guide you in making various adjustments. Since each manufacturer has different methods for adjusting the various parts of the saw, we cannot give specific instructions. However, we can tell you how to measure the error and what needs to be adjusted to correct it. It will be up to you to read the saw's owner's manual to find out how to do it.

6.1 Checking the flatness of the blade

There are no perfect blades. Every blade will show some amount of surface flatness variation. Good quality blades available today should show no more than 0.004" variation across their entire surface. Symptoms of a warped blade include rough cuts or regularly spaced burn marks. Severe warp can induce blade vibration which could produce an extremely dangerous situation. It is also important to be able to tell the difference between a warped blade, a bent arbor, runout, and dirt on the arbor flange. TS-Aligner Jr. can help you to determine exactly what's wrong.

For this test, you will need to connect the Stylus Offset Bar with the ball stylus to the dial indicator plunger using the #4-48 screw.

1. Always make sure that your saw is disconnected from power.

2. Place TS-Aligner Jr. in a miter slot and extend the Cross Bar so that the stylus is against the blade and reads somewhere in the middle of the dial indicator's range (small hand pointing near "2"). Rotate the scale so that the large hand points to zero. This is your reference point.

3. Rotate the blade by pulling the belt, or turning the motor pulley (be careful not to pinch your fingers!). Avoid touching the blade if possible because this is dangerous and could also invalidate

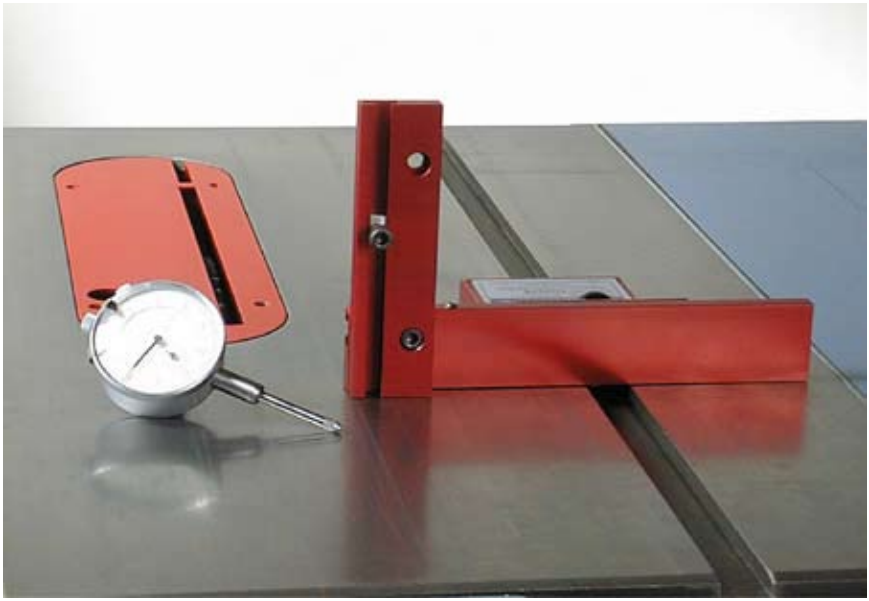
your readings if you flex the blade. Cabinet saws connected to dust collection systems usually force you to rotate the blade by touching it.

4. All parts of the surface can be checked by rotating the blade and moving TS-Aligner Jr. to various positions in the slot. Observe and record the greatest amount of change and its position on the blade (for example, you could mark the lowest reading spot with a felt tip pen).

5. Loosen the arbor nut and rotate the blade to a new position on the arbor. Retighten the nut and measure the blade again. If you notice the same reading at the same location marked on the blade, then the blade is warped. If the location changes you are viewing an arbor/flange problem. Clean the arbor, flange and blade completely and perform the measurement again.

6.2 Checking arbor runout

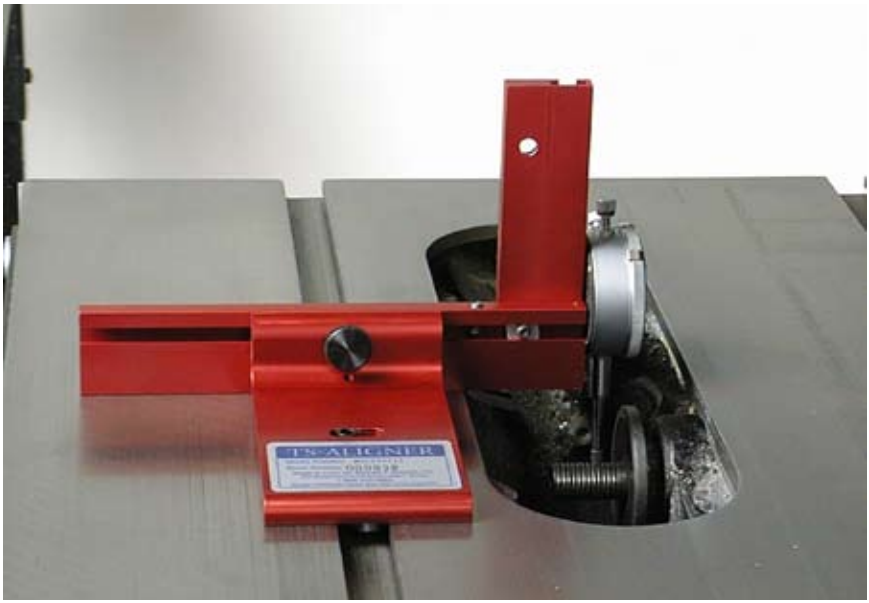
If you believe you might have a bent arbor, TS-Aligner Jr. can be configured to measure runout on the arbor directly. The following picture illustrates how the Upright Bar is connected to TS-Aligner Jr. For this test, you will need to remove the Offset Bar and place the ball stylus point on the offset bar onto the plunger of the dial indicator.



The dial indicator then connects to the Upright Bar using the supplied 1/4-20 socket head screw and nut as shown in the following photo.

The dial indicator can then be adjusted up and down along the slot in the Upright Bar. Remove the throat plate and blade from your saw.

Using the photo below as your guide, adjust the Cross Bar so that the dial indicator is directly over an un-threaded portion of the arbor. Adjust the height of the dial indicator so that the stylus is in contact



with the arbor and the dial indicator reads about mid scale. Establish a reference point by rotating the scale so that the large hand points to zero.

Now rotate the arbor by pulling on the belt or turning the motor. Observe the reading on the dial indicator as the arbor rotates. You may need to consult with the manufacturer of the saw to determine how much runout is acceptable but you should see virtually no change in reading as the arbor rotates. Correcting this problem involves replacing the arbor or having a qualified machine shop straighten it.

6.3 Aligning the blade parallel to the miter slots

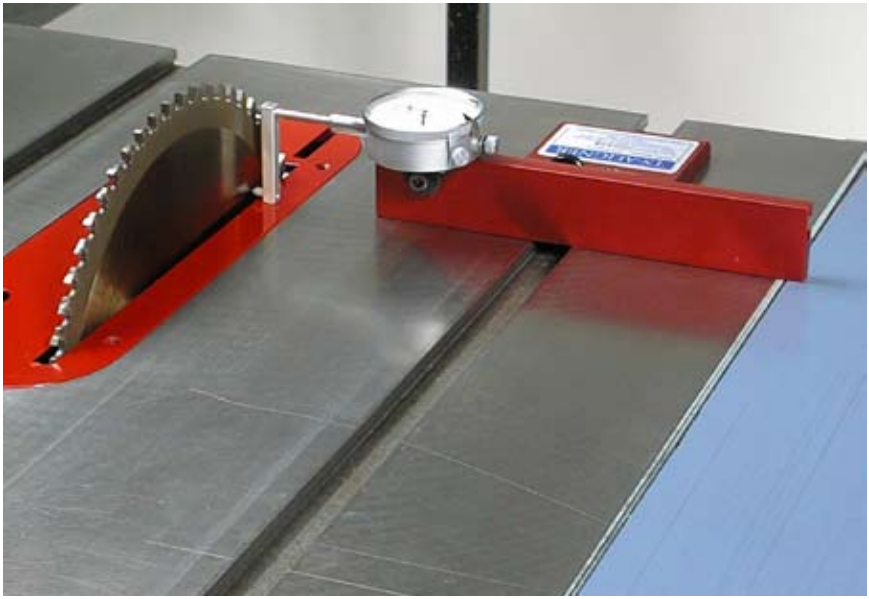
This adjustment is where most woodworkers will see a vast improvement in the quality of their cuts. It takes almost no time to check for blade parallelism, and is usually a simple matter to correct if it is off. Blades are not always perfectly flat and arbors are not always perfectly true. If you detected a blade or arbor problem in the previous section, you would be well advised to correct these problems before attempting any further alignment.

For this test you will need to use the Stylus Offset Bar with the ball stylus attached.

1. Place TS-Aligner Jr. in one of the miter slots and extend the Cross Bar so that the stylus contacts the surface of the blade as in the first photo. The dial indicator should read somewhere in the middle of it's range. Tighten the knob so that the Cross Bar will not slip.

2. Rotate the scale on the dial indicator so that the large hand points at zero and mark the spot on the blade where the stylus touches. A felt tip marker is good for this purpose. This will be your reference point. Be careful to avoid hitting carbide teeth with the stylus tip as it can cause chips and micro-fractures in the surface of the carbide.

3. Slide TS-Aligner Jr. to the other end of the blade and rotate the blade so that the same spot is under the stylus. The second photo shows the TS-Aligner Jr. in this second position. Check the reading on the dial indicator to see how much it has changed. The change will indicate how much misalignment there is between the surface of the blade and the miter slot.



4. As little as 0.005" change in reading can adversely affect the quality of your cuts. Some saws require that you move the table surface. Others have you shift the trunnions. Refer to your saw's manual to determine how the adjustment is made (it is sometimes referred to as adjusting the "heel" of the blade). You can leave TS-Aligner Jr. in contact with the blade while you make

the adjustment so that you can watch the change.

5. Keep in mind that you are changing your reference point when you make this adjustment. You will need to reestablish the reference point and check again (steps 1-3) after each adjustment.

6.4 Aligning the blade square to the table

Everyone wants square cuts. Half of the battle is getting your blade square in relation to the table. For this adjustment you will need to install the Angle Attachment Gage and calibrate the one inch point with a square.

1. Raise the blade as far as it will go. Loosen the knob that locks the Cross Bar and place the stylus on the dial indicator against the blade. Push the Cross Bar in until the fixed point is also against the blade as shown in the photo. Make sure that the Cross Bar remains flat on the table surface.

2. Observe the reading on the dial indicator. If it reads exactly the same as your **One Inch Point** then your blade is square.

3. If you need to adjust the blade tilt to square up the blade, leave the Cross Bar knob loose and push in toward the blade while you adjust the tilt mechanism. This will keep both points against the blade and will enable you to read the dial indicator while you make the adjustment. When you reach the one inch calibration

point, your blade is square. Remember to make sure and keep the Cross Bar flat on the table while you make the adjustment.

6.5 Checking the condition of the arbor bearings

Over time, the arbor bearings of any saw will wear. When this happens, the accuracy of your cuts will decrease as blade vibration and wobble increase. The manufacturer can tell you how much play is acceptable before the bearings need replacing. TS-Aligner Jr. can tell you how much play exists on your saw. **DANGER: This test requires that you touch the blade. Make certain that there is NO WAY that the saw can start unexpectedly by disconnecting the power source.** Also, to gain the best picture of the condition of your bearings you will want to loosen the belt(s) between the motor and the arbor.

For this test you will need to attach the stylus offset with the ball stylus to the dial indicator.

Position TS-Aligner Jr. so that the stylus close to the center of the blade and the plunger on the dial indicator is depressed about half way. Establish a reference point (rotate the scale so the large hand points to zero). Press one side of the blade. The reading on the dial indicator will change as the blade is flexed. When you release the pressure, the reading should return to zero. If it does not, the amount of play can be read as the difference between the new reading and zero. Press on the other side of the blade and note any non zero reading. If this value seems excessive check with the manufacturer to determine how much play is acceptable.

6.6 Adjusting the blade tilt

Many a woodworker has discouraged their customer from compound angle joints because of the time consuming trial and error method of setting the saw to cut those perfect angles. Even simple miter joints can take hours to prepare. Certainly the scale on the front of most saws gives nothing more than a rough estimate.

6.6a Without angle blocks

For this adjustment you will need to install the Angle Attachment Gage and have it calibrated for both the **Zero Point** and the **One Inch Point**.

Look up the angle you want in the tangent table on the back page of the manual (or calculate the value yourself). The number next to the angle is the reading that will be on the dial indicator when the blade is tilted to the correct angle. Place TS-Aligner in the miter slot as shown

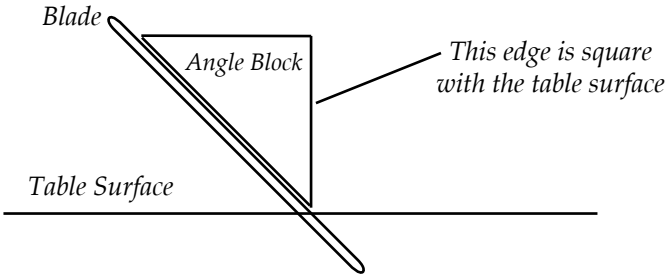
with both stylus points against the blade as shown in the photo.

If the reading on the dial indicator doesn't match the value in the table, then you will need to adjust the blade tilt. With the Cross Bar knob loosened, push in so that both stylus points remain against the blade. Then adjust the blade tilt until the reading on the dial indicator matches the value in the table. Be sure to keep the Cross Bar flat on the table surface.

6.6b Using angle blocks

For greater accuracy, you can use angle blocks to adjust the blade tilt. For this adjustment, you will need to install the Angle Attachment Gage and have the **One Inch Point** calibrated.

Tilt the blade to the approximate angle. Place the angle block on the blade surface as shown in the drawing. Be sure to avoid having the angle block rest on any teeth, it must be flat on the blade body.



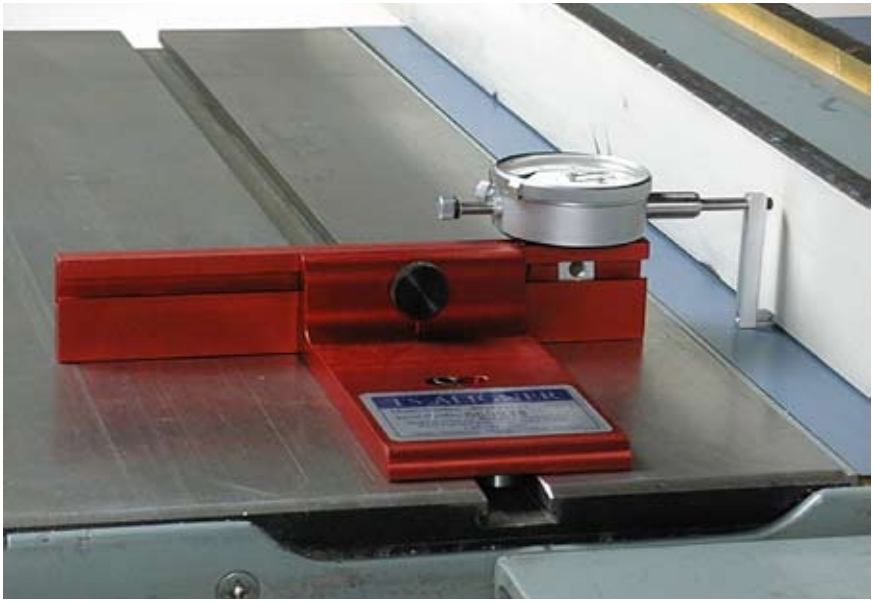
With TS-Aligner on the table, push the Cross Bar so that both stylus points are against the edge of the angle block. When the dial indicator reads exactly the same as your **One Inch Point**, then the blade is tilted to the correct angle.

6.7 Aligning the fence parallel to the miter slot

Probably one of the biggest reasons for burned edges when ripping is the alignment of the fence relative to the blade. The blade should already be aligned so that it is parallel to the miter slot. If you skipped that step, or there is any question about the blade alignment, go back and check it. We are going to align the fence so that it is parallel to the miter slot as well. When the blade and the fence are both parallel to the miter slot, they will be parallel to each other. Remember, the miter slot is one of our two unchanging references.

For this alignment, you can use the stylus offset on your dial indicator as shown or you can just use a round faced stylus tip from the indicator point set.

Start by placing TS-Aligner Jr. as shown in the photo. Adjust the Cross Bar so that the dial indicator reads mid-scale. Rotate the scale so that the large hand points at zero. Slide TS-Aligner Jr. down the miter slot and observe the reading on the dial indicator.



If the front end of the fence reads differently from the rear end, you may need to adjust it so that the two ends read the same. If your blade

manufacturer recommends that you leave a small gap at the rear end of the fence, you can make this change very easily by adjusting the fence until the dial indicator displays the proper amount.

BEWARE: BE VERY CAREFUL TO MAKE SURE THAT YOU DO NOT ADJUST THE FENCE SO THAT THERE IS *LESS* SPACE BETWEEN THE REAR OF THE FENCE AND THE BLADE. THIS IS AN EXTREMELY DANGEROUS CONDITION THAT WILL CAUSE BURNED EDGES AND CAN CAUSE A KICKBACK.

If you find you are having trouble because the fence surface is not flat, skip ahead to the section on fence flatness. It is potentially very dangerous to attempt to use a warped fence for rip cuts. If the board you are cutting becomes pinched between the fence and the blade, you will be lucky if you are not seriously injured. Don't try to align a warped fence. Repair or replace it and then align it.

6.8 Aligning the fence square to the table

Whether you cut thick or thin boards, you want to be sure that when you set your fence for a certain width of cut, that all boards come out to that width. If your fence is not square with the table surface, then the top will be closer or further away from the blade than the bottom. It might not seem like much difference until you use part of your fence as a stop for shoulder cuts on a tenon.

For this test you will need to install the Angle Attachment Gage and have it calibrated at the **One Inch Point.**

Place TS-Aligner Jr. as shown in the photo. In the same way the blade was checked for squareness you are now able to check the fence. Some fences are not adjustable for squareness and you may need to fashion a new face for your fence that adjusts (or at least compensates for the error).

6.9 Checking the flatness of the fence

While aligning your fence to the miter slot or squaring it with the table, you may have noticed the reading on the dial indicator was not entirely consistent. Perhaps it began to rise, and then fall back to zero as you moved from end to end. This would indicate that the fence surface isn't flat but is bowed away from the blade. Similarly, if the reading began to fall and then rise back to zero, the fence surface is bowed toward the blade. Perhaps you noticed that one end of the fence was square with the table surface but the other one wasn't. This would indicate that the fence is twisted. These problems could explain why poor rip cuts persist even after careful alignment with TS-Aligner Jr..

If the flatness is less than 0.005", you're fence is probably fine. Anything greater than that and you should see if you can get the problem repaired or get the fence replaced. You may have to bring your fence to a machine shop to have it milled or ground flat. The danger here cannot be minimized. Fixing a fence flatness problem will not only make your saw safer, but you will re-gain control of your rip cuts. They will not wander away from the fence, or be pinched between the fence and the blade.

6.10 Micro adjusting the fence position

There are times when you need to move the fence "just a hair". So, you loosen the locking lever and...tap tap tap...Oops! Too far! Then you try to find where it was before you moved it! It could keep you busy all afternoon. However, if the stylus on TS-Aligner Jr. was against the fence when you moved it, not only would you know how far you moved it, but you would have known how far you needed to move it in the first place.

You would also find it no trouble at all to restore the fence to its original position. Just make sure you start by setting the scale so that the big hand on the dial indicator points to zero. Using this technique, I regularly cut aluminum and composite materials on my saw to within

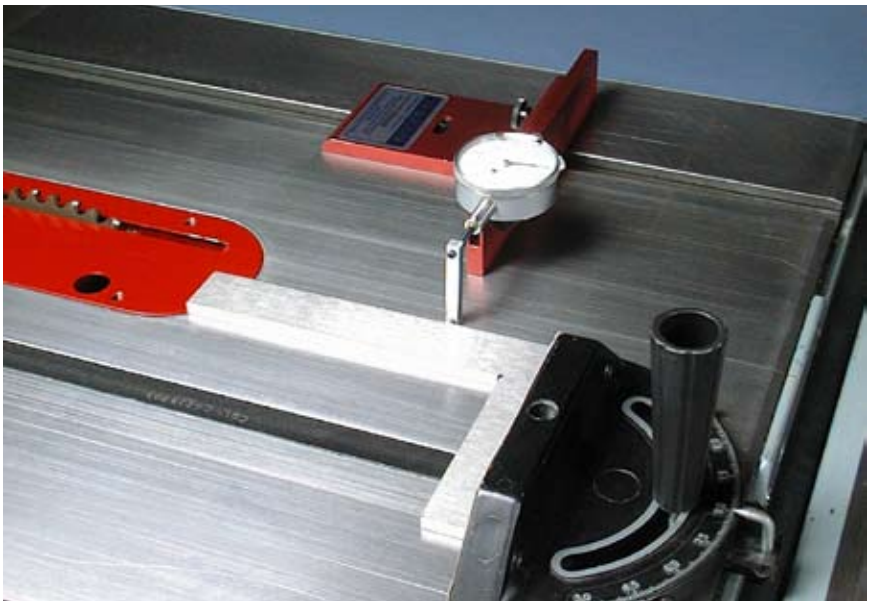
0.001". Most table saws really can do accurate work when used with TS-Aligner Jr.

6.11 Adjusting the miter gauge for squareness

For this adjustment, you will need an accurate square. We recommend a square similar to the one we offer as an accessory: Class II or better with an extra thick blade. If you can't find one with a thick blade, you can place the thin blade against miter gauge and use the beam (the wide part) against the stylus of TS-Aligner Jr.. Make sure you perform this adjustment after you are sure that the blade is parallel to the miter slot. We are going to adjust the miter gauge so that it is square to the miter slot. If the blade is parallel to the slot, then the miter gauge will be square to the blade.

You will need to install the Stylus offset on the dial indicator for this test.

Place the beam (or blade) of the square on the face of the miter gauge as shown in the photo. Position TS-Aligner Jr. as shown and adjust the rod so that the indicator reads mid-scale. Slide the miter gauge and square down the miter slot together. Make sure the square doesn't slip around on the face of the miter gauge. You will be able to determine very quickly if the miter gauge is square to the miter slot. Watch for



a change in reading and adjust the angle of the miter gauge to obtain the minimum amount of change. Always move the miter gauge and

leave TS-Aligner stationary. If you move TS-Aligner and leave the miter gauge stationary, you will be aligning the miter gauge so that it is square with the slot that TS-Aligner is in.

6.12 Measuring parallelness of the miter gauge slots

Using the setup described in adjusting the miter gauge for squareness you can check to see if your miter slots are parallel. If you move both the miter gauge/square combination and the TS-Aligner down the slots at the same time, any change in reading will indicate a change in distance between the slots.

While it is very rare that the slots would not be parallel, it does explain why you might have problems on only one miter slot. Symptoms of this problem include: burning of end grain or cuts that aren't square over their entire length. You may be forced into aligning your saw to one slot and using it exclusively.

This sort of defect can be repaired by a machinist but it will be a rare one that will have a milling machine big enough. In addition, the end result would leave you with larger miter slots.

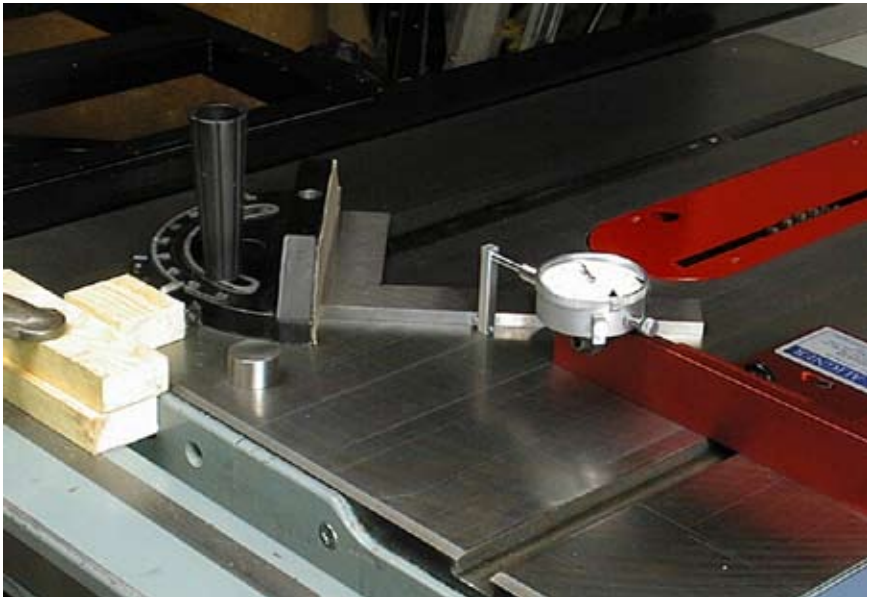
6.13 Adjusting the Miter gauge to any angle

TS-Aligner gives you two methods in setting the angle of your miter gage. The first involves using some high school trigonometry together with a square and a one inch spacer block. The second, more accurate method, uses angle blocks. For both methods, you will need to install the stylus offset bar.

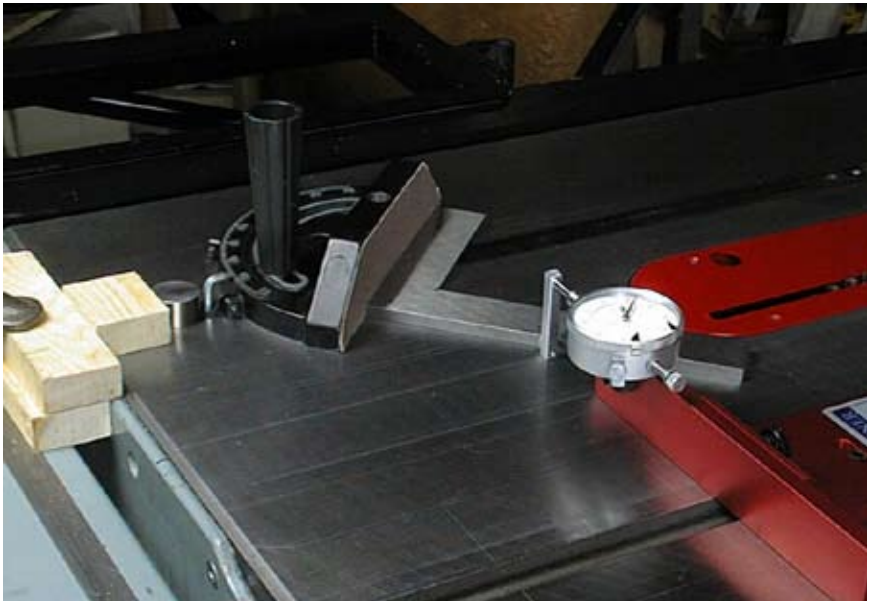
6.13a Using a square and a one inch spacer

Place the square against the face of the miter gauge as shown. Clamp a block of wood behind the miter gauge to act as a stop. Place TS-Aligner Jr. in the other miter slot with the stylus against the edge of the square. The first photo depicts this setup.

Notice the cylinder sitting off to the side of the miter gauge. That is going to be used as a gage block to limit the travel of the miter gauge to exactly one inch. Adjust the Cross Bar on TS-Aligner Jr. so that the stylus of the dial indicator is almost all the way pushed in and both hands are pointing at zero. Now, push the miter gauge forward, place your one inch spacer in between the wooden stop block and the miter gauge. Now, pull back the stylus of the dial indicator and slide the miter gauge back so that it is against the spacer block. Carefully release the stylus of the dial indicator. Take the reading on the dial indicator



and look it up in the tangent table on the back page of this manual. That will tell you what angle the miter gauge is adjusted to.

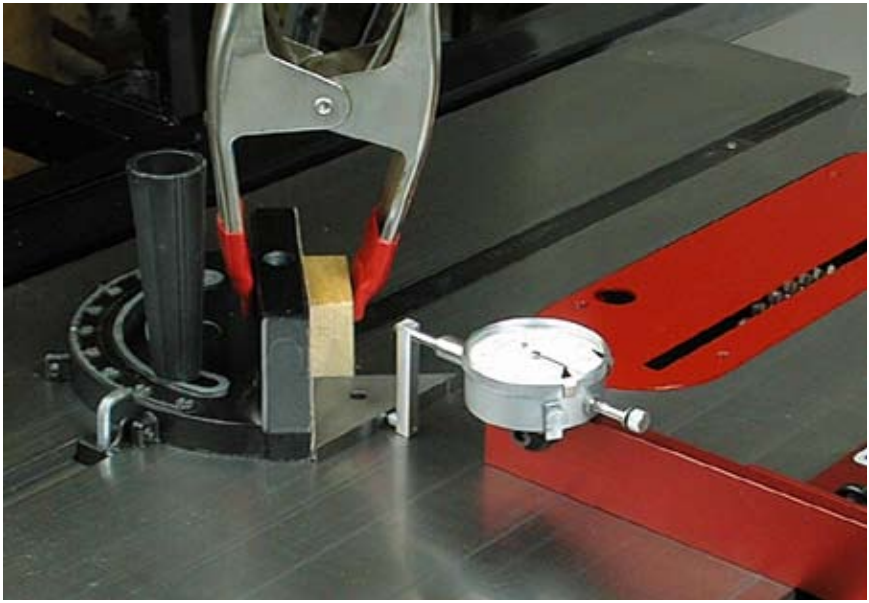


The above picture shows the setup with the spacer block in place. Make sure TS-Aligner Jr. doesn't move while you make this adjustment. If you find this adjustment tricky you are not alone. Even with practice it's fairly cumbersome. For greater accuracy, you will need to use the

angle block method.

6.13b Using an angle block

If a square can be used to set the miter gauge to 90°, then an accurate angle block can be used in the same manner to set the miter gauge to any angle. The key here is to use accurate angle blocks (like the ones we offer as accessories). Use the photo as your guide in setting up.



Notice that we have clamped a block behind the angle block to help make sure it doesn't move out of position. You can easily see that the edge of the angle block will be parallel to the miter slot when the miter gauge is at the correct angle. As you slide the miter gauge/angle block combination down the slot, watch for a change in reading that would indicate that the miter gauge is not at the correct angle. Carefully adjust the miter gauge until there is no change in reading for the entire length of the angle block. Again, make sure you move your miter gauge and not your TS-Aligner Jr.. Otherwise, you will be aligning to the slot that the TS-Aligner is in. Unlike the square, the angle block is small and light. You will probably need to hold it down more carefully behind it. Be careful that the edge of the angle block always remains in contact with the face of the miter gauge and that there is no dust between them.

6.14 Checking the miter gauge for play

Probably the first thing you noticed when you squared up or set the angle on your miter gauge is the amount of play. Just when you think

everything is perfect, you shift the bar of the miter gauge in the slot and perfection goes out the window. Not many miter gauges have an adjustment for play. If yours does that's great. If it doesn't, then you will have to figure out a way to remove the play or cope with it (i.e. always pushing the bar to one side, etc.). It is, however, good to know how much play exists and what effect it will have on your cuts.

6.15 Other machines

Now that you are fairly familiar with the functions of TS-Aligner Jr., you probably have all sorts of ideas on how it can be used on other machines in your shop. Whenever you need to check some surface parallel to a slot or and edge, TS-Aligner Jr. will be there to help. If you need to check the squareness of something you can use TS-Aligner Jr. there too. If there is an angle adjustment to be made, TS-Aligner Jr. will make it easier and more accurate. If the height of something needs to be measured, using TS-Aligner Jr. will give you the best results possible. Here are just a few examples to get you started.

6.15a The Drill Press

There's a couple of parameters that are real important on a drill press. In order to drill straight, perpindicular holes, you'll need to make sure that the axis of the spindle is perpindicular (or square) to the table. The best way to do this is to "sweep" the table with a dial indicator. This involves connecting the dial indicator (via some fixture) to the spindle and taking measurements from the surface of the table as the spindle is rotated. Whenever the reading changes as the indicator sweeps the table, it is showing that the table is not perpindicular to the table. If the reading does not change (or changes very little), then the table and spindle are perpindicular.

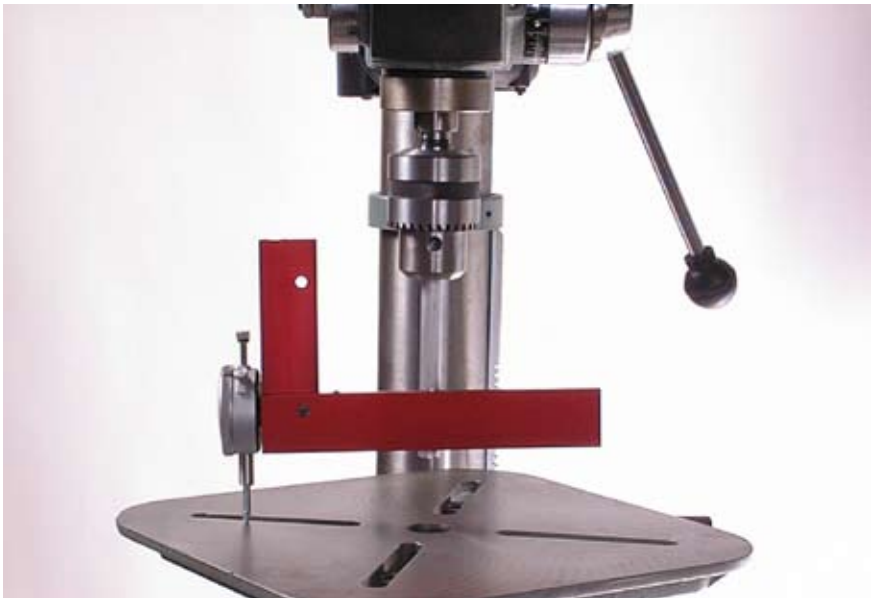
WARNING: All of the tests on all of the machines in this manual are performed manually, without power applied. DO NOT DO ANY OF THESE TESTS WITH A POWER SOURCE ATTACHED TO THE TOOL.

Start this procedure by installing the Spindle Rod in the drill chuck .

Next, mount the Cross Bar onto the Spindle Rod using the thumb-screw.

Now attach the Upright Bar to the Cross Bar so that it extends upwards as shown in the next photo.

Finally, attach a round or domed stylus tip to the Dial Indicator and mount the Dial Indicator to the Upright Bar so that it points downwards. The photo below shows how it should look.



Lower the quill or raise the table so that the stylus is in contact with the table surface and the reading is about mid scale. This is your reference point. the next step is to manually rotate the spindle so that the

stylus of the dial indicator traces a circle on the surface of the table. BE CAREFUL! The stylus of the dial indicator will want to fall into any holes or slots in the table surface. Make sure you manually hold the stylus up while passing over these spots. Also note that the cross bar can rock slightly while being held by the spindle rod. This is normal and no amount of tightening on the thumbscrew will prevent this. Just make sure that it's always in one position as you take your readings. Finally, you'll find it much easier to rotate the spindle if you loosen or remove the drive belts.

The following photos show the Dial Indicator sweeping the table. Most drill presses only allow you to adjust the tilt of the table from side to side (not front to back). So, if you find any problem with the front to back squareness of the table, you may need to consult a machinist or add some shims.

A reasonable quality drill press will allow you to adjust the table to within about 0.005". Your results may vary considerably but there's still no better way to square up the drill press table.

The next test you will want to perform can tell you how true your drill chuck and spindle rotate. This is refered to as measuring the spindle runout. It will also give you an idea of the condition of the spindle

bearings.

Mount only the Spindle Rod into the drill chuck. Use your TS-Aligner Jr. with the base attached and a round or dome shaped stylus tip on the Dial Indicator. Lower the spindle (or raise the table) so that the stylus of the Dial Indicator can contact the Spingle Rod at a point close to the chuck. Use the photo below as your guide. You will want to clamp the base of your TS-Aligner Jr. to the table surface to keep it from sliding around.

Establish a reference point with the stylus of the Dial Indicator in contact with the Spindle Rod. Now manually rotate the spindle and observe the reading on the dial indicator. A reasonable quality drill press with a good chuck will have no more than 0.002" of runout. If the reading jumps as you place side pressure on the chuck, you have some play in the bearings.

If you have excessive runout and suspect that the chuck is causing it, you can measure the actual spindle runout by removing the chuck and taking your reading directly off the spindle as shown in the following photo.

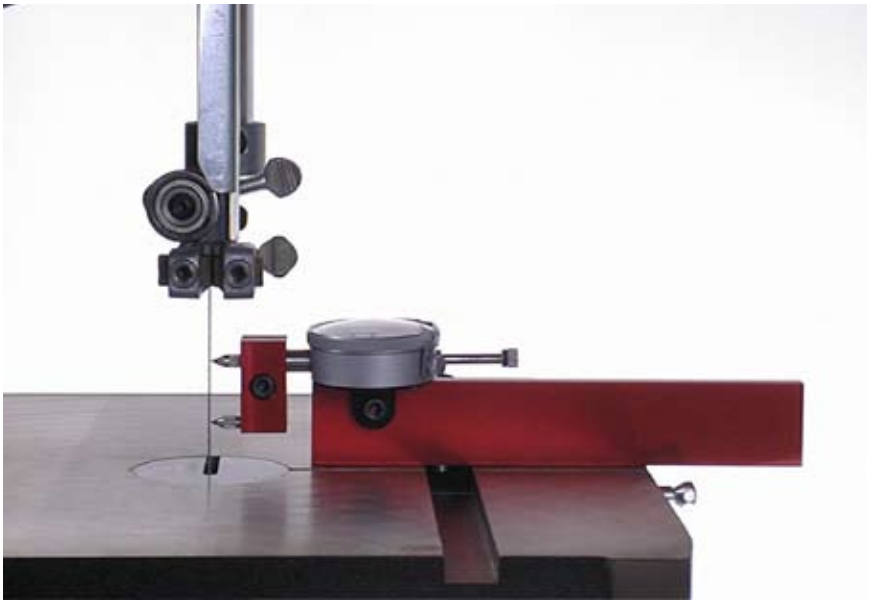
Actual spindle runout on a reasonable drill press will be less than 0.001". See your owner's manual for details on how to remove the chuck.

6.15b The Bandsaw

There's two adjustments on the bandsaw that can be made quickly and easily using TS-Aligner. First, you can setup a fence in the same way you did for the table saw. The big difference on the bandsaw is blade lead. Due to the variations in blade set and tension, bandsaw blades typically cut at an angle. This is called blade lead and can be compensated for by setting the fence to match the blade lead angle. To determine this angle, draw a straight line down the middle of a board that is parallel to its edges. Then start cutting along the line freehand. About midway down the board you'll notice that you are guiding the board at an angle in order to stay on the line. Stop cutting at that point but leave the board on the saw in the exact position you stopped cutting. Adjust the fence on your saw so that it matches the angle of the board's edge. Now use TS-Aligner Jr. to measure the blade lead. Place the stylus of the dial indicator against one end of the fence and zero the scale. Using this as a reference point, move down to the other end of the fence and record the change in reading. Now you know the lead angle for that particular blade. Next time you need to mount it you won't have to cut up another board. Just look up the number you recorded and adjust the fence using TS-Aligner Jr.

Squaring up the bandsaw is even easier. Just use you TS-Aligner Jr. with the Angle Attachment Gage as shown in the photo. You can

measure the squareness of the blade in the exact same way you did on the table saw.



6.15c The Jointer

Setting your jointer fence so that it is square or at a particular angle is easy using TS-Aligner Jr. It's as easy as setting the blade on your table saw. On some smaller jointers, you may want to remove the Base Plate and use Only the Cross Bar.

Setting jointer knives and the outfeed table is also made easier using TS-Aligner Jr. For this operation, you will want to use the Upright Bar to turn the Aligner into a height gage. You will also want to replace the stylus on the dial indicator with one that has a slightly rounded surface. The photo below shows TS-Aligner Jr. being used to measure the height of the jointer knives. If you start the procedure by zeroing the dial indicator on the outfeed table, you will be able to adjust the height of the knives to match the level of the outfeed table. This will eliminate any snipe. Then you can check the level of the infeed table to determine the depth of cut.

6.15d The Shaper or Router Table

You can check the squareness of the spindle on your router table or shaper in the exact same manner as the drill press. Install the Spindle Rod into the collet on your machine. Since the spindle points up, you will be mounting the Cross Bar upside down. However, you can still mount the Upright Bar so that it points upwards and then mount the Dial Indicator so that it points down toward the table surface. Then sweep the table to determine squareness.

Checking spindle runout and play is done exactly the same as on the drill press.

You can also use your TS-Aligner Jr. to set the fences on a shaper or router table. You may need to make sure that they both at the same level, you may also need to adjust the infeed fence for a particular depth of cut. Both operations are easy with TS-Aligner Jr. You can also use the Aligner as a height gage for setting cutter heights. This will save you huge amounts of time when setting up cutter sets for making doors.

7. Maintenance

Your TS-Aligner Jr. should remain accurate for a long, long time. There's not much maintenance needed to keep it in good shape. Just keep the following in mind.

1. Never expose TS-Aligner Jr. to excessive dirt or sawdust. The bearings are sealed but the dial indicator can be contaminated. It's not necessary to avoid dust altogether, just don't store the aligner so that it gets covered in it.

2. Keep TS-Aligner Jr. in it's Storage Case.

3. Check the calibration occasionally and adjust as necessary.

8. Trouble Shooting

In the unfortunate event you ever encounter any difficulty using TS-Aligner Jr., we have included this section to assist you before you call. If you cannot correct the problem after reading this section, feel free to call us for help. We will be glad to help you resolve the problem.

8.1 Normal operation of TS-Aligner Jr.

It's good to know what to expect from your TS-Aligner Jr. before you conclude that you are having a problem.

1. It is difficult to tighten the middle guide bearing from the top of TS-Aligner Jr. We are aware of the difficulty and are working on alternative solutions. Feel free to contribute any realistically economical ideas. If you overtighten the Allen nut you can cause the bearing guide to dig into the base plate causing rough spots in the slot. Avoid doing this as it will only make adjustment that much more difficult.

2. The Aligner Jr. slides freely down part of the miter slot and then seems to bind in the slot. Dirt may have collected on the walls of the slot causing the bearings to bind. If cleaning doesn't resolve the issue, it could be due to wear or a poorly machined slot. By adjusting the middle guide bearing so that there is a little more room, you can avoid this problem.

3. You'll notice that the Cross Bar, being supported at only one point in the center, tends to rotate out of line with the Base. This design allows the Cross Bar to sit flat on the table surface, independantly of the base.

8.2 Abnormal operation of TS-Aligner Jr.

Listed here are the things that should not happen. Some things can be corrected by you. Others may need factory repair.

1. You can't seem to get your TS-Aligner Jr. calibrated even using a square and a 45 degree angle block. Check the following:
   a. The accuracy of the square or angle block you are using. The edges must be flat as well as square.
   b. The flatness of your table saw top
   c. Is there any dirt or dust on the square, table surface, or base of TS-Aligner Jr.?
   d. Has your TS-Aligner Jr. been dropped or jarred? If the Cross bar becomes bent or develops a burr it may be difficult to achieve alignment.

2. The guide bearings do not turn freely.
   a. Check for dirt or sawdust in the bearings.
   b. Check to make sure they are not rubbing on the base plate (the brass washers under the bearings will prevent this).

3. The dial indicator does not operate freely and/or makes a grinding noise.
   a. The number one cause for this problem is damage caused by over tightening the screw on the end of the plunger. Inside the indicator is a bar that travels in a plastic channel. This bar is designed to prevent rotation of the plunger. When too much force is applied to the screw the bar is forced out of the plastic channel. Often, the bar can be placed back into the channel and the dial indicator will function properly. Sometimes, the channel is damaged so that the bar can no longer be retained. Repair of this damage is expensive and often the dial indicator must be replaced completely. **Such repair or replacement is not covered by the warranty.**
   b. Check for dirt or sawdust inside the dial indicator. Often, blowing out the dust will restore normal operation.
   c. Has your TS-Aligner Jr. undergone any severe jolt?

If you need assistance with these or any other problems you are experiencing, please call me. I will work with you to resolve the problem in a timely manner. My technical support hotline is:

800-333-4994

Normally, I will be available during business hours and sometimes beyond. If I'm already helping someone else or am not able to answer the phone you will be transfered to my personal voicemail. Please leave your name and phone number so that I can call you back. If you don't, then I will never know that you need my help.

9. Warranty

My business is not selling tools or custom furniture. I strive to provide solutions for my customers. As such, your satisfaction is my measure in determining success. Certainly, I won't be meeting needs very long if I don't follow good business sense. Therefore, I want to outline my commitment to you and let you know what I can and cannot do to help you. You gave me your money. Now I give you my product, and with it a promise.

I warrant your TS-Aligner Jr. to be free from manufacturing defects. You have ONE YEAR from the date of purchase in which to discover and report any of these defects to me. If you report a defect within one year I will replace or repair (my decision) your TS-Aligner Jr. free of charge.

You should call me first and discuss the problem to determine the nature of the defect. If I determine that you have abused your TS-Aligner Jr. in such a way as to cause the failure, I will not be able to pay for the repair. I have carefully laid out what constitutes proper use in this manual. I have also outlined some potential abuses. Read it carefully. I will not be responsible for units that have been dropped or physically damaged. I will not pay for damage caused by neglect or modification. I will not pay if the unit has been disassembled. These problems may be covered under our Calibration Service. If you send your Aligner to me, along with $10.00, I will clean, upgrade (if necessary), test, and calibrate it. If any damaged parts need replacing, I will advise you of any charges.

If you report a defect to me after one year from the date of purchase, I won't leave you out in the cold. I will be happy to make every effort to rectify your problem. I am always on the lookout for manufacturing and design flaws. When I find one that I decide is significant, I issue a "Service Note". The service note (published on the web site) allows for the problem to be rectified free of charge. If the problem you are encountering is not covered by a service note, I will be happy to repair the unit for a reasonable charge that you agree to in advance.

TS-Aligner Jr. is designed to perform only those alignments outlined here in the manual. While it is applicable to many other tasks and applications, I cannot guarantee its performance or suitability for such.

Tangent Table

Below is a tangent table to help you convert readings on your dial indicator to angles when using the Angle Attachment Gage. You can use a calculator to determine the correct value for any angle. Just make sure that your calculator is giving you answers in degrees, not radians.

The formula is: 1-Tan(angle)

Angle		*Angle*		*Angle*	
0.5	*0.991*	*15.5*	*0.723*	*30.5*	*0.411*
1.0	*0.983*	*16.0*	*0.713*	*31.0*	*0.399*
1.5	*0.974*	*16.5*	*0.704*	*31.5*	*0.387*
2.0	*0.965*	*17.0*	*0.694*	*32.0*	*0.375*
2.5	*0.956*	*17.5*	*0.685*	*32.5*	*0.363*
3.0	*0.948*	*18.0*	*0.675*	*33.0*	*0.351*
3.5	*0.939*	*18.5*	*0.665*	*33.5*	*0.338*
4.0	*0.930*	*19.0*	*0.656*	*34.0*	*0.325*
4.5	*0.921*	*19.5*	*0.646*	*34.5*	*0.313*
5.0	*0.913*	*20.0*	*0.636*	*35.0*	*0.300*
5.5	*0.904*	*20.5*	*0.626*	*35.5*	*0.287*
6.0	*0.895*	*21.0*	*0.616*	*36.0*	*0.273*
6.5	*0.886*	*21.5*	*0.606*	*36.5*	*0.260*
7.0	*0.877*	*22.0*	*0.596*	*37.0*	*0.246*
7.5	*0.868*	*22.5*	*0.586*	*37.5*	*0.233*
8.0	*0.859*	*23.0*	*0.576*	*38.0*	*0.219*
8.5	*0.851*	*23.5*	*0.565*	*38.5*	*0.205*
9.0	*0.842*	*24.0*	*0.555*	*39.0*	*0.190*
9.5	*0.833*	*24.5*	*0.544*	*39.5*	*0.176*
10.0	*0.824*	*25.0*	*0.534*	*40.0*	*0.161*
10.5	*0.815*	*25.5*	*0.523*	*40.5*	*0.146*
11.0	*0.806*	*26.0*	*0.512*	*41.0*	*0.131*
11.5	*0.797*	*26.5*	*0.501*	*41.5*	*0.115*
12.0	*0.787*	*27.0*	*0.490*	*42.0*	*0.100*
12.5	*0.778*	*27.5*	*0.479*	*42.5*	*0.084*
13.0	*0.769*	*28.0*	*0.468*	*43.0*	*0.067*
13.5	*0.760*	*28.5*	*0.457*	*43.5*	*0.051*
14.0	*0.751*	*29.0*	*0.446*	*44.0*	*0.034*
14.5	*0.741*	*29.5*	*0.434*	*44.5*	*0.017*
15.0	*0.732*	*30.0*	*0.423*	*45.0*	*0.000*