



Minitex CNC Mini-Mill User's Guide



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Preface

Copyright

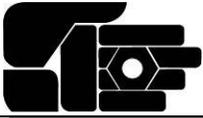
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Warranty

Minitex Machinery Corporation warrants the Mini-Mill Desktop Manufacturing System to be in good working order for a period of one year from the date of purchase from Minitex or an authorized dealer. Should this product fail to be in "good working order" at any time during the warranty period, Minitex will, at its option, repair or replace the product at no additional charge except as set forth below. This limited warranty does not include service to repair the product resulting from misuse, abuse, or non-Minitex modifications to the product.

Limited warranty service may be obtained by registered owners by delivering the product to an authorized dealer or Minitex with documentation of purchase date. If this product is shipped, the owner agrees to assume full risk of loss or damage in transit and prepay shipping charges to the warranty service location.

For service, contact and authorized dealer or write to Minitex at 6050 Peachtree Pky Ste. 240-205 Norcross, Georgia 30092.

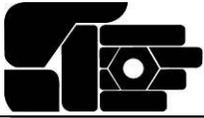
All express and implied warranties for this product, including warranties of merchantability and fitness for a particular purpose, are limited in duration to one year from the date of purchase, and no warranties, whether expressed or implied will apply after this period.

If this product is not in "good working order" as warranted above, the sole remedy shall be repair or replacement as provided above. In no event will Minitex be liable for any damages, including lost profits, lost savings or incidental or consequential damages arising out of the use, or inability to use such product, even if Minitex, or any authorized dealer has been advised of the possibility of such damages, or for any claim by any party other than the original purchaser.

The foregoing warranty is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness, or adequacy for any particular purpose or use. Minitex shall not be liable for any special, incidental, or consequential damages, whether in contract, tort, or otherwise. In no event shall Minitex be liable for incidental, consequential or special damages. Liability to third parties for bodily injury including death relating to our performance or products delivered hereunder shall be determined in accordance with applicable law and shall not exceed the payment, if any, received by us for the product or service furnished. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Minitex warrants the product to function properly only when used Microsoft Windows 7 operating system. Minitex does not warrant the product to function properly in every hardware/software environment. Furthermore Minitex does not guarantee or warrant that the Mini-Mill will make or produce any specific part.

This warranty provides specific legal rights, other rights may exist due to the varying State laws.



Federal Communications Commission Statement

This equipment complies with the requirements in part 15.103(c) of FCC Rules for Test Equipment. Operation of this equipment in a residential area may cause interference to radio and TV reception requiring the operator to take whatever steps are necessary to correct the interference. This unit is not for resale to the general public.

There is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

Reorient the receiving antenna.

Relocate the computer with respect to the receiver.

Move the computer away from the receiver.

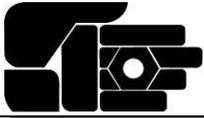
Ensure that the expansion slot covers are in place when no board is installed.

Use properly shielded cables and connectors.

Plug the computer into a different outlet so that the computer and the receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communication Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the

US Government Printing Office, Washington, DC, Stock no. 004-000-00345-4.

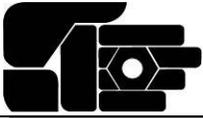


Safety

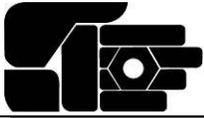
The most important lesson to learn is that of safety. Caution and safety must be considered at all times when using the Mini-Mill, as well as any machine tool. Although the Mini-Mill possesses only limited possibilities of creating injury, users should learn and follow all safety rules any time they operate the Mini-Mill.

Safety Rules:

1. Never Run A CNC Machine Unattended - CNC machines are potentially dangerous. Untrained people must not operate the CNC machine. CNC machines are not toys. Keep kids away. Never let the machine run unattended. Always wear safety goggles. Unexpected machine movement can occur at any time. You are responsible for the safety of yourself and others. You are working at your own risk.
2. Always Wear Safety Glasses - foresight is better than no sight! The Operation of any power tool can result in foreign objects being thrown into the eyes, which can result in severe eye damage. Always wear safety glasses or eye shields before commencing power tool operation. For the best protection we recommend wide vision safety mask and standard safety glasses.
3. Know Your Mini-Mill Machine - Read the owner's manual carefully. Learn its application and limitations as well as the specific potential hazards.
4. Ground All Power Connections - All the AC plugs are equipped with a three pronged plug. Make certain the receptacle is properly grounded.
5. Keep Guards In Place - Never remove the safety shield. Use it for the protection of flying debris.
6. Remove Adjusting Keys And Wrenches - Form a habit of checking to see that keys and adjusting wrenches are removed from the spindle and machine prior to turning the machine on.
7. Keep Work Area Clean - Cluttered areas and benches invite accidents.
8. Avoid Dangerous Environments - Do not use power tools in damp or wet areas. Keep area well illuminated.
9. Keep Children Away - All visitors should be kept a safe distance from the machine area.
10. Make Work Area Child Proof - with locks, master cutoff switches.
11. Do Not Force Tool - Do not force tool or attachment to do a job it was not designed for.
12. Use The Right Tools - Do not force tool or attachment to do a job it was not designed for.
13. Wear Proper Apparel - Avoid loose clothing or jewelry that could get caught in the moving parts of the machine and spindle mechanism. Wear protective head gear to keep long hair away from moving parts.
14. Use Safety Glasses - Also use a dust mask if cutting operation is dusty



15. Secure Work - Use clamps or a vise to hold work. Do not use your hands to hold work down.
16. Do Not Touch Machine When It Is On - Avoid touching any part of the machine while it is operating. If the proper settings are made, and the work is fastened properly, there is no need to touch the machine.
17. Maintain Tools In Top Condition - Keep tools sharp and clean for best results and safest performance. Follow instructions for lubricating and changing accessories.
18. Disconnect Tools - before servicing and when changing accessories such as end mills, and cutters.
19. Avoid Accidental Starting - Make sure spindle switch is off before plugging in power cord.
20. Use Recommended Accessories - Consult the instruction guide. Use of improper accessories may be hazardous.
21. Check That All Holding, Locking, And Driving Devices Are Tightened - At the same time, be careful not to over-tighten these adjustments. They should be just tight enough to do the job. Over-tightening may damage threads or warp parts thereby reducing accuracy and effectiveness.
22. Be Aware Of These Safety Precautions - and use these as a basis for your safety protection. Implement your own safety rules in conjunction with these.



System Requirements

Prior to setting up your Mini-Mill make sure you have the proper requirements for the system. It is also recommended that you first setup your computer system and software prior to installing the machine. The minimum requirements for the Mini-Mill are:

Processor	1Ghz CPU
Memory	512
USB	1.1 or 2.0
Operating System	Windows 2000, Windows XP, Windows Vista, or Windows 7
Software	Mach3 Version R3.042.040 with Minitex Screen Sets



Installation

Shipment Review

You should review your Minittech shipment to see how many packages you received. To do this, check first with the Ship List located on the outside of box number one. If there is only one box, then it will be marked as 1/1, or 1 of 1 box.

Review the ship list carefully. The ship list provides you with the contents of each box and the items ordered. Although you may not be completely familiar with all the items, it is important that you become introduced to items as they become unpacked.

If you are uncertain of what some of the items are, do not worry. Simply call Minittech on our toll-free telephone number, if you need any assistance or would like further information on setting-up your system. We are happy to assist you.

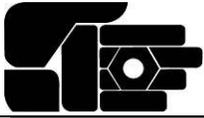
To open the shipment follow the instructions below.

1. Carefully open the crate containing your Mini-Mill machine. This should be a large wooden crate.
2. As you open the box, notice the four mounting screws that attach the mill to the plywood base. This secures the machine during shipping and is not need for operating the machine. Therefore, remove the four mounting screws from the base, prior to attempting to remove the machine from the box. Note: Some Mini-Mills have only mounting straps that need to be removed.
3. Once the machine is unsecured from the plywood base, it can then be pulled-out of the box and placed on a bench or desktop. Do not lift machine by the stepper motors. This should be within a five-foot distance from the computer system you want to control your new Mini-Mill. Remove any items from your bench that may interfere with the operations of the mill, or items that may become entangled with the spindle mechanism.
4. Open all other boxes (if any) and inspect their contents with the ship list provided.

Mounting the Machine

Use your discretion to mount the machine to a solid surface. We recommend mounting the Mini-Mill to a table surface for maximum stability and machining accuracy. The four mounting holes in the chip tray provide an excellent way to bolt the machine to a mounting surface. The Mini-Mill can be mounted to a machined surface, or pre-finished board using four machine bolts and rubber washers, and nuts available through local hardware stores.

This arrangement will give the Mini-Mill a stable and secure platform for operating the machine. The rubber washers will help in reducing noise created by the spindle motor, spindle, and cutting surface. The better the foundation, the less vibration will occur and the better the machine will perform.



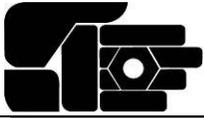
Computer Interface Connection



The Mini-Mill is controlled by a PC based computer. This means that the signals used to control the table movements and other operations are all controlled by the computer. The Mini-Mill system is supplied with a USB cable with the same type of connector at each end. It is a standard cable which can be purchased at any computer outlet, if you should misplace this item.

Do not attempt to connect the interface cable while either the computer or Mini-Mill is powered on. This may cause electronic failure to These electronic components. For your safety and the integrity of the equipment, turn all devices off prior to making any interface connection.

Setup the computer to be used with the machine and install the controller software. Refer to the **CNC Stepper Motor Control Box CS5SA8-1** manual for installation instructions. If at anytime you experience inconsistent table motions, or no table motions at all, check this cable to make sure it is properly installed.



Controller Connections



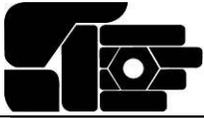
Follow these instructions to make the cable connections for USB interfacing, AC power in, motor and sensors

The Mini-Mill's **CNC Stepper Motor Control Box (Controller)** outputs DC current, and is supplied by AC current coming in from a 110 outlet (international 220 VAC). The power cord is equipped with a 3-prong ground plug that must be connected to a properly grounded receptacle for your safety. If an electrical failure occurs, the grounded plug and receptacle will help protect the user from electrical shock. Only use a properly grounded outlet when running your Mini-Mill.

NOTE: The power supply must be connected to a properly grounded receptacle for your safety

NOTE: Do not attempt to make any connections to the controller while the power supply is plugged in, or turned on. Unplug the power supply, and make sure the power switch is in the off (down) position.

1. Connect the supplied AC cable. One end goes to the wall outlet, the other goes into the receptacle marked AC IN.
2. Connect the interface cable from one of the computer's USB ports to the back of the controller, marked USB.
3. Stepper Motor Cables - These get connected to each one of the stepper motors. Each cable corresponds to a motor; match the X to the X motor, Y to Y, etc. The other end gets connected to the Controller – marked X Y Z A
4. The sensor cable gets connected to the RJ45 marked SENSORS
5. The other RJ45 marked Spindle will be covered below



Front

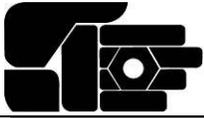
Power Switch - This is on the right side of the controller box. On is in the up position, off is down. A light illuminates when power is on.

Emergency Stop - This cuts the power to the stepper motors in case of a failure. Press this when you want the stepper motors to shut off.



BACK

AC IN - Connect the power cord from your wall outlet into this connector. It supplies the AC power for the controller.



Computer Interface - Connect the parallel cable from your computer into this connections
Stepper Motor Connections

Stepper Motor Cables - These get connected to each one of the stepper motors. Each cable corresponds to a motor; match the X to the X motor, Y to Y, etc.

The Mini-Mill has three stepper motors that control the movements of each table. Each stepper motor has a cable that leads from the motor's case to the controller box.

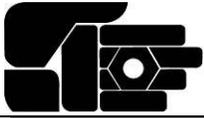
NOTE: Make sure all power devices including the computer, controller and spindle are turned off prior to making the stepper motor connections.

Take the lead of each motor and find the corresponding outlet. Snap the connector into the corresponding connector.

NOTE: The stepper motor connections are important. To assure you have made the right connections review the following diagram. Make sure the correct axis is connected to the corresponding axis port on the controller box.

Problem Solving: To check to see if AC power is getting to the controller power supply, turn it on and the red light switch should come on. If it does not, check the fuse on the back side of the power supply. If it is blown, replace it with the same power rating. Do not attempt to operate the power supply with out the properly installed fuse.

Problem Solving: Check DC power. There are two ways to see if DC power is getting to your Mini-Mill. One, you will hear and feel a fan come on, when the power supply is turned on. If no fan, check connections and retry. Second, when the power is turned on, the motors should be torqued and it becomes difficult to turn the lead screws by hand. If the lead screws are easy to turn (with the power on) you are not getting power to the interface card and the stepper motors.



Milling Basics

The Mini-Mill's three table motions are classified as X, Y and Z axes, and are standard to most industrial operations. Additional CNC programming terminology is explained in the CNC User's Guide. If you are not familiar with CNC program and controls, it is recommended that you study this prior to using the Mini-Mill system.

Types of Work

There are three basic types of work the Mini-Mill can perform; milling, drilling, and boring. Additional work with accessory items such as our Mini-Rotary Table is available for attaining machining of cylindrical objects.

Milling on the CNC Mini-Mill is usually accomplished with end-mills. These are the cutters designed to cut with both the sides and the end.

Drilling is accomplished by special CNC commands given to the mill. It is also recommended that center drills be used prior to drilling to achieve the maximum degree of accuracy.

Spindle Mechanism

It is important to note that you can overload the spindle motor. The many variables involved in machining, such as materials being machined, size and shape of end mill, sharpness, can lead only to one rule to follow Common Sense!

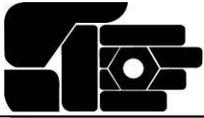
Heavy cuts at low RPM will make the motor run hotter than light cuts at high RPMs. In normal operations the spindle motor will run warm to the touch, but not hot. This does not mean your machine can not run at low RPMs, but only that the load put on the motor must be considered in each setup and operation of the machine.

Cutting Tools and Standard Accessories

End Mills

End mills are the standard vertical mill cutting tools. Your Mini-Mill was designed to employ miniature series end mills, having 1/8", 3/16", or 1/4" shank sizes. A 3/8" end mill holder is also available. We recommend using 2-flute, single-end, high speed steel end mills. The solid carbide tools are more expensive,

and the cutting edges will chip unless used properly. End mills may be purchased from industrial machine shop outlets or catalogs. As smaller diameter cutters (less than 1/8") are



quite fragile, the largest diameter cutter possible for the job requirements should be employed. Be certain that the RPM is appropriate before attempting to remove any material. An end mill can be instantly damaged if a cut is attempted at excessive RPM.

There are no firm rules other than common sense in determining the depth of cut. Commence with very light cuts, and increase depth of cut until satisfactory cuts are achieved.

Note that end mills should not be used for drilling; however, they may be employed to enlarge an existing hole.

Collet Set

The main purpose of the collet set is to hold end mills securely. The spindle nose has an internal Morse No. 1 taper, which closes the collet as the Draw bolt is tightened. Morse tapers are approximately 5/8" per foot and are self locking. Therefore, to loosen a collet, the draw bolt must be loosened a few turns, and tapped with a hammer to release.

Hold Down Provisions

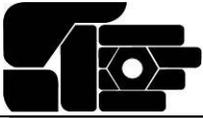
Some CNC Mini-Mills are supplied with a set of V-block clamps. This secures most materials to the surface of the mill's table top. The table top supports several 1/4-20 tapped holes separated at one inch centers for modular placement of parts. For additional hold-downs, it may be necessary to purchase a small manual vise. This can be fitted with bolts to secure it to the table.

Mini-Mill Operating Instructions

Minitex machines are among the finest tools that can be purchased for the price, along with offering the degree of precision found in machines costing several times more, they are capable of very precise and exacting work when properly employed. In short, we feel that this is the best possible product in its price range on the market today.

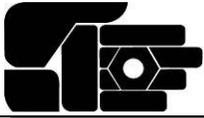
Follow these guidelines prior to operating your Mini-Mill:

1. The Mini-Mill is a small, light duty machine which should not be used for removing large amounts of material. For efficiency, select a piece of stock that is close to the finished size as possible.
2. Stresses on any mill are high when cutting most materials. These stresses cause most machines to be constantly adjusted for gib tightness and backlash. The Mini-Mill does not have these adjustments to make, because of its dual linear shaft design. It also supports a



zero-backlash lead screw nut that does not need adjusting.

3. End mills must be true and be sharp. Holding end mills in a drill chuck is a poor practice. Use collets instead.
4. For accurate setup, you should have and know how to use a dial indicator. The trueness of the spindle can be more accurately attained, which results in more accurate work.
5. Often, more time is spent on designing part programs and setup, than on actual machine time.
6. Always plan on having a start reference point from which to begin the job.
7. A good rule to follow is: if the tool chatters, reduce the spindle speed and increase the feed rate.
8. It takes a long time to accumulate the knowledge, tools and fixtures required for many different types of applications. Try not to become discouraged by starting with a job that is too complex or by using materials that are extremely difficult to machine.
9. Test your part programs and work in prototyping material first. This will reduce the cost of materials and allow you to practice machining. You can even test your programs without cutting anything, just let the machine go through the motions - cutting air.



The CNC Milling Machine

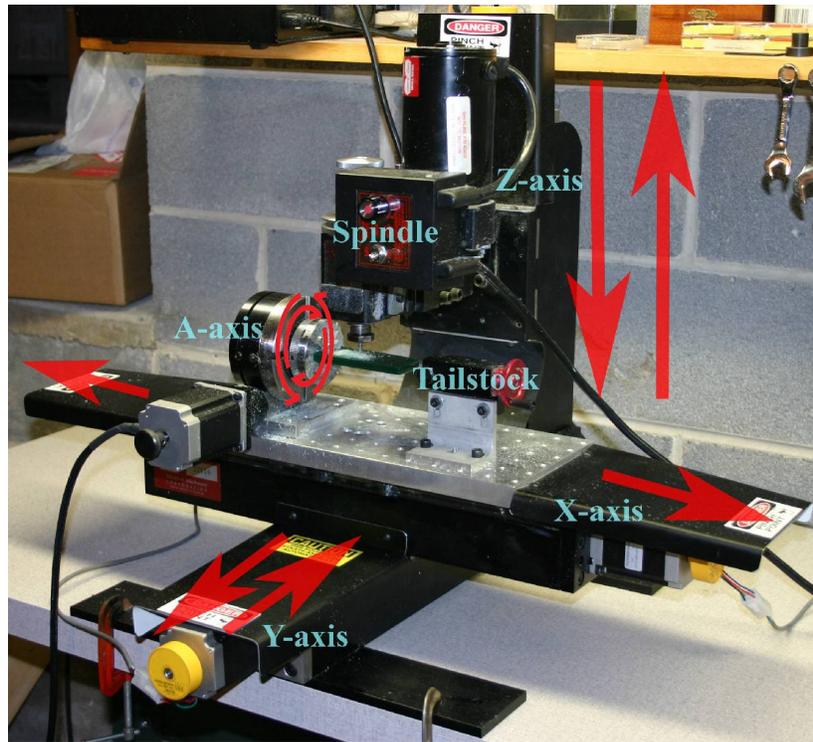


Figure 6: Mini-Mill 3

Parts of the Machine

Figure 6 is a photograph of the Minittech Mini-Mill 3. This particular model is a 4-axis vertical CNC milling machine. There are three linear axis; X,Y, and Z; and one is rotational, A. The figure illustrates the machine axis and their direction of movement.



Aligning the Machine Tool

The following processes are recommended for advanced users only. If these adjustments need to be made please contact your authorized dealer and a qualified service technician can perform this service. These machines go through a quality control process before delivery and these tests have already been performed.

Minitex nor its affiliates will be responsible for damage or injury done from use of these processes or use of the machine.

Alignment Tools

Ideally all parts of a machine are perfectly uniform, square, flat, and perpendicular or parallel to one another. The reality is that there are tolerances to which the machine is true. A machine can not create parts anymore accurate or precise than the accuracy or precision of the machine itself. So it is important that the machine be adjusted properly to obtain dimensionally accurate parts repeatedly. In order to do these adjustments and understand the nuances of your machine you will need a set of tools. The list of recommended tools is below.

Dial test indicator with 0.0005" increments

A steel parallel bar that is accurate and uniform

A steel round bar with center drill hole in end that is accurate and uniform

Hex key set

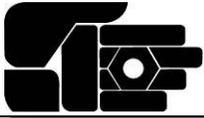
Shim material (rolling papers)

A micrometer with 0.0005" increments

With careful attention to detail and the processes illustrated below you will be able to use the mill to produce parts to tolerances of ~0.001".

X/Y Table Alignment Flatness

The first step is to test the flatness of the machine table. The table is not perfectly flat. It is good to know how flat it is so when mounting parts on the table you can make adjustments. This will become important when mounting material or a fixture like a tail stock or rotary axis on the table. In the pictures the red arrows indicate the direction the tool is moving relative to the table. Understand that the tool never moves except up and down, but the position of the machine is always referred to by the position of the tool tip. To test the flatness of the table the process is as follows.



1. Mount the dial test indicator in the spindle.
2. Jog the machine so the indicator is at the end of the table and lower the Z-axis so that the lever of the dial test indicator touches the table.
3. 3. Once the ball of the lever touches the table, make sure the needle moves at least a few thousands. Then zero the indicator.
4. 4. Jog the X-axis to the left.
5. As the table moves underneath the indicator note the change in height on the indicator.
6. You will see that the table is pretty flat but not perfect.
7. 7. Move the Y-axis so that the tool is at the front of table, set the indicator then move the Y-axis and note changes in height.

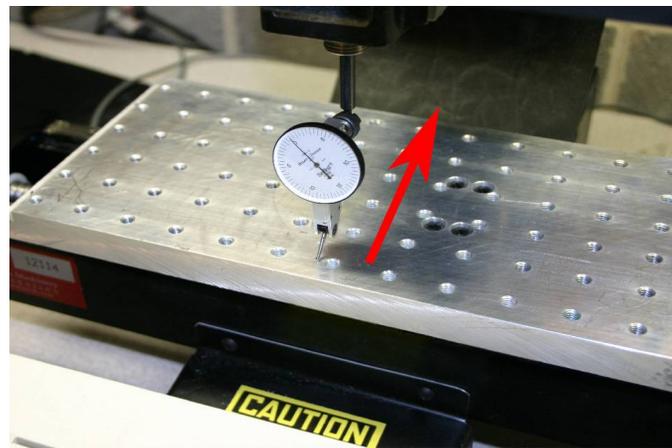
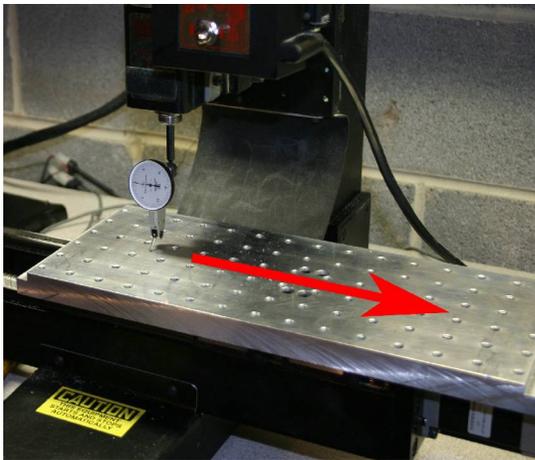
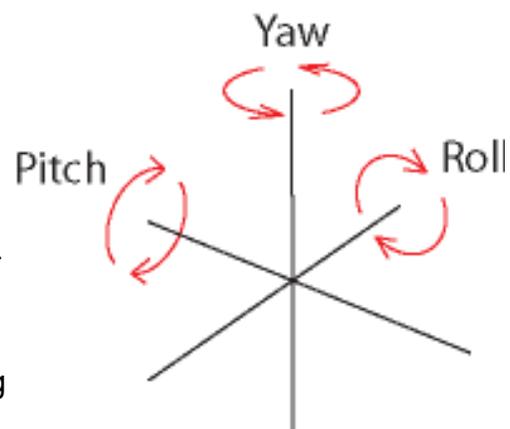


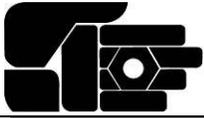
Figure 8: Measuring table flatness across x and y

Alignment

There are six degrees of freedom that need to be accounted for in aligning the machine table. They are the pitch, roll, and yaw. Pitch is the how perpendicular the machine bed is along the X-axis relative to the Z-axis. Roll is how perpendicular the machine bed is along the Y-axis relative to the z axis. Yaw is how perpendicular the machine bed is along the x-axis relative to the y-axis.

Adjusting the pitch and roll is possible by screw tightening





methods and shimming. Adjusting the yaw of the machine is not necessary and beyond the scope of the manual. The methods of measuring the pitch and roll are described below.

1. Place a precision parallel bar on the table. (pictured bar is flat/parallel to .0001" over 6")
2. Run the dial test indicator along the parallel bar noting the change in pitch.
3. Do the same for the roll.

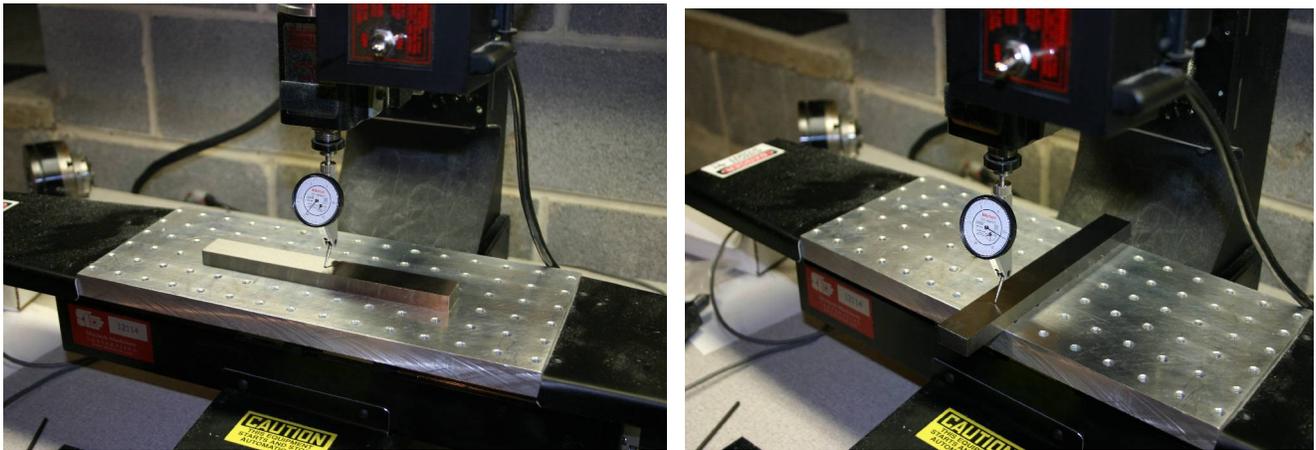


Figure 9: Measuring pitch and roll of table.

4. If for any reason the table must be removed or replaced it is important the table is properly installed to insure accuracy. This will require the loosening and/or removal of sixteen slide screws and the four screws which attach the table to the lead nut. Figure 10a shows the lead nut screws. Figure 10b shows the area to place the shim.

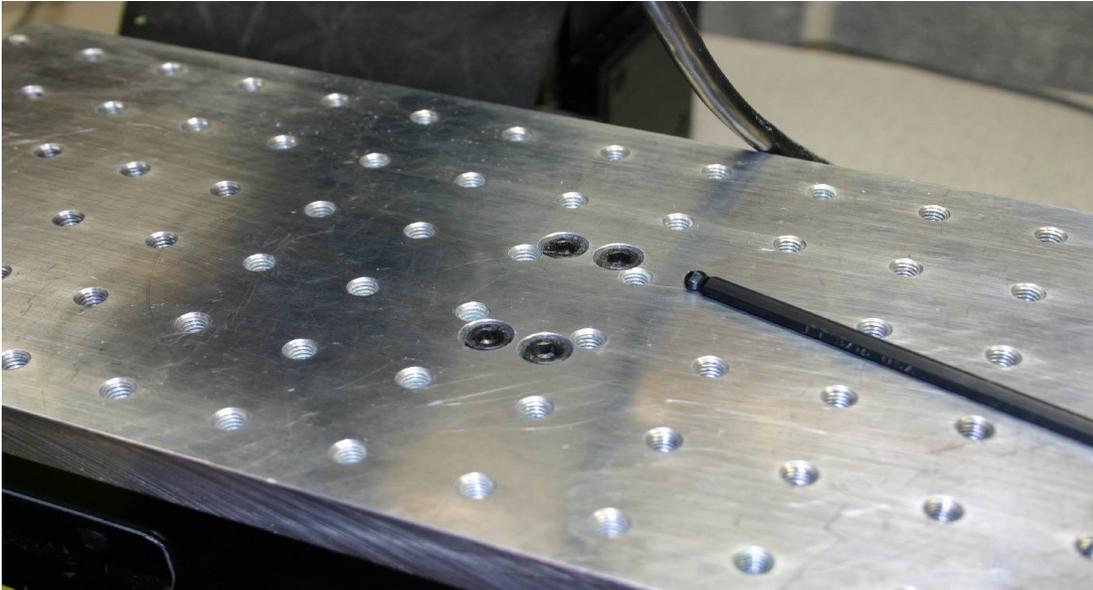
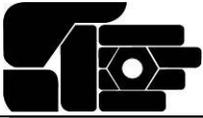


Figure 10a: Lead nut screws

The screw tightening pattern is the most important process in making this adjustment. The pattern illustrated in figure 11 will bring the table down evenly so it sits as flat as possible. The process is as follows:

1. Tighten all screws by number only using two fingers on the hex key. Do not crank them down real tight, it should be a soft snug. Figure 12 shows the pattern.
2. Make a second tightening pass to snug the screws down tight. Exclude the lead nut screws from final tightening (screws 1-4). They will be done in the following steps.
3. Once screws 5-20 are tight jog the table left and right a few times in the X direction. This will help to seat everything before the lead nut is tightened. Once done make final tightening of the lead nut screws in order.
4. Do a final check on the table pitch and roll to make sure you have done it correctly.

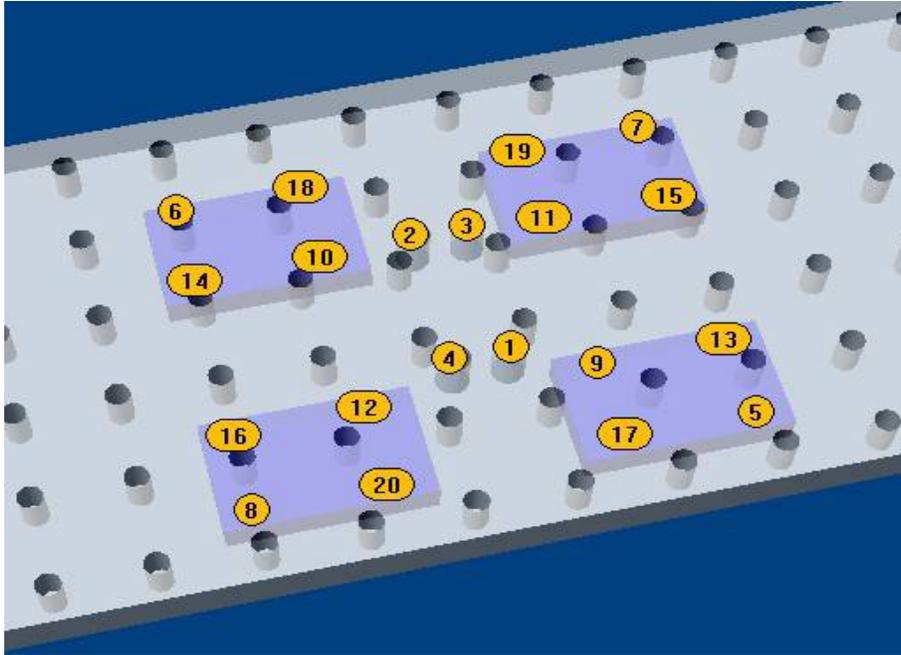
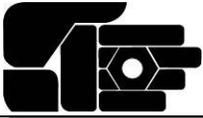


Figure 11: Screw tightening pattern.

Tramming the head

Tramming the head means to make the spindle perpendicular to the table. It is important that the table already be aligned before you begin this process. There are two directions that the head must be adjusted.

The tramming process is illustrated below.

1. Mount the dial test indicator in the spindle. (if you like you can put your parallel bar on the table and indicate off of it)
2. Orient your test indicator as shown in figure 12 and zero it.
3. Rotate the spindle in a half circle motion from left to right and check the indicator.
4. Adjust the spindle in a clockwise or counter-clockwise direction until the head is perpendicular, this is shown in figure 13.
5. The indicator needle should give the same reading at each end of the half circle. To adjust the spindle you will need to partially loosen the screws shown in figure 14.

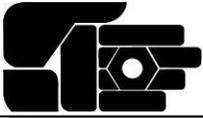


Figure 12

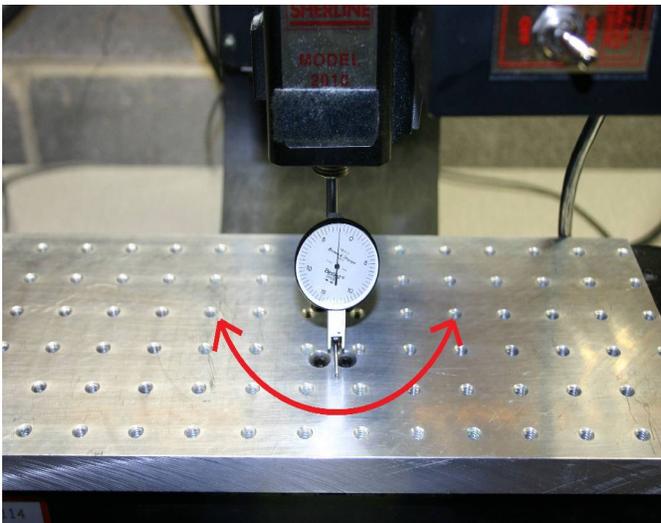


Figure 14

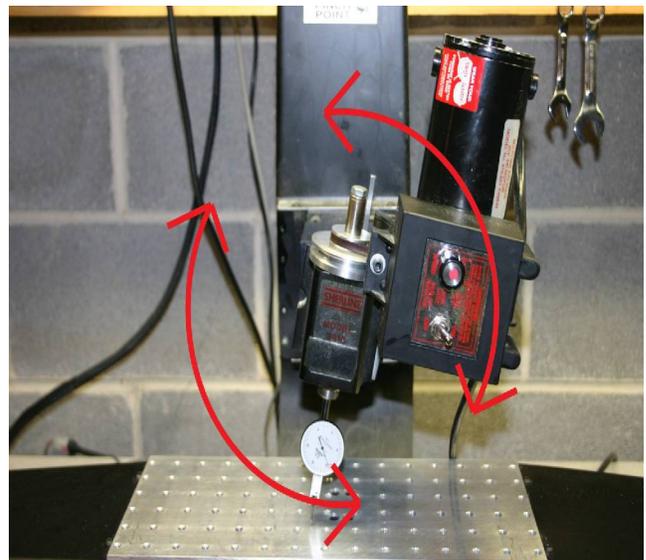


Figure 13

6. Orient your indicator as shown in figure 15 and zero it.
7. Now rotate the spindle with indicator in a half circle motion from front to back.
8. To adjust for this (figure 16) you will need to shim between the spindle and the mounting plate as shown in figure 17.
9. Once done spin the spindle in a complete circle and check the indicator ideally the needle should not move, re-shim or readjust as needed.

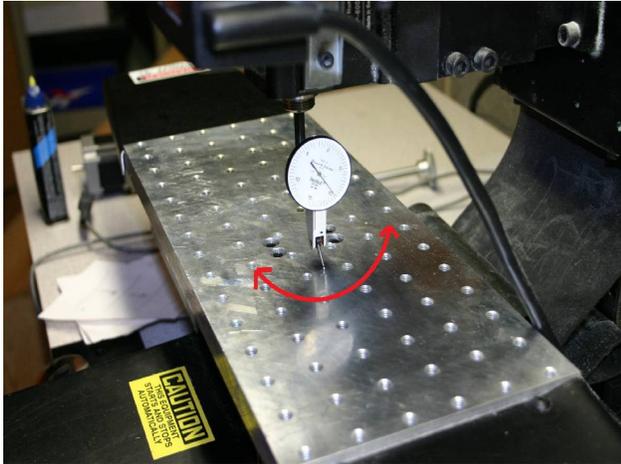
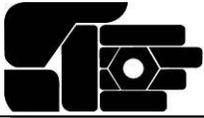


Figure 15

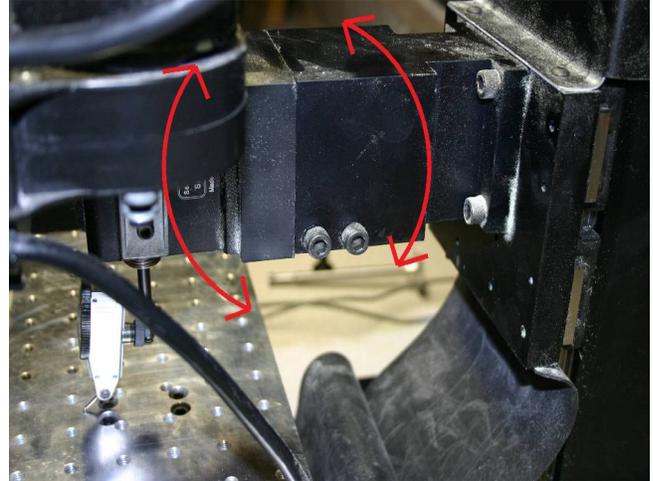
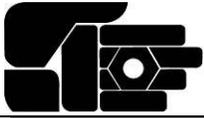


Figure 16

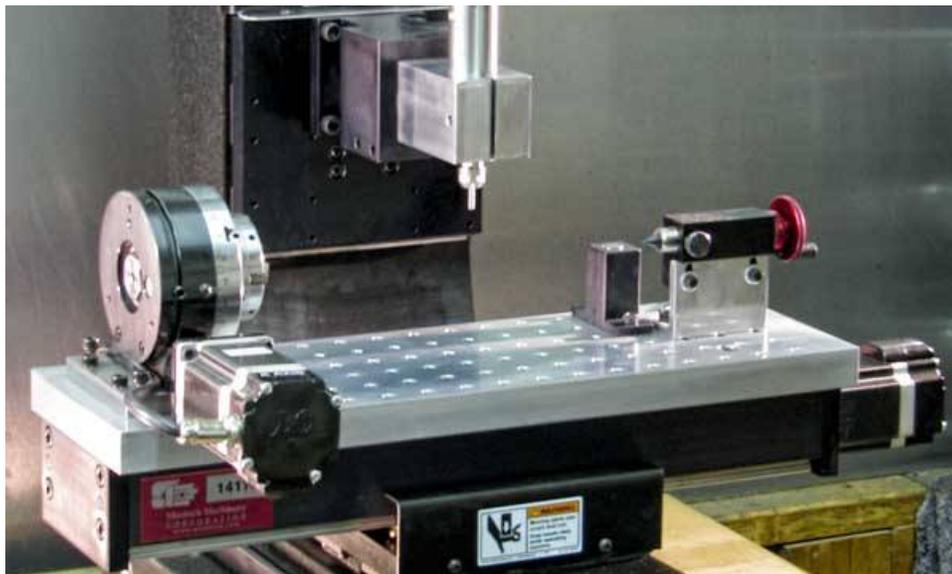


Figure 17



Rotary Table and Tailstock

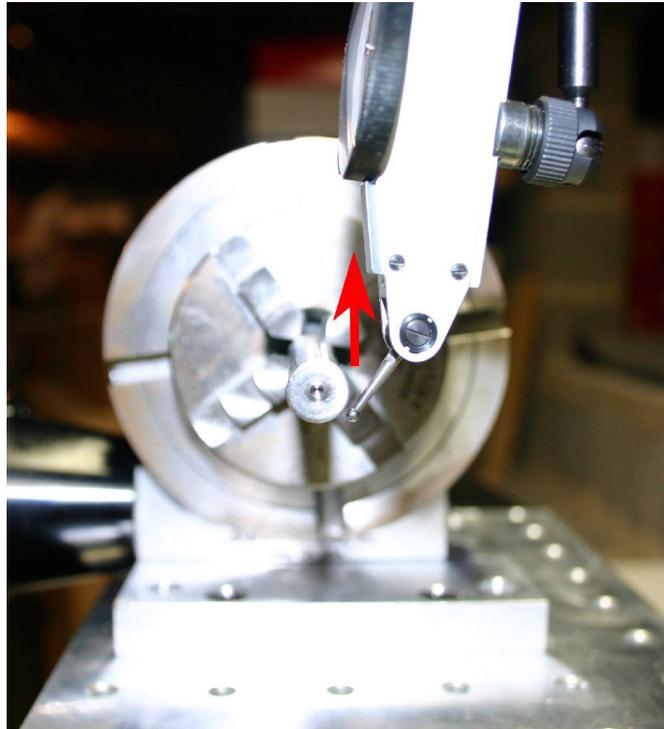
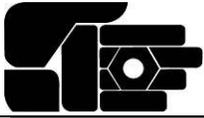
The rotary table and chuck are the 4th axis of the machine referred to as the A-axis. This part is used for cutting round objects or indexing. There are three alignments to be made to the 4th axis. It is normally mounted vertically on the left or right of the table parallel to the x axis. There are other orientations of the A axis which are useful, but the setup process for other configurations is similar and should be obvious if you can make it through this one.



Rotary Table and Tailstock

Run Out

The properties of concern are the concentricity of the rotary table and chuck, and the parallelness to the X axis. Setup the rotary table, chuck, and indicator with a straight round bar as shown in figure 20. To measure concentricity of the rotary setup make sure the round bar is properly fixed in the chuck. Rotate the A-axis 360 degrees, and note the change on the dial test indicator at the chuck and about an inch away from the chuck. The run out on the pictured setup was about 0.002" at about two inches out. If your run out is larger than you required part tolerances contact the manufacturer and this can possibly be adjusted.

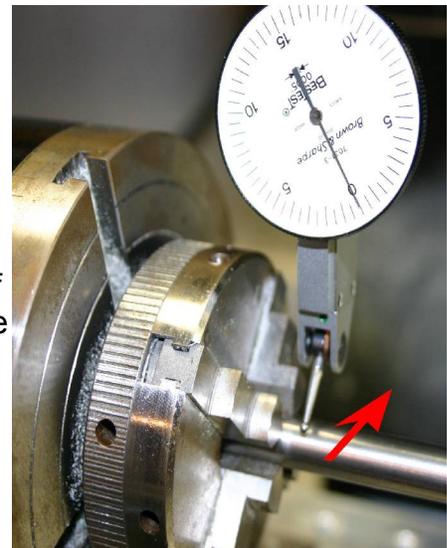


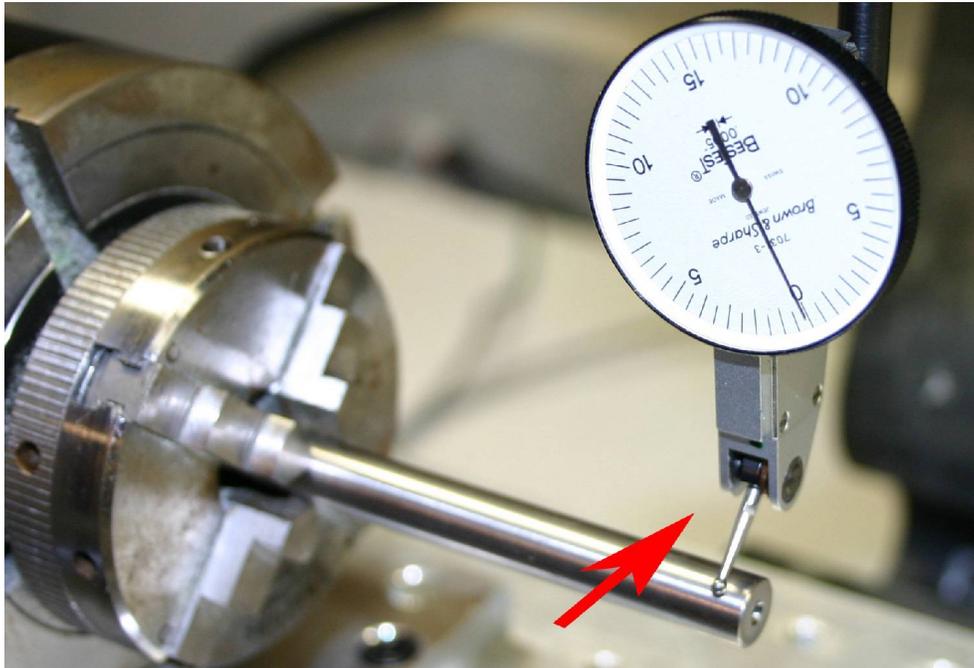
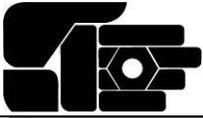
Alignment

The next step is to mount the A-axis parallel with the X-axis. This means the pitch and yaw of the A-axis will need to be adjusted properly. Follow the steps below to setup the rotary axis.

Figure 20: Run out check

1. Mount the rotary table on the XY table as parallel as you can by eye. Tighten the screws by starting with the front right, then back left, then back right, and then front left. This will help to insure that the mounting plate is level.
2. To check the A-axis pitch, indicate at the bar at the chuck face by moving the indicator lever overtop of and in front of the bar. Then slowly move the Y-axis toward the front of the machine and as the indicator drags over the bar note the highest point on the indicator as in the figure
3. Repeat this process an inch or two down the bar. Note the high point, as in figure 22.
4. Compare the points. If the first point is higher than the second then the bar is sloping down. If the second point is higher then the bar is sloping up.



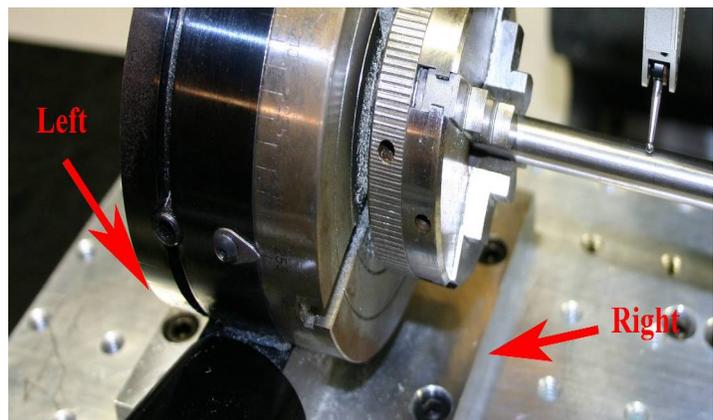


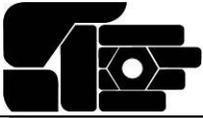
5. You can do this test a few times by rotating the A-axis and retesting. This way the run out can be considered.
6. To improve the alignment if your readings result in numbers much larger than the run out of the A-axis you will need to place a shim under the rotary table mounting plate. Place it on the right if the bar is sloping down and on the left if it is sloping up as in

After the pitch is adjusted the yaw of the rotary table needs to be aligned. This is done with the same setup and method but on the side of the round bar rather than the top.

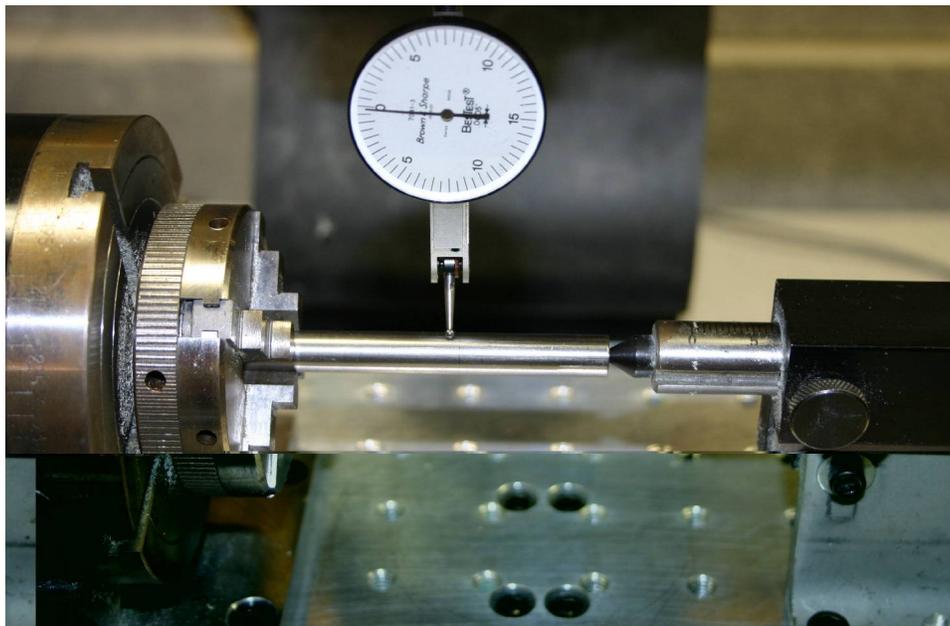
The method is described below.

1. To check the A-axis yaw, indicate at the bar at the chuck face by moving the indicator lever below and behind the bar. Then slowly move the Z-axis up and as the indicator drags over the bar note the highest point on the indicator as in the figure 24.





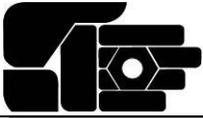
3. Repeat this process an inch or two down the bar.
4. Compare the points. If the first point is higher than the second then the bar is sloping toward the front of the machine. If the second point is higher then the bar is sloping away.
5. You can do this test a few times by rotating the A-axis and retesting. This way the run out can be considered.
6. To improve the alignment if your readings result in numbers much larger than the run out of the A-axis you will need to loosen the screws in the mounting plate and rotate the table.



You will probably have to repeat the alignment processes a couple times if you want to make it very accurate. You will need the same setup to align the tailstock to the center of the rotary axis. This time you will make use of the center hole drilled in the end of the round bar. The center hole is visible in figure 24.

To align the tailstock follow the steps below.

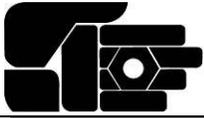
1. Move the tailstock tip into the center hole at the end of the round bar with the dial test indicator set on the bar. Probably best even closer to the tailstock end of the bar than in figure 25.
2. Note the change in the dial test indicator. Adjust accordingly.
3. You will need to check with the dial test indicator on top of and behind or in front of the bar. This will take into account the pitch and the yaw. Screws mounting the plate to the table will be loosened to adjust the yaw. The screw attaching the tailstock to the mounting plate will be loosened to adjust the pitch.



Setting Home and Probe Positions

The home switches and tool probe sensors are optional items used to Home the machine and check to the position of the tool's tip. This is an advanced feature for experienced operators.

1. Press Home All from the main screen near the Work Coordinates This brings the Z up to its highest position and stops. Then Y moves back to the switch and stops. X will then moves the table to the right, tool to the left and stops.
2. Use Jog to move the tool so it just presses the switch for the tool probe. A Green light will come up on the screen in the Tool section. This is the lower right side of the Main Screen.
3. Select the Tools/Fixture bottom from the Main Screen and it will lead you to a new screen. On the far right look for Tool Probe Position and press Set. This sets the position for the probe.
4. Press the Page UP key on your key board and raise the tool about 1/4" above the Probe. Make sure the Green light goes Off. This is the Probing Start Position and you need to press Set under the Probing Start Position.
5. Next use the Jog commands from the Main Screen to move the tool to your Fixture Home coordinate. This is usually the center of the rotary table, or a known start location for your part. Once in that position, press the Set button on the Fixture screen for Fixture1 This will set XY and store a hidden Z value. Note that Z Probe to Fixture height did not change it will be calculate by the software in the next step. You have 4 positions available for the Fixture home. Most users will only use the Fixture 1 (G54).
6. The next step is to press Probe 1st Tool. This will home all axes, probe the tool, and auto-calculate the Z to probe Height Value.
7. From here on you will use Home and Probe and Probe for tool setting, the first when starting up the machine the latter when changing tools during a machining operation.



Maintenance

Proper maintenance and tool cleanliness are major requirements in all industrial environments, as well as for anyone learning this type of equipment. The lessons practiced here with the Mini-Mill are required in any future application. To ensure safety reliable service from the Mini-Mill, it is important that you follow these recommended maintenance procedures.

Proper Work Site

The Mini-Mill and work site must be clean and free of obstructions before and after each use. The computer must be cleaned of all debris by brushing-off or vacuuming.

Clean Mini-Mill

The key points on the Mini-Mill where foreign matter buildup occurs are in the operating mechanism of the mill. These areas include the slide shafts and bearing sleeves, and the lead screws and lead screw nuts.

The user should brush, wipe or blow clear these areas, as well as all other areas where debris occurs. You can also remove the table top by unscrewing the four bolts exposed at each ends of the table. This allows you to gain access to the many places of debris accumulation, and the lead screw assemblies of the X and Y axes.

Note: The table top, and spindle mount are the only parts you should remove without damaging or misaligning the machine. Do not remove any other parts for cleaning.

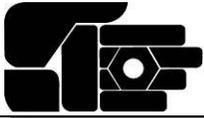
Examine Couplers

Periodically examine the stepper motor to lead screw coupling device. This is the black component that attaches the lead screw onto the shaft of the stepper motor. Two set screws are on each side of the coupler.

If these become loose, it will cause slipping of the table movements, and loss of motion. This will also cause errors on parts you are attempting to machine.

The following are the recommended procedures for examining and reattaching a coupler.

1. Turn off and unplug all electronic devices such as the computer, spindle mechanism, and DC power supply.
2. By hand turn each lead screw so that each axes is in the following positions. Lower the Z axis as far down

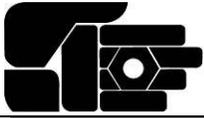


as possible, move the X and Y axes to approximate centers

3. Remove the table top by un-securing the bolts at each top-end of the table.
4. Complete the following procedures for all three couplers
5. Turn the coupler so that you can see the two set screws. Loosen the set screws with the proper Allen wrench. You do not need to remove the set screws from their tapped holes - just one or two turns.
6. Remove the four socket cap head screws from that attach the stepper motor onto the frame of the Mini-Mill.
7. Carefully withdraw the stepper motor with the coupler attached to the motor from the lead screw. Pull in through the hole opening without any sideways motion.
8. Examine the coupler and its secures to the stepper motor shaft. Notice that between the coupler and the motor face is a set of thrust bearings. Make sure the thrust bearings have no play in between the coupler and the motor face.
9. If there is any spacing between the thrust bearings, loosen the coupler's set screws and push coupler onto the motor so there is no spacing.
10. Re-tighten coupler by tightening both set screws a little at a time until both become tight. Do not tighten one all the way and then the other.
11. Replace the motor onto the Mini-Mill.
12. Tighten the two set screws attaching the coupler to the threaded lead screw Lubricating the Machine Make sure to lubricate the machine. Lubrication frequency will depend on the environment and the use of the machine.

Lubrication directions are below.

1. Use lithium grease and/or 3and1 oil on the rails on the X,Y, and Z.
2. Use 3and1 oil on the ball screws. It will be necessary to remove the way covers to gain access to the ball screws.
3. Also use 3and1 oil on the rotary axis there is an oil port on the face of the rotary table.



Service and Support

If the Minitex CNC Mini-Mill malfunctions in any way, be sure to check the system's hardware thoroughly first. Then, you may call a Minitex service technician by telephoning 1-800-662-1760.

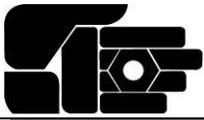
When you call, please include the following information:

1. The date of purchase and authorized dealer's name
2. The purchase invoice number
3. A full description of the problem as best described
4. Your mailing address and telephone number

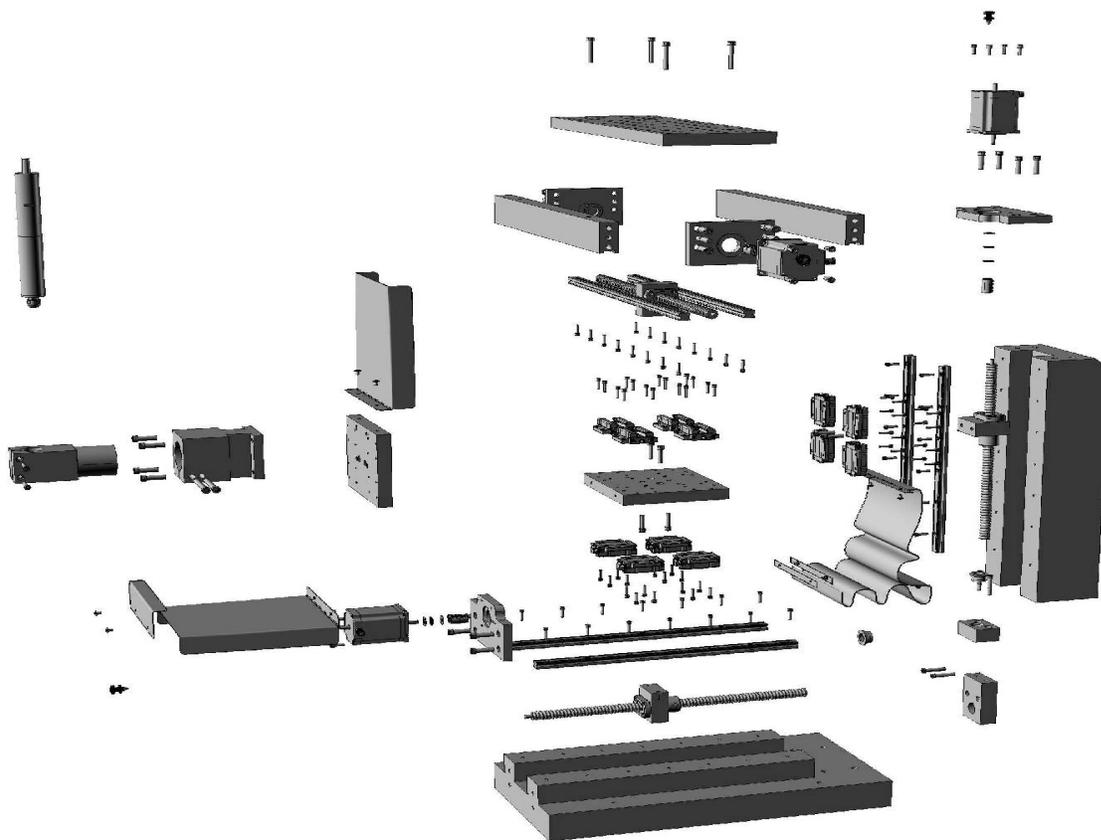
The service technician may be able to determine the problem without the need for returning any parts. If the return of a component is necessary, please include the above information in a note with the defective part. Do not return any components, hardware or courseware without prior authorization from Minitex. This authorization will take the form of a Return Merchandise Authorization (RMA) number issued by the Minitex technical support representative.

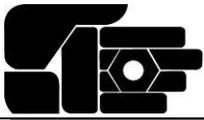
When returning products to Minitex, write the RMA number clearly on the outside of the shipping carton, in a conspicuous place. Ship the component in a suitable shipping carton prepaid and insured to the address shown below. If you do not have a suitable carton, Minitex will provide you with one.

Minitex Machinery Corporation
Attn: Service Department RMA _____
6050 Peachtree Parkway Suite 240-205
Norcross, GA 30092



Drawings of the Machine Components





Drawings of the Machine Components

