

SHOPMASTER OWNERS MANUAL

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2015 MILL TURN VFD



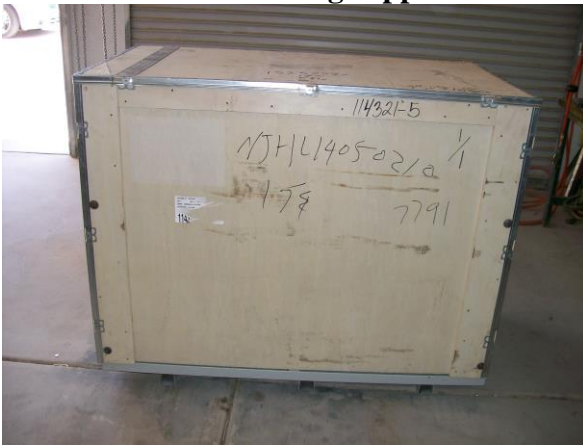
Dear owner, thank you for choosing SHOPMASTER. This owner's manual is being sent to you in .PDF format prior to the delivery of your machine so that you can be prepared for its setup upon arrival. As the owner, you may print out a hard copy of this manual or have a bound copy done at a local office supply house for your personal use. Copying or printing the manual for sale or distribution to others is prohibited.

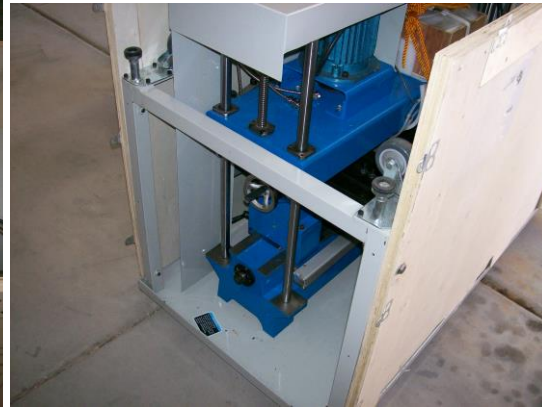
INSPECTION OF CRATE UPON ARRIVAL

Your machine will arrive at your destination by truck freight. The driver will ask you to sign the delivery slip. Before you sign, please inspect the crate carefully for any signs of rough handling such as holes, broken pieces etc. Because the machines travel a great distance from the factory to you, scuff marks, scratches and small chips in the crate are normal. However there should not be any panels broken loose or holes punched through the wood exterior. The machine sits on 3 steel tube skids, designed to allow movement by forklifts, and some dents on the edges are normal. However, any skids that appear to be bent over or compressed are an indication of the unit having been dropped. The slight dents will not show once the bench assembly is completed. After you have inspected the machine, and if you find anything you feel is out of the ordinary, make a note on the delivery slip when you sign and also document the issues with photos.

OPENING THE CRATE AND TAKING INVENTORY

You will see that the wood crate has bend-over metal locking tabs holding the components together. Using a screwdriver and pliers, straighten out the tabs and remove both ends and the top of the crate. The sides of the crate are secured to the bench legs with 10 mm bolts. You will need a ratchet and socket (17 MM or 11/16) to remove the bolts. Set the bench panels aside and save the bolts. You will find the rear sheet metal panels for the bench and the 2 doors secured inside the crate, remove them and set them aside. The 2 end panels are already installed. You can now see that the bench leg assembly is mounted upside down on the base, which allows it to form a strong support for the crate.





At this point you should look over the machine for any signs of damage that may not have been apparent while it was crated and document them by photos. You will find the PC and monitor in a box containing the standard tooling and another box containing the keyboard, mouse, digital tachometer and cables. Open the box and compare the contents to the list of standard accessories that was posted on our website before you placed your order. Make a note of any missing items and send us an e-mail detailing those and any damage you may have found. Also inventory any extra tools that you ordered with the machine which we place inside the crate before shipping. If any items are on back order, you will find a list placed inside the crate. Set the PC, monitor, keyboard, mouse and cables aside for now.

**MILL TURN PACKING LIST
INSIDE YOUR CRATE YOU SHOULD FIND:**

- 1. PC and Monitor mounted in box of tools.**
- 2. Sheet metal panels and doors for bench**
- 3. 1 Morse 3 center for use in tailstock**
- 4. Keyboard, mouse and cables for PC**
- 5. 1 Morse 3 drill chuck arbor for use in tailstock**
- 6. 1 Morse 4 to R-8 adapter sleeve**
- 7. 1 set hex wrenches**
- 8. 1 set allen wrenches**
- 9. 1 3 jaw chuck (installed on machine) plus chuck key and 3 extra jaws**
- 10. 1 Quick change toolpost and 5 holders**
- 11. 2 ½" drill chuck and key**
- 12. 1 R-8 drill chuck arbor and drawbar**
- 13. 3 High speed steel end mills-**
- 14. 6 piece set of carbide tipped lathe cutting tools**
- 16. 1 TTS style collet chuck**

17. 3 ER 20 collets
18. 1 R-8 collet for holding the TTS style collet chuck
19. Plastic bag of fasteners for bench panels and keys for door locks
20. 1 special wrench for spindle
21. 2 drawbars 12MM and 7/16-20 threads

**** Some early production machines have a Morse # 4 taper in the mill spindle and are fitted with a Morse #4 to R-8 adaptor, a**

**SHOPMASTER MILL TURN
WARRANTY REGISTRATION**

SERIAL # _____

DATE OF PURCHASE _____

DATE OF DELIVERY _____

**PLEASE TAKE TIME TO RECORD THIS INFORMATION, AS
IT WILL MAKE SPARE PARTS ORDERING FASTER.**

LIMITED WARRANTY

***FOR 36 MONTHS FROM THE DATE OF PURCHASE, SHOPMASTER
WILL SUPPLY REPLACEMENT PARTS FREE OF CHARGE IF SHOWN TO BE
DEFECTIVE IN MATERIAL OR WORKMANSHIP.***

***THE REPLACEMENT OF PARTS DOES NOT INCLUDE OILS, GREASES, BELTS
OR CUTTING TOOLS WORN DURING THE COURSE OF OPERATION. THIS
WARRANTY DOES NOT INCLUDE CLEANING OR ANY DAMAGE CAUSED BY
ACCIDENT, NEGLIGENCE OR MISUSE AND CEASES WHEN THE MACHINE IS
SOLD, RENTED OR OTHERWISE DISPOSED OF. THE MACHINE OR ITS
COMPONENTS MUST BE SHIPPED FREIGHT PREPAID TO THE ADDRESS
SHOWN BELOW ALONG WITH PROOF OF PURCHASE.***

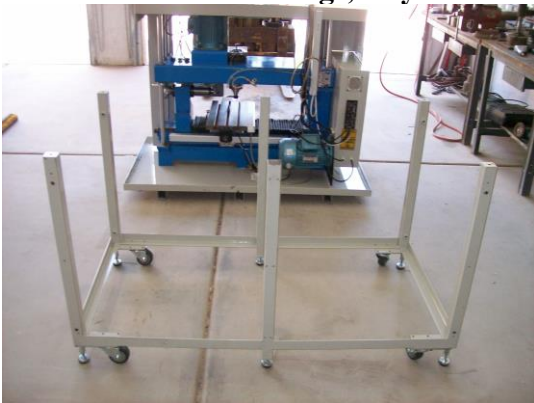
***THIS WARRANTY DOES NOT COVER ANY INCIDENTAL OR CONSEQUENTIAL
DAMAGE.***

***Please note: In some cases we will send parts immediately upon the customer's
request, but failure to return the defective part within 30 days will permanently void
your warranty and return policy.***

***SHOPMASTER
7839 NORTH TORREY PINES DRIVE
LAS VEGAS, NV. 89131***

ASSEMBLING THE BENCH

Now it's time to remove the bench leg assembly which is held in place by 6 bolts threaded up from below the bench pan into the 6 legs. Remove these 6 bolts and the leg assembly can be lifted off the pan. The leg assembly is not heavy, but due to its size, its best to have someone help you so you can lift it straight up and off the machine. Be cautious here that you do not bang the leg assembly against the machine and chip the paint or break any of the control knobs. Once the leg assembly is clear of the machine, flip it over so that it is sitting on the 6 leveling pads. Be sure that it is resting solidly on the pads, not on the casters. Also be sure to orient the leg assembly so that when you lift the machine onto it, the front portion faces the front of the machine. You will see that on one side, the center leg has 2 tabs welded in place on each side. These are the plates for the door latches, so this leg should face the front of the machine. **NOTE:** Install the 2 doors before lifting the machine onto the legs, or you won't be able to fit the hinge pins into place.



Now it's time to lift the machine up onto the legs. If you have a forklift, it will be easy to just pick the machine up and slide the legs under it. If you are using an overhead hoist or a roll around "cherry picker" style hoist, then you will need to place your straps or chains under the bench pan and get them secured in position so that the machine is balance when lifted. Protect the machine finish by placing towels between the straps or chains and the machine. Also be sure none of the lifting straps bind against handles, sheet metal etc. At this point, move with care and caution as you raise the machine up. Do not get your hands or feet under the machine and keep others away while you proceed. Once the machine is high enough, slide the leg assembly under it, again noting the position of the front of the bench. Slowly lower the machine down until it is almost resting on the legs and then

thread the 6 bolts down through the bench pan into the legs. Lower the machine down completely until it is resting solidly on the legs and remove your lifting mechanisms. Leave the 6 bolts just finger tight for now. Don't be concerned if the assembly seems a bit unsteady at this point.

In your box of accessories you will find a bag of fasteners for the panels. Place each back panel in place and get all the bolts started, but not tight. Now you may go around and begin tightening all the fasteners for the sheet metal panels, all the while checking for squareness and even gaps. Once done, your doors should open and close freely and the latches should catch the tabs on the center leg when closed. You will also now see that the assembly has taken on a very strong and solid feel. Now you can tighten each of the 6 bolts holding the bench pan to the legs, but first, put a bead of silicone sealer around each hole to prevent leaks if you use a coolant system. Once those 6 bolts are sealed and tightened, your bench should be rock solid. Finally, open the front doors and double check the tightness of the 6 bolts holding the machine to the bench pan. The bolts are accessed by holes in the 3 skids. These bolts are sealed at the factory against leaks, but it's possible that they may have vibrated loose during transportation.

ADDING SHELVES AND DRAWERS

While your machine is still in the open and accessible from all sides, you may want to add some shelves and/or drawers. A lower shelf is easy to measure and cut, and by removing one end sheet metal panel it can be slipped into place. You can even use the crate material by gluing 2 panels together and stacking some cinder blocks on them while the glue dries and then cutting them to size. You can also buy drawer assemblies, or use one of those low cost toolbox units sold at discount stores placed inside the cabinet and resting on the lower shelf. There are plenty of variations of shelves and drawers to suit your own style. The openings behind the doors are 24" wide, 25" tall and 25" deep.

CHOOSING A LOCATION AND WIRING

Now that your machine is all prepared to move into place, you need to decide on its placement. Keep in mind access for future maintenance and cleaning. Ideally, you should be able to walk around the machine, but we know that many of these machines are going into home garages where space is limited. With the casters, you can easily move the machine around should the need arise. Keep in mind that the access panel for your electronics is on the left as you face the machine and should you be turning long parts in the lathe which protrude through the spindle, you will need some space on the left side. You definitely do not want to place the left side in a corner. Once you have chosen your location, it's time to run your wiring. The machine comes with an 8' long cord wired to a NEMA 6-15 220 volt plug. The NEMA 6-15 is a common plug found at any home improvement store and you can find the corresponding outlet as well. You will only need a 15 amp 220 volt circuit for the machine. The cord comes out the back of the machine on the left side about 36" from the floor. Measure out your location and have your outlet wired so the cord can reach. (use of a 3-4' extension cord of sufficient wire gauge is acceptable if necessary) The outlet should be about 48" from the floor. You will also need a 110 volt outlet near the machine for the computer and monitor and any lights, fans etc. you may want to use.

MOVING INTO PLACE AND LEVELING

Now that you are all wired and ready to move the machine into place, screw the adjustable legs up into the bench legs until the machine is resting on the casters. Now one person can easily roll the machine around. However, be careful and move slowly because the machine is very top heavy, and even a small nut or bolt could stop the caster and cause the machine to tip over if rolling too fast. Sweep up your entire area before beginning the move. If you are mounting the machine close to the back wall, be sure to release the computer mount and swing it out toward the front of the machine before getting up close to the wall. Once you are in the chosen place, begin screwing the adjustable levelers out of the bench legs until the machine is lifted off the casters. Most shops have concrete floors, but in the unlikely event you are on a wood floor, you should cut some 6" X 6" steel pads to place beneath the levelers to spread the load. Mark the place on the floor with paint or sharpie so you can always return there if you should need to move the machine. If you have a machinist's level, that is great, but a good quality carpenter's level will work as well. Place the level on the top carriage of the machine and begin to adjust the levelers until you are level left to right, forward to back and at 45 degrees to both positions. The machine castings are very rigid, and there is little chance of distortion as long as all 6 legs are planted firmly on the ground. Once the machine is leveled and in place, look to the top corner of the upper cover toward the rear of the machine. You will see 2 holes in the sheet metal cover leading to a hole in the framework. This is for the attachment of an "earthquake" strap. From each of these holes you can run a metal brace back to the wall to tie the top of the machine in place. In the unlikely event of an earthquake, they would keep the machine from tipping over. As a bonus they add greatly to the rigidity of the milling head assembly.

REVIEWING THE CONTROLS

For now, leave the machine unplugged from the wall and take some time to review the controls. You will notice that the DRO display was mounted upside down during shipping in order to clear the bench legs. At this point you can remove the nut from the mounting stud and turn the display right side up. The functions and features of the DRO are covered in the DRO manual itself. The mill head was placed at its lowest level for shipping, so you can now unfold the handle from the wheel and move the mill head upwards manually to about half way. There is no lock on the travel, as the stepper motors lock it into place when energized. You can also move the Y axis forward and back and the X axis left and right until they are in the mid way position of their travel, but be sure to loosen the carriage locks. On the front panel to the left are all the controls for the spindles and CNC. Your machine PC has been pre-configured as well as the VFD inverter, so your machine will be fully functional when you get ready to turn it on.

Toward the top of the front left panel is the VFD keypad and display. In the delivered setup, all the functions of the VFD are controlled through Mach 3, and the display will simply read the Hz reading going to your motors. Please note, this is not the RPM of the spindle, that will read on your Mach 3 screen. This key pad can also be configured for manual control with the small knob and the buttons. This is all covered in the NOWFOREVER manual. Below the VFD Key pad are the machine

controls. The top left switch is for selecting which spindle will run. Later on you will note that when selecting the lathe, you will hear a snap sound from the inside of the panel- that is the magnetic contactor engaging. To the right of this switch is your main power switch for the VFD inverter and the spindle motors. When this switch is on, you will also have the red light on. Below these switches in the center is the E-Stop switch. This switch shuts off all power to the VFD inverter as well as the Gecko drive, so in the event of a crash, all you need to do is push the red button in. To re-engage the switch you just turn it clockwise, but be sure to read the instruction and turn off all other switches first. Below the E-Stop and to the left is the power switch for the Gecko drive. When this switch is on, your CNC system is activated. To its right is the stepper motor switch. With the CNC on and the stepper switch on, the stepper motors are locked in position and can only be moved by Mach 3. If you want to move the carriages manually, you must turn the stepper switch off. Check each switch and watch to be sure it is properly “clocked” so the white stripe points to the proper place on the decal. On the panel at 90 degrees to the switches you will find the flow regulator for the air cooled spindles. You will also note that after flowing past the spindles, the air exits through a flex nozzle which can be used as a coolant for the cutting tools. Opposite the controls on the rear of the panel you will find the inlet for the spindle air. PLEASE NOTE- the spindles will work fine without the air coolant, but if you want to use this feature you will need to install 2 things-

1. A pressure regulator
2. An air drying system

Too much pressure could blow the seals out of the bearings and moisture in the air could corrode the bearings.

Above the air inlet is the Gecko drive to which the computer and stepper motors are attached. You will see that X, Y and Z axes are hooked up, and A axis is open for use with other CNC tools like the rotary table. Make sure all the cable securing screws are still tight after shipping. You will also see a small slide switch marked CHARGE PUMP. This should remain in the ON position. The charge pump is a safety feature that prevents the machine from moving suddenly if you forget to boot the computer prior to turning on the CNC power. Above the Gecko drive is the auxiliary coolant fan inlet. The system has 3 fans altogether to keep the operating temperature at the proper levels.





INSPECTING THE ELECTRONICS

Before plugging the machine into the power, it's a good idea to look inside the control cabinet. This will give you an idea what's inside and how it all works. Remove the 4 bolts holding the panel in place. Looking inside and starting at top left you will see the auxiliary cooling fan which pulls air from outside, blows it across the electronic components and then it exits out down over the X axis stepper motor. To the right of the fan is the CNC power supply. This converts 220 volts AC into 48 volts DC for the Gecko drive. To the right of the power supply is the module for the spindle sensors which send signals to Mach 3 for RPM reading, threading, tapping etc. To the right of the module is the back side of the VFD keypad with the ribbon cable running back to the VFD inverter. Just below the fan is the Gecko drive with wires running to the inverter, switches and power supply. To the right of the Gecko is the VFD inverter which takes the 220 volt single phase input and converts it to 380 volt 3 phase output for the motors. The inverter also accepts signals from Mach 3 to control the spindle speeds, forward, reverse etc. To the right of the inverter is the magnetic contactor that switches the 3 phase output to either the lathe or mill motor. The inverter and the power supply each have their own cooling fans as well as temperature sensors that shut down in case of overheating. You will also see the air coolant piping going to the flow regulator. In the central panel where the lathe spindle and drive belt are located you can see the lathe spindle sensor mounted to its bracket. Note that this section is sealed off to prevent any chips or debris from belt wear entering the electronics components. To the far right you see the backs of the control switches and you can see the white tab which allows the switch portion to disconnect from the knob should you need to do maintenance. At the bottom right you see the X axis stepper motor and drive belt going to the pulley on the end of the X axis ball screw.



While the end panel is open and power disconnected you should check the drive belt tension, stepper belt tension and adjust any switch knobs that are not properly “clocked”.

NOTE: At this time please read and follow the procedures outlined in the service bulletin that was sent along with this manual.

SAFETY RULES FOR THE MILL TURN

WARNING -- DO NOT ATTEMPT TO OPERATE UNTIL YOU HAVE READ THOROUGHLY AND UNDERSTAND COMPLETELY ALL INSTRUCTIONS AND RULES CONTAINED IN THIS MANUAL. FAILURE TO COMPLY CAN RESULT IN ACCIDENTS INVOLVING FIRE, ELECTRIC SHOCK, OR SERIOUS PERSONAL INJURY. MAINTAIN YOUR OWNERS MANUAL AND REVIEW FREQUENTLY FOR CONTINUING SAFE OPERATION AND INSTRUCTING POSSIBLE THIRD-PARTY USER.

1. KNOW YOUR MILL TURN MACHINE

For your own safety, read the owner's manual carefully. Learn its application and limitation as well as the specific potential hazards peculiar to this tool.

2. NEVER ATTEMPT ANY OPERATION OR ADJUSTMENT IF THE PROCEDURE IS NOT UNDERSTOOD.

3. KEEP GUARDS IN PLACE AND IN WORKING ORDER.

4. REMOVE ADJUSTING KEYS AND WRENCHES.

Form habits of checking to see that keys and adjusting wrenches are removed from the MILL TURN before turning on the machine.

5. DON'T USE IN DANGEROUS ENVIRONMENT.

Don't use the MILL TURN in damp or wet locations or expose it to rain. Keep work area well illuminated.

6. DO NOT REMOVE DRIVE COVERS WHILE IN OPERATION.

7. DON'T FORCE TOOLS.

It will do the job better and be safer at the rate for which it was designed.

8. WEAR PROPER APPAREL.

No loose clothing, gloves, neckties, rings, bracelets, or jewelry to get caught in moving parts. Non-slip footwear is recommended. Wear protective hair covering to contain long hair.

9. ALWAYS USE SAFETY GLASSES.

Every day eyeglasses only have impact-resistant lenses. They are NOT safety glasses.

10. SECURE WORK.

Always secure your work to the table with clamps or vise- NEVER attempt to hold a part by hand.

11. DON'T OVERREACH

Keep your balance and proper footing at all times.

12. MAINTAIN TOOLS IN TOP CONDITION.

Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.

13. DISCONNECT TOOL FROM POWER SOURCE.

Before servicing and when changing accessories such as bits or cutters.

14. AVOID ACCIDENTAL STARTING.

Make sure switch is in "OFF" position before plugging in cord.

15. USE RECOMMENDED ACCESSORIES.

Consult the owner's manual for recommended accessories. Use of Improper accessories may be hazardous.

16. CHECK DAMAGED PARTS.

Before further use of the MILL TURN, a guard or other part that is damaged should be carefully checked to ensure that it will operate properly and perform its intended function-check for alignment of moving parts, binding of moving parts, breakage of parts and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.

17. DIRECTION OF FEED.

Only feed work into a cutter against the direction or rotation of the cutter.

**18. NEVER LEAVE YOUR MILL TURN RUNNING UNATTENDED.
TURN POWER OFF.**

Don't leave the machine until it comes to a complete stop.

**19. NEVER PERFORM AN ABNORMAL OR LITTLE USED OPERATION
WITHOUT STUDY AND USE OF ADEQUATE BLOCKS, JIGS OR
FIXTURES.**

TEST RUN THE MACHINE

To begin the first test run of the machine, bring the computer mount around and adjust it to a comfortable position. Hook up the keyboard and mouse and the monitor and Parallel port cables. Plug the monitor and PC power cables in to the 110 volt wall outlet. Turn the PC on. It should boot up and on your desktop screen you should have 2 icons. RECYCLE BIN and MACH LOADER. Double click Mach Loader and then select machmill. The mach 3 screen should load up at this point. Now make sure all your switches on the machine panel are in the OFF position and plug your 220 cord into the 220 outlet. Set the selector switch to MILL mode and turn on the SPINDLE POWER switch. You should get a red light and hear the auxiliary cooling fan running. Turn on the CNC POWER switch and you should get a red light and also hear the power supply fan running. Turn on the STEPPER switch and you should hear the steppers jump to locked position. You should not be able to turn the handles at this point. The DRO display may or may not light up at this point. It is hard wired into the power switch, but also has a separate ON-OFF switch on the back of the display. On the lower left of the Mach 3 screen you will see a reset button flashing- click on this to reset. Note- every time you turn off the stepper switch, the reset will flash and you will need to reset it. Once the reset button is reset, go to the top of the screen and select MDI (Manual Data Input). A bar will open up for data entry. First type G91 and hit enter. G91 is the code for incremental moves. Now type G0 Z1 and hit enter. The mill head should move up 1". Now try G0 Z-1 and hit enter. The mill head should move down 1". Try the same commands for X and Y axes according to the chart on the right sheet metal shield.

PLEASE NOTE: The command is G "ZERO" not G "OH"

Now try a spindle command- type M3 S200 and hit ENTER. The mill spindle should turn at 200 RPM. Type M5 and hit ENTER to stop the spindle. Type M4 S200 and the spindle should rotate the opposite direction. Always use M5 to stop the spindle.

Close out of machmill and go to Mach Loader- select machturn. Switch the MODE switch to Lathe (you should hear the contactor snap).

Hit the reset button and in machturn select MANUAL and type in G 91

Now try some G0 commands as you did in mill, but be aware that the axes have different designations in TURN as shown on the decal on the right panel. You can also give the spindle some M3, 4 and 5 commands. On your DRO screen, you can set all axes to zero and then compare the readings with commands you have given. As your spindle is running, on the Mach 3 screen you will have a display that shows the RPM you requested and another display showing the true rpm as read from the spindle sensor. These should be very close, but can be adjusted in the CONFIG files. At this point you are ready to begin the final adjustments of the spindle rpm, steps per inch and backlash compensation as well as installing your Mach 3 license. We have sent you a number of files for these operations along with this manual. We have set the adjustments as close as possible, but every machine will be slightly different and once installed in its final location these fine adjustments must be completed by the operator.

NOTES ON CNC, DRO AND BALL SCREWS

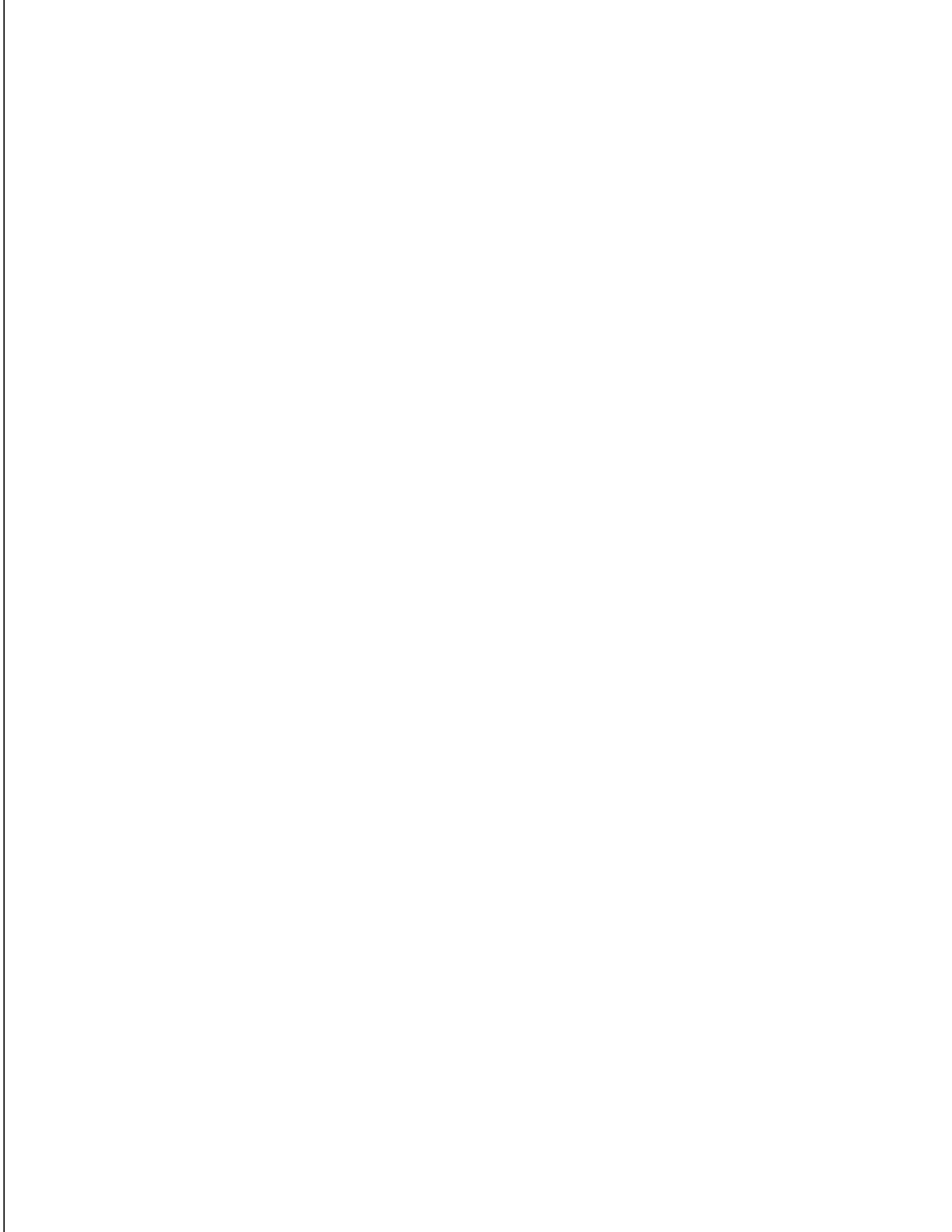
Your DRO system has been installed at the factory and is hard wired into the main panel. When you turn on the main power switch the DRO may or may not come on right away. If it does not come on, look at the back of the display and turn on the power switch. A separate manual is included for the DRO operation.

The standard lead screws supplied with the MILL TURN are 5MM metric ball screws. You have DRO installed, so these ratios become unimportant because the DRO reads table motion exactly.

Our CNC system is a micro stepping controller, so the motors require 2000 steps for 1 revolution. On the X axis, the belt ratio is 2-1, so it requires 4000 steps for 1 revolution of the lead screw. A 5 pitch screw would require 5 turns for 1 inch of travel. ($5 \times 2000 = 10,000 \times 2-1 \text{ ratio} = 20,000$) Because the ball screws are metric, the exact travel per revolution is slightly less than a 5 pitch inch screw. Therefore, with the standard ball screws it requires 20320 steps for 1" of travel. On the Y axis, it is a direct drive, so it requires 10157 steps per inch. The Z axis has a 4-1 reduction ratio and requires 40656 steps per inch of travel. The A axis is designated as angular (rotational) and is set at 2143 steps per degree to match the optional cnc rotary table. These are initial

settings, and once you begin testing the motions you may add or subtract steps in the motor tuning section until you have the settings exact. Always do the steps per inch settings prior to doing the backlash compensation setup. Also be sure backlash compensation is set to OFF during the steps per inch setup.

LUBRICATION OF THE UNIT



NOTES ON 3 JAW CHUCK

Your MILL TURN comes with a conventional 3-jaw chuck. Some also come with a 4-jaw chuck as an option. See the notes on the 4-jaw chuck in the next section. The normal 3-jaw chuck has three inside jaws and three outside jaws. Be sure to take careful note that all bolts that hold the chuck to its face plate are tight and that the chuck fits properly in the face-plate recess made for it. The various parts of the chuck are an integral part of that particular chuck and should always maintained as a unit. Each chuck is manufactured as a unit and is dialed in with the jaws that are provided with the chuck. The serial number of each individual chuck is stamped on the body and on each of the jaws (see following illustration). The order in which the jaws go into the chuck is also critical to maintain accuracy. Note that the jaws are numbered 1, 2 and 3 as well as stamped with the serial number.

THE NUMBER ON THE CHUCK JAW, BOTH INSIDE AND OUTSIDE, INDICATE THE POSITION THAT THEY SHOULD BE PLACED IN THE CHUCK BODY. Jaw NO. 1 must go in the slot stamped NO. 1 on the chuck body. The same NO. 1 slot will also typically have the chuck serial number stamped immediately after the slot number. Make certain you follow the instructions for installation exactly.

INSTALLATION OF THE CHUCK JAWS

1. Using the chuck key provided, scroll to where the beginning of the scroll thread is visible in the NUMBER ONE slot, then back the thread off until the beginning of the thread is no longer visible in the slot (one-half turn counter clockwise will usually do it).

2. Next, insert the jaw numbered NO. 1 in the slot and firmly push it toward the center of the chuck.

3. Scroll the chuck until the thread becomes visible in the second slot; at this point pull out on the previously installed jaw to ensure that the scroll has engaged the teeth on the back of the jaw. If the jaw comes out, repeat steps 1 & 2. If the jaw holds proceed to step 4.

4. With the beginning of the thread visible in the second slot, again back it off one-half turn and insert the jaw. Push it firmly toward the center of the chuck.

**5. Scroll the chuck until the thread becomes visible in the third slot;
pull out on 2nd jaw to ensure the scroll has engaged the teeth.**

6. Repeat the steps for the third jaw.

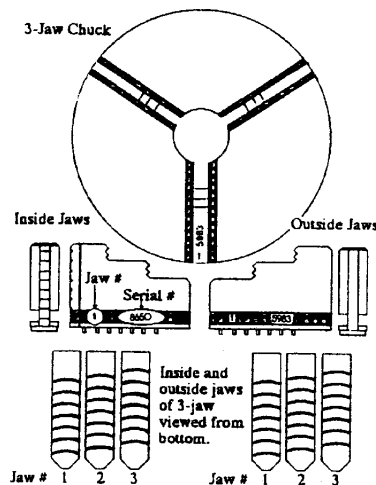
**WHEN ALL THE JAWS ARE INSTALLED AS
INSTRUCTED ABOVE,
THEY WILL MEET AT THE CENTER OF THE
CHUCK SIMULTANEOUSLY.**

TO RECAP THE PROCEDURE...

1. Jaws are inserted in numerical order 1-3.

2. Always begin with slot No. 1.
3. Scroll until the beginning of the thread is visible.
4. Install jaw, pushing it firmly toward center of chuck.
5. Scroll until the beginning of the thread is visible in the next slot.
6. Test the jaw just installed by pulling out.
7. Repeat from STEP 4 until all the jaws are firmly installed.
8. Scroll the chuck until all jaws meet in the center of the chuck.

IMPORTANT! IF ALL THE JAWS DO NOT MEET AT THE CENTER, REPEAT THE STEPS ABOVE AFTER REMOVING THE INCORRECTLY INSTALLED JAWS.



NOTE!

IF YOU LOSE THE JAWS YOU WILL HAVE TO BUY A COMPLETE NEW CHUCK-PARTS ARE NOT INTERCHANGABLE.

NOTES ON THE FOUR-JAW CHUCK

The 4-jaw chuck can be purchased as an option. Whether or not you need the extreme accuracy offered by a 4-jaw chuck is a decision that you need to make. Also, some units come with a machined installation plate while others come with plate which must be machined by you (this depends upon our suppliers). The diagram and instructions included at the back of this owner's manual will tell you how the plate must be machined to fit properly. It is not a very difficult procedure and might well qualify for your first serious project after you get set up and take a few practice cuts to familiarize you with your machine.

FACEPLATE MODIFICATION FOR THE FOUR JAW CHUCK.

Due to factory specification changes, please modify your faceplate according to the following instructions. Please refer to the following diagram for assistance.

1. Remove the three jaw chuck from the spindle.
2. Bolt the 8" face plate that came with your standard accessories to the spindle.
3. Cut away the existing shoulder that exists on your faceplate. This was used as a centering boss for an old-style chuck that is no longer available.
4. Make a cut across the surface of the face plate to true it to the spindle. Be sure to work slow to attain a ultra-smooth surface.
5. Cut away the face plate on the outside edge to create a new shoulder 0.200" high and 4.920" (125 mm) in diameter.
6. Test the fit of the 4-Jaw chuck to the face plate.
7. When the fit is snug, remove the face plate from the spindle.
8. Clamp the chuck to the face plate and mark the position of the four mounting holes.
9. Drill and tap holes to accept the bolts supplied or any of your choice.

When performing any lathe work, please be sure to remove the chuck key from chuck **BEFORE TURNING ON THE MACHINE!** Serious injury can result if you carelessly leave the chuck key in the machine. It becomes a flying object of great speed due to the centrifugal force generated by the fast turning chuck.

A NOTE ON FEED RATES

For any machining exercise, certain parameters must first be calculated and set up on the machine, including RPM, FEED RATE, etc. FEED is described as the machine movement that causes a tool to cut into or along the surface of a work piece. The amount of FEED is usually measured in thousandths of an inch per revolution when cutting metal.

The most frequent recommendations regarding FEED RATES are .010 to .020 inches per revolution for rough machining and .003 to .005 inches per revolution for finish machining. Consultation of professional machinist manuals such as the Machinist's Ready Reference (ST 39#24) is highly recommended for detailed descriptions and tables that prove invaluable for nearly any machining operation.

ELECTRICAL TROUBLESHOOTING

**!!! When Checking Electrical System,
Always Disconnect Unit From The Power Source !!!**

1. Neither motor will run-

- A. Be sure unit is plugged in.**
- B. Check the E-Stop button to see if it is in the RUN position.**
- C. Check your outlet with an electrical tester to be sure it is "hot".**
- D. Ensure electrical breaker hasn't been tripped.**
- E. Check the cord connections to the E-Stop button.**
- F. Check the connections from the E-Stop button to the power ON-OFF switch.**
- G. Check the connections from the ON-OFF switch to the inverter.**
- H. Check the wires from the inverter to the relay.**
- I. Check for power on all 3 wires from inverter to relay.**

For other diagnosis refer to the VFD manual section

2. Only one motor runs-

- A. Check relay for engage/disengage**
- B. Check all connections on inoperable motor junction block.**
- C. Check connections of wires on relay.**
- D. Check connections of wires from relay to VFD inverter.**

3. Motor runs only one direction-

- A. Check all connections on junction box.**
- B. Check connections from Forward/Reverse switch to inverter.**

SPARE PARTS