

# OTMT®

## Super X3 Milling Machine



### User's Guide and Installation Manual

Version date: 11-17-2010

Please Read This Manual Carefully Before Operating this Machine.  
Copyright by Travers Tool Co., Inc., December 2010.

# Table of Contents

<b>IMPORTANT SAFETY INSTRUCTIONS</b> .....	<b>3</b>
<b>Parts of the Mill</b> .....	<b>4</b>
<b>Welcome</b> .....	<b>5</b>
User Manual.....	5
Capabilities of the Mill .....	5
<b>Setting up the Mill</b> .....	<b>6</b>
Electrical Requirements .....	6
Lifting the Mill .....	6
Bench Mounting .....	6
Machine Cleanup .....	7
<b>Operating Controls and Features</b> .....	<b>8</b>
Table Motion Controls .....	8
Locking Levers .....	8
Vertical Motion Control.....	8
Quill Digital Readout .....	9
<b>Electronic Controls</b> .....	<b>9</b>
Control Panel Buttons .....	9
Emergency Stop Button .....	10
<b>Tooling and Accessories</b> .....	<b>11</b>
Drill Sets.....	11
End Mills .....	11
Securing Work to the Table.....	12
Clamping Sets.....	12
Milling Vises .....	12
Parallels .....	12
Eye Protection.....	13
<b>Basic Milling and Drilling</b> .....	<b>14</b>
Initial Checkout.....	14
Safety Checks .....	14
Drilling.....	15
Milling.....	16
<b>Advanced Features</b> .....	<b>18</b>
Tilting Head Feature.....	18
Power Tapping Feature.....	18
<b>Maintenance</b> .....	<b>20</b>
Periodic Lubrication.....	20
Ball-Race Lubrication .....	20
Z-Axis Drive Gears.....	20
Bare Metal Surfaces.....	20
Adjusting the Gibs .....	20
<b>Appendices</b> .....	<b>22</b>
Appendix A.....	22
Appendix B – Parts Diagrams .....	23
Appendix C – Parts List.....	26
Appendix D – Electrical Block Diagram .....	27



## IMPORTANT SAFETY INSTRUCTIONS

Common sense and caution are factors which cannot be built into any product. These factors must be supplied by the operator.

### PLEASE REMEMBER:

1. When using electric tools, machines or equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock, and personal injury.
2. Keep work area clean. Cluttered areas invite injuries.
3. Consider work area conditions. Don not use machines or power tools in damp, wet or poorly lit locations. Don not expose equipment to rain, keep work areas well lit. do not use tools in the presence of flammable gases or liquid.
4. Keep children away; all children should be kept away from the work area.
5. Guard against electric shock. Prevent body contact with grounded surfaces such as pipes, radiators, ranges and refrigerator enclosures.
6. Stay alert. Never operate a power tool if you are tired.
7. Do not operate the product if under the influence of alcohol or drugs. Read warning labels on prescriptions to determine if your judgment or reflexes might be impaired.
8. Do not wear loose clothing or jewelry as they can be caught in moving parts.
9. Wear restrictive hair covering to contain long hair.
10. Use eye and ear protection. Always wear.
11. Keep proper footing and balance at all times.
12. Do not reach over or across running machines.

### Before operations

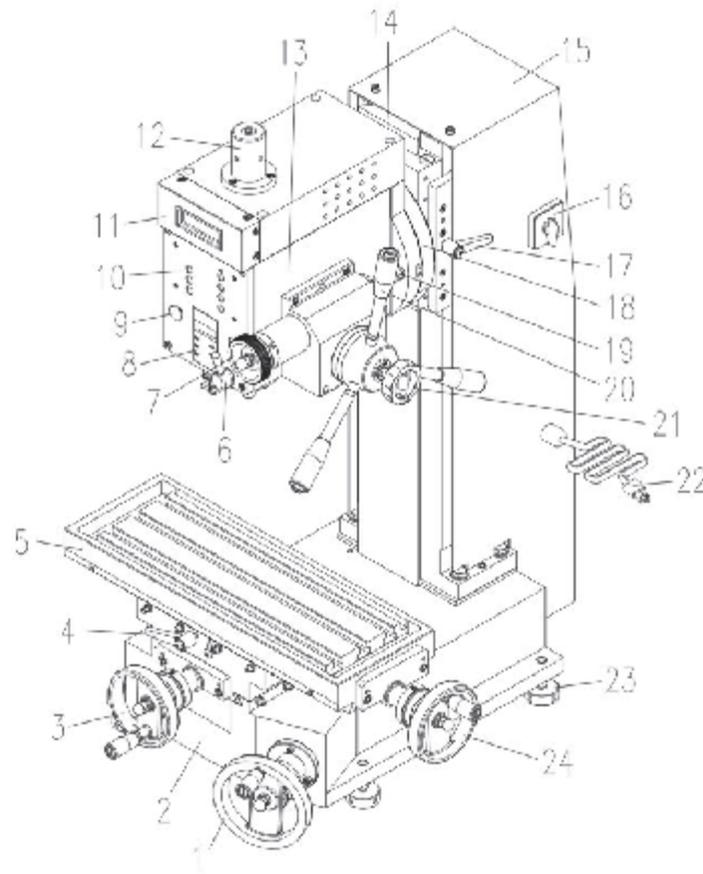
1. Be sure the power switch is OFF when not in use and before plugging in.
2. Do not attempt to use inappropriate attachments in an attempt to exceed the tool's capacity.
3. Check for damaged parts before using any tool, and part that appears damaged should be carefully checked to determine that it will operate properly and perform its intended function.
4. Check for alignment and binding of all moving parts, broken parts or mounting fixtures and any other condition that may affect proper operation. Any part that is damaged should be properly repaired or replaced by a qualified technician.
5. Do not use the tool if any switch does not turn off properly.

### Operation

1. Never force the tool or attachment to do the work of a larger industrial tool. It is designed to do the job better and more safely at the rate for which it was intended.
2. Do not carry the tool by its power cord.
3. Always unplug the cord by the plug. Never yank the cord out of the wall.
4. Always turn off the machine before unplugging.

## Parts of the Mill

Before operating the mill, please study the diagram below to become familiar with the components and operating controls.



1	Lifting handwheel	13	Spindle box
2	Base	14	Fuselage
3	Cross feed handwheel	15	Cover for fuselage
4	Lock handle	16	Power switch
5	Worktable	17	Lock handle
6	Spindle lock handle	18	Rotate connect plate
7	Fine feeding handwheel	19	Lock bolt
8	Depth display	20	With tapping handle
9	Emergency stop switch	21	Fine feeding lock handle
10	Touch Switch panel	22	Power plug
11	Rotate speed display	23	Adjust bolt
12	Protective cover	24	Longitudinal handwheel

## Welcome

Congratulations on selecting the OTMT Super X3 Milling Machine. You have chosen a precision machine tool that can perform a wide range of complex and precise milling operations. With proper maintenance and care, it will provide many years of service. Should you have any questions regarding the operation of your mill, please contact **Travers Technical Support** for assistance.

### Technical Support

(1-800-234-9985, press 4)

Fax: 718-661-5637

email: [tech@travers.com](mailto:tech@travers.com)

*Note: A PDF version of this manual, available on the Super X3 page at Travers.com, has direct links to suggested accessories.*

### ***User Manual***

The purpose of this manual is to familiarize the operator with the installation and controls of the machine and basic drilling and milling procedures. To become proficient in using the mill, the operator should seek in-depth training using reference books, resources available on the internet, training courses at community technical schools or from an operator already skilled in the use of a similar milling machine.

### ***Capabilities of the Mill***

Together with a lathe, a vertical milling machine is one of the essential tools in the machine shop. It can produce a wide variety of precision shapes and forms in most metals, including steel, brass, aluminum and even tough metals such as stainless steel and bronze. It can also work effectively with many plastics and engineering materials such as Teflon (PTFE), Delrin and Nylon. The mill also will serve very effectively as a precision drill press.

A vertical mill such as the Super X3 is capable of a wide variety of operations where the holding mechanisms, cutting tools and materials being machined will vary depending on the requirements of a particular job. With a selection of accessories available from Travers, you can increase the range of work that your mill can perform.

## Setting up the Mill

The Super X3 mill should be located in a well-lighted and well-ventilated area free from excessive humidity or moisture that could cause rusting of the precision metal surfaces or tooling.

### **Electrical Requirements**

The Super X3 mill configured for U.S. operation uses standard 120V AC 60-cycle single-phase power and has a peak current demand of 12 amps. While a 15-amp circuit may be sufficient for powering the mill, a 20-amp circuit is recommended. The circuit must not be shared with other high-current devices, such as an air compressor, window air conditioner or coffee pot, that may be operating, or switch on, while the mill is in use. Low current devices, such as a work lamp, may share the same circuit as the mill.

A plug-in power failure emergency light that will automatically turn on in the event of a power failure or tripping of an overloaded circuit breaker is recommended for safety. In the event that power to the mill, or workspace lighting, should be interrupted while the mill is in use, the emergency light will enable the operator to safely turn off the power switch to the mill and move away from the mill until power is restored. Suitable lights are available at most hardware and home-supply stores.

Care should be taken to ensure a safe work area with electrical wiring and grounding approved by local electrical codes. The mill uses a three-prong electrical plug to protect the operator from risk of shock or electrocution. The mill must be plugged into a properly grounded outlet to ensure safe operation. Do not attempt to modify the plug to fit a 2-prong outlet or extension cord by removing the ground conductor or by using an adaptor. Doing so may result in shock or electrocution.

If it is necessary to plug the mill into an extension cord, the extension cord must have a properly functioning 3-prong electrical ground plug and outlet, plugged into a properly grounded 3-prong wall outlet. The extension cord must have at least 15 Amps of current-carrying capacity to avoid overheating the cord, which could cause a risk of fire. A cord rated for 20 Amps or more is recommended. In no case should the length of the extension cord exceed 20 feet.

### **Lifting the Mill**

The Super X3 mill weighs approximately 365 lbs. (165 kg.) and must be mounted on a strong table or bench capable of supporting 400 lbs. or more. A shop crane with a nylon lifting strap or other suitable lifting apparatus should be used to safely lift the machine onto the table or bench.



**Shop crane (Item # [96-004-166](#))**

If necessary, the head and table can be removed so that mill can be lifted in three parts:

1. Base and column
2. Head
3. Table

These components are still quite heavy and two workers should work together to lift them. Proper lifting techniques (e.g. bend at the knees, not at the back) should be used to minimize any risk of personal injury. Consult the Internet for information on proper lifting techniques.

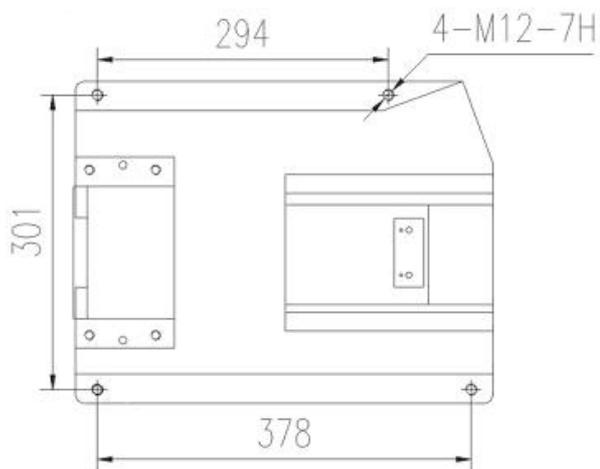
### **Bench Mounting**

Adjustable metal feet are provided which can be screwed into the base of the mill and adjusted individually to level the mill. Alternatively, the mill may be bolted directly to the table or bench top. Metal washers or shims may be used, as needed, to ensure that the mill table is level. A carpenter's or machinist's level should be used to verify that the mill table is level.

Plywood or Medium Density Fiberboard (MDF) panels cut to size may be used under the base of the mill to provide additional clearance between the handwheels from the bench top.

Sufficient clearance must be provided on both sides of the machine to allow for movement of the table through its full range of motion and for

turning the handwheels that move the table. Space must also be provided to the left side of the milling table for the power feed option if it will be installed.



**Dimensions of Base  
in millimeters**

### ***Machine Cleanup***

The milling machine is protected from rust during shipping by a waxy red grease that must be removed before putting the machine to use. This is best done using disposable shop rags and paint brushes together with a solvent such as kerosene or WD-40™. Avoid solvents such as paint thinner that may damage the painted surfaces of the mill, and highly volatile solvents such as acetone that present a fire and inhalation hazard.

Good ventilation must be provided when solvents are used and care must be taken to avoid open flames, smoking materials or electrical sparks that could ignite solvent fumes. Care should be taken to clean the shipping grease from all moving parts, including parts that may be hidden from view, such as leadscrews under the table.

## Operating Controls and Features

### Table Motion Controls

For many milling operations the workpiece is held in a vise or is clamped to the table and moved into the rotating cutting tool by turning the table handwheels. The lengthwise motion of the table is referred to as the X-axis, the front-to-back motion as the Y-axis and the up and down motion of the head as the Z-axis.

The table can be moved a measured distance by observing the graduated collars on each handwheel and by counting full rotations of the handwheels. The graduated collars on the X- and Y-axis handwheels can be set to a zero reference point by holding the handwheel steady while turning the graduated collar to zero.



**Setting dial to zero**

The X-axis handwheel may be disengaged from the leadscrew by pulling outward on the handwheel. This feature is used mainly in conjunction with the optional power feed to reduce the risk of the handwheel striking an object while turning under power.



**Disengaging the handwheel**

### Locking Levers

For maximum accuracy, the axes that are not being moved should be locked in place using the locking

lever for that axis. The locking levers are spring-loaded so that the resting position of the lever may set to a convenient orientation by pulling out on the lever, turning it, then releasing it.



**Exploded view of locking lever**

### Vertical Motion Control

The cutting tool can be moved in the Z- or vertical axis by turning the Z-axis handwheel, located near the front right corner of the mill, to raise or lower the head. The cutting tool also can be raised or lowered using either the 3-spoke lever or the fine-feed handwheel to move the spindle.

When advancing the spindle using the 3-spoke handwheel, the mill functions as a high precision, heavy-duty drill press.

**CAUTION:** Do not release the 3-spoke handwheel and let it snap back under spring pressure. Control the retraction by winding the spindle back by hand.

For precise control of the cutting depth for milling operations either the Z-axis handwheel or the quill fine-feed handwheel may be used. The fine-feed handwheel is engaged by turning the fine-feed lock handle (#21 on the parts diagram) located at the center of the 3-spoke handwheel. Turning this knob clockwise engages the fine-feed; turning it counter-clockwise disengages the fine-feed.



**Fine-feed handwheel**

When the fine-feed handwheel has been used to set the quill to the desired cutting depth, the quill should be locked in position using the quill locking lever to ensure maximum rigidity of the cutting tool.

For safety, a polycarbonate plastic shield with an electrical interlock must be opened to access the spindle while changing tools. The interlock prevents the spindle from being powered on while the safety shield is in the open position.

### Quill Digital Readout

The depth of the quill feed can be read directly from the digital readout for both drilling and milling operations. The digital readout control buttons are

**OFF/ON** – toggles the display on or off

**Mm/Inch** – toggles the display between inch and millimeter units

**ZERO** – sets the readout to zero at the current quill position



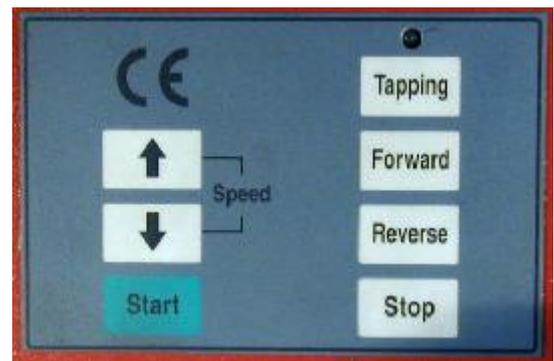
### Quill extension digital readout (DRO)

In practice, the digital readout usually is zeroed when the tip of the cutting tool is just touching the top surface of the workpiece.

### Electronic Controls

The main power switch for the mill is located on the right side of the column. The switch should be turned to the OFF position when the mill will not be used for periods of several hours or more. When the power switch is in the ON position, the green pilot lamp above the spindle lock lever is illuminated.

### Control Panel Buttons



### Control buttons

Located on the control box on the left side of the head are the electronic operating controls:

⤴ - Increase spindle RPM speed

⤵ - decrease spindle RPM speed

**Start** – start the spindle motor

**Tapping** – switch tapping feature on or off

**Forward** – set spindle to forward rotational direction

**Reverse** – set spindle to reverse rotational direction

**Stop** – stop the spindle motor

After insuring that the cutting tool is clear of the workpiece and that the spindle safety shield is secured in the fully closed position, press the green START button to start the spindle rotation.

The first time that the START button is pressed after turning on the power to the mill, or after resetting the Emergency Stop button, the spindle will begin turning at its slowest speed, about 100 RPM. The current spindle rotational speed is displayed on the digital display above the electronic control panel.



### Spindle-speed tachometer

To increase the speed of spindle rotation, depress and hold down the Up-arrow button. To decrease spindle speed, depress and hold down the Down-arrow button. Small incremental changes to the spindle speed may be made by momentarily pressing the Up- or Down-

arrow buttons. To stop the spindle rotation, press the STOP button.

### ***Emergency Stop Button***

Located below the START button, the red Emergency Stop button is used to quickly stop the spindle in the event of an emergency, such as a workpiece working loose from the vise.



**Emergency Stop button**

Pressing the Emergency Stop button firmly with the heel of the hand will bring the spindle to a stop and keep the mill from restarting until the Emergency Stop button is reset by rotating the knurled rim of the button in a clockwise direction. Pressing the START button, or any other control on the panel, will have no effect until the Emergency Stop button is reset. When the Emergency Stop button is reset, the spindle speed will also be reset to the minimum speed of about 100 RPM.

## Tooling and Accessories

### Drill Sets

The Super X3 mill uses industry-standard R8-taper tooling. A drill chuck with an R8 shaft is provided with the mill. Drill sets in inch, metric and number and letter sizes will provide a great range of capabilities when using the mill as a precision drill press.



[Inch-size Drill Sets](#)

### End Mills

End mills usually are the most commonly used cutting tools for milling operations. End mills are available in a wide range of sizes, configurations and materials specialized for different types of work. For general use, a set of 2- and 4-flute, high-speed-steel (HSS) is convenient to start with, as it will handle many basic operations.



**Set of 2- and 4-flute end mills  
(Item # [09-335-905](#))**

End mills may be held either in properly sized R8 collets or R8 end mill holders. R8 collets and end mill holders may be purchased individually in sizes corresponding to the shank sizes of the end mills you will be using, or may be purchased in sets that will accept a range of end mill shank sizes.



**Set of R8 Collets (Item # [69-510-063](#))**



**R8 Tooling**

When in use, the shaft of the R8 collet or end mill holder must be held tightly in the spindle taper by the drawbar provided with the mill. Use a shop rag to clean off any chips or grit from the surface of the taper and the inside taper of the spindle. Align the slot with the pin in the spindle and insert the shaft fully into the spindle. While holding the collet or end mill holder in the spindle, the drawbar is first screwed by hand into the top of the collet or end mill holder. Then, while gripping the spindle firmly, or using a tool provided for this purpose, tighten the drawbar snugly, but not overly tight, using a wrench. Only a moderate amount of tightening force is needed to secure the drawbar. To avoid being cut by the sharp edges of cutting tools, the tool can be held in a shop rag or leather glove.

To remove a tool from the spindle, grip the spindle firmly and loosen the drawbar using a wrench, reversing the process used to tighten it. While simply loosening the drawbar may be enough to cause the tapered tooling to drop loose from the spindle taper, typically a light tap on the top of the drawbar from a brass or lead hammer is needed to break the grip that binds the two tapered surfaces together.

## Securing Work to the Table

When working with the mill, the workpiece may be held in a milling vise, a specialized holder such as a rotary table or may be clamped directly to the surface of the table. Care must be taken that both the workpiece and the holding device(s) are secured by bolts and T-nuts so that they do not move due to the cutting force of the mill.

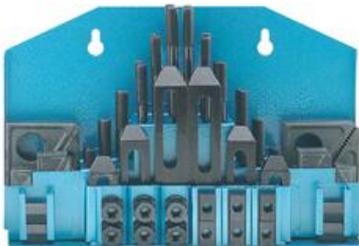
## Clamping Sets

For convenience in positioning work anywhere on the table surface, slots run the length of the table to be used with T-nuts. T-nuts are special nuts, with a cross-section in the shape of the letter 'T' that can be positioned along the slots. They can be purchased individually but usually are purchased as part of a clamping set.



**T-nut**

The clamping set includes several T-nuts as well as an assortment of varying length rods threaded on both ends, stackable spacers, clamps and clamping bolts. With such a set, a wide variety of clamping configurations can be devised to clamp work of varying shapes and sizes securely to the mill table.



**Clamping set (Item # [83-010-255](#))**

When using T-nuts to secure a workpiece or holding device to the table, the T-nut bolt must not extend

past the bottom of the T-nut or it may apply force to the table casting as it is tightened and crack the T-slot. Excessive force must not be applied when tightening T-nuts; just enough force to securely hold the work in place against the cutting forces of the mill.

## Milling Vises

A heavy milling vise often is the most convenient means for securing work to the mill table. Milling vises are available in various configurations suited to different work requirements. They are manufactured to exacting standards to ensure that the work is held parallel and square to the mill table.



**Milling vise with rotating base.  
(Item # [61-204-304](#))**

## Parallels

Parallels are used to support work when clamping it in a milling vise. They serve to raise the top surface of the workpiece above the top edges of the milling vise jaws so that the milling cutter will not strike the vise jaws.

Parallels typically are sold in sets of matching pairs in a series of heights, such as 1/2" through 1-1/2" in increments of 1/8" and in thicknesses of 1/8", 1/4", 3/8" and 1/2". Special parallels, such as "wavy-parallels" are used in specialized work-holding applications.



**Set of parallels (Item # [57-101-400](#))**

## ***Eye Protection***

Milling machines produce hot and sharp metal chips that can fly out from the cutting area at high speed to a distance of 24 inches or more. Always wear appropriate industrial-quality safety glasses or face shields when operating the mill. Safety shields attached to the machine or held by a magnetic base may also be used together with eye protection for additional safety.



**Safety glasses (Item # [96-085-300](#))**



**Face shield (Item # [97-000-794](#))**



**Safety shield (Item # [99-003-525](#))**

## Basic Milling and Drilling

### Initial Checkout

Before the mill is used for any machining operations, it should be checked for proper operation. After confirming that the black locking levers are disengaged, use the handwheels to move the table and head through their full range of motion to verify that everything is moving freely without binding or excessive resistance.

If the chuck is installed in the spindle, ensure that it is tight and that the chuck key has been removed.

Turn the motor on and gradually increase the spindle speed from slow to high speed and back to slow speed again and then off to verify that the speed controls are functioning properly and that the spindle turns freely.

If any unusual noises or other unexpected events occur, contact **Travers Technical Support** for assistance.

### Technical Support

(1-800-234-9985, press 4)

Fax: 718-661-5637

email: [tech@travers.com](mailto:tech@travers.com)

### Safety Checks

Before beginning any cutting operation:

- Be sure that the work is securely fastened to the table by a vise or clamping devices
- Verify that the tool and tool holders are secure and tight before starting the spindle.
- Clear the work area of any objects that could cause you trip or slip; also any tools or other objects on or near the mill table that are not required for the current operation.
- Avoid loose sleeves or loosely fitting shirts that could become entangled in rotating parts. Remove or secure necklaces and other jewelry. Tie back long hair to avoid getting it entangled in rotating machinery.

- Be careful when removing work that has just been machined. Both the work and the tool used to cut it may be very hot from the frictional forces of cutting.
- Use recommended cutting fluids to reduce the force required by the cutting tool. This will help keep the tool cooler and increase its life, and will make it less likely that chips will weld to the tool or workpiece causing rough surface finishes.

The following procedures describe typical sequences for setting up a workpiece for basic drilling and milling operations. Before operating the mill, please review the safety practices.

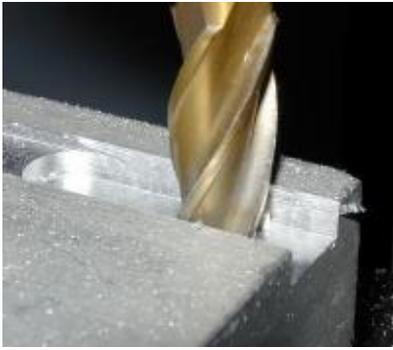
## Drilling

1. Turn on the main power switch to the mill (on the right side of the column.)
2. Raise the head to provide enough clearance to set up a vise on the table. Make sure that the head is raised high enough to provide clearance for the drill chuck and drill bit above the top surface of the workpiece.
3. Mount a milling vise on the table. Use a machinist's square or dial test indicator to align the fixed jaw of the vise parallel to the table. Use T-nuts and bolts to secure the vise to the table. Ensure that the bolts are secure but not overly tight.
4. Position the workpiece in the vise. Support the workpiece on parallels if necessary.
5. Firmly tighten the workpiece in the vise. Check to make sure that the workpiece cannot be moved.
6. If the workpiece will be drilled all the way through, verify that the drill bit will not hit the parallels or the base of the vise below the workpiece. Remove the parallels, if necessary, while keeping the workpiece tightly clamped in the vise.
7. Install a drill chuck in the spindle. Secure the R8 tool holder using the drawbar. Tighten the drawbar firmly, but not overly tight.
8. Insert the drill bit into the chuck and tighten the chuck using the chuck key. It is good practice to tighten the chuck at two or all three chuck key positions to ensure that the drill is tightly secured in the chuck.
9. Close the spindle safety shield.
10. If necessary, lower the head on the column using the Z-axis handwheel until the tip of the end mill is about 1/4-1/2" above the workpiece. Use the Z-axis lock to lock the head in position on the column.
11. Use the X- and Y- table handwheels to position the workpiece below tip of the drill bit at the location where the hole is to be drilled. It is good practice to mark this point in advance using a center punch. The depression formed by the center punch will help to keep the drill tip from wandering when the hole is started.
12. While not required, it is good practice to lock the X- and Y-axis table locks to prevent any movement of the table during the drilling operation.
13. Turn on the DRO display.
14. Check to make sure that the spindle lock is unlocked
15. Use the 3-spoke quill downfeed handle to advance the drill bit until the tip just touches the surface of the workpiece. Press the **ZERO** button on the quill DRO to set the depth to zero. Gradually release pressure on the handle, allowing the quill to move up to its fully retracted position.
16. Press the green **Start** button to start the spindle rotation.
17. Use the UP-arrow button and the tachometer display to set the desired spindle speed. 800 RPM may be used for testing purposes.
18. Use the 3-spoke quill downfeed handle to advance the drill into the workpiece. If the hole will be deeper than 2 to 3 times the diameter of the drill bit, back the drill bit out frequently to clear chips from the hole, then advance the drill to continue drilling until the hole is at the desired depth.
19. When the hole has been drilled to the desired depth, press the **Stop** button to stop the mill motor. Keep clear of the cutting tool until the spindle has come to a complete stop.

## **Milling**

There are many different cutting operations that use an end mill, such as milling a slot, surfacing a workpiece, milling a shoulder or milling a pocket.

The following exercise is based on milling a  $\frac{1}{2}$ " wide slot to a depth of  $\frac{3}{8}$ " (0.375") beginning at the right side of the workpiece. While at first this exercise may seem somewhat slow and tedious, with practice this type of operation will become quick and nearly second-nature.



**Milling a slot**

1. Turn on the main power switch to the mill (on the right side of the column.)
2. Raise the head to provide enough clearance to set up a vise on the table. Make sure that the head is raised high enough to provide clearance for the milling tool holder and end mill above the top surface of the workpiece.
3. Mount a milling vise on the table. Use a machinist's square or dial test indicator to align the fixed jaw of the vise parallel to the table. Use T-nuts and bolts to secure the vise to the table. Ensure that the bolts are secure but not overly tight.
4. Position the workpiece in the vise so that the part to be milled is about  $\frac{1}{4}$ " above the top of the vise jaws. Support the workpiece on parallels if necessary.
5. Firmly tighten the workpiece in the vise. Check to make sure that the workpiece cannot be moved.
6. Select a  $\frac{1}{2}$ " diameter collet or end mill holder and a  $\frac{1}{2}$ " diameter end mill to be used for this exercise.
7. If using an R8 collet to hold the end mill, insert the collet into the spindle and engage the drawbar threads into the upper end of the collet. Turn the head of the drawbar several turns but leave the collet open so that the end mill can be inserted. Insert the end mill shank into the collet, then fully tighten the drawbar to secure the end mill.
8. If using an end mill holder (end mill adapter) to hold the end mill, insert the holder into the spindle, engage the drawbar into the thread at the top of the holder and tighten the drawbar until it is snug, but not overly tight. Use gloves or hold the sharp end of the milling cutter in a shop rag to avoid cutting your fingers. Insert the end mill into the holder, aligning the flat spot on the shank with the setscrew in the holder. While advancing the setscrew, wiggle the end mill so the setscrew engages with the recessed flat spot, then fully tighten the setscrew to secure the end mill in the holder.
9. Close the spindle safety shield.
10. For maximum rigidity during milling operations it is good practice to keep the spindle locked in the fully retracted position and use the Z-axis handwheel to lower the head to control the depth of cut. However, it is sometimes more convenient to lock the head to the column and lower the spindle to control the depth of cut if heavy cuts are not required. For this exercise, we will lock the head and lower the spindle.
11. With the spindle fully retracted, lower the head on the column using the Z-axis handwheel until the tip of the end mill is about  $\frac{1}{4}$ " above the workpiece.

- Use the Z-axis locking lever to lock the head in position on the column.
12. Use the X- and Y- table handwheels to position the workpiece below tip of the end mill at the location where the slot is to be milled.
  13. Turn on the DRO display.
  14. Check to make sure that the spindle lock is unlocked
  15. Use the 3-spoke quill downfeed handle to advance the end mill until the tip just touches the surface of the workpiece.
  16. Press the **ZERO** button on the quill DRO to set the depth to zero.
  17. Rotate the black metal handwheel at the center of the 3-spoke handle to engage the spindle fine-feed. Rotate the handwheel clockwise until it is tight.
  18. Rotate the spindle depth handwheel (the silver knob at the right side of the head) counter-clockwise to raise the spindle by about 10-20 thousandths of an inch as measured on the DRO display. This will provide clearance above the workpiece to move the end mill back past the edge of the workpiece where the cut will begin.
  19. Rotate the X-axis table handwheel clockwise to move the table to the left until the left edge of the end mill clears the right edge of the workpiece.
  20. Engage the Y-axis locking lever (below the right side of the table) to keep the table from shifting in the Y-axis direction.
  21. Rotate the fine-feed handwheel clockwise to lower the tip of the end mill to a cutting dept of 0.020 (twenty thousandths of an inch) as displayed on the DRO.
  22. Rotate the spindle locking lever clockwise until snug to lock the spindle.
  23. Press the green **Start** button to start the spindle rotation.
  24. Use the UP-arrow button and the tachometer display to set the desired spindle speed. Approximately 1000 RPM may be used for this exercise.
  25. Slowly rotate the X-axis handwheel counterclockwise to move the table to right, advancing the right edge of the workpiece towards the cutting tool
  26. Continue rotating the X-axis handwheel counterclockwise until the slot has been cut to a length of approximately one inch (for this exercise the length of the slot is not important.)
  27. Now rotate the X-axis handwheel in the opposite direction (clockwise) to move the table and workpiece back to the left, thus retracing the slot that was just cut. Continue until the tip of the cutting tool is completely clear of the workpiece.
  28. Unlock the spindle lock, then use the spindle fine-feed handwheel to lower the cutting tool tip to a depth of 0.100" as indicated by the DRO display.
  29. Lock the spindle.
  30. Repeat steps 26-29, adjusting the cutting depth to 0.200", 0.300" and 0.375" for the final cut.
  31. Withdraw the cutting tool away from the workpiece.
  32. Press the **Stop** button to stop the mill motor. Keep clear of the cutting tool until the spindle has come to a complete stop.

## Advanced Features

### Tilting Head Feature

The head of the Super X3 can be tilted to an angle for milling angled surfaces on a workpiece, or may be rotated to a fully horizontal position for horizontal milling.

For example, to rotate the head to a 30 degree angle, follow these steps:

- Loosen the two chrome nuts on opposite sides of the head
- Use a 6mm hex wrench to turn locking bolt 45° clockwise
- Turn the head until the 30 degree mark lines up with the index line
- Tighten the two chrome nuts



### Power Tapping Feature

The quickly reversible motor of the Super X3 makes it possible to do power tapping operations. Due to the fast advance of the tap, this feature should be used only at the lowest RPM setting (100 RPM) and only for tapping holes in which the hole is drilled all the way through the workpiece, allowing chips to escape while tapping.

A high-quality tapping fluid should be used to minimize binding of chips in the hole or to the cutting surfaces of the tap.



Tap Magic tap cutting fluid  
(Item # [81-002-914](#) )

Located on the end of each of the downfeed handles is a green button. Pressing any one of these buttons when the mill is in tapping mode causes the motor immediately to reverse direction, thus facilitating backing the tap out of the hole to clear chips.



Tapping button reverses spindle direction

To tap a hole using the tapping feature:

1. Install the drill chuck in the spindle.
2. Select the proper size tap drill for the tap; secure the tap drill in the drill chuck.
3. Secure the workpiece in the milling vise and align the hole location with the spindle.
4. Mark and drill the tap pilot hole all the way through the workpiece.
5. Turn off the motor.
6. Replace the tap drill with the corresponding size tap.
7. Tighten the chuck firmly, using all three holes for the chuck key



**Tapping a hole**

8. Turn on the motor.
9. Press the **Tapping** button on the control panel
10. Apply tap cutting fluid (e.g. Tap Magic®, Tapmatic®, etc.)
11. Use the downfeed handle to slowly advance the tap into the pilot hole until the tap takes hold.
12. Allow the tap to draw the spindle down while maintaining a hold on the downfeed handle.
13. After the tap has advanced about 2-3 times its diameter into the work, press any one of the green buttons on the ends of the downfeed handles to reverse the spindle direction.
14. Allow the tap to retract a few turns from the hole to clear chips, but not come

- completely free of the hole. If the tap comes free of the hole it will be difficult to accurately re-engage the threads that already have been cut.
15. Press any one of the green tapping buttons to resume advancing the tap
  16. Repeat steps 13-15 until the tap has advanced all the way through the bottom of the hole.
  17. Press the green button to reverse the tap and withdraw it completely from the hole. Keep your hand on the downfeed lever being careful not to let it snap free as the tap clears the hole.
  18. Press the **Stop** button on the control panel to stop the motor.

## Maintenance

To ensure a long lifetime of safe and accurate operation, lubrication and adjustments must be carried out on a regular basis.

### *Periodic Lubrication*

The moving surfaces of the mill, such as the table dovetails and leadscrews, should regularly be lubricated. 20W non-detergent machine oil is recommended, but ordinary 10W-30 motor oil also works well for this purpose. Oil ports with spring-balls to seal out foreign material are provided at several locations on the mill. An oiler with a fine tip that opens the ball while oil is dispensed should be used on these ports to inject a small quantity of oil. A few drops of oil should be injected into each port at least monthly, and more often if the mill is used frequently.

### *Ball-Race Lubrication*

Open ball-bearing races are used on the shafts of the X- and Y-axis handwheels. Every two years, or more often if the mill is used frequently, these bearings should be removed, cleaned and lubricated with fresh grease. The old grease can easily be removed by immersing the bearings in a shallow pan of kerosene or WD-40® and cleaning them with a small disposable paintbrush.



**Handwheel bearing race**

All of the sealed bearing races used in the mill are permanently lubricated. No oil, grease or other lubricant or solvent should be applied to these bearings.

### *Z-Axis Drive Gears*

Every two years, or more often if the mill is used frequently, check the grease on the Z-axis drive gears and replace or replenish as needed.

To lubricate these gears, first unplug the mill. Remove the back panel of the column. Use a small brush or fingertip to spread grease onto the gear teeth where the two gears mesh.



**Z-axis drive gears**

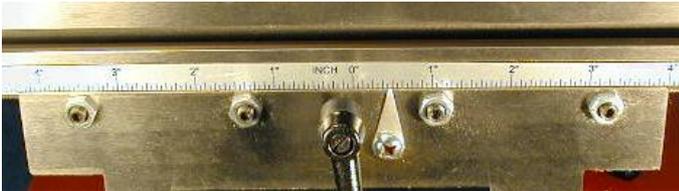
### *Bare Metal Surfaces*

Bare metal surfaces such as the table, dovetails and quill should be protected by wiping them periodically with a light coating of oil to prevent rust. Light rust caused by damp conditions can be removed by wiping the affected area with WD-40 or a similar solvent.

### *Adjusting the Gibs*

Gibs, or gib strips, are metal strips with a diamond-shaped cross section that are used as the bearing surface on one side of a dovetail slide. As the dovetails gradually wear with normal use, the gibs are adjusted to take up any clearance so that the dovetails operate smoothly and precisely.

On the X- and Y-axis of the mill table, set screws with locking nuts are used to adjust the gibs. To adjust the gibs, loosen each locknut in turn, then gently tighten the set screw until resistance is felt.



### **X-axis gib adjustment screws**

Back off the set screw 1/8 turn, then, while holding the set screw with a hex wrench so that it does not turn, tighten the lock nut. When the gibs are properly adjusted, the table should move without resistance or excessive force needed to move the handwheels, but grasping the ends of the table and twisting should allow very little or no visible movement of the table.



### **Y-axis gib adjustment screws**

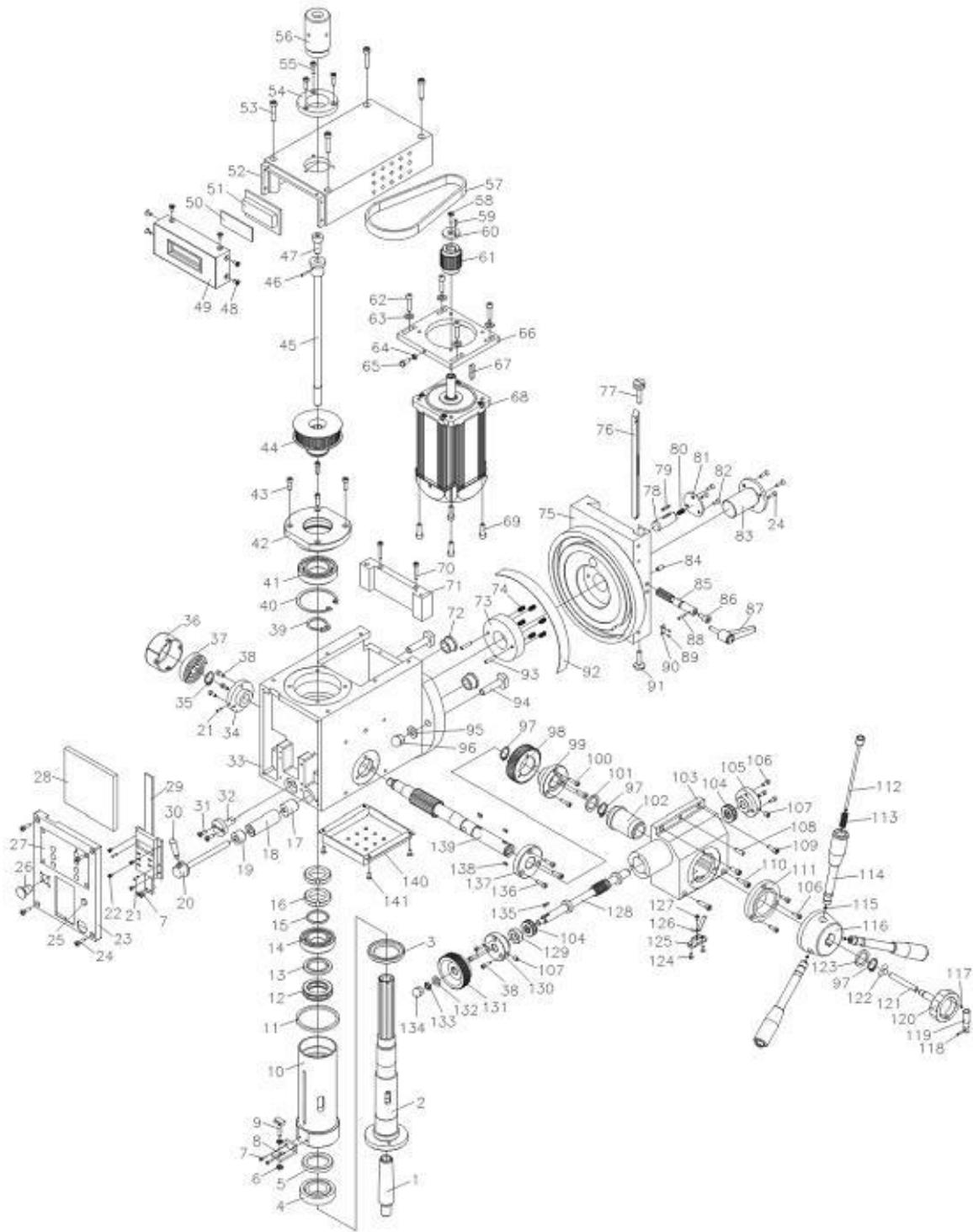
## Appendices

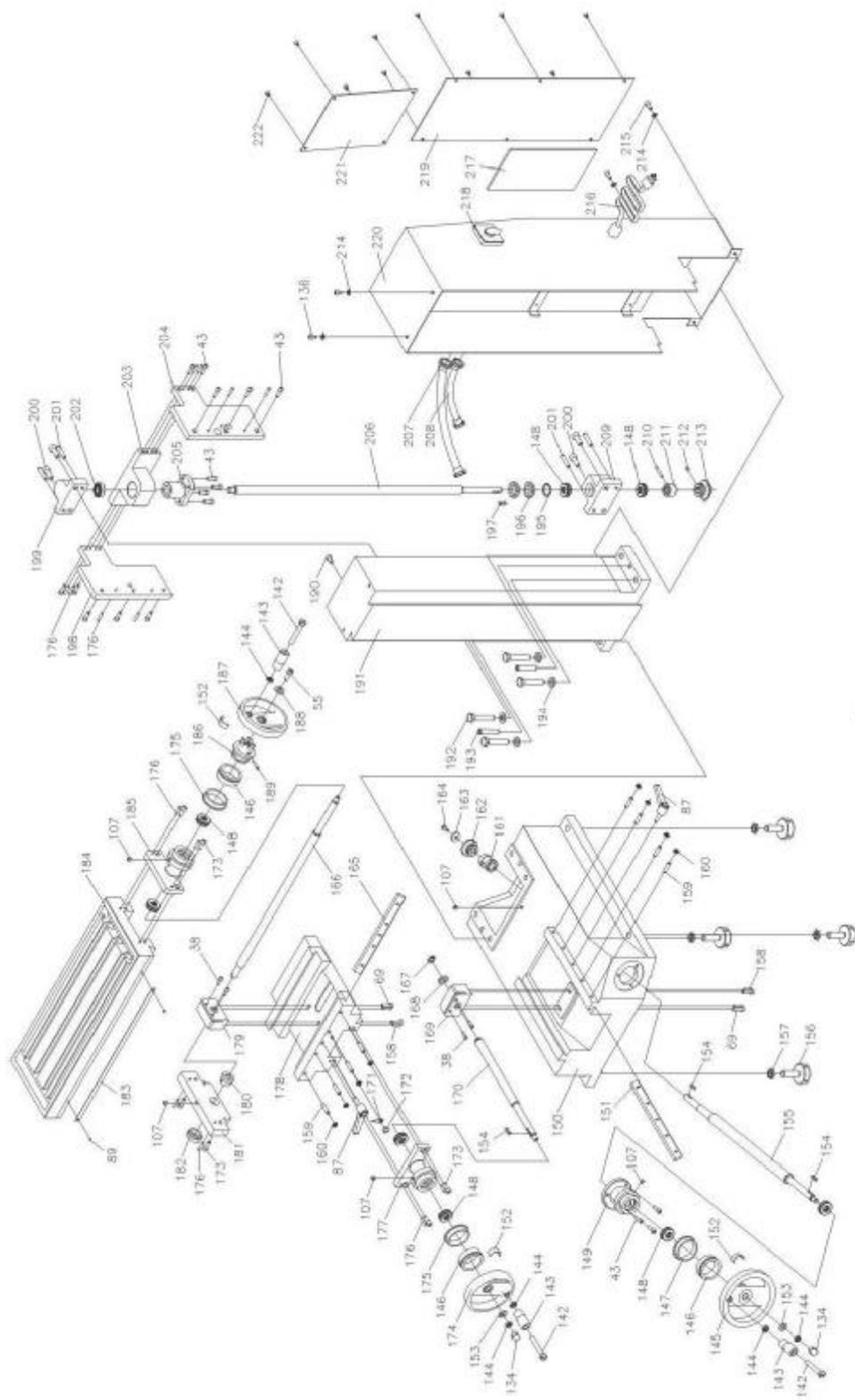
### Appendix A

#### Specification

Max. drilling capacity:	25 mm
Max. tapping capacity:	12 mm
End mill capacity	25 mm
Face mill capacity	50 mm
Spindle stroke	80 mm
Throat	230 mm
Max. distance spindle to table	350 mm
Spindle taper	MT#3 or R8
Spindle speed	100-1750 rpm $\pm$ 10%
Table effective size	550*160 mm
T-slot size	12 mm
Table cross travel	160 mm
Table longitudinal travel	300 mm
Motor output power	1000 W
Overall dimension(L*W*H)	685*560*830 mm
Weight (Net/Gross)	165 / 198 Kg
Packing size (L*W*H)	840*820*1040 mm

***Appendix B – Parts Diagrams***





11

## Appendix C – Parts List

No.	Headstock Assembly	QTY	QTY	No.	Headstock Assembly	QTY
1	Taper Shank	1		54	Dustproof cover I for spindle	1
2	Spindle	1		55	Screw M6*40	1
3	Under Oil Seal I	1		56	Dustproof cover II for spindle	1
4	taper bearing 32907	1		57	Timing belt	1
5	under oil seal II	1		58	Screw M6*16	1
6	nut M5	1		59	Pin 3*10	1
7	Screw m3*8	60		60	Washer	1
8	display fixed bracket	1		61	Motor timing pulley	1
9	square screw	1		62	Screw M6*20	1
10	spindle sleeve	10		63	Washer 6	1
11	sleeve limit pad	1		64	Nut M5	1
12	Bearing 8106	1		65	Bolt M5*25	1
13	upper washer II	1		66	Motor support plate	1
14	bearing 80106	1		67	Key 5*25	1
15	upper washer I	1		68	Brushless motor	1
16	small round nut M27*1.5	1		69	Screw M5*20	1
17	spindle sleeve brake sleeve II	1		70	Screw M4*35	1
18	spindle sleeve brake sleeve I	1		71	Spindle box paneling	1
19	deep washer	1		72	Orientalator steel sleeve	1
20	lock bolt	1		73	rub circle	1
21	spring round pin 3*8	1		74	compress spring 1*6*20	1
22	screw M3*8	1		75	vertical slide	1
23	Switch panel	1		76	tiled wedge	1
24	Screw M4*16	1		77	adjust screw	1
25	indicator light	1		78	Orientalator small gear shaft	1
26	emergency stop switch	1		79	Key 4*12	1
27	touch panel	1		80	Compress spring 0.7*4.7*25	1
28	PC board	1		81	Cover board	1
29	electron display	1		82	Screw M4*10	1
30	Small handle	1		83	Center orientation shaft	1
31	screw M3*10	1		84	Screw M6*8	1
32	Spindle sleeve orientation shaft	1		85	Small gear shaft	1
33	Spindle box	1		86	Inlay shaft	1
34	Left support flange	1		87	Small handle assembly	1
35	check ring 16	1		88	Taper pin 3*10	1
36	check spring cover	1		89	Sculcheon rivet	1
37	clockwork spring	1		90	Indication brand	1
38	screw M4*12	1		91	Adjust screw	1
39	check ring 35	1		92	Staff gauge	1
40	check ring 65	1		93	Pin 5*20	1
41	bearing 80107	1		94	T screw	1
42	Bearing seal	1		95	Washer 10	1
43	screw M5*16	1		96	T screw	1
44	synchronization pulley	1		97	Check ring 20	1
45	lock bolt	1		98	Tiled gear	1
46	taper pin 3*16	1		99	Fastness sleeve	1
47	screw M10*16	1		99	Screw M4*16	1
48	screw M4*6	1		100	Washer I	1
49	cover	1		101	Guide electricity assembly	1
50	block plate	1		102	Worm support box	1
51	rotate speed display	1		103	Bearing 3101	1
52	spindle box cover	1		104	Worm right support flange	1
53	screw M6*40	1		105	Worm left support flange	1
				106	Screw M4*10	1
				107	Cup oil 6	1
				108	Screw 6*20	1
				109	Screw M5*16	1
				110	Screw M5*20	1

No.	Headstock Assembly	QTY	No.	Headstock Assembly	QTY
111	Right support flange II	1	168	Washer	1
112	Joy stick	1	169	Cross lead screw nut	1
113	Compress 0.7*6*25	1	170	Cross lead screw	1
114	Handle assembly	1	171	Finger	1
115	Check ring 4	1	172	Screw M5*6	1
116	Big handle seat	1	173	Screw M6*16	1
117	Small magnetism block	1	174	Handwheel	1
118	Pin 3*14	1	175	Inlay circle	1
119	Assistant small handle	1	176	Taper pin 4*20	1
120	Worm wheel lock handle	1	177	Bearing Seal	1
121	Lock small shaft	1	178	Saddle	1
122	Steel ball 8	1	179	Portrait lead screw nut	1
123	Adjust mat	1	180	left bearing sleeve	1
124	Screw M3*6	1	181	Left support	1
125	Touch fastness fight	1	182	Left support stop up	1
126	Guide electricity bar	1	183	Staff gauge	1
127	Screw M3*6	1	184	Work table	1
128	Worm	1	185	Portrait lead screw bearing seat	1
129	Worm adjust mat	1	186	Limit screw clutch	1
130	Worm left support flange	1	187	Handwheel	1
131	Worm handwheel	1	188	Washer	1
132	Washer 8	1	189	Pin 4*26	1
133	Nut M8	1	190	Screw M5*10	1
134	Cup nut M8	1	191	Verticality lead rail	1
135	Key 4*10	1	192	Bolt M10*50	1
136	Screw M5*12	1	193	Taper pin 6*40	1
137	Right support flange I	1	194	Washer 10	1
138	Key 6*8	1	195	Washer	1
139	Gear shaft	1	196	Small round nut M16*1.5	1
140	Spindle box below cover	1	197	Key 4*26	1
141	Screw M4*10	1	198	Side support plate II	1
142	Screw M8*55	1	199	Upper bearing seal	1
143	Handle sleeve	1	200	Screw M6*20	1
144	Nut M8	1	201	Taper pin 6*30	1
145	Handle wheel	1	202	Bearing 80101	1
146	Dial	1	203	Support fight	1
147	Inlay circle	1	204	Side support plate I	1
148	Bearing 51101	1	205	Verticality lead screw nut	1
149	Support flange	1	206	Verticality lead screw	1
150	Base	1	207	Tube connector	1
151	Cross wedge	1	208	Tube	1
152	Rand	1	209	Below bearing seat	1
153	Washer 8	1	210	Taper pin 4*26	1
154	Key 4*16	1	211	Limit sleeve	1
155	Rotate shaft	1	212	Set screw M5*8	1
156	Adjust bolt	1	213	Taper gear II	1
157	Nut M12	1	214	Washer 5	1
158	Taper pin 3*20	1	215	Screw M5*8	1
159	Screw M8*25	1	216	Power line	1
160	Nut M6	1	217	PC Board	1
161	Shaft sleeve	1	218	Power switch	1
162	Taper gear	1	219	Cover II	1
163	Washer	1	220	Back cover	1
164	Screw M5*14	1	221	Cover I	1
165	Portrait wedge	1	222	Screw M4*6	1
166	Portrait lead screw	1			
167	Checking 12	1			

**Appendix D – Electrical Block Diagram**

