

ProtoTRAK[®] RMX

K3 Knee Mill & Retrofit

Safety, Installation, Maintenance, Service & Parts List Manual

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TRAK MACHINE
TOOLS



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1.0 Safety

The safe operation of the TRAK K Mills depends on its proper use and the precautions taken by each operator.

- Read and study this manual and the ProtoTRAK RMX Programming, Operating, and Care Manual. Be certain every operator understands the operation and safety requirements of this machine *before* its use.
- Always wear safety glasses and safety shoes.
- Always stop the spindle and check to ensure the CNC control is in the stop mode before changing or adjusting the tool or workpiece.
- Never wear gloves, rings, watches, long sleeves, neckties, jewelry, or other loose items when operating or around the machine.
- Use adequate point of operation safeguarding. It is the responsibility of the employer to provide and ensure point of operation safeguarding per OSHA 1910.212 - Milling Machine.

1.1 Safety Publications

Refer to and study the following publications for assistance in enhancing the safe use of this machine.

Safety Requirements for Manual Milling, Drilling and Boring Machines with or without Automatic Control (ANSI B11.8-2001). Available from The American National Standards Institute, 1819 L Street N.W., Washington D.C. 20036

Concepts And Techniques Of Machine Safeguarding (OSHA Publication Number 3067). Available from The Publication Office - O.S.H.A., U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, DC 0210.

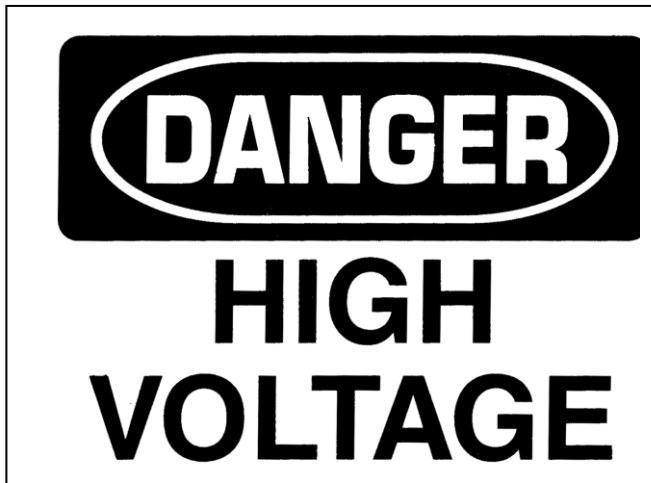
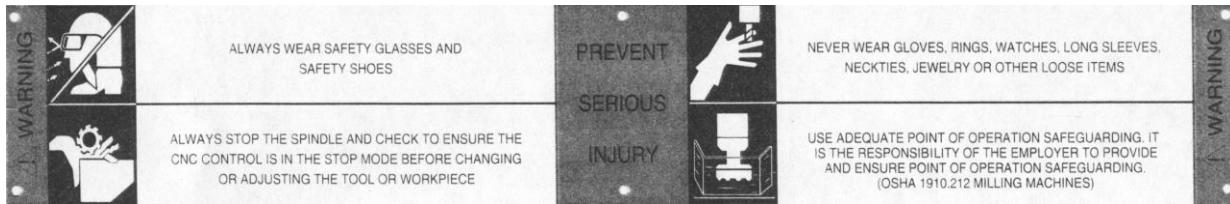
1.2 Danger, Warning, Caution, and Note Labels & Notices As Used In This Manual

DANGER - Immediate hazards that **will** result in severe personal injury or death. Danger labels on the machine are red in color.

WARNING - Hazards or unsafe practices which *could* result in severe personal injury and/or damage to the equipment. Warning labels on the machine are orange in color.

CAUTION - Hazards or unsafe practices, which *could* result in minor personal injury or equipment/product damage. Caution labels on the machine are yellow in color.

NOTE - Call attention to specific issues requiring special attention or understanding.



NOTICE: The manufacture is not liable (responsible) for any damages or injury of any kind to persons or property caused by or resulting from the improper or unauthorized use, operation, maintenance, alteration, modification, change in configuration of this machine or any of its component parts, or the use of this unit with any third party accessories or parts.

.i00775

Safety & Information Labels Used On The
 TRAK K Milling Machines

It is forbidden by OSHA regulations and by law to deface, destroy or remove any of these labels
 RMX K3 – Non Spindle Control

TRAK MACHINE TOOLS
 SOUTHWESTERN INDUSTRIES, INC.
 2615 HOMESTEAD PLACE,
 RANCHO DOMINGUEZ, CA 90220

MODEL
 S/N

THIS UNIT HAS 2 POWER SOURCE(S)
 ELECTRICAL RATINGS:
 VOLTS AMPS PHASE
 Hz
 VOLTS AMPS PHASE
 Hz
 FLA OF LARGEST MOTOR AMPS
 SCCR NOT MORE THAN
 RMS SYM AMPS V MAX

ELECTRICAL DWG #:
 MACHINE (ONLY) MADE IN TAIWAN

TRAK MACHINE TOOLS
 SOUTHWESTERN INDUSTRIES, INC.
 2615 HOMESTEAD PLACE,
 RANCHO DOMINGUEZ, CA 90220

MODEL
 S/N

THIS UNIT HAS 2 POWER SOURCE(S)
 ELECTRICAL RATINGS:
 VOLTS AMPS PHASE
 Hz
 VOLTS AMPS PHASE
 Hz
 FLA OF LARGEST MOTOR AMPS
 SCCR NOT MORE THAN
 RMS SYM AMPS V MAX

ELECTRICAL DWG #:
 MACHINE (ONLY) MADE IN TAIWAN

RMX K3 – Spindle Control

TRAK MACHINE TOOLS
 SOUTHWESTERN INDUSTRIES, INC.
 2615 HOMESTEAD PLACE,
 RANCHO DOMINGUEZ, CA 90220

MODEL
 S/N

THIS UNIT HAS 2 POWER SOURCE(S)
 ELECTRICAL RATINGS:
 VOLTS AMPS PHASE
 Hz
 VOLTS AMPS PHASE
 Hz
 FLA OF LARGEST MOTOR AMPS
 SCCR NOT MORE THAN
 RMS SYM AMPS V MAX

ELECTRICAL DWG #:
 MACHINE (ONLY) MADE IN TAIWAN

Safety & Information Labels Used On The
 TRAK K3 Milling Machines

It is forbidden by OSHA regulations and by law to deface, destroy or remove any of these labels

1.3 Safety Precautions

1. Do not operate this machine before the **TRAK K Mill Installation, Maintenance, Service and Parts List Manual**, and **ProtoTRAK RMX Programming, Operating & Care Manual** have been studied and understood.
2. Do not run this machine without knowing the function of every control key, button, knob, or handle. Ask your supervisor or a qualified instructor for help when needed.
3. Protect your eyes. Wear approved safety glasses (with side shields) at all times.
4. Don't get caught in moving parts. Before operating this machine remove all jewelry including watches and rings, neckties, and any loose-fitting clothing.
5. Keep your hair away from moving parts. Wear adequate safety headgear.
6. Protect your feet. Wear safety shoes with oil-resistant, anti-skid soles, and steel toes.
7. Take off gloves before you start the machine. Gloves are easily caught in moving parts.
8. Remove all tools (wrenches, chuck keys, etc.) from the machine before you start. Loose items can become dangerous flying projectiles.
9. Never operate a milling machine after consuming alcoholic beverages, or taking strong medication, or while using non-prescription drugs.
10. Protect your hands. Stop the machine spindle and ensure that the CNC control is in the stop mode:
 - Before changing tools
 - Before changing parts
 - Before you clear away the chips, oil or coolant. Always use a chip scraper or brush
 - Before you make an adjustment to the part, fixture, coolant nozzle or take measurements
 - Before you open safeguards (protective shields, etc.). Never reach for the part, tool, or fixture around a safeguard.
11. Protect your eyes and the machine as well. Don't use compressed air to remove the chips or clean the machine.
12. Disconnect power to the machine before you change belts, pulley, and gears.
13. Keep work areas well lighted. Ask for additional light if needed.
14. Do not lean on the machine while it is running.
15. Prevent slippage. Keep the work area dry and clean. Remove the chips, oil, coolant and obstacles of any kind around the machine.
16. Avoid getting pinched in places where the table, saddle or spindle head create "pinch points" while in motion.
17. Securely clamp and properly locate the workpiece in the vise, on the table, or in the fixture. Use stop blocks to prevent objects from flying loose. Use proper holding clamping attachments and position them clear of the tool path.

18. Use correct cutting parameters (speed, feed, depth, and width of cut) in order to prevent tool breakage.
19. Use proper cutting tools for the job. Pay attention to the rotation of the spindle: Left hand tool for counterclockwise rotation of spindle, and right hand tool for clockwise rotation of spindle.
20. After an emergency stop, always turn the FORWARD/REVERSE switch to "Off" (STOP) before releasing or resetting the E-Stop.
21. Prevent damage to the workpiece or the cutting tool. Never start the machine (including the rotation of the spindle) if the tool is in contact with the part.
22. Check the direction (+ or -) of movement of the table, saddle, and quill when using the jog or power feed or ram out.
23. Don't use dull or damaged cutting tools. They break easily and become airborne. Inspect the sharpness of the edges, and the integrity of cutting tools and their holders. Use proper length for the tool.
24. Large overhang on cutting tools when not required result in accidents and damaged parts.
25. Handwheels must have the crank folded inside when using CNC programmed machining or rapid feeds, power feed or jog.
26. Prevent fires. When machining certain materials (magnesium, etc.) the chips and dust are highly flammable. Obtain special instruction from you supervisor before machining these materials. Keep flammable materials and fluids away from the machine and hot, flying chips.
27. Changing the speed of rotation of the spindle must be done while the rotation is on for non spindle control machines.
28. Interlocked table guards may be purchased from Southwestern Industries, Inc. if deemed necessary by the user.

2.0 Installation

Read and understand this entire installation section before beginning the installation procedure.

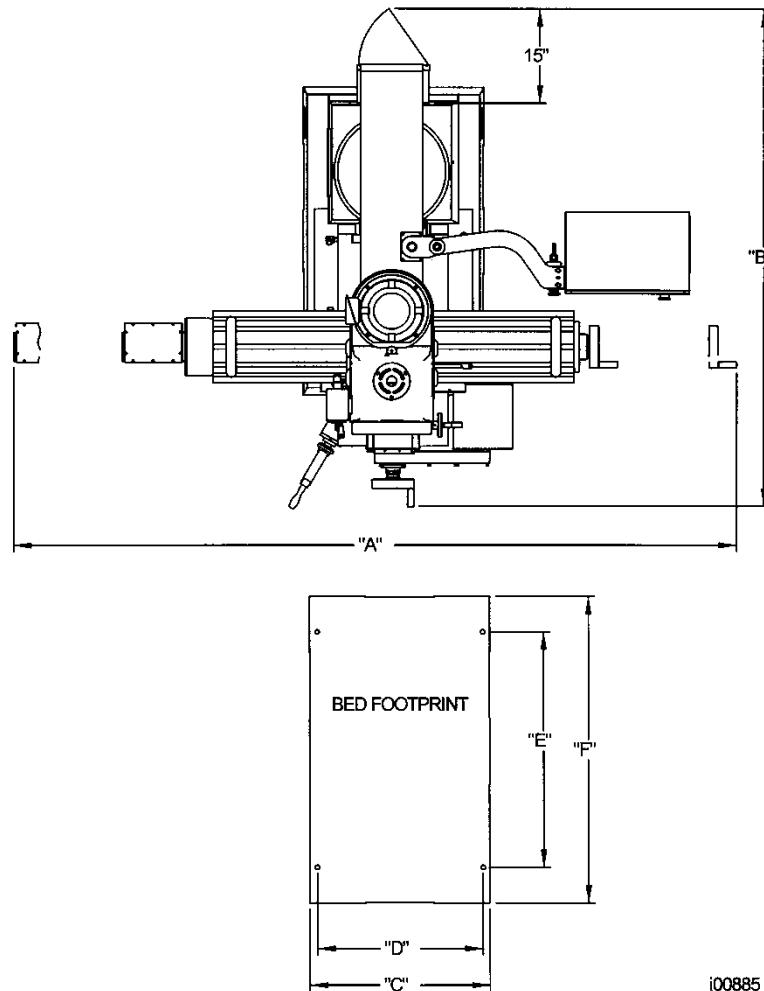


Figure 1 – Machine Footprints

2.1 Floor Plan, Layout & Space Requirements – K3

	K3
Weight (approximate) net	2800 lbs
Weight (approximate) shipping	3100 lbs
Pallet Size	6' x 6'
A Overall width	103"
B Overall length	67.6"
C Base width	24.2"
D Width between leveling screws	21.9"
E Distance between leveling screws	29.7"
F Base length	38.8"

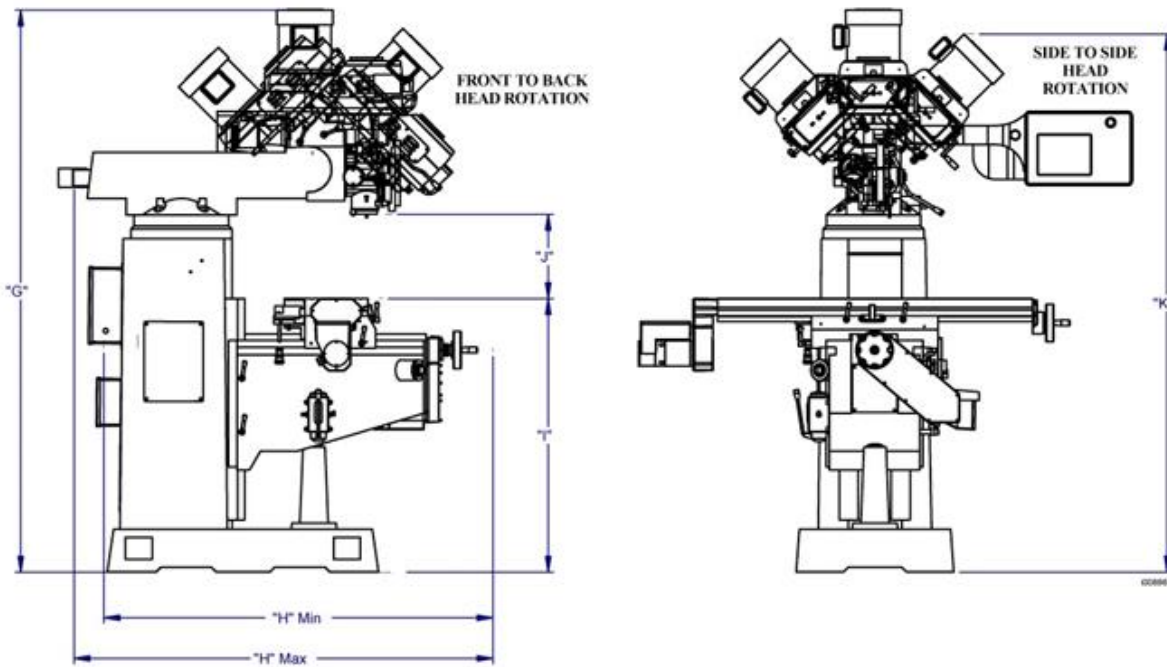


Figure 2 – Overall Dimensions

	K3
Table Size	10" x 50"
T-Slots (number x width)	3" x 5/8"
Dimension G (Non Spindle Control)	87"
Dimension G (Spindle Control)	92"
Dimension G Min	65"
Dimension H Min	64"
Dimension H Max	78"
Dimension I Min	38"
Dimension I Max	49"
Dimension J Max	17"
Dimension K	69"

2.2 Uncrating

Carefully remove the wood crate and protective packaging, paying attention not to scratch, damage, or mar any parts of the machine.

Remove the cardboard boxes with the PENDANT DISPLAY (handle carefully) and the box containing the TOOL BOX. The leveling pads and screws for the machine can be found in the toolbox. The Y way covers are shipped in a separate tube.

Loosen and remove 4 screws and nuts holding the machine to the wood pallet.

ATTENTION!

Immediately report, in writing, any damages observed at this time that can be attributed to the transportation or improper handling/moving of the machine.

2.3 Shortages: Inventory Checklist

- _____ Machine (check model and serial number)
- _____ Manual drawbar with washer
- _____ Leveling pads (FC114), screws (FC112) and leveling nuts (FC113) (4 each)
- _____ Pendant Display with four M6 SHCS screws for mounting
- _____ Pendant Arm assembled to the column
- _____ Toolbox with various tools
- _____ Way covers K3 – front of saddle - 20872
- _____ Way covers K3 – rear of saddle - 20871

In case of shortages, contact the representative from whom you purchased the machine.

2.4 Installation Instructions & Checklist

Installer: Use this checklist to assure a complete set-up of the K3 or RMX 2 or 3-axis retrofit or upgrade.

..	1. Shut off power to the machine.
..	2. Visually inspect the 208 or 480V wiring going into the electrical panel. Visually verify the wiring is correct per our wiring diagram. Make sure a strain relief is being used where the wiring enters the cabinet. Have the customer repair any wiring discrepancies. Measure the 208 volt or 480 volt and 110 volt input power to make sure it is within specification. If not, notify customer and report on service report. 208 Volts only used for spindle control machines.
..	3. Clean the machine if needed and remove any remaining grease.
..	4. Unlock the table, saddle, and knee gib locks.
..	5. Mount the pendant to the pendant arm using (4) M6 socket head cap screws.
..	6. Make and check all the proper electrical connections from the pendant to the electric box. See drawing 29983-3 at rear of manual.
..	7. On retrofits, place the nameplate serial # plate (21934) on the pendant arm. This serial # plate is the main system # for that machine. Place the serial # plate using 2 drive screws to the front of the pendant arm near the pivot point of the arm. Use a #36 drill bit for drive screws. See drawing 29756-6 or -8 at the rear of the manual.
..	8. On retrofits and TRAK knee mills make sure to plug in the machine ID key on the pendant.
..	9. Turn on the power to the machine and to the pendant.
..	10. Load software from our website. The pendant may or may not have the latest software loaded. (Retrofits and upgrades only.)
..	11. Lubricate all the way surfaces and the ball screws.
..	12. Jog the table and saddle back and forth until the way surfaces are well lubricated. Oil should be visible on all the way surfaces.
..	13. Check the level of the machine. The machine should be level to within 0.0005" front to back and 0.0005" side to side. Even though it is the responsibility of the customer, make any adjustments if necessary.
..	14. Check tram on head and adjust as necessary.
..	15. Turn on features like glass scales, limit switches and electronic handwheels via service codes 304, 305, 312 (338). The EHW option is turned on by the option key. Check to make sure the EHW's are turned on under the Status info screen.
..	16. Jog each axis. If you see a fault, you may need to reverse the direction of the glass scales via service codes 322 and 321.
..	17. If the motors are running in the wrong direction, perform service code 97.
..	18. Check to make sure that the E-Stop button is functioning correctly and turns off power to the axis motors. On SWI machines make sure the spindle turns off as well. On retrofits we do not interface with the spindle.
..	19. Run spindle at various RPM's. For spindle control knee mills, check the spindle calibration with service code 510. Note any noise as you run the spindle in forward and reverse.
..	20. Check and adjust gibs as required.
..	21. Perform Service Code 12, Feed Forward Constant.

..	22. Perform Service Code 100 in both directions for the X and Y and make sure the feedrate is at least 120 ipm. Note – code 100 on the Z axis does not work on 3 axis knee mills.
..	23. Perform Service Code 11 to automatically calculate the backlash for the X and Y-axis of glass scale machines.
..	24. Perform Service Code 123 to calibrate the X and Y-axis using a 150mm standard. If you do not have a precision standard, cut a part, measure it and then enter a calibration factor in service code 122.
..	25. Perform Service Code 128 to enter backlash for the X and Y-axis of single feedback machines (i.e. motor encoder only).
..	26. Check for positional accuracy and repeatability on the X and Y-axis using programs SWI Test programs X REPEAT 2 AXIS.PT10 and Y REPEAT 2 AXIS.PT10 respectively. Positioning and repeatability values should be less than or = to 0.0005”.
..	27. Perform Service Code 123 and quill softkey to calibrate the Z-axis quill (2 axis knee mills) or press Z axis to calibrate the 3 rd axis on 3 axis knee mills using a 75mm or 3” standard. If you do not have a precision standard, cut a part, measure it and then enter a calibration factor in service code 122.
..	28. Perform Service Code 128 to enter backlash for the Z-axis. Applies to 3 axis systems only.
..	29. Check for positional accuracy and repeatability on the Z-axis using SWI test program Z REPEAT.PT10. Positioning and repeatability values should be less than or = to 0.0005” for the quill and 0.001” or so for the 3 axis knee mill quill. If using a 3” standard, the Z repeat program will need to be modified to use 3” vs 75 mm.
..	30. If the machine or retrofit came with an auxiliary function option, then use accessory key on pendant and make sure the coolant pump and/or solenoid for the mister fires. The accessory key should be in the ON position to test coolant pump or solenoid. The control should be in DRO mode. Make sure air is hooked up to the machine during the test. If the machine has a separate coolant pump switch mounted to the pendant, then turn this on and off to test.
..	31. Perform service code 530 and enter machine serial number. The pendant serial number should be set at the factory.
..	32. If the machine has a power drawbar option, check to make sure that the tools load and unload properly. N/A to retrofits.
..	33. Wipe down the machine prior to leaving.

2.5 Machine Specifications

Specifications	K3
Movement and ranges (X, Y, Z axis)	32" x 16" x 16"
Quill Travel (maximum)	5"
Quill Diameter	86 mm
Spindle Taper	R8
Speed Range – non spindle control	60-4200 RPM
Speed Range – spindle control	40-5000 RPM
Spindle to Column	8" to 32"
Quill Feeds Per Revolution of Spindle (Not applicable on three axis)	.0015/.003/.006 "
Head Tilt	+/- 90°
Head Swivel	+/- 45°
Spindle Motor Power	3 HP
Voltage – Non Spindle Control	208/480 V
Voltage – Spindle Control	208 V
Phase/Cycle	3 phase/60 Hz
Current- Non Spindle Control	8.5/4.25 amps
Current – Spindle Control	11 amps
Maximum Weight of Workpiece	850 lbs
Coolant Capacity	9 gallons

2.6 Maximum Work Capacities

Capacities	K3
Drilling Mild Steel (2-axis manual feed)	1 ¼"
Tapping Mild Steel – non spindle control	1" ½"
Tapping Mild Steel – spindle control	
Milling (metal removal rate/mild steel)	1 ½ inch ³ /min
Drilling (3-axis systems)	½"

Maximum work capacities are dependent on a lot of variables that cannot be controlled by the machine manufacturer. Each one of the following will have an impact on the above numbers: speeds, feeds, cutter, cutter sharpness, material, setup, coolant and machine adjustments. The numbers above assume all conditions are optimal and may be higher or lower depending on material composition.

2.7 ProtoTRAK RMX Control Hardware

ProtoTRAK RMX CNC Specifications

The list below summarizes the features and specifications.

2.7.1 Basic System Specifications

Control Hardware

- Digital Servo Amplifiers – custom designed for ProtoTRAK operation
- D.C. Servo Motors – rated at 280 in-oz. continuous torque providing double the amount of torque required
- Precision Ball Screws – in the table and saddle
- Modular Design – simplifies service and maximized uptime
- 115V/60HZ/12 amps
- Polycarbonate Sealed Membrane Keypad to lock out contamination
- Rugged Industrial PC
- Glass Scale on quill for Z-axis readout
- 2 or 3-axis CNC, 3-axis DRO
- Real handwheels for manual operation
- 15.6" Touchscreen LCD
- Intel® 2.0 GHz processor
- 4 GB Ram
- At least 32 GB of mSATA SSD
- 5 USB connectors
- 2 Ethernet Ports (1 for user and 1 for motion control)
- Override of program Feedrate
- Override of spindle speed (Only applicable for Spindle Control machines)
- LED status lights built into run panel
- E-stop
- Feed STOP and GO
- Fine vs Course EHW resolution control
- Accessory button to control coolant and AUTO mode in RUN mode
- Headphone jack for video sound (headphone supplied)

Canned Cycles (Event types):

- Position Drill
- Bolt Hole
- Mill
- Arc
- Circular profile
- Rectangular profile
- Irregular Profile (with Auto Geometry Engine)
- Face Mill
- Circle pocket
- Rectangular pocket
- Irregular Pocket (with Auto Geometry Engine)
- Islands including Pocket and Island shapes
- Subroutine Repeat
- Subroutine Mirror

- Subroutine Rotation
- Copy (O)
- Copy Mirror (O)
- Copy Rotate (O)
- Engrave (O)
- Engrave subroutines and copy (O)
- Aux Event
- Clear Off – 3 axis (O)

Options

- Remote Stop/Go (RSG) switch
- USB thumb drive for program storage and transfer.
- Offline programming system
- DXF and Parasolid programming
- Clear off event on 3 axis
- MT Connect
- TRAKing
- EHW (Electronic Handwheel Option)
- Aux Function Option
- Advance Feature Software Option
- Programmable Spindle Control
- Riser Blocks
- Power Drawbar
- Limit Switches
- Glass Scales on X and Y
- Chip Pan
- Power Knee Feed
- Tableguard on K3 Mill
- Coolant Pump on K3 Mill
- Worklamp
- Vise

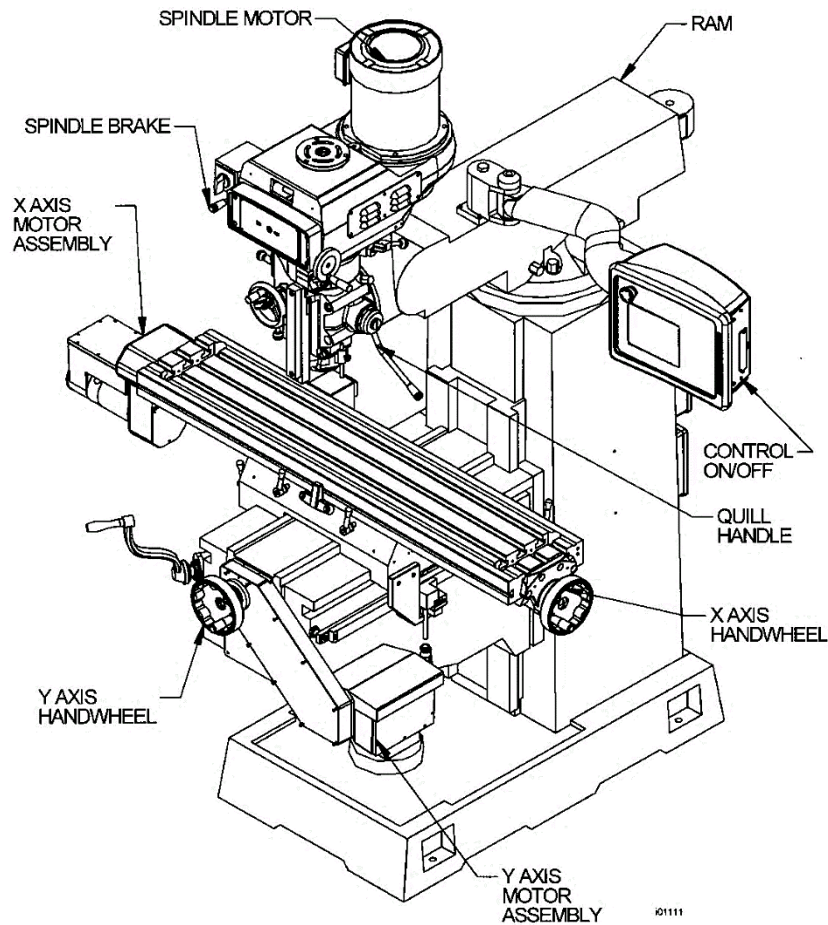


Figure 3 - Knee Mill Component Identification

Item	Part Number	Description
	K3	
1	20819	Non Spindle Motor
2	24162	Spindle Control Motor
3	29006-5 29006-6	RMX Pendant – non spindle control RMX Pendant – spindle control
4	15616	Y-Axis Handwheel (Saddle)
5	15616	X-Axis Handwheel (Table)
6	21946	EHW for X or Y
7	20296	X, Y or Z Motor
8	24101-4	Servo driver
9	29770-1	Cable Breakout Box
10	15609-12, -16, -19	Y Axis Ballscrew – depends on machine, K3 uses 16"
11	15608-36, -42, -48, -54	X Axis Ballscrew – depends on machine, K3 uses 48"

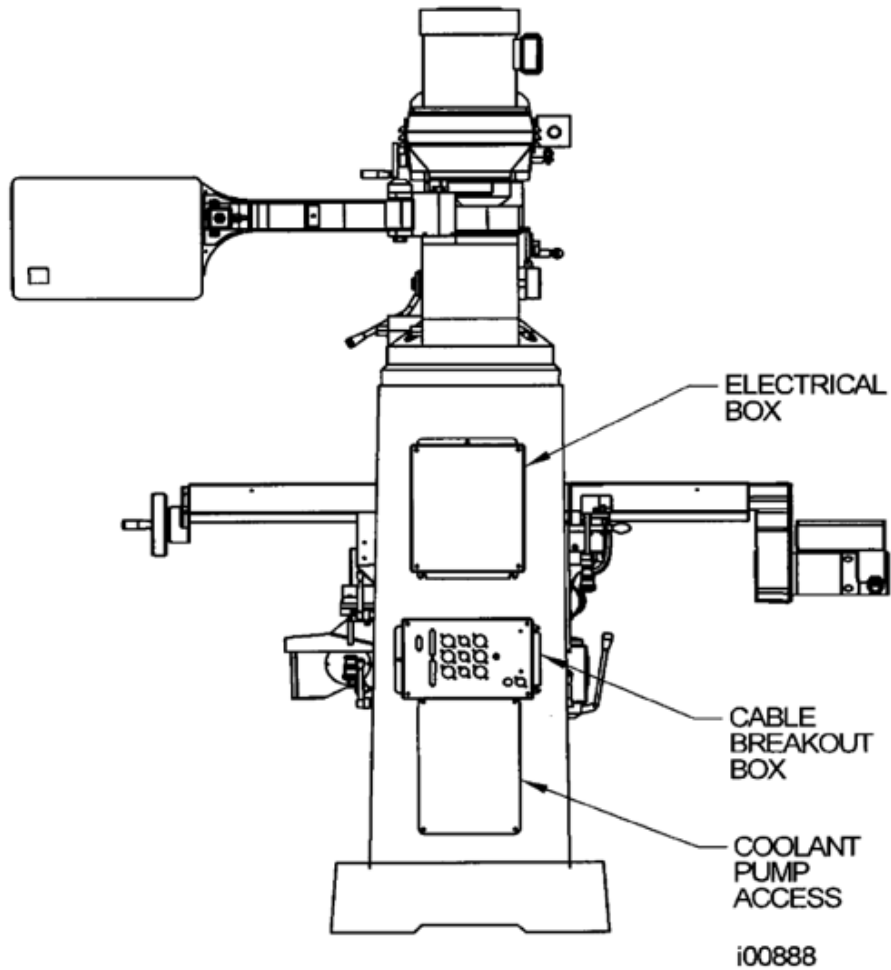


Figure 4 - Knee Mill Rear View

Item	Part Number – K3	Description
1	208V=20676 480V=20676	Electrical Box – Non Spindle Control
2	24060-4	Spindle Control Electrical Box
3	29770-1	Cable Breakout Box (optional)
4	9001	Lube Pump
5	20676-2	Electrical box (if have tableguard option)

2.8 Lifting and/or Moving the Machine

CAUTION!

The K3 machine weighs approximately 2800 lbs. Proper equipment of sufficient capacity must be used when lifting and/or moving the machine.

See Figure 5 to Prepare the Mill before Lifting:

1. Using a steel cable with protective sleeving (min 3/4" diameter) or a 3-ton sling, position sling loops on machine as shown in Figure 5.
2. Use cardboard pieces or other suitable protective sheets on both sides of the machine to prevent scratching.
3. Remove the 4 nuts and screws holding the machine to the wood skid.
4. Lift the machine (the machine should lift approximately level).
5. Insert the 4 screws for leveling pads in their place in the bed.
6. Place the machine in its location (see floor plan and bed footprint drawing), carefully positioning each leveling pad under each leveling screw.
7. Remove the lifting cable or sling and all protective cardboard.

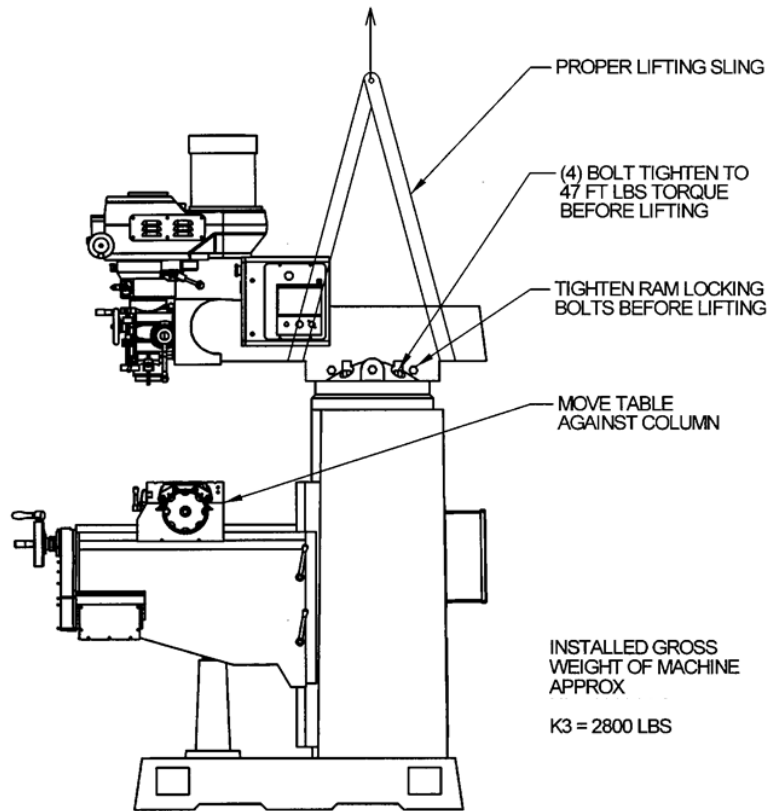


Figure 5 - Lifting the Machine

2.9 Cleaning

1. Remove rust protective coating from the machine before moving any slideways (table, saddle, knee, etc.).
2. The coating is best removed with clean, dry rags. Do not use a cleaning solution that may damage the rubber way scrapers, plastic parts, or paint.

WARNING!

Do not use gasoline or other flammable cleaning agents for cleaning the machine.

3. It may be necessary to move back and forward, left and right, and up and down the table, saddle and the ram. Always release the clamp levers (two in front of the table, one underneath the saddle on each side, and two ram lockbolts on the right side of the column) before attempting to move the above parts.

CAUTION!

Never move any of the above parts over ways that were not previously cleaned. Serious damage to the TURCITE surface of slideways can occur.

4. Be certain the table, saddle and spindle move freely and smoothly over their entire length.

2.10 Leveling: Leveling Tolerance is .0005"/10"

1. Set the machine on its 4 leveling pads on a solid, level floor prepared in accordance with the state and local rules for machine tool installation as shown in Figure 6.
2. Put one or two precision Spirit Levels or Electronic Levels in the center of the table in the positions illustrated in Figure 6A.
3. Adjust the 4 corner leveling screws on their pads until the machine is level to .0005 in/10 in.
4. If the machine must be anchored to the floor, follow the general instruction for installing machine tools and use for leveling any well-known methods: shims, etc.).
5. If the machine must be installed on vibration mounts/pads (rubber, commercially available leveling and vibration mounts, etc.) follow the instructions delivered with the mounts/pads, ordering them to satisfy the load of the machine and the maximum weight of the work piece.
6. When machine is correctly level, lock the adjusting screws in place with their hex nuts.

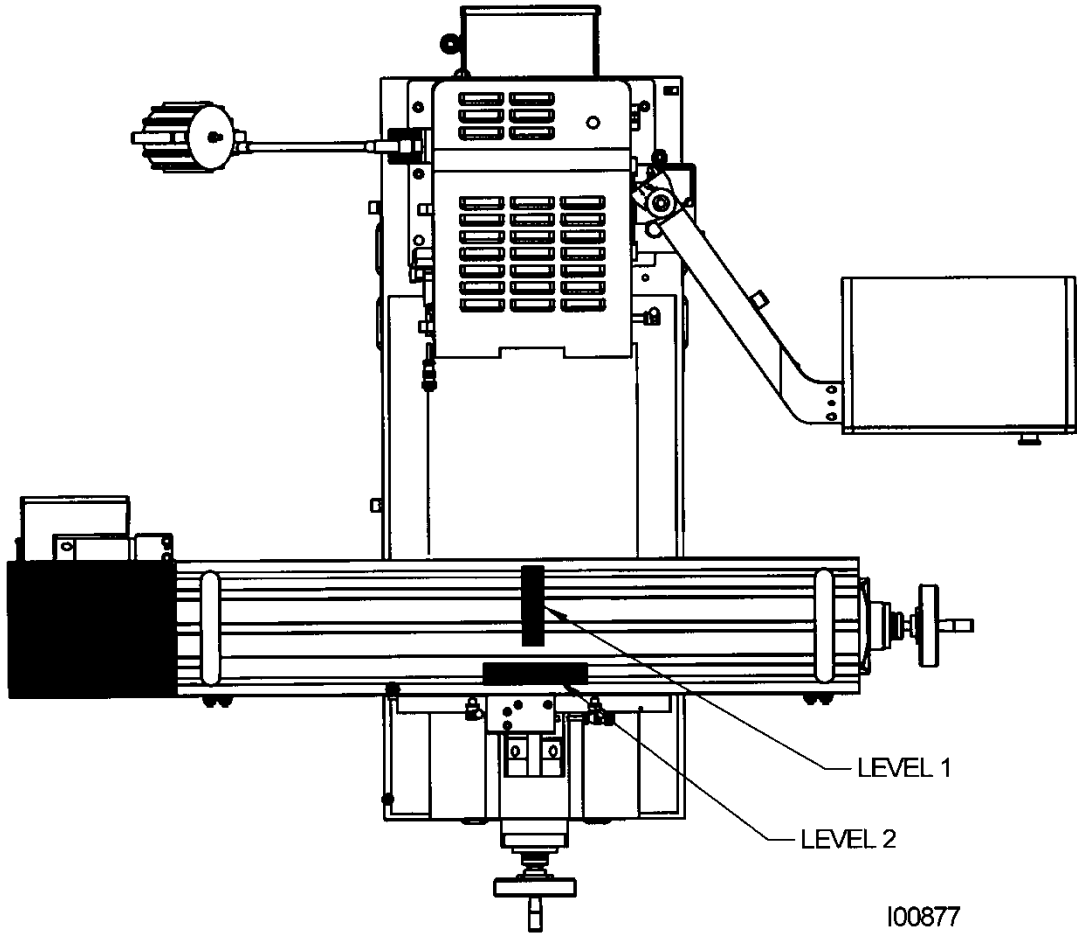


Figure 6A - Placement of Levels

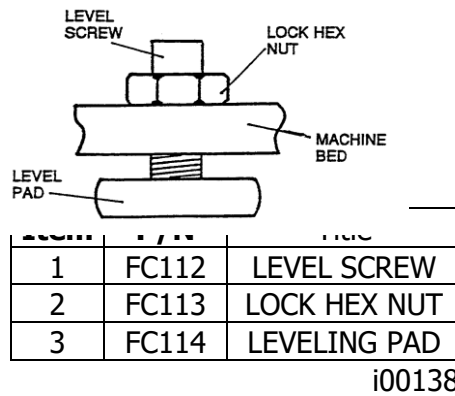


Figure 6 - Leveling Screws

2.11 Electrical Connection

The TRAK K3 Knee Mill can be configured for 208 or 480 volt 3 phase electricity. These machines also require a 110V power source to power the control. Spindle control machines come with 208 volts only.

DANGER!

Be certain that 200-volt electricity (typical range 200 – 240V) is used only with a machine labeled 208 volts at the motor and at the electric's box on the back of the column.

Be certain that 400-volt electricity (typical range 415 - 500V) is used only with a machine labeled 480 volts at the motor and at the electric's box on the back of the column.

DANGER!

The 208 or 480-volt line must originate from a dedicated and independent fused box with a manual shut-off lever. It is the responsibility of the purchaser to supply a wired box that meets all local codes and regulations.

Incoming 208 or 480-volt power connects to the machine through the electrical box located on the back of the column. The power cable enters the black box through a hole on the top of the box.

DANGER!

Only a qualified electrician should wire the 208 or 480-volt 3-phase electricity.

Non Spindle Control Machines only - To convert a K3 machine from 208 to 480 volt power or vice versa 3 things must happen: spindle motor must be rewired (see diagram below), overload relay must be set to 8.5 amps for 208 V and 4.25 for 480 volts and the voltage stickers on the electric's box must be replaced.

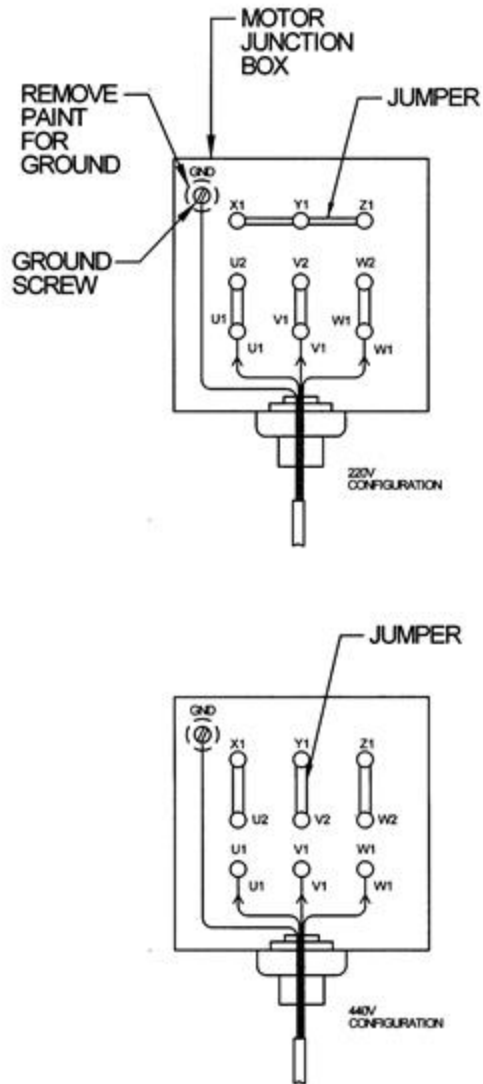
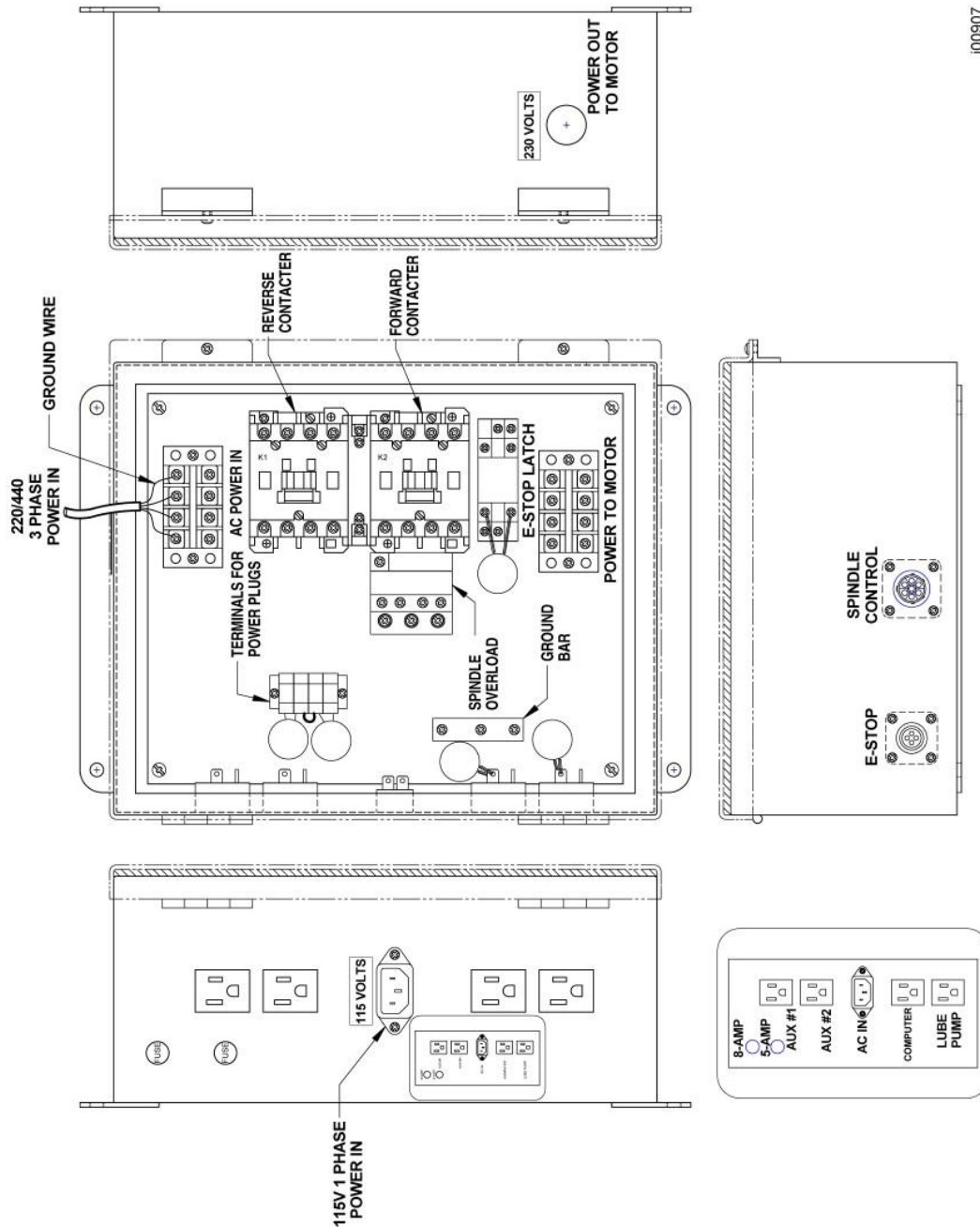


Figure 7 – Spindle Motor Rewiring – Control Machines Only

Southwestern Industries recommends the machine be earth grounded by driving a copper rod into the ground. It is the responsibility of the customer to install this rod.



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Figure 8 - Wiring K3– Not for Retrofit – non spindle control

Part Number	Description
K3	
208V & 480V = 20676	Electrical Box
208V & 480V = 23438-3	Overload
23436	Contactor (Qty = 2) (Reverse or Forward)

NOTE: If equipped with Table Guard Option, the Electrical Box the P/N is 20676-2.

3 phase power goes inside electrical cabinet as shown. Hook up 208 volts to the power switch. Hook ground wire to ground bar.

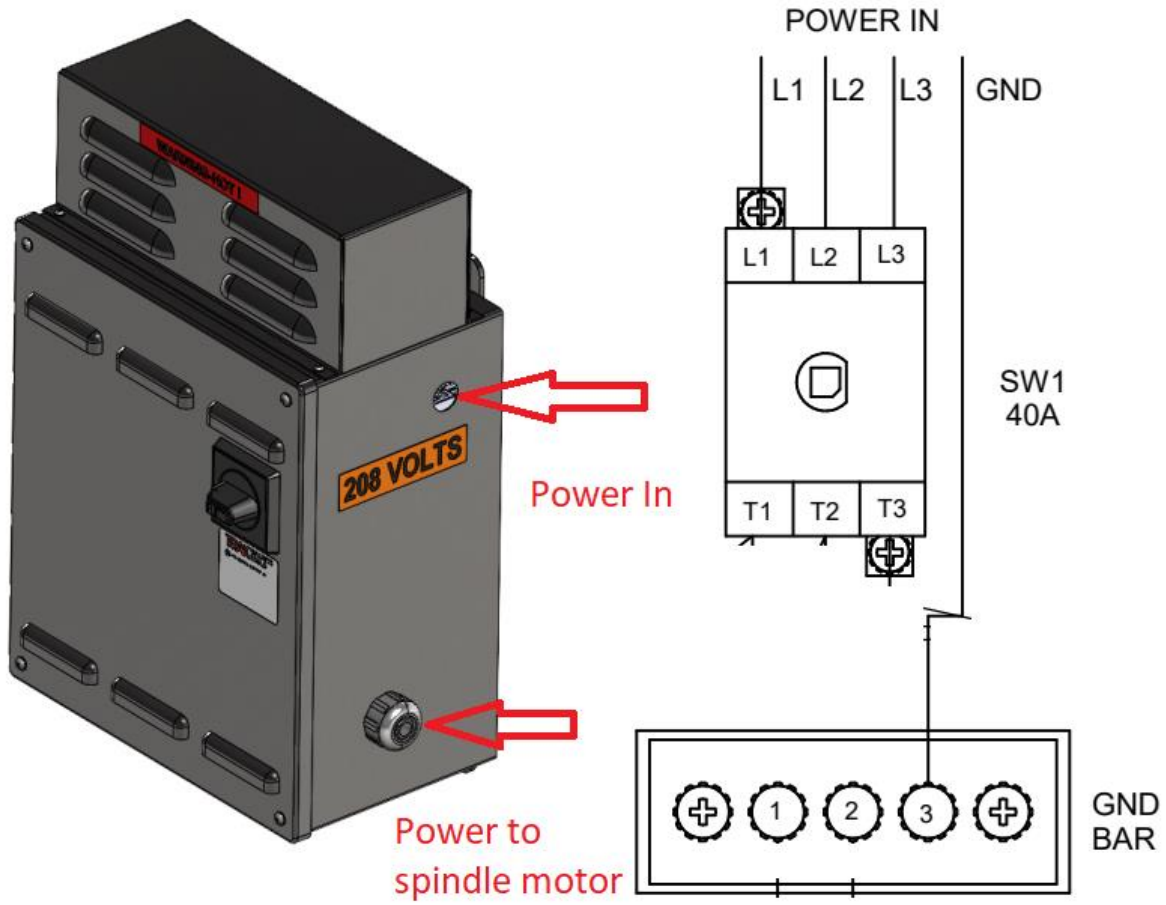


Figure 9 - Wiring K3– Not for Retrofit – spindle control

2.12 Air Connection - Optional

The K mill machines have an air hookup in the rear of the machine if the machine has a power drawbar or auxiliary function option. Auxiliary function options are only found on 3 axis mills.

If the machine has a power drawbar option then the machine will include an air regulator, air manifold and an oiler. The air fitting is ¼" NPT. Within the manifold there is an additional air line port in case the user wants to hook up an air line to clean chips. Remove the plug to gain access to this port. If the machine has an auxiliary function option then the machine will include an air solenoid.

The air regulator is set to 90 psi at the factory for the power drawbar unit and solenoid. See a drawing 22580-7 at the rear of the manual for more information on the power drawbar unit. The air comes in through the manifold, and then into the air regulator that tees off into an oiler for the power drawbar unit and into an air solenoid. The solenoid is used for a misting system the user may install later on this machine. There is a ¼" quick disconnect air fitting on the solenoid where the mister air hose can be plugged into. See drawing 22380-1 at rear of manual for a drawing of this assembly.

The air requirement for the power drawbar option is 17.5 SCFM or 2.5 CFM at 90 psi.

2.13 Mounting the Display Pendant

The ProtoTRAK RMX display pendant mounts to the pendant arm with four M6 SHCS. There is a locating screw on the pendant arm to help align the pendant with the mounting holes.

CAUTION!

The locating screw in the arm is used for positioning. Keep a hold of the pendant until the screws are fastened.

If the pendant arm rotates too freely, remove the painted cap on the bracket attached to the column and tighten the hex nut to adjust it. Replace the cap. See Drawing 29756-6 at rear of manual.

2.14 Cable Interconnections

All cable interconnections are made at the factory except for those connecting to the pendant display. See drawing 29983-3 at rear of manual for all cable interconnections. Find the configuration that pertains to your application. Please pay attention if you machine has spindle control or not.

With the main power to the machine turned off, plug in the connectors that are bundled on the pendant arm. Each cable mates to only one connector on the pendant display back panel. Use the key on the pendant to match up the connectors with the correct port.

Make sure there is sufficient slack in the cables for when the pendant is rotated with the pendant arm. The worst case is when the pendant is all the way forward toward the operator.

Make sure the machine ID key is plugged into the machine or it will not run

CAUTION!

Make sure the main power is turned off on the back of the electrical cabinet before plugging in the cables.

2.15 Lubrication

CAUTION!

Failure to properly lubricate the mill will result in the premature failure of bearings, sliding surfaces & ballscrews

2.15.1 Manual Lubrication

The TRAK mill X & Y way surfaces and ball screws need to be manually lubricated. The Manual Lube automatically discharges about 4ml of oil every plunge.

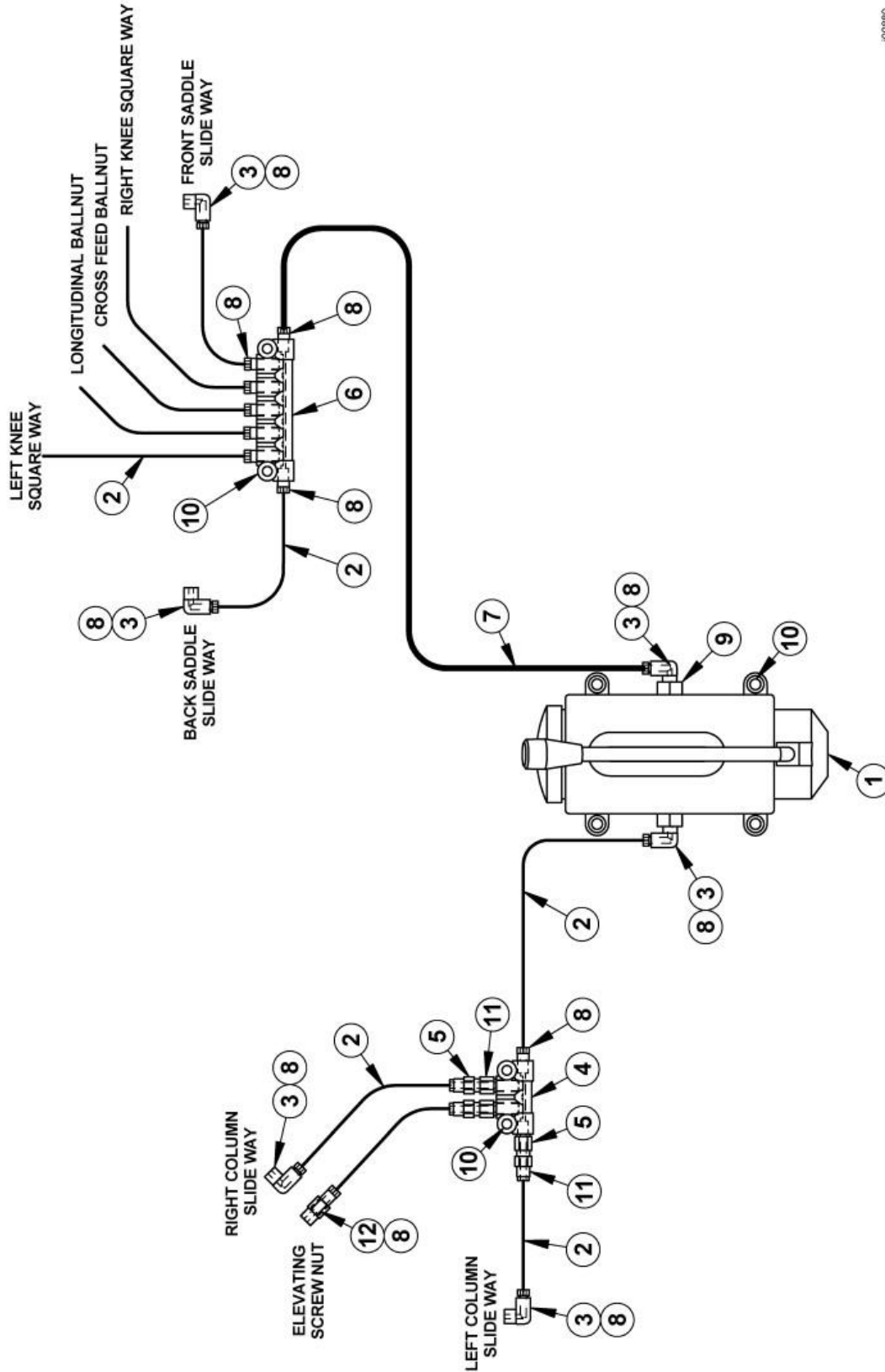
1. At the beginning of each day, manually pull the pump handle.

Note: If the machine has been sitting for a long while, run the machine through the full length of its travel to ensure lubrication reaches all surfaces.

2. At the beginning of each day, check the oil level in the system. If low, fill with Mobil Vactra Oil No. 2 or equivalent.

CAUTION!

Failure to manually activate the pump at the beginning of each day and allowing the pump to run dry may cause severe damage to the TRAK mill way surfaces and ball screws.



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Figure 10 - Knee Mill Lubrication

2.15.2 Parts List –Knee Mill Lubrication (Figure 10)

Item	P/N	Title	Qty
1	9001	HAND OILER	1
2	9002	ALUMINUM PIPE	6
3	9003	ELBOW	6
4	9004	T-JOINT - 4 HOLES- M8 X 1.0	1
5	9005	CONNECTOR	3
6	9006	REGULATING DISTRIBUTOR	1
7	9007	FLEXIBLE TUBE - 21 inches	1
8	9008	SCREW NUT - M8 X 1.0 MALE	15
9	9009	SCREW NUT - PD 1/8- 19MM	2
10	9010	SCREW - M5 X 20 mm LG	8
11	9011	SCREW NUT - M8 X 1.0 FEMALE	3
12	9012	ADAPTER	1
13	9013	SLEVE - 4.1 mm I.D.	18

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2.15.3 Head Lubrication

Once Each Week:

Add SAE 30 or 30W oil to fill the side cup on the head. This will provide lubrication to the quill. See Figure 11.

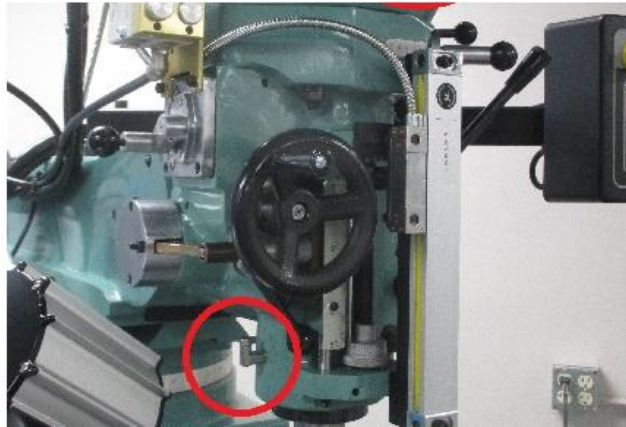


Figure 11 Side Cup

Twice a Month:

Apply 2 drops of oil in upper cup on front of head with SAE 30 oil. This feed supplies oil to the feed cradle for the power quill feed to keep the grease pliable. If oil is not added, the grease on the feed cradle will thicken and this makes it difficult to engage the power quill feed. See Figure 12.

WARNING!

Do not overfill this oil cup as excess oil could wash down into the upper spindle bearings and wash away the grease.



Figure 12 Upper Cup

Every Four Months:

Apply a good grade of general-purpose grease through the grease fittings on the back of the head. This grease lubricates the Low range gear set and the feed change gears respectively.

3.0 Troubleshooting by Symptom

Use this section to begin the process of resolving a service problem. Each symptom type is described in a few words and then more fully described in an explanatory paragraph. Following this is a chart that directs in the most logical steps.

3.1 Problems Relating to Machining Results

3.1.1 Poor Finish

The part finish is marred with scallops or is very rough.

Do the following Service Codes and document values:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 11** Measures backlash in the system (Only used on Dual Feedback systems)
- **Code 12** Feed Forward Constant
- **Code 128** Enter backlash compensation (for Z-axis on three-axis systems; not used on Dual Feedback systems)

Possible Cause	Check This
Too much backlash entered for code 128 or calculated with code 11.	Verify nothing is mechanically loose and the backlash values are not higher than what physically is in the system.
Machine Tool & Setup problem	Check for any looseness in the setup (Tool, Tool holder, Part, Vise, or Fixture). Check the condition and type of cutter being used, type of material, RPM and Feedrate, etc.
Table, Saddle, or Knee Locks are locked	Make sure the Table and Saddle Locks are unlocked. Never use gib locks with a CNC machine.
Inadequate or no Lubrication to Ballscrews and Way surfaces	Make sure all the Way surfaces are getting proper lubrication. If not, check to make sure that the lube pump is functioning properly. Also check for any pinched or blocked oil lines.
X, Y, and knee Gibs are not adjusted properly	Check the adjustment of the X and Y gibs. See X and Y Gib Adjustments in Section 5.1.
X & Y-axis Drive Trains are loose	Check Repeatability using the Repeatability and Positional Accuracy procedure. Step by step, carefully inspect the Drive Train for any looseness. It may be necessary to disassemble and then reassemble the Drive Train.
Way surfaces are pocked, scarred, or excessively worn	Visually check the condition of all the Way surfaces. For machines that may have excessively worn Way surfaces you may need to adjust the Gibs in this area. This will affect performance when using the

	machine outside of this area. Check lubrication to affected areas.
--	--

3.1.2 Circles Out of Round

Circles are not round within 0.002" TIR over 3.0" DIA. This is best measured by placing a dial indicator in the quill and sweeping around the part.

Note: The typical slideway-milling machine is not capable of achieving more precise results although careful adjustments to a new milling machine may produce better results. If more precise circles are required, then it is recommended to use a precision boring head/boring bar.

Do the following Service Codes and document values:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 11** Measures backlash in the system (Only used on Dual Feedback systems)
- **Code 12** Feed Forward Constant.
- **Code 128** Enter backlash compensation.

Possible Cause	Check This
Rolling torque values on X and Y-axis are too high.	Make sure torque is lower than 20 in-lbs. Normal values for a machine that is aligned and adjusted properly should be between 10 and 15 in-lbs. Make sure rolling torque is consistent across axis travel.
Machine Tool and Setup problem	Check for any looseness in the setup (Tool, Tool holder, Part, Vise, or Fixture).
Machine not level	Verify that the machine is level to specification.
Head is not Trammed	Verify that the Head is Trammed to specification. See Trimming the Head Sec 5.2.2.
X and Y Gibs are not adjusted properly	Check the adjustment of the X and Y Gibs using the X and Y Gib adjustment procedures.
Calibration or Backlash problem	Recalibrate the machine. Reset the Backlash. Check Repeatability and Positional Accuracy.
Glass Scale problem	Make sure that the Glass Scale is installed correctly according to the Glass Scale Installation procedures. Check for any loose brackets or misalignment etc. Also, check to make sure the Glass Scale assemblies are functioning correctly.
X & Y-axis Drive Trains are loose	Check Repeatability using the Repeatability and Positional Accuracy procedure. Step by step, carefully inspect the Drive Train for any looseness. It may be necessary to disassemble and then reassemble the Drive Train.
Head Bolts are loose	Verify that all the head bolts are tight. 50 lbs.

3.2 Problems Regarding the Motion of the Machine

3.2.1 Run Away Axis

The axis makes an unwanted move at rapid speed in one direction and faults out. This is usually caused by an encoder signal being interrupted.

Do the following Service Codes:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 100** Axis open loop test. Used to check the maximum feedrate of an axis and if the encoders are counting properly.
- **Code 131** Manual DRO – turn handwheels to check motor encoder counts vs glass scale counts.

Possible Cause	Check This
Motor encoder versus glass scale encoders are counting in opposite directions	This would be apparent during a new install or when a pendant/computer module is replaced. Run service code 131 or 100 to confirm this is your problem. If it is your problem run services codes 322 for the X axis or 321 for Y axis.
The home positions or tools are not set correctly and hence the machine moves to location that is surprising to the operator.	See the Controls Programming, Operations and Care manual.
The Glass Scale is not reading.	Turn off glass scale and see if faulting goes away.
Bad Motor Encoder	Run service code 131. If the motor is not counting, check the connection.
Motor has failed	Swap motor with other axis and replace motor as necessary.

3.2.2 Axis Will Not Jog

The system powers up but will not respond to the jog command. Generally when this happens, you will see a fault on one of the axis. See section 3.3.1.

Do the following Service Codes and procedures:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 100** Axis open loop test. Used to check the maximum feedrate of an axis and if the encoders are counting.

Possible Cause	Check This
E-Stop is pressed in	Check E-Stop. Especially if both axes will not jog.
Servo Drive failure	Especially, if only one axis will not jog. Swap the axis motors to see if problem stay with motor or with the pendant.
Motor has failed	Swap motor with other axis and replace motor as necessary
Poor cable or wiring connections	See Electrical Connection per drawing 29983-3 at rear of manual.
Computer/Pendant failed	If the motor appears good and you have power, then the pendant and/or computer module may need to be replaced.

3.3 Problems Relating to the Operation of the Control

3.3.1 Fault X or Y

The program run or jogging operation is interrupted with a Fault Message on the display.

Do the following Service Codes and procedures:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 100** Axis open loop test. Used to check the maximum feedrate of an axis and if the encoders are counting.
- **Code 131** Manual DRO – turn handwheels to check motor encoder counts vs glass scale counts.

Possible Cause	Check This
Motor encoder versus glass scale encoders are counting in opposite directions.	This would be apparent during a new install or when a pendant/computer module is replaced. Run service code 131 or 100 to confirm this is your problem. If it is your problem run services codes 322 for the X axis or 321 for Y axis.
Cable connection problems	Check all cable connections. See drawing 29819 at rear of manual.
Table and Saddle Locks are locked.	Make sure the Table and Saddle Locks are unlocked. High torque on any axis may cause faulting problems.
X and Y Gibs are adjusted extremely tight.	Check the adjustment of the X and Y Gibs using the X and Y Gib adjustment procedures.
Binding or looseness in the Drive Train	Inspect drive trains
Incoming electrical power	Incoming voltage too low. Should be 105 volts and above.
Motor encoder or glass scale not working properly	Run service code 131 or 100.
Motor or Servo Drive failure	Swap motor from one axis to another and see if problem stays or follows motor.
Pendant/computer module failure	If problem does not follow motor, then replace computer module.

3.4 RMX Pendant Troubleshooting LED's

The following LED's are found on the back of the RMX pendant and may be useful when troubleshooting with our customer service department:

LED FUNCTIONS

24V DC	<input type="checkbox"/>	<input type="checkbox"/>	110VAC-2 OK
12V DC	<input type="checkbox"/>	<input type="checkbox"/>	110VAC-3 OK
5V DC	<input type="checkbox"/>	<input type="checkbox"/>	E-STOP1
5V-1DC	<input type="checkbox"/>	<input type="checkbox"/>	E-STOP2
3.3V DC	<input type="checkbox"/>	<input type="checkbox"/>	K100-FAULT
RSG	<input type="checkbox"/>	<input type="checkbox"/>	K101-FAULT
DOOR SW1	<input type="checkbox"/>	<input type="checkbox"/>	WDT-FAULT
DOOR SW2	<input type="checkbox"/>	<input type="checkbox"/>	SPARE
DOOR LOCK1	<input type="checkbox"/>	<input type="checkbox"/>	SPDL EN
DOOR LOCK2	<input type="checkbox"/>	<input type="checkbox"/>	BUTTON PRESS

LED	Description
24VDC	24VDC power
12VDC	LCD power
5VDC	External 5VDC power
5V-1DC	CPU Power
3.3VDC	Apps board logic power
<p>If one or more LED's above are not on, there is a power problem on the pendant and the pendant/computer module will most likely need to be replaced. Check power connector and reboot to see if this solves the problem.</p>	
RSG	RSG button state indicator. ON = Button Pressed. Each press of the RSG button should turn this LED on and off.
DOOR SW1	Door guard switch 1 indicator. ON = Switch Closed. Switch closed means table guard doors are physically closed. The door switches are wired normally closed.
DOOR SW2	Not used on USA machines.
DOOR LOCK1	Not used on USA machines.
DOOR LOCK2	Not used on USA machines.

LED	Description
	The 4 LED's below should be on when the e stop is not pressed and you are in DRO mode. If one or more of these LED's are off in this condition, then there is an internal problem with the pendant/computer module and the pendant will most likely need to be replaced.
110VAC-2 OK	K100 relay feedback indicator. ON when K100 contacts are closed.
110VAC-3 OK	K101 relay feedback indicator. ON when K100 and K101 contacts are closed.
E-STOP1	K100 relay command indicator. ON when system is commanding K100 contacts to close.
E-STOP2	K101 relay command indicator. ON when system is commanding K101 contacts to close.
	The K100 and K101 fault LED's below will be on when relays K100 or K101 are in an unexpected condition. Confirm the E stop button is not pressed or Euro bypass connector jumper is missing or loose. If the K101 fault LED remains ON, check the input power polarity. If you still see this condition, then there is an internal fault inside of the pendant and the pendant/computer module will most likely need to be replaced.
K100-FAULT	K100 relay fault indicator. ON = Fault Detected.
K101-FAULT	K100 relay fault indicator. ON = Fault Detected.
WDT-FAULT	Watchdog fault indicator. Slow blink (1 sec on/1 sec off) = Normal operation. Fast blink (5 time/sec) = Watchdog fault occurred. If this occurs, reboot to see if the problem is solved. If not, the pendant/computer module will most likely need to be replaced.
SPARE	Unused.
SPDL EN	Spindle enable indicator. ON = Spindle Enabled. Should be on when in DRO or RUN modes, which allow you to turn on the spindle.
BUTTON PRESS	ON when any overlay button is pressed. This verifies all overlay keys are recognized. Service code 81 can also be used.

4.0 Service Codes

The following is a list of service codes used on the RMX control system.

The Service Codes are divided into logical categories. The table below is a quick summary of the service codes. More detailed information can be found below.

All Service Codes are accessed in the SET-UP Mode by pressing the soft key for "SERV CODES". The service codes can be found under one of the headings listed on the main screen. Press the heading you want to access the code in question. If you know code # you want press the CODE # softkey and it will take you directly to the code in question. Press CODE #, enter the number you want, press SET.

4.1 Software

Code	Description	Comment
33	Software, Firmware and PLC versions	Displays current software versions and system settings.
141	Load configuration file from USB thumb drive	To load configuration files from a USB thumb drive to the RMX control. Follow the directions on the screen.
142	Save configuration file to USB thumb drive	To save the configuration files for reloading later. When a computer replacement is necessary, saving the settings to a thumb drive for reloading them later is highly desirable. Follow the directions on the screen.
316	Update Software	Runs the routine that copies new software from a USB thumb drive device to the ProtoTRAK system. Use this routine to install new ProtoTRAK software.
318	Converter and Software Options	Displays which software options are turned on. Options in bold letters mean the option is active.

4.2 Machine Set-Up

11	Hysteresis	Measures the backlash between motor encoders and glass scales.
12	Feed Forward Constant	Measures the friction characteristic of the machine.
97	Axis Configuration	It allows the user to set the positive direction for each axis.
100	Axis Open Loop Test	
122	Axis Calibration Using Offset	This is a scale factor (one per axis) that is defined as the length of the part programmed divided by the physical dimension of the actual part measured. It is less than 1 for a part that was cut too big and greater than 1 for a part that was cut too small.
123	Calibration Mode	Use to calibrate the RMX control with a standard.
128	Backlash Calibration Constant	Use to load backlash compensation for each axis.

150	Set Jog Acceleration Percentage	Used to adjust the jog speed to adjust for a compatibility issue with some older servo's (p/n 20375-XX). Applies to MX upgrades only.
304	Toggle X Glass Scale On or Off	Turn on or off
305	Toggle Y Glass Scale On or Off	Turn on or off
308	Reverse X EHW Direction	Change direction of EHW on X axis.
309	Reverse Y EHW Direction	Change direction of EHW on Y axis.
311	Run Machine With Spindle Off	Allows user to run with the spindle off. Applies to spindle control machines only. Mainly used by FST to run programs without the spindle on. Should be set to NO.
312	Toggle Limit Switches On or Off	Turns limit switches on or off.
321	Reverse Y Position Sensor	Reverse the direction of the glass scale.
322	Reverse X Position Sensor	Reverse the direction of the glass scale.
325	Reverse Quill Position Sensor	Reverse the quill glass scale. Service code 97 should do the same.
338	Toggle Limit Switches from 1 to 2 input	Tells software which style limit switch is present.
400	Update Foreign Language MLS File	Used to update the software language table. Please contact your distributor for available languages and for more information.
530	Set Pendant and Machine Serial Numbers	Service code to record pendant and machine serial numbers. A warning will be given to user until this requirement is met.
540	Disable File-Based Write Filter	Allows user to temporarily turn off the operating system write filter to make changes to network settings.
550	Glass Scale Gain Adjustment	Service code that allows for adjustment of gains used for glass scales.

4.3 Diagnostic Codes

1	Program, Configuration File, Log Back up	The following service code captures all important data from the machine. This includes the users program, configuration files, message log, fault log etc. This is meant to be used to help us solve problems that may pertain to our software. This file can then be emailed to our service department.
54	Continuous Run Mode	Cycles through the program in current memory.
81	Program Panel Keyboard Test	Gives a tone feedback to a button push and highlights the button.
100	Open Loop Test	Run an axis at rapid speed for 1 second to check motors and encoders.
131	Manual DRO	Turns off servos so you can check encoders. Turn handwheel to compare motor encoder counts vs glass scale counts.

132	Electronic Handwheel Test	Test the EHW signals. One revolution of hand wheel should read 0.2000" when in fine mode and 0.800" in course mode.
314	Test Light Indicator	Turns on and off some test lights used for troubleshooting.
319	Message Log	Logs the machine as it runs. It captures all key presses, error messages and data as the machine runs. It is saved automatically with service code 1.
320	Fault Log	A log that captures all faults and error messages.
326	Error Message Display	Displays error messages on screen.
327	Display Memory Check	Displays memory availability of various devices.
521	Launch Hardware Tester	Advanced hardware troubleshooting tool that allows service personnel to monitor I/O and other functions.
522	Diagnostic Charting Tool	Advance tool used for troubleshooting. Allows plotting of data within this tool.

4.4 Operator Defaults/Options

79	Turn On/Off Beeper	Turn the beeper on when pressing keys on either of the front panels.
143	Spindle Stays on at Tool Change	Applies to spindle control machines and 3 axis knee mills only.
328	EPA On/Off	Turns EPA INFO button on or off.
600	Manage User Profiles	Allows users to set their own Defaults for the control.
602	MT Connect	Allows user to decide which version of MT Connect they want to use.

The following explains some of the service codes in more detail.

4.5 CODE 11: Hysteresis

Note: This code is use only for systems with Glass Scales on the table and saddle.

The Code 11 service routine checks the readings of the motor encoder against the glass scale encoder. It is a measurement of how much motor motion is necessary to create table or saddle motion. This test helps us to look at two things:

- Play: How much backlash must be taken up when motion is reversed.
- Friction: How much the mechanical components must be "torqued up" in order to break the friction and create motion.

The Code 11 procedure is very useful and will help in diagnosing all types of motion and performance problems.

3. Position the table and saddle in the center of travel. Note: You will lose your DRO position reference.
4. Go into the Service Codes and input Code 11.
5. The system will run the checking routine automatically and then display the values in the position readout.

Explanation:

As an overall measure of the system hysteresis, we are looking for the X and Y values to be less than .004". A value greater than this indicates a problem with either excessive friction or play that may affect the finish or accuracy of machined parts.

4.6 CODE 12: Feed Forward Constant

The Code 12 procedure helps the control "learn" the friction characteristics of the machine by sending a graduated series of motor signals and observing the results. The process takes 30 to 45 seconds to run. It is both a diagnostic routine that displays values, and a routine that sets the parameters of the control for the particular machine.

The Code 12 is used for diagnosing and resolving:

- Problems with machine motion.
- Machined parts come out bad – especially poor finish.

Note: Code 12 routine will set the parameters for the particular machine and its particular situation. If the machine changes its friction characteristic, the Feed Forward Constant should change too, or the servo may not operate properly. Whenever gibs are adjusted or a heavy workpiece has been added to the table, you should run a Code 12. When the heavy workpiece is removed, Code 12 should be run again.

1. Position the table and saddle in the center of travel. Note: You will lose your DRO position reference.
2. Go into the Service Codes and input the Code 12.
3. Press Auto
4. The system will run the routine automatically and then display values on the position readout.

Explanation:

Typical values should be between 8.08 and 12.12 are considered normal for each axis. Higher values indicate excessive friction in the system. Lower values indicate a loose system and may mean a gib adjustment is necessary. Value 8.08 means the friction is a factor of 8 in one direction, and 8 in the other direction. The values should be within 3 or 4 of each other in both directions. A value of 8.10 would still be considered normal.

4.7 CODE 97: Set Positive Motor Encoder Direction

This procedure sets the Plus and Minus motion for the Motor encoders.

It may be necessary to perform this procedure after a new installation or after installing a new Computer Module.

STEPS:

1. Center the table and saddle and position the quill about halfway down.
2. Go into Service Codes and input Code 97.
3. Very carefully, move the table, the saddle and the quill in the positive direction, approximately 1 inch for each axis. Positive motion is:

- X - table moves to the left (so the tool moves to the right relative to the workpiece)
- Y - saddle moves toward the front (so the tool moves up relative to the workpiece).
- Z – the head moves up (DPM machines)
- Z - the quill moves up.

If you do not move correctly from the beginning, repeat the procedure.

4. Press INC SET to signal the procedure is complete.

Note – On 3 axis PT3 (old style) knee mills, if the motor encoder and ballscrew encoder are counting backwards then you may need to run service code 325 to reverse the ballscrew encoder.

4.8 CODE 100: Axis Open Loop Test

Code 100 procedure is used to diagnose problems with the configuration of the system, the encoders and incoming A/C voltage.

IMPORTANT -- SAFETY NOTICE

During this procedure the designated axis will be given a command to move at maximum speed for 1 second in the direction you choose. Avoid crashes by making sure the quill is out of the way and by starting with the table and saddle centered. **MAKE SURE THAT NO ONE IS STANDING IN THE WAY OF THE TABLE OR SADDLE!**

Note: You will lose the DRO reference position.

This procedure is to be run for each axis that is servo-driven, and for both the plus and minus direction for each axis.

1. Center the table and saddle and raise the head. Make sure the gib locks are released.
2. On the Pendant display, go into the Service Codes and input the Code 100.
3. The conversation line will say: "SELECT AXIS". Input the axis. Either X or Y. Please note, code 100 does not work on the Z axis of 3 axis knee mills.
4. In the conversation line it will say "WHICH DIRECTION? PLUS".
 - If you want to run in the plus direction, press INC SET.
 - If you want to run in the minus direction, press +/-, then INC SET
5. In the conversation line it will say "PRESS GO". Press Go after you are sure that the machine will not crash in the direction and axis that you have specified.

6. Afterward the screen will display values next to the DRO position axes. The table below assumes machine has secondary feedback. Machines with motor encoders only will display the reading next to the axis in question.

Your input	Display	Data displayed.
X +	X	Motor encoder reading
	Y	nothing (should be 0)
	Z	Table encoder reading
	Feedrate	the maximum feedrate attained

X -	X	Motor encoder reading
	Y	nothing (should be 0)
	Z	Table encoder reading
	Feedrate	the maximum feedrate attained

Y +	X	nothing (should be 0)
	Y	Motor encoder reading
	Z	Table encoder reading
	Feedrate	the maximum feedrate attained

Y -	X	nothing (should be 0)
	Y	Motor encoder reading
	Z	Table encoder reading
	Feedrate	the maximum feedrate attained

Interpretation of the resulting values displayed:

The values for the encoder displays should be in the range of 2.0000" to 3.0000" for the X and Y motor.

- If the motor encoder or glass scale reading is not within this value, then the one that is out of specification may be the problem. If one of the encoders is not reading then it will need to be replaced.
- The feedrate should be a minimum of 120 ipm for the X and Y axis.
- If the feedrate is less than 120 ipm and inconsistent in both directions, check the incoming AC voltage and mechanics of the drive train.

4.9 CODE 122: X, Y, Z And Quill Calibration Using Part Measurements

This service code can be used to calibrate each axis if you do not have a precision standard which is used when calibrating with service code 123.

Service code 122 allows you to apply a scale factor (one per axis) that is defined as the length of the part programmed divided by the physical dimension of the actual part measured. It is less than 1 for a part that was cut too big and greater than 1 for a part that was cut too small.

The values are limited between .99 and 1.01. If the user enters a number outside that range, limit the number and prompt the user that the value was limited.

An example of how a user might use this service code. This would be used if you did not have a precision standard like our FST's carry. The user could cut a 3" square and then measure the length along the X axis. For example, let's say the user measure 2.9985". He would then take 3.0000/2.9985 and enter 1.0005003 into service code 122 for the X axis. This service code allows up to 8 digits to be entered after the decimal point.

For your quill scale calibration, machine a reference plane and set your DRO Z readout to 0. Use the DRO to position the quill or 3 axis knee mill Z axis down to some number, for example 1.0000". Machine some material away from a corner so it will be easy to measure the difference between your reference plane and your new plane.

To calculate your offset with a 1.0000" difference in position, measure the actual amount machined and compare it with 1.0000".

For example, if your measurement showed the difference between the reference plane and the machined plane is 0.9975", calculate the offset:

$$Z \text{ calibration offset} = \text{DRO} \div \text{actual} = 1.0000 \div 0.9975 = 1.0025063$$

Once you have calculated your values, use Service Code 122 to enter them.

4.10 CODE 123: X, Y, Z and Quill Calibration

Calibration is used teach the machine a known distance. We typically calibrate our machines over a 150 mm distance. There is no limit to how far you can calibrate the machine.

On 2 axis knee mills, press the Quill button to calibrate the quill sensor. On 3 axis knee mills, press the Z button to calibrate the Z motor.

1. Set-up a gauge block or standard and indicate it parallel to the axis you are calibrating.

Note: Put the display in Inch or mm to match your gage block. Recommended gage blocks are:

- X and Y -- 150mm or 6"
 - Z -- 75 mm or 3"
2. Set a 0.0001" indicator in the spindle and move it up to one side of the gage block or standard.
 3. Go to setup mode, go to section "B" and press CODE 123.
 4. Select the axis you want to calibrate X or Y. For the quill press the F1 key labeled QUILL.
 5. Follow the instructions on the screen to complete calibration.

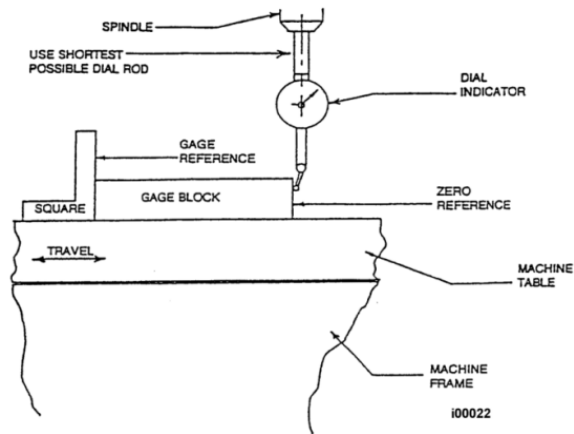


Figure 13 - Calibration Set-Up

4.11 Code 128: Input Backlash Constant

Code 128 allows you to enter the backlash values for each axis. It displays the value after it enters. This code is only used on machines with motor encoders only.

4.12 Code 304: Toggles X and Y Sensor or Glass Scale On/Off

This service code toggles the X sensor or glass scale on or off. It is used to configure the machine and also is a useful tool for troubleshooting.

4.13 Code 312: Toggles Limit Switch On/Off

This service code turns on and off the limit switch option. By default they will be turned off. Once you turn on our limit switches, make sure to select if you have a 2 input type limit switch or a 1 input type. Old ProtoTRAK systems all came with 1 input type limit switches.

4.14 Code 321: Reverse Y Position Sensor Direction

This service code reverses the direction of the encoder. It may be needed if sensors or glass scales are mounted on different sides of the machine. If you turn on your TRAK Sensors or Glass scales and get an immediate axis fault, there is a good chance the table encoders are reading backwards to the motor encoders. Use this service code for Y and code 322 for X to reverse their direction.

4.15 Code 322: Reverse X Position Sensor Direction

This service code reverses the direction of the encoder. It may be needed if sensors or glass scales are mounted on different sides of the machine.

4.16 Code 338: Selects 1 or 2-input type limit switch

Older machines that used M, MX or AGE controls all came with 1 input type limit switches. Newer style limit switches may be 1 or 2 input. Select as required.

4.17 Code 510: Spindle Setup and Calibration

This service code provides spindle calibration function. Follow screen instructions and enter values. Note: Used on spindle control machines only.

INFO	CODE 510 - Spindle RPM Calibration:										MODES
STATUS	1. Make sure milling head is in high gear (if it has a high and low gear). Turn the spindle on.										DRO
TOOL TABLE	2. Measure RPM with a tachometer, enter this RPM and press ABS set.										PROG
EPA	3. Spindle will now run at a higher RPM. Measure this RPM with a tachometer and enter RPM.										EDIT
MATH HELP	4. Spindle will then turn off and service code will exit.										SET-UP
											RUN
DEFAULTS											PROG IN/OUT
KEY BOARD											
CALC											
	ENTER RPM			LOAD DEFAULT						RETURN	

4.18 Code 530: Set Pendant and Machine Serial Numbers

This service code allows us to keep track of pendants and machines by serial number. The values entered show up in our message logs and allow us to know what software is running on certain hardware. If you fail to enter a value for these serial numbers, the control will remind you to do so.

INFO	Code 530 - Set Machine and Computer Module Serial Numbers								MODES
STATUS	<p>The machine serial number needs to be entered into service code 530 when a computer module or pendant is installed. The computer module and pendant serial number should come already entered from the factory.</p> <p>If it is not, then you can find the serial number on a label found on the computer module and on the rear of the pendant. The machine serial number is found on a serial number plate attached to the outside sheet metal on the machine.</p> <p>The MAC address is updated automatically via our software.</p> <p>MAC Address: D8-9E-F3-30-E5-C0 Machine Serial Number: Not Entered Pendant Serial Number: Not Entered Machine Name:Not Entered</p>								DRO
TOOL TABLE									PROG
EPA									EDIT
MATH HELP									SET-UP
DEFAULTS									RUN
KEY BOARD									PROG IN/OUT
CALC									
									RETURN

4.19 Code 325: Reverse Quill Position Sensor Direction

This service code reverses the direction of the encoder. It may be needed if sensors or glass scales are mounted on different sides of the machine.

4.20 Code 131: Manual DRO

A manual diagnostic routine to check the motor encoder and table encoders: Turn the X hand wheel to display the encoder readings. This code will display the actual DRO counts and the raw encoder counts before the calibration and backlash factors have been factors into the counts.

4.21 Code 150: Set Jog Acceleration Percentage

This service code was added because we learned during some upgrades that some older servo's P/N 20375-XX had different characteristics than our newer servos. These characteristics caused some servos to fault when trying to JOG an axis. The symptom does not appear in any other run modes nor does it happen when a user has an EHW option.

The value chosen below we believe will work for most situations, but if it does not and you are still seeing a fault, the number should be lowered until the faulting goes away. The downside to a lower value is the acceleration of the motors will be slower in JOG mode. For newer servos, the value can be set to 100 and no problems should be noticed. It is engineering's opinion that most users will not notice any issues leaving the value at 20%.

INFO	CODE 150 - Set Jog Acceleration Percentage										MODES
STATUS	Valid range is 5 - 100%										DRO
TOOL TABLE	Current Value = 20.0										PROG
EPA											EDIT
MATH HELP											SET-UP
											RUN
DEFAULTS											PROG IN/OUT
KEY BOARD											
CALC											
	Please Input Jog Acceleration Percentage										
	Input Jog Accel Percent : <input type="text" value="20.0"/>										
											RETURN

5.0 Maintenance

5.1 Gib Adjustments

The objective of adjusting the gibs is to eliminate as much play in the table and saddle sliding surfaces as possible without having the tightness of the gib interfere with their free movement and cause a decrease in the accuracy and/or performance of the machine due to excessive friction.

5.1.1 Table Gib Adjustment, X-Axis

See Figure 14.

1. Clean all chips, dirt and excess oil from the table and saddle.
2. Center the saddle on the bed ways.
3. Move the table fully to the left side of the saddle.

Note: For machines that have excessive wear in the center of the table way, it will be necessary to center the table on the saddle. The resulting adjustment of the gib will be compromised to account for the varying clearance from the center to the ends of the table.

4. Attach a .0001 dial indicator with a magnetic base to the left front of the saddle. Place the indicator stylus on the front surface of the table as close to the indicator base as possible.

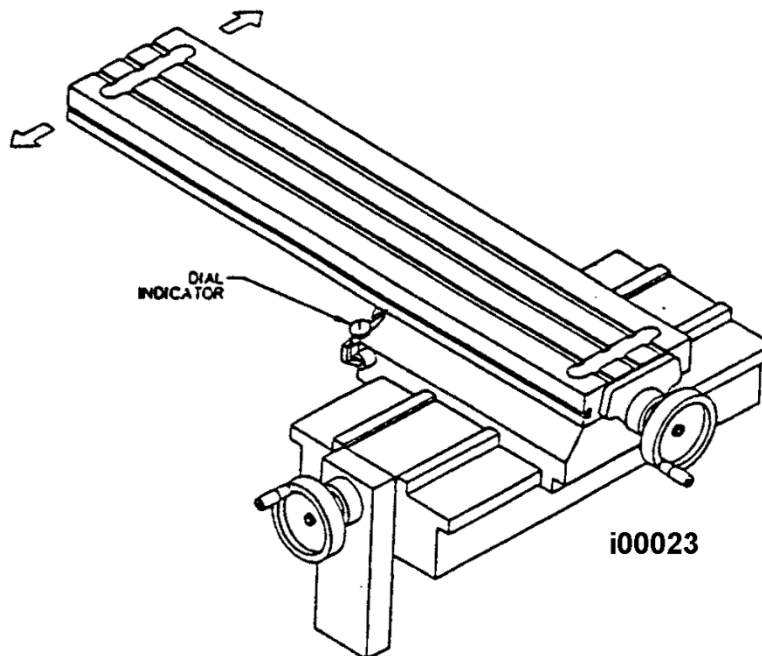


Figure 14 - Table Gib Adjustment

5. Move the left end of the table back and forth and note the amount of movement on the dial indicator. Adjust the X-axis gib until the registered movement is .0010-.0015.

To adjust the gib for excessive clearance: Loosen the gib lock screw on the right end of the saddle. Estimate the amount of gib lock screw adjustment required and tighten the gib lock screw on the left end of the saddle. Tighten the gib lock screw on the right end of the saddle to lock the gib in place and recheck. Repeat as necessary.

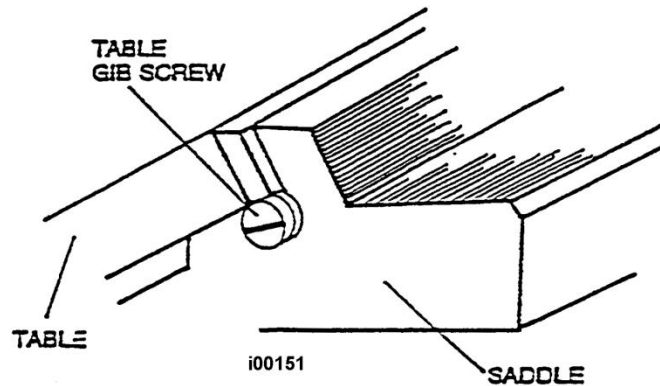


Figure 15 - Table Gib Screw

To adjust the gib for too small of a clearance: Loosen the gib lock screw on the left end of the saddle. Estimate the amount of gib lock screw adjustment required and tighten the gib lock screw on the right end of the saddle. Tighten the gib lock screw on the left end of the saddle to lock the gib in place and recheck. Repeat as necessary.

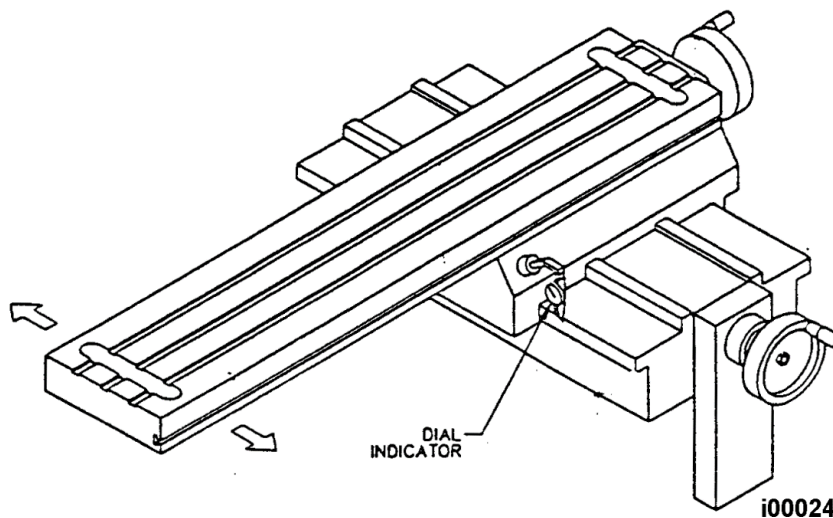


Figure 16 - Saddle Side Gib Adjustment

5.1.2 Saddle Side Gib Adjustment, Y-Axis

See Figure 16.

1. Clean all chips, dirt and excess oil from the table and saddle.
2. Center the saddle on the bed ways.
3. Move the table fully to the left side of the saddle.
4. Remove the chip wiper guard and chip wiper from the front and rear of the left side box way.
5. Attach a .0001 dial indicator with a magnetic base to the left front of the saddle. Place the indicator stylus on the edge of the large box way.
6. Move the left end of the table back and forth and note the amount of movement on the dial indicator. Adjust the Y-axis side gib until the registered movement is .0010-.0015.

To adjust the gib for excessive clearance:

Loosen the gib lock screw on the back of the saddle. Estimate the amount of gib lock screw adjustment required, and tighten the gib lock screw on the front of the saddle. Tighten the gib lock screw on the back end of the saddle to lock the gib in place, and recheck. Repeat as necessary

To adjust the gib for too small of a clearance:

Loosen the gib lock screw on the front of the saddle. Estimate the amount of gib lock screw adjustment required, and tighten the gib lock screw on the back of the saddle. Tighten the gib lock screw on the front of the saddle to lock the gib in place, and recheck. Repeat as necessary.

7. Replace the front and rear chip wiper, and chip wiper guard.

5.1.3 Saddle Bottom Gib Adjustment, Y-Axis

See Figure 17.

1. Clean all chips, dirt and excess oil from the table and saddle.
2. Center the saddle on the bed ways.
3. Move the table fully to the left side of the saddle.
4. Attach a .0001 dial indicator with a magnetic base to the left front of the saddle. Place the indicator stylus on the top surface of the box way.
5. Lift the end of the table up and note the amount of movement on the dial indicator. Adjust the Y-axis left bottom gib until the registered movement is .0010-.0015.
6. Move the table fully to the right.
7. Reposition the indicator to the right front of the saddle.

- Lift the right end of the table up and note the amount of movement on the dial indicator. Adjust the Y-axis right bottom gib until the registered movement is .0010-.0015.

To adjust the gib for excessive clearance:

Loosen the gib lock screw on the back of the saddle. Estimate the amount of gib lock screw adjustment required, and tighten the gib lock screw on the front of the saddle. Tighten the gib lock screw on the back end of the saddle to lock the gib in place, and recheck. Repeat as necessary.

To adjust the gib for too small of a clearance:

Loosen the gib lock screw on the front of the saddle. Estimate the amount of gib lock screw adjustment required and tighten the gib lock screw on the back of the saddle.

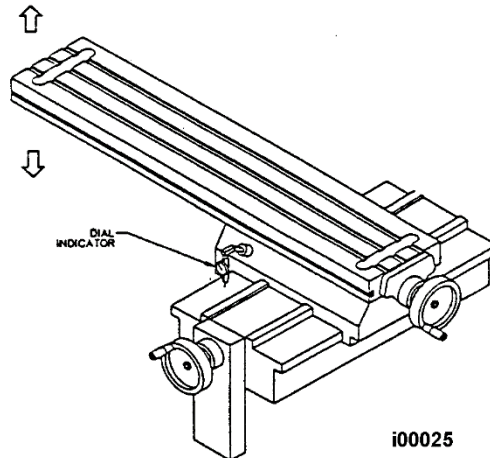


Figure 17 - Saddle Bottom Gib Adjustment

Tighten the gib lock screw on the front of the saddle to lock the gib in place, and recheck. Repeat as necessary.

5.2 Head Rotational and Trimming

The TRAK knee head is free to rotate up to 90 degrees to the right or left. The K3 can also rotate 45° front to back.

5.2.1 To Rotate the Head Side to Side:

- Loosen the four locknuts.
- Rotate the head with the adjusting worm shaft. When rotating to greater than a 45° angle, support head by hand.
- Tighten the locknuts. Snug each locknut, then lightly tighten each locknut, then fully tighten each locknut in a crisscross pattern.

4. Use the method shown in the figure below and a parallel bar to square the head to the table.

5.2.2 Tramming the Head

The purpose of tramming the head is make sure the head is perpendicular to the top of the table from both side to side and back to front.

Side to side tolerance – 0.001”

Side-to-Side Alignment

1. Make sure the machine is level.
2. Make sure the table has been cleaned.
Mount a dial indicator in a tool holder and mount in the quill.
3. Adjust the Y-axis so that the spindle is in the center of the table.
4. Adjust the Knee so that the dial indicator will reach the table.
5. Move the dial indicator to 6 o'clock position and adjust the face so the needle is zero.
6. Do a series of sweeps from 9 o'clock to 3 o'clock and check for the repeatability of the setup.
7. If the head is out of tram from side to side then loosen the 4 head bolts and rotate the head with the worm shaft.
8. Once the head has been trammed, tighten the 4 heads bolts. Be careful not to move the head while tightening. Tighten the bolts in a criss-cross pattern. Torque = 50 ft-lbs.

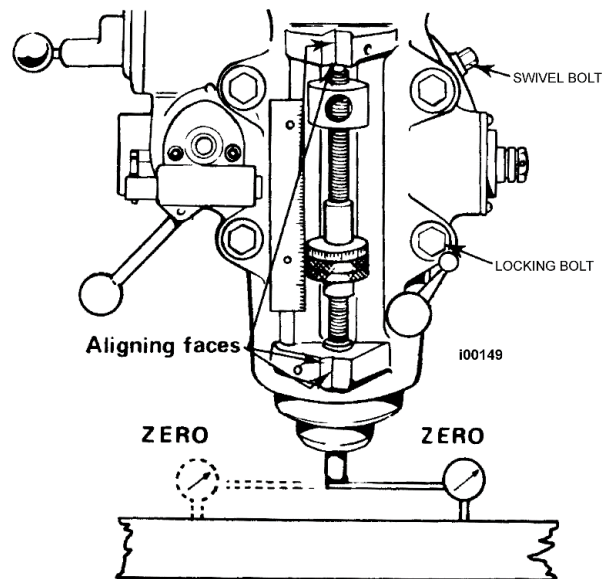


Figure 18 - Tramming of Head

5.2.3 Back to Front Adjustment

1. Make sure the table has been clean.
2. Mount a dial indicator in a tool holder and mount in the quill.
3. Adjust the Y-axis so that the spindle is in the center of the table.
4. Adjust the knee so that the dial indicator will reach the table and lock the 2 clamps on the knee.
5. Move the dial indicator to 6 o'clock position and adjust the face so the needle is zero.
6. Do a series of sweeps from 6 o'clock to 12 o'clock and check for the repeatability of the setup. The head should be trammed as close as possibility to $\pm 0.0005''$
7. Loosen the three bolts and adjust the tram with the bolt mounted on the top of the ram.

Once the head has been trammed tighten the three bolts. Be careful not to move the head while tightening. Tighten the bolts a little at a time. (Note: the head should droop down rather than up because tool pressure will take care of the extra $0.0005''$.)

6.0 Introduction to Self-Service

The objective of this section of the manual is to allow the user of the ProtoTRAK Control to resolve the majority of potential service problems.

This manual assumes that the user is not experienced with CNC troubleshooting and repairs. Special tools are not required for the procedures described in the manual.

Please see Section 3 for basic troubleshooting sections of the manual.

6.1 When You Have a Service Problem

SWI recommends that you consult this manual or our web site first. Often it will be possible for you to resolve the problem yourself or isolate the problem to a particular cause.

Your next step is to contact the SWI Customer Service Group for assistance.

6.1.1 Communication with the SWI Customer Service Group

SWI Service Department Direct Line: (800) 367-3165

Web Address – www.southwesternindustries.com

This phone line rings directly into the SWI Customer Service Group. If a Customer Service Representative (CSR) is not available within the first few of minutes, your call is transferred into our voice mail system.

Our voice mail is continuously monitored. If you have an emergency, indicate this in your message. Our Service Voice Mail box number is 555.

SWI Service Department Direct Fax number (310) 886-8029

Customer Service Group hours:

Monday - Friday 7:00 AM to 4:30 PM Pacific Time.

SWI observes a normal holiday schedule.

6.2 Replacements

6.2.1 Exchange Program

SWI keeps in stock the major subassemblies required to resolve service problems. With very few exceptions, the part needed to resolve any given service problem is on the shelf and ready to ship.

A little bit of troubleshooting on your part means that we can get the right part to you fast.

After replacing the failed unit with the replacement unit, simply put the failed unit in the same box that the replacement part came in and ship it back to us via UPS ground service.

This unique Exchange program gives our customers access to re-built "like-new" subassemblies that have been brought up to current design revisions and go through the same QC procedures as our new products. These high-quality replacement units are available at a fraction of the price of a new subassembly.

6.2.2 Return Authorization (RA) Number

All shipments of replacement parts are accomplished through our Return Authorization (RA) system. At the same time the CSR is diagnosing the problem and ordering the part, they will issue an RA number that will allow us to efficiently process the return part.

7.0 Figures and Parts Lists

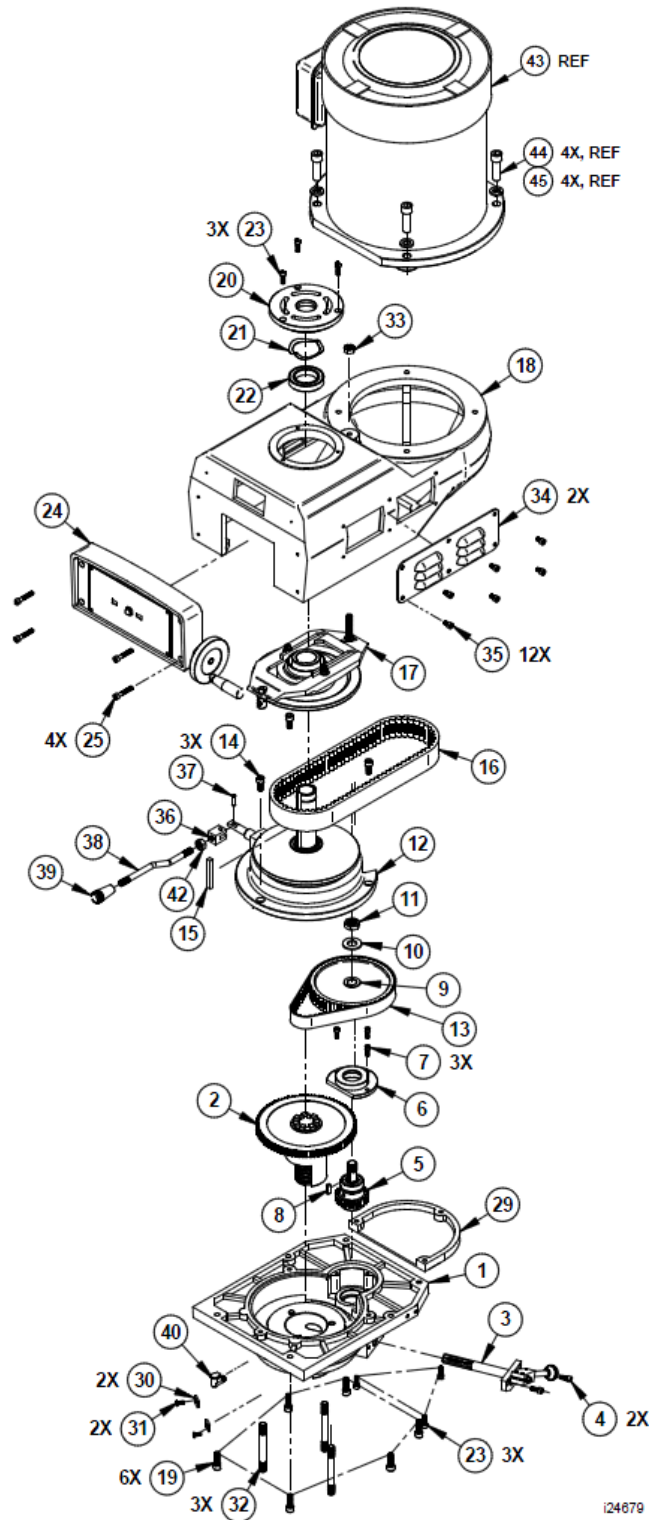
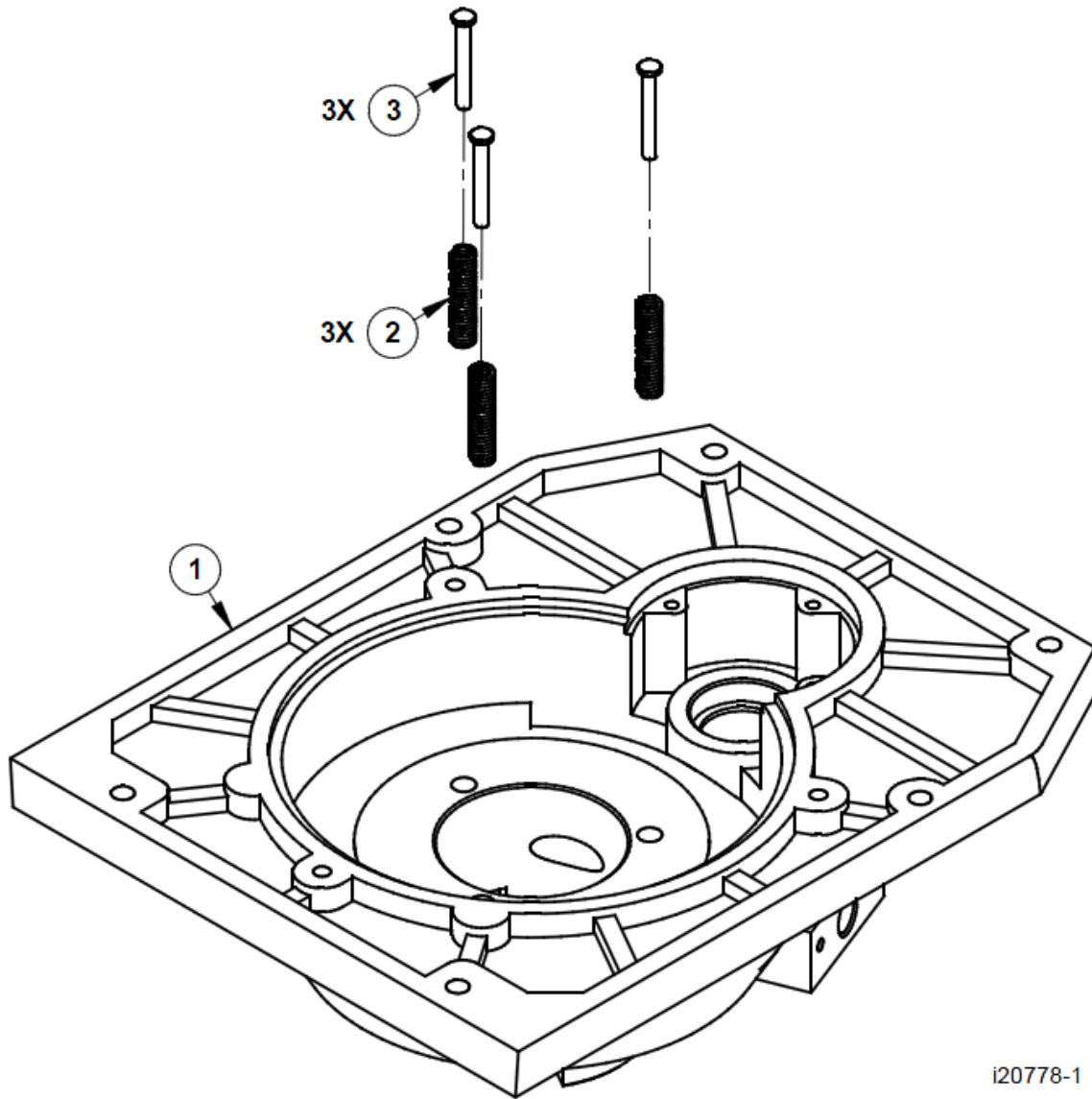


Figure 19- K3 - Top Housing Assembly

Parts List - K3 -Head Top Assembly (Figure 19)

Item	P/N	Title	Qty
1	20778-1	GEAR HOUSING ASSY	1
2	20778-2	HI-LOW SHIFT CLUTCH ASSY	1
3	20778-3	HI-LOW SHIFT ASSY	1
4	VS12	FRU-K3-SOCKET CAP SCREW M6-P1.0x15L	2
5	20778-4	PULLY PINION ASSY	1
6	VS64	FRU-K3-BULL GEAR PINION BEARING CAP	1
7	VS93	FRU-K3-SCREW M5-P0.8x15L	1
8	VS117	FRU-K3-KEY 5x525L	1
9	VS62	FRU-K3-TIMING BELT PULLEY	1
10	VS126	FRU-K3-WASHER Ø 5/8	1
11	VS61	FRU-K3-JAM NUT 5/8-11NC	1
12	20778-5	LOWER VARI-DISC DRIVE ASSY	1
13	VS63	FRU-K3-BELT 3/8"-#225	1
14	VS14-1	FRU-K3-SCREW M8-P1.25x18L	3
15	VS135	FRU-K3-KEY 8x7x60L	1
16	VS4	FRU-K3-BELT	1
17	20778-6	UPPER VARI ASSY-DISC DRIVE-R8	1
18	VS1	FRU-K3-BELT HOUSING	1
19	VS137	FRU-K3-SOCKET CAP SCREW M8-P1.25x25L	1
20	VS13	FRU-K3-TOP BEARING CAP	1
21	VS13-1	FRU-K3-WAVE WASHER	1
22	VS15	BEARING-DEEP GROVE-6007V	1
23	VS129	FRU-K3-SCREW- SOC HD CAP M6-P1.0x18L	1
24	20778-7	SPEED CHANGE HANDWHEEL-ASSY-R8	1
25	VS07	FRU-K3-SCREW- SOC HD CAP M6-P1.0x35L	1
29	VS11	FRU-K3-MOTOR PULLEY COVER	1
30	VS104	FRU-K3-COPPER CHIP(2REQ.)	2
31	VS131	FRU-K3-SCREW- FLAT HD PHILIP M5-P0.8x10L	1
32	VS132	FRU-K3-STUD Ø 7/16-100L	2
33	VS96	FRU-K3-JAM NUT 3/8"-16NC	1
34	VS101	FRU-K3-VENTILATOR(2REQ.)	2
35	VS136	FRU-K3-SCREW- SOC HD CAP M6-P1.0x10L	12
36	VS54	FRU-K3-HANDLE FIX BLOCK	1
37	VS55	FRU-K3-SET SCREW	1
38	VS56	FRU-K3-BRAKE LOCK HANDLE	1
39	VS57	FRU-K3-BAKELITE BALL HANDLE	1
40	OIL-1	FRU-K3-OIL CUP	1
41	20817	FRU-SK2/SK3-BEARING SPACER	1
42	VS52-1	FRU-K3-NUT	1
43	20819	SPINDLE MOTOR ASSY-K2 & K3-3HP	(1)
44	VS130	FRU-K3-WASHER- FLAT Ø 10.2	(4)
45	VS111	FRU-K3-SOC HD SCREW- 3/8-16NCx32L	(4)

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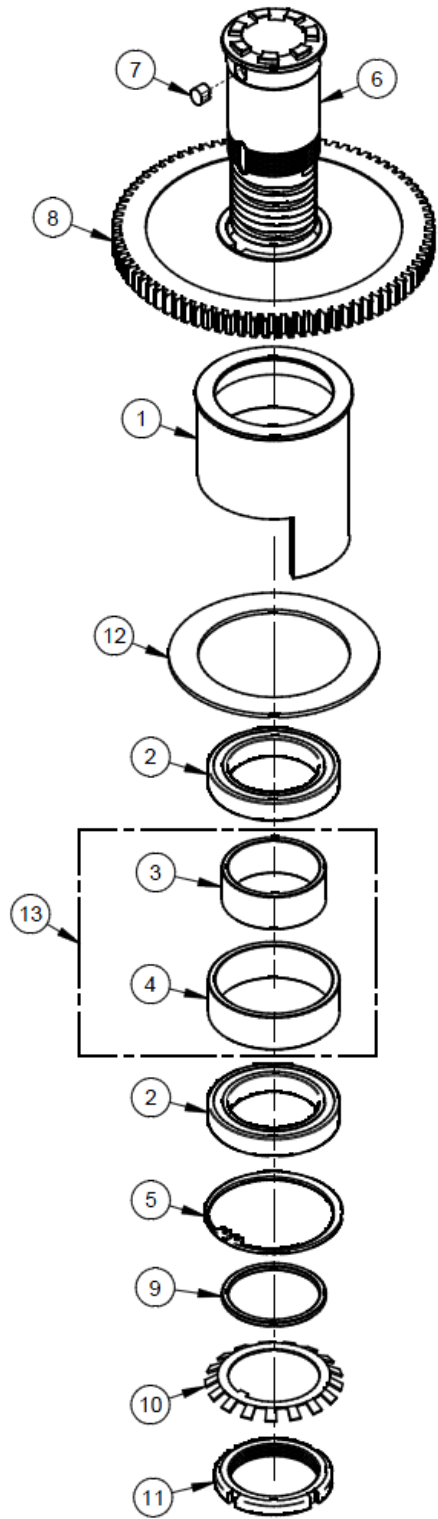


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Figure 20- K3 - Gear Housing & Parts List

Item	P/N	Title	Qty
1	VS82	FRU-K3-GEAR HOUSING	1
2	VS112	FRU-K3-GUIDE SPRING	3
3	VS113	FRU-K3-SPRING GUIDE PIN	3

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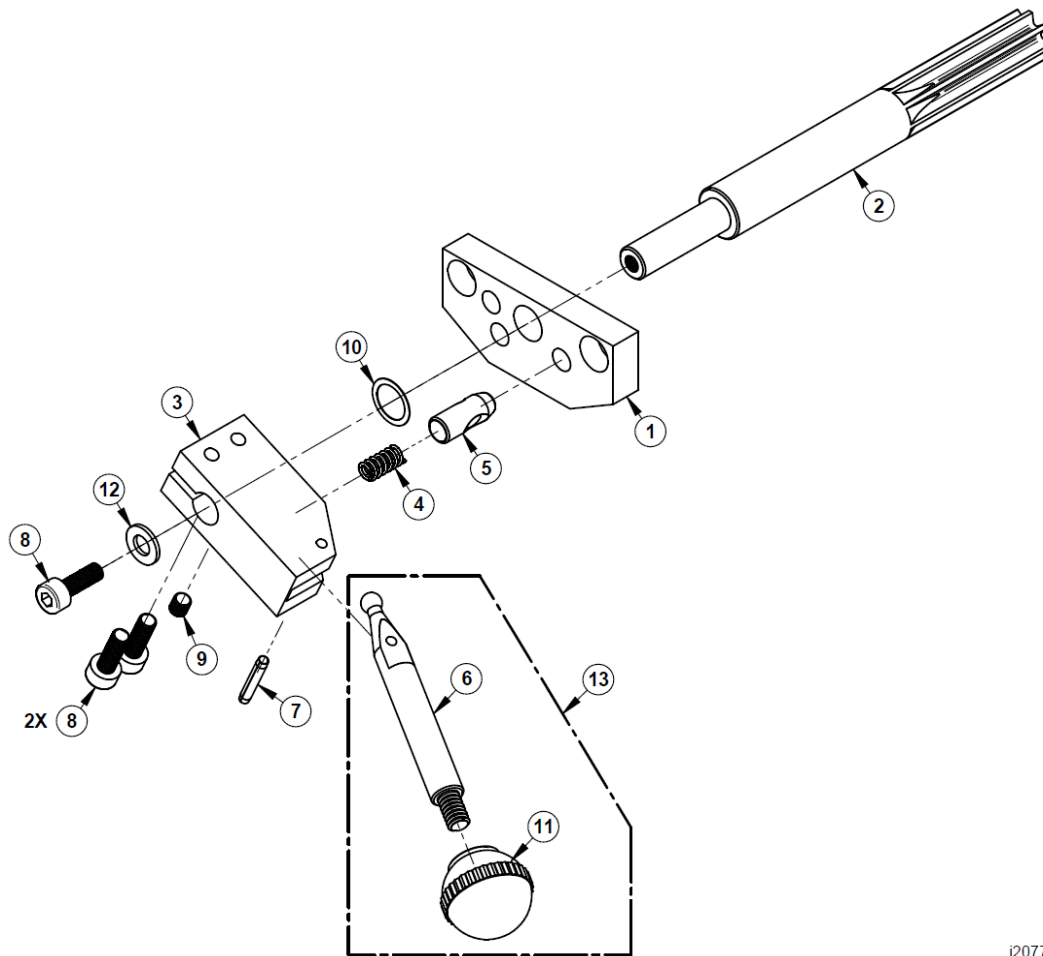
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Figure 21 - K3 - Hi-Low Shift Clutch Sub-Assembly

Parts List –High-Low Shift Clutch

Item	P/N	Title	Qty
1	VS75	FRU-K3-BEARING SLEEVE	1
2	VS77	FRU-K3-BALL BEARING (2 REQ.) 6908ZZ	2
3	VS78	FRU-K3-BEARING SPACER	1
4	VS79	FRU-K3-BEARING SPACER	1
5	VS80	FRU-K3-SNAP RING R-65	1
6	VS73	FRU-K3-SPLINED GEAR HUB	1
7	VS72	FRU-K3-KEY 8x7x10L	1
8	VS74	FRU-K3-SPINDLE BULL GEAR	1
9	VS114	FRU-K3-WASHER	1
10	VS115	FRU-K3-EXTERNAL TOOTH WASHER Ø 40	1
11	VS81	FRU-K3-LOCK WASHER Ø 9/16-18NC	1
12	VS76	FRU-K3-RING	1
13	20817	BEARING SPACER ASSY	(1)

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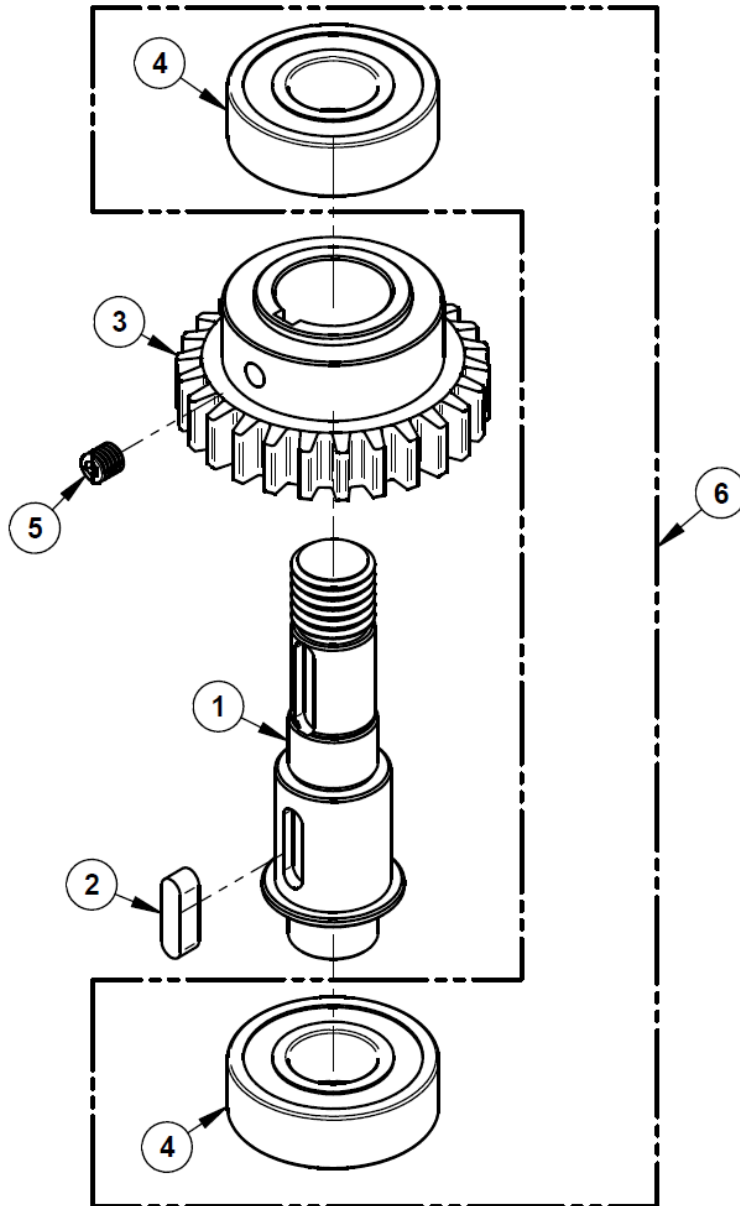
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Figure 22 - K3 - Hi-Low Shift

Parts List - Hi-Low Shift

Item	P/N	Title	Qty
1	VS89	FRU-K3-HI-LOW DETENT PLATE	1
2	VS87	FRU-K3-CLUTCH GEAR SHAFT	1
3	VS92	FRU-K3-HI-LOW PINION BLOCK	1
4	VS91	FRU-K3-SPRING	1
5	VS90	FRU-K3-HI-LOW DETENT PLUNGER	1
6	VS94	FRU-K3-HI-LOW SHAFT CRANK	1
7	VS88	FRU-K3-PIN Ø 3X19L	1
8	VS93	FRU-K3-SCREW M5-P0.8x15L	3
9	VS92-1	FRU-K3-SET SCREW M5-P0.8x5L	1
10	VS92-2	FRU-K3-WASHER- FLAT Ø 11	1
11	VS57	FRU-K3-BAKELITE BALL HANDLE	1
12	VS116	FRU-K3-WASHER- FLAT Ø M5	1
13	24083	HI/LOW SHAFT ASSY	(1)

i20778-3



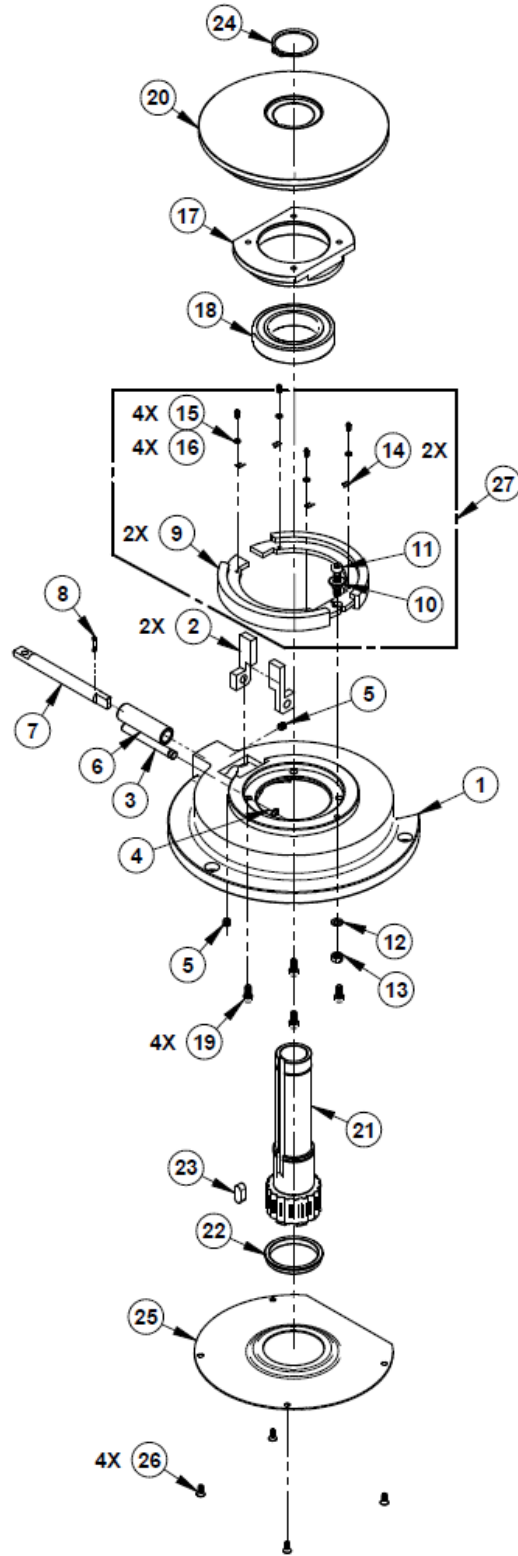
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Figure 23 - K3 - Pulley Pinion & Parts List

Parts List - K3 Pulley Pinion

Item	P/N	DESCRIPTION	Qty
1	VS67	FRU-K3-BULL GEAR PINION COUNTER SHAFT	1
2	VS69	FRU-K3-KEY 5X5X18L	1
3	VS66	FRU-K3-BULL GEAR PINION	1
4	AK118	BEARING-DEEP GROOVE-6203ZZ	2
5	VS3	FRU-K3-SOCKET SET SCREW M6-P1.0x6L	1
6	23954	BEARING-DEEP GROOVE-SET (2)-6203ZZ	(1)

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**Figure 24 - K3 - Lower Vari-Disc Drive
(assembly not available, order parts separately)**

Parts List – K2/K3 Lower Vari-Disc Drive (Figure 24)

Item	P/N	Title	Qty
1	VS50	FRU-K3-BELT HOUSING BASE	1
2	VS59	FRU-K3-BRAKE BLOCK	2
3	VS58	FRU-K3-TURNING BLOCK SHAFT	1
4	VS103	FRU-K3-RETAINING RING Ø 7	1
5	VS51	FRU-K3-SET SCREW M6-1.0X6L	2
6	VS53	FRU-K3-BRAKE LOCK BUSHING	1
7	VS52	FRU-K3-BRAKE LOCK SHAFT	1
8	VS52-2	FRU-K3-BRAKE LOCK PIN DIA 3 X 5/8"L	1
9	VS47	FRU-K3-BRAKE SHOE	2
10	VS48	FRU-K3-BRAKE SHOE PIVOT SLEEVE	1
11	VS17	FRU-K3-SOCKET CAP SCREW M6-P1.0x35L	1
12	VS17-1	FRU-K3-WASHER Ø 6	1
13	VS17-2	FRU-K3-NUT M6-P1.0	1
14	VS49	FRU-K3-BRAKE SPRING	2
15	VS122	FRU-K3-WASHER DIA 3.3	4
16	VS120	FRU-K3-SCREW-PAN HEAD PHILIP 5-40NC	4
17	VS46	FRU-K3-BRAKE BEARING CAP	1
18	VS43-1	FRU-K3-BALL BEARING 6010ZZ	1
19	VS14	FRU-K3-SOCKET CAP SCREW M5-0.8x12L	4
20	VS45	FRU-K3-STATIONARY DRIVEN VARIDISC	1
21	VS70	FRU-K3-SPINDLE PULLY ASSY	1
22	VS100	FRU-K3-SPINDLE PULLY SPACER	1
23	VS71	FRU-K3-KEY 8x7x20L	1
24	VS97	FRU-K3-SNAP RING Ø 40	1
25	VS50-1	FRU-K3-DUST COVER	1
26	VS50-2	FRU-K3-SCREW-FH-PH-STL-BO M6-1.0X6L	4
27	24055	BRAKE SHOE ASSY	(1)

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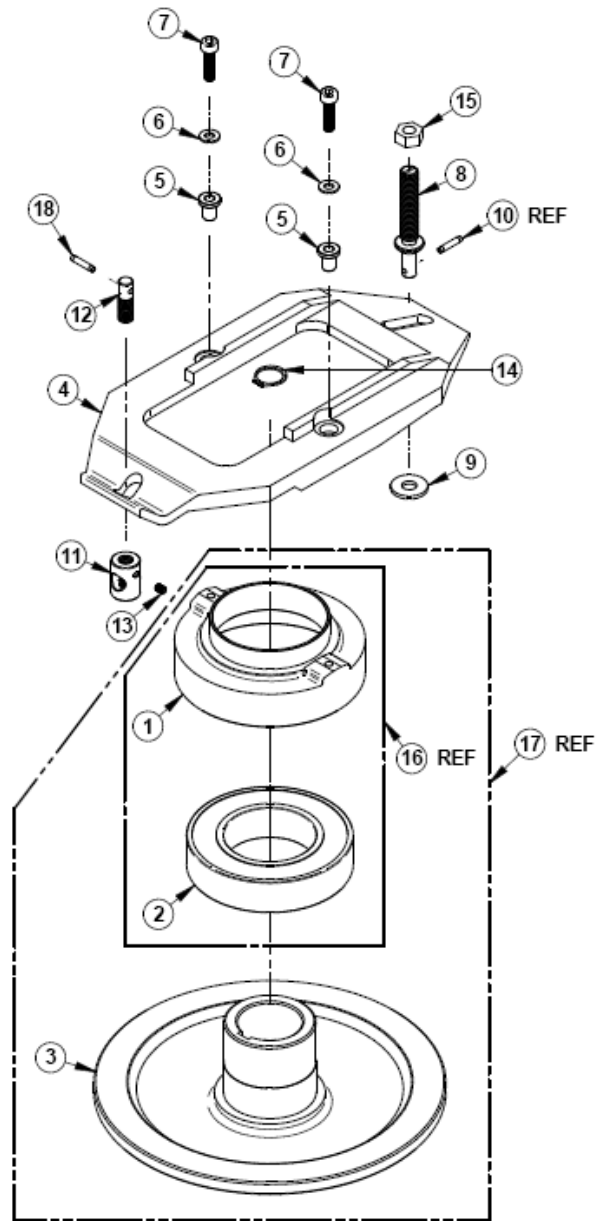


Figure 25 - K3 - Upper Vari-Disc Drive Sub-Assy

Parts List – K3 Upper Vari-Disc Drive Sub-Assy

1	VS42	FRU-K3-SPINDLE PULLEY BEARING HOUSING	1
2	24643	BEARING-DEEP GROVE-6210ZZ	1
3	VS44	FRU-K3-ADJUSTABLE-DRIVEN VARIDISC	1
4	VS36	FRU-K3-SPEED CHANGE PLATE	1
5	VS38	FRU-K3-PIVOT SLEEVE Ø 5	2
6	VS37	FRU-K3-WASHER M5 P0.8X20L	2
7	VS123	FRU-K3-SCREW-SHCS M5-0.8X20L	2
8	VS39	FRU-K3-SPEED CHANGE PLATE PIVOT STUD	1
9	VS41	FRU-K3-WASHER Ø 8.2	1
10	VS40	FRU-K3-ROLL PIN Ø3x15L	2
11	VS35	FRU-K3-ADJUSTMENT NUT	1
12	VS34	FRU-K3-CHAIN END STUD	1
13	VS33	FRU-K3-CHAIN FRONT SCREW M4-P0.7x5L	1
14	VS97	FRU-K3-SNAP RING Ø 35	1
15	FVS96	JAM NUT 3/8-16NC	1
16	24564	BEARING HOUSING ASS'Y - K2/K3	(1)
17	24631	VARIDISC ASSY-ADJUSTABLE	(1)
18	VS31	ROLL PIN Ø4 X 30	1

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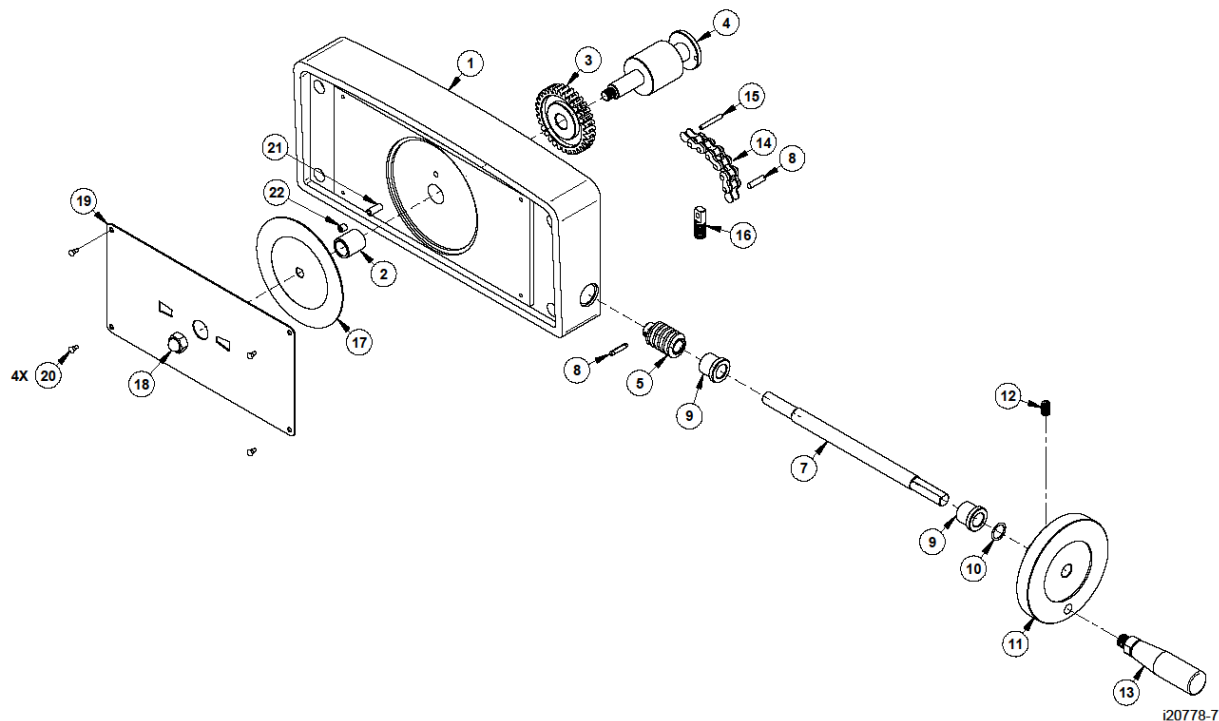


Figure 26 - K3 - Speed Change Handwheel & Parts List

Item	P/N	DESCRIPTION	Qty
1	VS16	SPEED CHANGE HOUSING	1
2	VS20	BEARING SELF LUBRICATING	1
3	VS22	SPEED CHANGER GEAR	1
4	VS31	SPEED CHANGE CHAIN DRUM	1
5	VS21	WORM	1
7	VS25	SPEED CHANGE SHAFT	1
8	VS40	ROLL PIN Ø3x15L	2
9	VS24	COPPER BUSHING	2
10	VS24-1	WASHER-WAVE	1
11	VS27	SPEED CHANGE HANDWHEEL	1
12	VS18	FULL DOG SOCKET SET SCREW M6-P1.0x10L	1
13	VS28	HANDLE 3/8-16NC	1
14	VS32	CHAIN #310X9.525	1
15	VS31-1	DOWEL PIN Ø3x25L	1
16	VS30	SPEED CHANGE STUD	1
17	VS16-1	SPEED DIAL	1
18	VS95	NUT-ACORN 5/16-18 NC	1
19	VS16-2	NAME PLATE	1
20	VS19	SCREW-DRIVE	4
21	M5-0.8X14 40B	SCREW-SOC SET-STL-BO-CUP	1
22	M5-0.8X5 40B	SCREW-SOC SET-STL-BO-CUP	1

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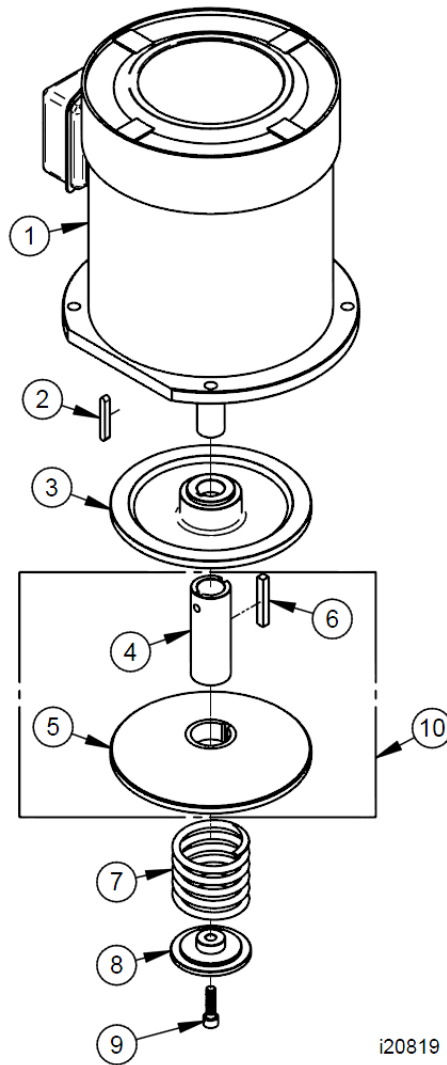


Figure 27 - K3 - Spindle Motor & Parts List

Item	P/N	Title	Qty
1	VS110	FRU-K3-MOTOR 3 HP	1
2	VS3-1	FRU-K3-KEY 6x6x45L	1
3	VS2	FRU-K3-STATIONARY MOTOR VARIDISC	1
4	VS6	FRU-K3-BUSHING	1
5	VS5	FRU-K3-ADJUSTABLE MOTOR VARIDISC ASSY.	1
6	VS6-1	FRU-K3-KEY 7x7x50L	1
7	VS8	FRU-K3-SPRING FOR VARIDISC MOTOR SHAFT	1
8	VS9	FRU-K3-ADJUSTABLE VARIDISC SPRING COLLAR	1
9	VS10	FRU-K3-SCREW- SOC HD CAP M8-P1.25x30L	1
10	23953	VARIDISC ASSY-ADJUSTABLE MOTOR	(1)

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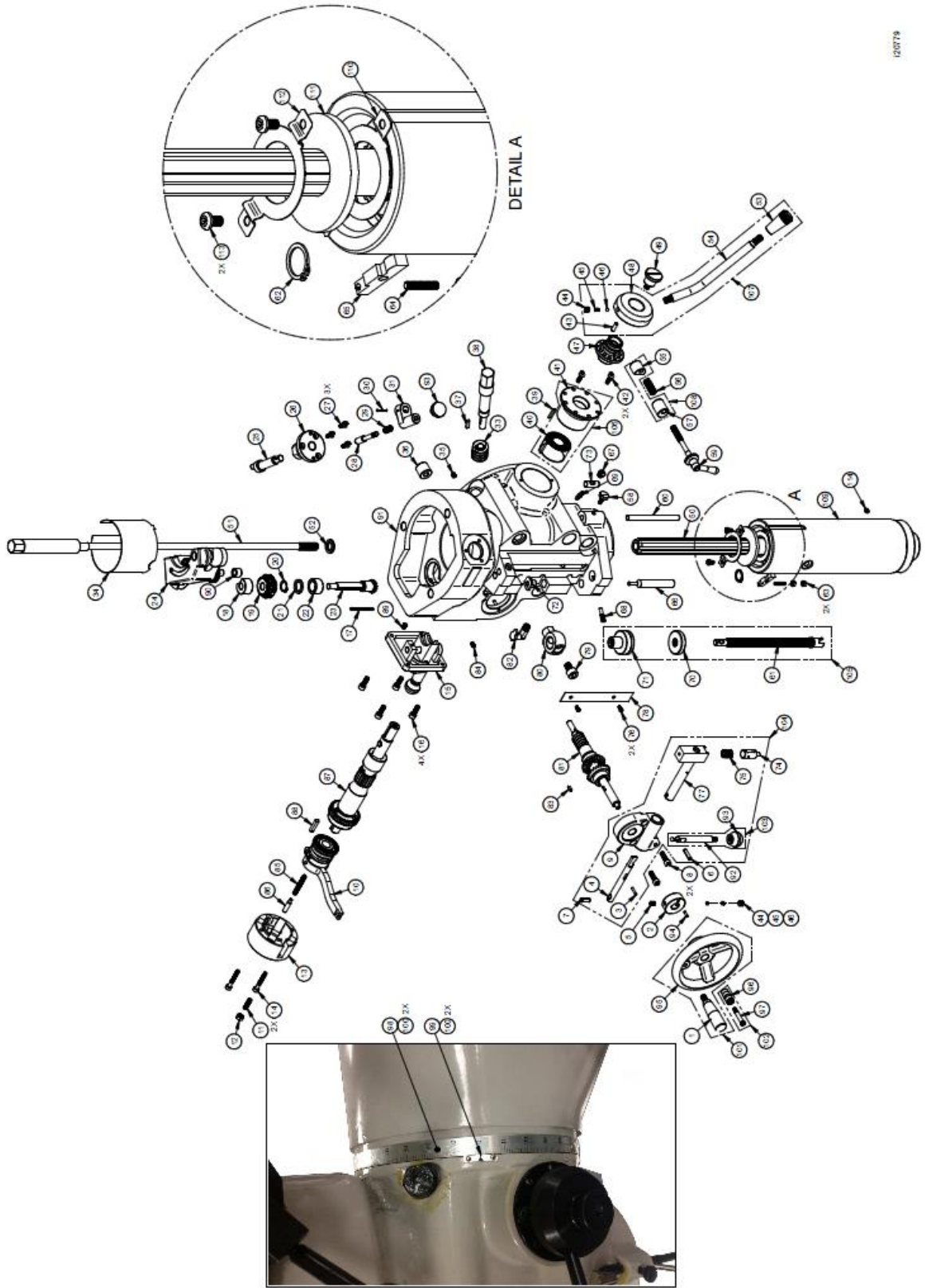


Figure 28- K3 - Lower Head Assembly

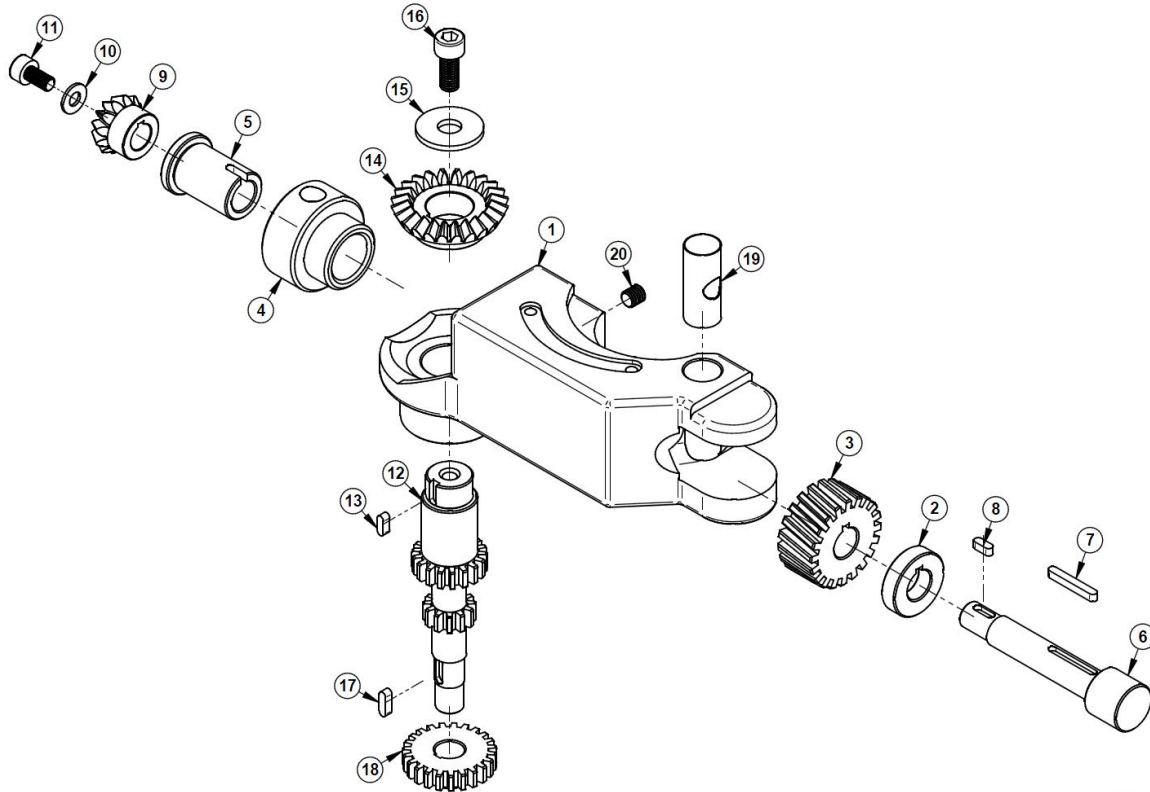
Parts List – K3 Lower Head Assembly (Figure 28)

Item	P/N	Title	Qty
1	K-B125-2	FRU-K3-HANDWHEEL HANDLE (AVAILABLE ONLY IN ASSY. 20835)	1
2	K-B113	FRU-K3-HAND WHEEL CLUTCH	1
3	K-B117	FRU-K3-ROLL PIN Ø3x15L	1
4	K-B103	FRU-K3-CAM ROD	1
5	K-B108	FRU-K3-SOCKET SET SCREW M6-P1.0x8L	1
6	K-B119-1	FRU-K3-ROLL PIN Ø3x20L	1
7	K-B103-1	FRU-K3-CAM ROD PIN Ø6x15L	1
8	K-B107	FRU-K3-CAP SCREW M6-P1.0x25L	2
9	K-B106	FRU-K3-FEED TRIP BRACKET	1
10	20779-4	OVERLOAD CLUTCH TRIP ASSY	1
11	K-B73	FRU-K3-SOCKET SET SCREW M6-P1.0x20L	1
12	K-B101	FRU-K3-CHEM BLACKED LOCKNUT M6-P1.0	1
13	K-B99	FRU-K3-CLUTCH ARM COVER	1
14	M5-0.8X50 25B	SCREW-SHCS-STL-BO	2
15	20779-2	QUILL FEED SELECTOR ASSY	1
16	K-B67	FRU-K3-CAP SCREW M6-P1.0x18L	4
17	K-B29	FRU-K3-CLUSTER GEAR KEY 3x3x45L	1
18	K-B27	FRU-K3-CLUSTER GEAR SHAFT UPPER BEARING	1
19	K-B28	FRU-K3-CLUSTER GEARS ASSEMBLY	1
20	K-B94	FRU-K3-SNAP RING 95 DOWEL PIN Ø 14	1
21	K-B32	FRU-K3-BEVEL GEAR THRUST SPACER	1
22	K-B33	FRU-K3-BEVEL GEAR BEARING	1
23	K-B31	FRU-K3-CLUSTER GEAR SHAFT 6602BB	1
24	20779-1	WORM GEAR CRADLE ASSY	1
25	K-B18	FRU-K3-WORM GEAR CRADLE THROW-OUT	1
26	K-B19	FRU-K3-SHIFT SLEEVE	1
27	K-B25	FRU-K3-CAP SCREW(3REQ.) M5-P0.8x12L	3
28	K-B20	FRU-K3-GEAR SHIFT PLUNGER	1
29	K-B21	FRU-K3-COMPRESSION SPRING	1
30	K-B22	FRU-K3-ROLL PIN Ø3x20L	1
31	K-B23	FRU-K3-SHIFT CRANK	1
33	K-B186	FRU-K3-WORM GEAR	1
34	K-B128	FRU-K3-QUILL SKIRT	1
35	K-B189-1	FRU-K3-ADJ WORM SHAFT SET SCREW M6-P1.0x6L	1
36	K-B42	FRU-K3-BUSHING	1
37	K-B187	FRU-K3-KEY 4x4x18L	1
38	K-B189	FRU-K3-ADJ WORM SHAFT	1
39	K-B171	FRU-K3-KEY 3x3x20L	1
40	K-B178	FRU-K3-CLOCK SPRING(CLOCK SPRING ASSY.)	1

41	K-B177	FRU-K3-SPRING COVER	1
42	K-B169	FRU-K3-RD.HEAD SCREW(2REQ.) M5-P0.8x15L	2
43	K-B170	FRU-K3-ROLL PIN	1
44	K-B175-3	FRU-K3-SET SCREW M8-P1.25x6L	2
45	K-B175-2	FRU-K3-COMPRESSION SPRING	2
46	K-B175-1	FRU-K3-STEEL BALL	2
47	K-B176	FRU-K3-PINION SHAFT HUB SLEEVE	1
48	K-B175	FRU-K3-RACK FEED HANDLE HUB	1
49	K-B172	FRU-K3-PINION SHAFT HUB SCREW	1
50	20836	SPINDLE ASSY-K2/K3	1
51	VS109	DRAWBAR-R8-MANUAL	1
52	VS109-1	FRU-K3-SPACER	1
53	K-B191	FRU-K3-BLACK PLASTIC BALL HANDLES	1
54	K-B190	FRU-K3-PINION SHAFT HUB HANDLE	1
55	K-B148	FRU-K3-QUILL LOCK SLEEVE	1
56	K-B148-1	FRU-K3-COMPRESSION SPRING	1
57	K-B153	FRU-K3-QUILL LOCK SLEEVE TAPPED	1
58	KB-201	FRU-K3-INDICATOR ROD SCREW	1
59	K-B149	FRU-K3-LOCK HANDLE	1
60	KB-202	FRU-K3-INDICATOR ROD	1
61	K-B164	FRU-K3-QUILL STOP MICRO-SCREW	1
62	K-B160	FRU-K3-SNAP RING Ø16	1
63	K-B124-2	FRU-K3-FEED TRIP PLUNGER NUT M40-P0.7	2
64	K-B124-1	FRU-K3-FEED TRIP PLUNGER SOC SET SCREW M4-P0.7x20L	1
65	K-B145	FRU-K3-FEED TRIP LEVER	1
66	K-B124	FRU-K3-FEED TRIP PLUNGER	1
67	K-B185	FRU-K3-REVERSE TRIP BALL LEVER SCREW	1
68	K-B144	FRU-K3-SOCKET SET SCREW	1
69	K-B183	FRU-K3-REVERSE TRIP BALL LEVER	1
70	K-B161	FRU-K3-QUILL MICRO-STOP NUT	1
71	K-B162	FRU-K3-MICROMETER NUT	1
72	K-B123	FRU-K3-TRIP PLUNGER BUSHING	1
73	K-B184	FRU-K3-FEED REVERSE TRIP PLUNGER	1
74	K-B121	FRU-K3-TRIP PLUNGER	1
75	K-B120	FRU-K3-COMPRESSION SPRING	1
76	K-B158	FRU-K3-CHEM BLACKED RD.HD.SCREWS(2 REQ.) M5-P0.8x8L	2
77	K-B118	FRU-K3-CAM ROD SLEEVE ASSY	1
78	K-B159	FRU-K3-MICROMETER SCALE	1
79	KB-200	FRU-K3-SCREW- SOC HD 3/8-24NFx15L	1
80	K-B163	FRU-K3-QUILL STOP KNOB	1
81	20779-5	FEED REVERSE CLUTCH ASSY	1

82	OIL-1	FRU-K3-OIL CUP	1
83	K-B109	FRU-K3-KEY 3x3x20L	1
84	K-B17-1	FRU-K3-WORM GEAR SET SCREW M6-P1.0x8L	1
85	K-B88-1	FRU-K3-COMPRESSION SPRING	1
86	K-B89	FRU-K3-OVERLOAD CLUTCH LEVER SPRING PLUNGER	1
87	20779-3	QUILL PINION SHAFT ASSY-R8	1
88	K-B167	FRU-K3-KEY 5x5x25L	1
89	K-B27-1	FRU-K3-SET SCREW M6-P1.0x8L	1
90	K-B41	FRU-K3-NEEDLE BEARING BA66 BEARING SIZE KO-BA66Z	1
91	K-B192	FRU-K3-QUILL HOUSING	1
92	K-B104	FRU-K3-TRIP HANDLE	1
93	K-B105	FRU-K3-BLACK PLASTIC BALL	2
94	K-B125-1	FRU-K3-HANDWHEEL SPRING PIN Ø3x3x10L	1
95	K-B125	FRU-K3-HANDWHEEL	1
96	K-B111	FRU-K3-REVERSE KNOB	1
97	K-B100	FRU-K3-CAP SET SCREW M5-P0.8x35L	1
98	25042	SCALE-HEAD ROTATION-R8	1
99	25043	POINTER SCALE	1
100	25044	DRIVE SCREW-SCALE	4
101	20835	FRU-SK2/SK3-HANDWHEEL ASSY	(1)
102	20834	FRU-SK2/SK3-FEED REVERSE KNOB ASSY	(1)
103	24052	TRIP HANDLE ASSEMBLY (INCLUDES PLASTIC BALL)	(1)
104	20832	FRU-SK2/SK3-FEED TRIP ASSY	(1)
105	20847	QUILL MICRO NUT & SCREW ASSY	(1)
106	24051	CLOCK SPRING ASSEMBLY (SPRING & COVER)	(1)
107	20849	FRU-SK2/SK3-FEED HANDLE ASSY (QUILL HANDLE)	(1)
108	20843	FRU-SK2/SK3-QUILL LOCK SLEEVE ASSY	(1)
109	K-B142	FRU-K3-QUILL	1
110	K-B150-1	STRAIGHT LOWER CLAMP	1
111	K-B151	FELT OIL STRAINER	1
112	K-B150-2	STRAINER UPPER CLAMP	1
113	K-B139	SCREW-PH-HD-M5-0.8X8L	2
114	M5-0.8X5 40B	SCREW-SOC SET-STL-BO-CUP	1

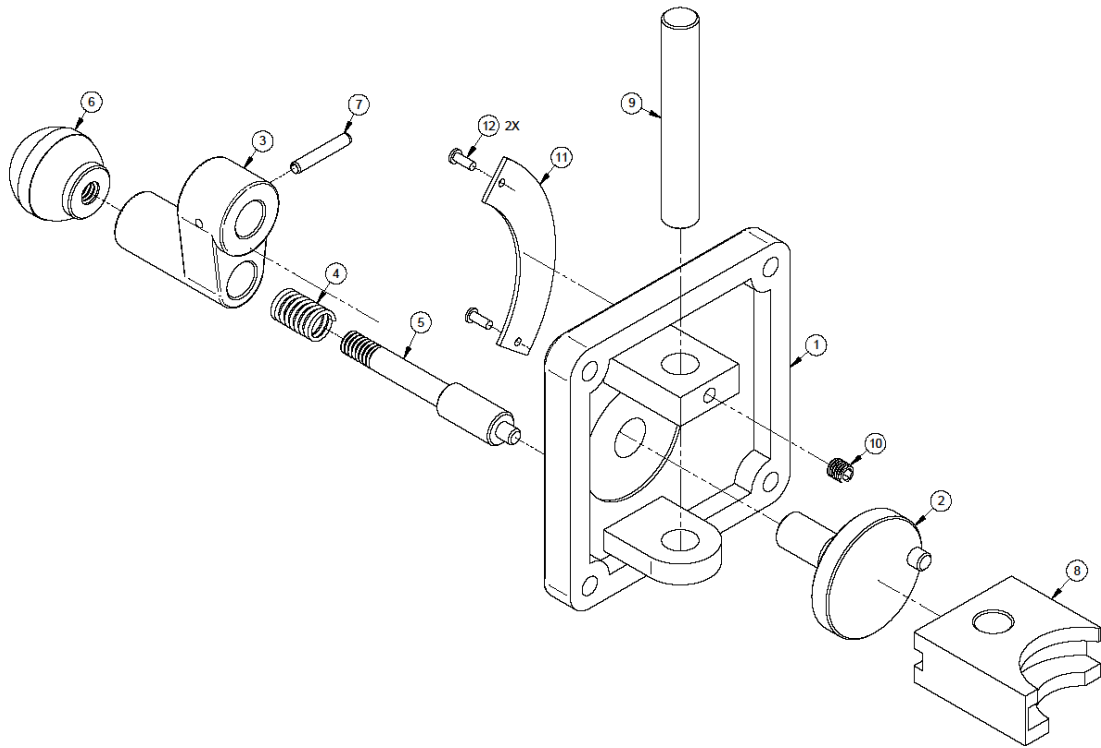
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Figure 29 - K3 - Worm Gear Cradle & Parts List

Item	P/N	Title	Qty
1	K-B17	FRU-K3-WORM GEAR CRADLE	1
2	K-B07	FRU-K3-WORM GEAR SPACER	1
3	K-B08	FRU-K3-FEED DRIVEWORM GEAR	1
4	K-B05	FRU-K3-WORM CRADLE BUSHING	1
5	K-B04	FRU-K3-FEED WORM GEAR SHAFT SLEEVE	1
6	K-B09	FRU-K3-FEED DRIVE WORM GEAR SHAFT	1
7	K-B11	FRU-K3-KEY 3x3x25L	1
8	K-B10	FRU-K3-WORM SHAFT KEY 3x3x8L	1
9	K-B03	FRU-K3-FEED BEVEL PINION	1
10	K-B02	FRU-K3-BEVEL PINION WASHER Ø 5	1
11	K-B01	FRU-K3-SOC.HD.SCREW M5-P0.8x10L	1
12	K-B36	FRU-K3-FEED DRIVING GEAR	1
13	K-B36-1	FRU-K3-KEY 3x3x8L	1
14	K-B15	FRU-K3-FEED REVERSE BEVEL GEAR	1
15	K-B13	FRU-K3-WASHER Ø 6, 22 OD	1
16	K-B14	FRU-K3-SOC HD SCREW M6-P1.0x15L	1
17	K-B37	FRU-K3-KEY 3x3x10L	1
18	K-B40	FRU-K3-FEED DRIVE GEAR	1
19	K-B16	FRU-K3-FEED ENGAGE PIN	1
20	K-B06	FRU-K3-SETSCREW M6-P1.0x6L	1



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Figure 30 - K3 - Quill Feed Selector & Parts List

Item	P/N	Title	Qty
1	K-B66	FRU-K3-CLUSTER GEAR COVER	1
2	K-B64	FRU-K3-CLUSTER GEAR SHAFT CRANK	1
3	K-B70	FRU-K3-SHIFT CRANK	1
4	K-B69	FRU-K3-SPRING Ø 3 x 20L	1
5	K-B68	FRU-K3-GEAR SHIFT PLUNGER	1
6	K-B72	FRU-K3-SHIFT KNOB-5/16-18NC	1
7	K-B71	FRU-K3-ROLL PIN Ø 3 x 20L	1
8	K-B63	FRU-K3-FEED GEAR SHIFT FORK	1
9	K-B65	FRU-K3-SHAFT	1
10	K-B61	FRU-K3-CAP SET SCREW M5-P0.8x5L	1
11	28072	SCALE-QUILL SELECTOR	1
12	25044-1	DRIVE SCREW-SCALE	2

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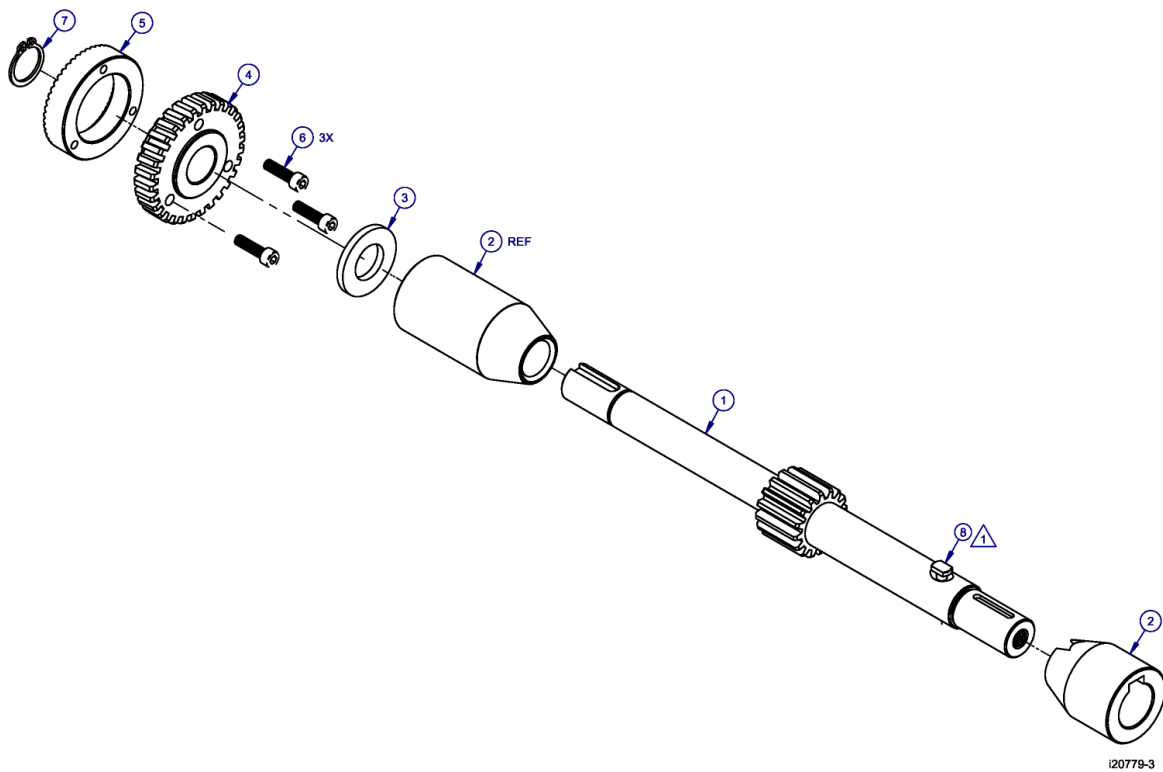
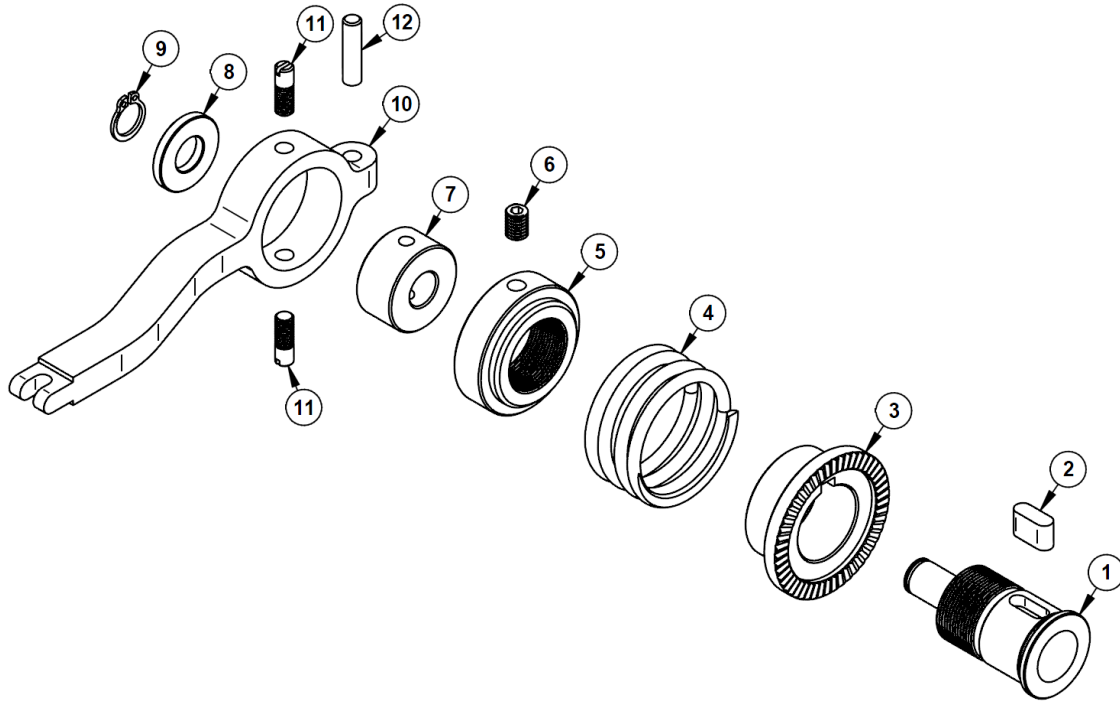


Figure 31 - K3 - Quill Pinion Shaft & Parts List

Item	P/N	Title	UseAs	Qty
1	K-B166	QUILL PINION SHAFT	EA	1
2	25706	BUSHING KIT-PINION SHAFT-R8	EA	1
3	K-B91	WASHER	EA	1
4	K-B92	OVERLOAD CLUTCH WORM GEAR	EA	1
5	K-B93	OVERLOAD CLUTCH RING	EA	1
6	K-B92-1	SCREW SOC HD CAP M4-P0.7x15L	EA	3
7	K-B94	SNAP RING 95 DOWEL PIN Ø 14	EA	1
8	K-B168	SCREW PIN	EA	(1)

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Figure 32 - K3 - Overload Clutch Trip & Parts List

Item	P/N	Title	Qty
1	K-B81	FRU-K3-OVERLOAD CLUTCH SLEEVE	1
2	K-B81-1	FRU-K3-KEY 5x8x13L	1
3	K-B80	FRU-K3-OVERLOAD CLUTCH	1
4	K-B79	FRU-K3-SAFETY CLUTCH SPRING	1
5	K-B78	FRU-K3-OVERLOAD CLUTCH LOCKNUT	1
6	K-B76	FRU-K3-SOCKET SET SCREW M6-P1.0x8L	1
7	K-B75	FRU-K3-CLUTCH RING	1
8	K-B97	FRU-K3-OVERLOAD CLUTCH WASHER	1
9	K-B98	FRU-K3-SNAP RING Ø 10	1
10	K-B96	FRU-K3-OVERLOAD CLUTCH TRIP LEVER	1
11	K-B74	FRU-K3-CLUTCH RING PIN (2REQ.)	2
12	K-B77	FRU-K3-BRASS PLUG	1

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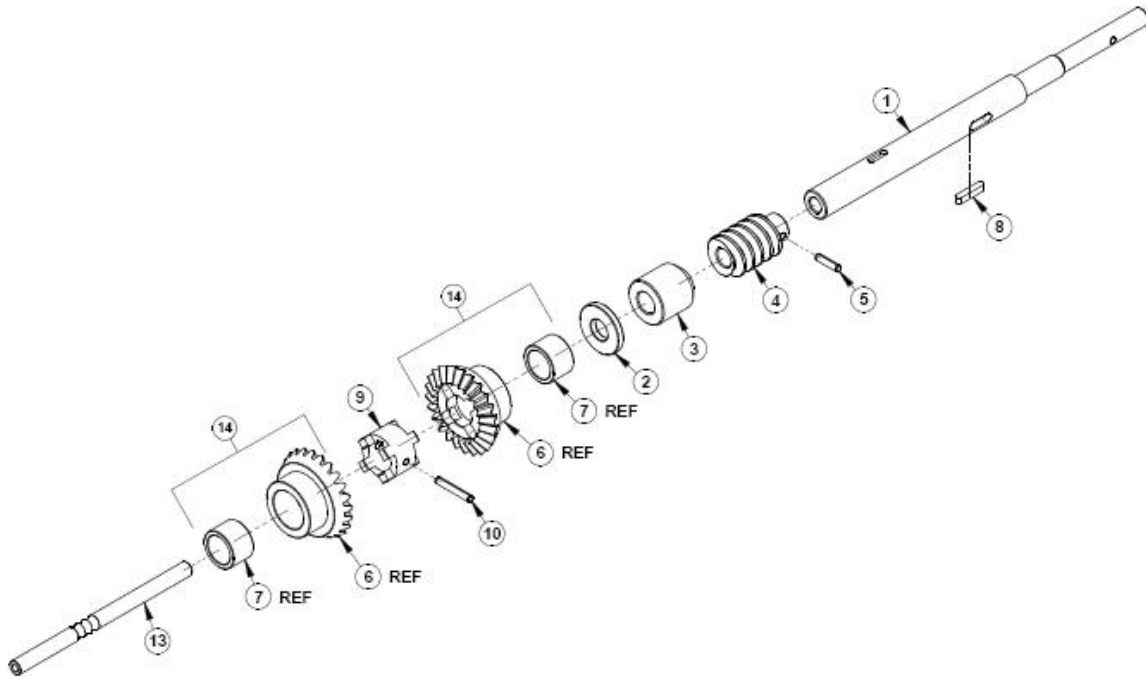


Figure 33 - K3 - Feed Reverse Clutch & Parts List

Item	P/N	Title	Qty
1	K-B57	FRU-K3-FEED WORM SHAFT	1
2	K-B47	FRU-K3-FEED WORM SHAFT THRUST WASHER	1
3	K-B44	FRU-K3-FEED WORM SHAFT BUSHING	1
4	K-B43	FRU-K3-WORM	1
5	K-B59	FRU-K3-PIN Ø 3x12L	1
6	K-B49	FRU-K3-FEED REVERSE BEVEL GEAR	1
7	K-B48	FRU-K3-BUSHING	1
8	K-B62	FRU-K3-KEY 3x3x15L	1
9	K-B50	FRU-K3-FEED REVERSE CLUTCH	1
10	K-B56	FRU-K3-PIN Ø 3x19L	1
11	K-B51	FRU-K3-FEED REVERSE BEVEL GEAR	1
12	K-B52	FRU-K3-BUSHING	1
13	K-B55	FRU-K3-REVERSE CLUTCH ROD	1
14	20826	FRU-SK2/SK3-FEED REVERSE BEVEL GEAR	2

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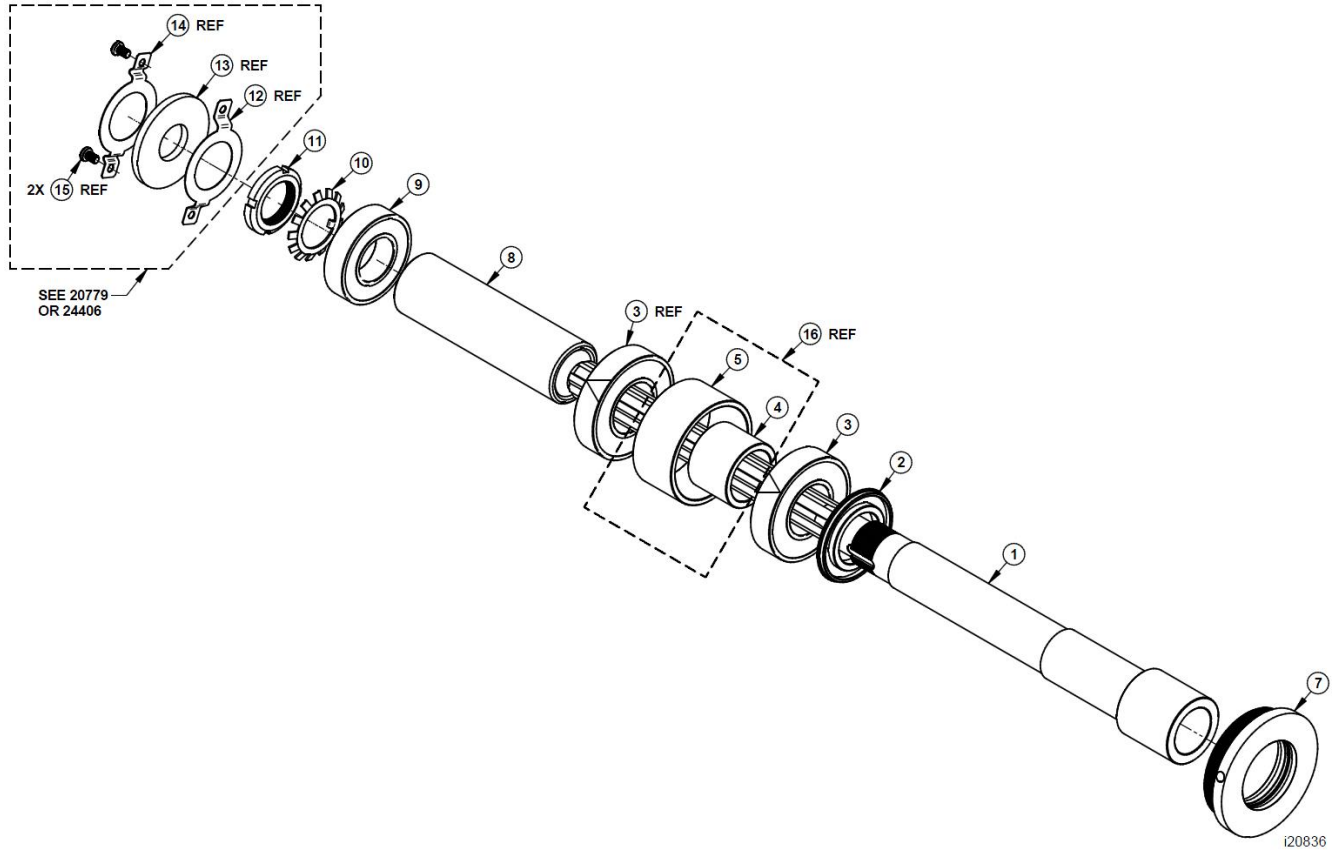


Figure 34 - K3 - Spindle Assembly & Parts List

Item	P/N	Title	Qty
1	K-B127	SPINDLE R8	1
2	K-B134	SPINDLE DIRT SHIELD	1
3	20838	BEARING-ANGULAR CONTACT-U/SET(2)-7207 P4	1
4	K-B136	BEARING SPACER-SMALL	1
5	K-B137	BEARING SPACER-LARGE	1
7	K-B133	NOSE-PIECE	1
8	K-B132	SLEEVE	1
9	K-B131	BEARING-DEEP GROVE-6206ZZ	1
10	K-B130	BEARING LOCK WASHER Ø 30	1
11	K-B129	SPINDLE BEARING LOCK NUT- Ø30-20N	1
12	K-B150-1	STRAIGHT LOWER CLAMP	(1)
13	K-B151	FELT OIL STRAINER	(1)
14	K-B150-2	STRAINER UPPER CLAMP	(1)
15	K-B139	SCREW-PH-HD-M5-0.8X8L	(2)
16	20840	BEARING SPACER SET	(1)

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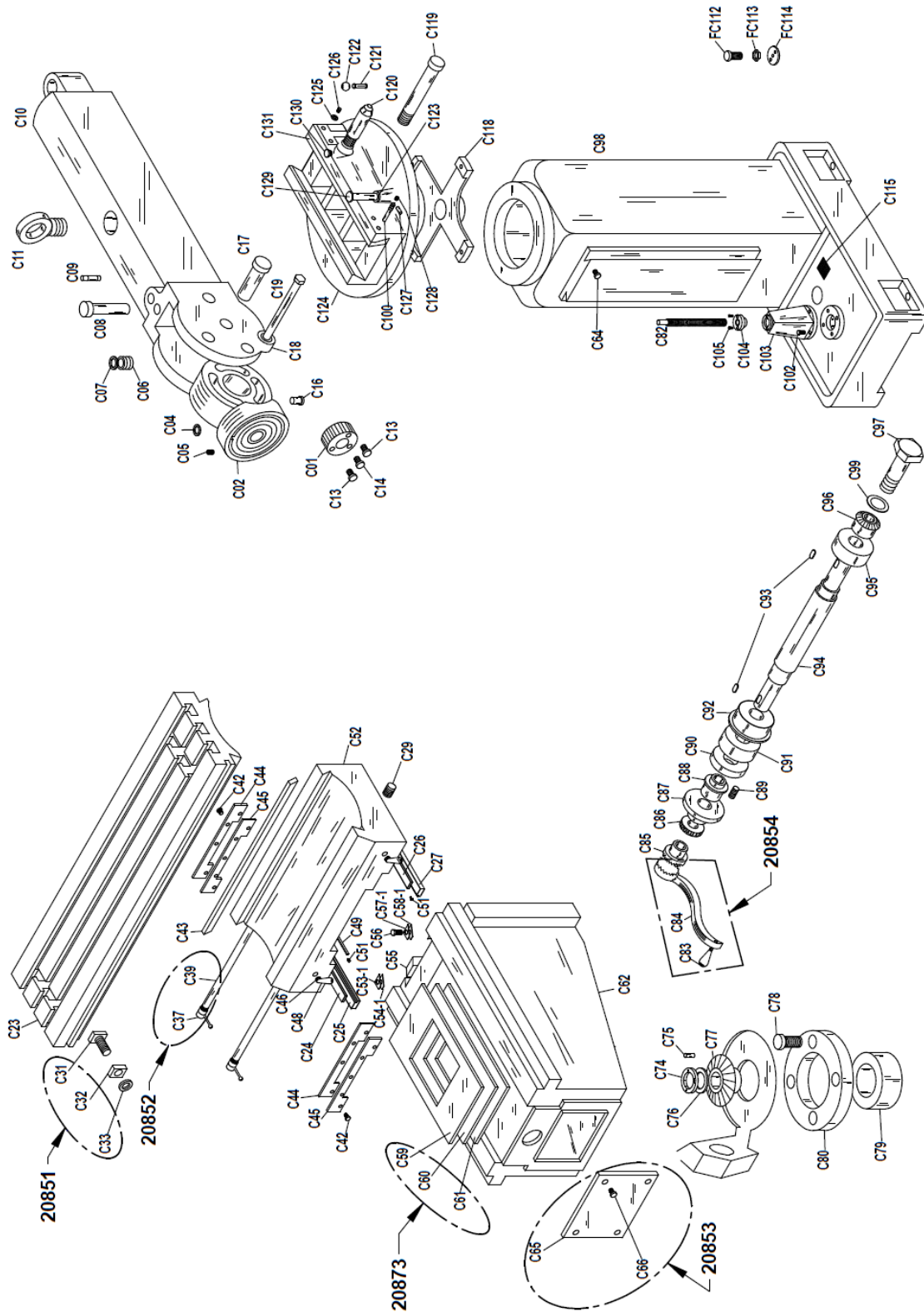


Figure 35 - K3 Base Machine

Parts List – K3 Base Machine (Reference Only)(Figure 35)

Item	P/N	Title	Qty
1	C01	FRU-K3-QUILL HOUSING ADJ.GEAR	1
2	C02	FRU-K3-RAM ADAPTER	1
3	C04	FRU-K3-NUT	1
4	C06	FRU-K3-VERTICAL ADJUSTING WORM	1
5	C07	FRU-K3-WORM THRUST WASHER(2REQ.)	2
6	C08	FRU-K3-VERTICAL ADJUSTING WORM SHAFT	1
7	C09	FRU-K3-WORM KEY	1
8	C10	FRU-K3-RAM	1
9	C13	FRU-K3-SOCKET CAP SCREW(2REQ.)	2
10	C14	FRU-K3-ROLL DOWEL PIN	1
11	C15	FRU-K3-ANGLE PLATE	1
12	C16	FRU-K3-ROUND HD DRIVE SCREW(5REQ.)	5
13	C17	FRU-K3-ADAPTER PIVOT PIN	1
14	C18	FRU-K3-CHAMFERED & HARDENED WASHER(7REQ.)	7
15	C19	FRU-K3-ADAPTER LOCKING BOLT(3REQ.)	3
16	C23	FRU-K3-TABLE 42" OR 48"	1
17	C31	FRU-K3-STOP PIECE T-BOLT(3REQ.)	3
18	C32	FRU-K3-TABLE STOP PIECE(2REQ.)	2
19	C33	FRU-K3-HEX NUT(3REQ.)	3
20	C37	FRU-K3-TABLE LOCK BOLT HANDLE	1
21	C38	FRU-K3-SADDLE LOCK BOLT	1
22	C39	FRU-K3-SADDLE LOCK PLUNGER	1
23	C40	FRU-K3-SOCKET HD CAP SCREW(2REQ.)	2
24	C41	FRU-K3-GIB ADJUSTING SCREW(3REQ.)	3
25	C42	FRU-K3-TABLE STOP BRACKET	1
26	C43	FRU-K3-SADDLE/TABLE GIB	1
27	C44	WIPER-FRONT/REAR-K2	2
28	C46	FRU-K3-TABLE LOCK PLUNGER	1
29	C47	FRU-K3-TABLE LOCK BOLT	1
30	C48	FRU-K3-TABLE LOCK BOLT HANDLE	1
31	C49	FRU-K3-SADDLE/KNEE GIB	1
32	C50	FRU-K3-SADDLE KNEE WIPER PLATE(4REQ.)	4
33	C51	FRU-K3-OVAL HEAD SCREW(8REQ.)	8
34	C53-1	FRU-K3-LEFT HAND COLUMN WIPER HOLDER	1
35	C52	FRU-K3-SADDLE	1
36	C54-1	WIPER-CHIP-LEFT KNEE-K3	1
37	C55	FRU-K3-KNEE/COLUMN GIB	1
38	C56	FRU-K3-ALLEN CAP SCREW(2REQ.)	2
39	C57-1	FRU-K3-RIGHT HAND COLUMN WIPER HOLDER	1

40	C58-1	WIPER-CHIP-RIGHT KNEE-K3	1
41	C59	FRU-K3-CHIP GUARDS-UPPER	1
42	C60	FRU-K3-CHIP GUARDS-MIDDLE	1
43	C61	FRU-K3-CHIP GUARDS-LOWER	1
44	C62	FRU-K3-KNEE	1
45	C64	FRU-K3-STOP SCREW	1
46	C65	FRU-K3-KNEE LOCK SHAFT ASSEMBLY	1
47	C69	FRU-K3-KNEE LOCK PLUNGER	1
48	C71	FRU-K3-KNEE BINDER PLUG(PLASTIC)	1
49	C72	FRU-K3-DOG POINT SET SCREW	1
50	C73	FRU-K3-SET SCREW	1
51	C74	FRU-K3-JAM NUT	1
52	C75	FRU-K3-KEY	1
53	C76	FRU-K3-WASHER	1
54	C77	FRU-K3-BEVEL GEAR	1
55	C79	FRU-K3-SEALED BALL BEARING	1
56	C80	FRU-K3-BEARING RETAINER RING	1
57	C81	FRU-K3-SOCKET HEAD CAP SCREW	1
58	C82	FRU-K3-ELEVATING SCREW ASSEMBLY	1
59	C83	FRU-K3-HANDLE	1
60	C84	FRU-K3-ELEVATING CRANK	1
61	C85	FRU-K3-GEARSHAFT CLUTCH INSERT	1
62	C86	FRU-K3-DIAL LOCK NUT	1
63	C87	FRU-K3-DIAL WITH 100 GRADUATIONS	1
64	C88	FRU-K3-DIAL HOLDER	1
65	C89	FRU-K3-SOCKET HEAD CAP SCREW	1
66	C90	FRU-K3-BEARING RETAINING RING	1
67	C91	FRU-K3-GREASE SEALED BEARING	1
68	C92	FRU-K3-BEARING CAP	1
69	C93	FRU-K3-KEY	1
70	C94	FRU-K3-ELEVATING SHAFT FOR 12" KNEE	1
71	C95	FRU-K3-GREASE SEALED BEARING	1
72	C96	FRU-K3-BEVEL PINION	1
73	C97	FRU-K3-SET SCREW	1
74	C98	FRU-K3-COLUMN	1
75	C99	FRU-K3-WASHER	1
76	C102	FRU-K3-SOCKET HEAD CAP SCREW	1
77	C103	FRU-K3-PEDESTAL	1
78	C104	FRU-K3-ELEVATING SCREW NUT	1
79	C105	FRU-K3-SOCKET HEAD CAP SCREW	1
80	C118	FRU-K3-SPIDER	1

82	C120	FRU-K3-RAM PINION	1
83	C121	FRU-K3-RAM PINION HANDLE	1
84	C122	FRU-K3-PLASTIC BALL	1
85	C123	FRU-K3-CHAMFERED HARDENED WASHER	1
86	C124	FRU-K3-TURRET	1
87	C125	FRU-K3-GIB SCREW NUT	1
88	C126	FRU-K3-GIB SCREW	1
89	C127	FRU-K3-LOCK BAR	1
90	C128	FRU-K3-SCREW	1
91	C129	FRU-K3-LOCKING BOLT	1
92	C130	FRU-K3-RAM PINION SCREW	1
93	C131	FRU-K3-RAM/TURRET GIB	1
94	20851	FRU-SK2/SK3-STOP PIECE T-BOLT ASSY	(1)
95	20852	FRU-SK2/SK3-TABLE LOCK HANDLE	(1)
96	20853	FRU-SK2/SK3-KNEE LOCK HANDLE & SHAFT	(1)
97	20854	FRU-SK2/SK3-KNEE CRANK HANDLE ASSY	(1)
98	20873	CHIP GUARD SET K2/K3	(1)
99	FC112	CAP SCREW	1
100	FC113	NUT	1
101	FC114	MACHINE MAT	1
102	C11	EYEBOLT	1
103	C05	INTERNAL SET SCREW	1
104	C100	GIB LOCK	1
105	C45	WIPER-FRONT/REAR-K2	2
106	C29	GIB ADJUSTMENT SCREW	1
107	C24	GIB-LEFT	1
108	C25	BRACKET-LEFT	1
109	C26	GIB-RIGHT	1
110	C27	BRACKET-RIGHT	1
111	C66	M6-1.0X16L	4
112	C78	1/4-20X1.0	4

i20785

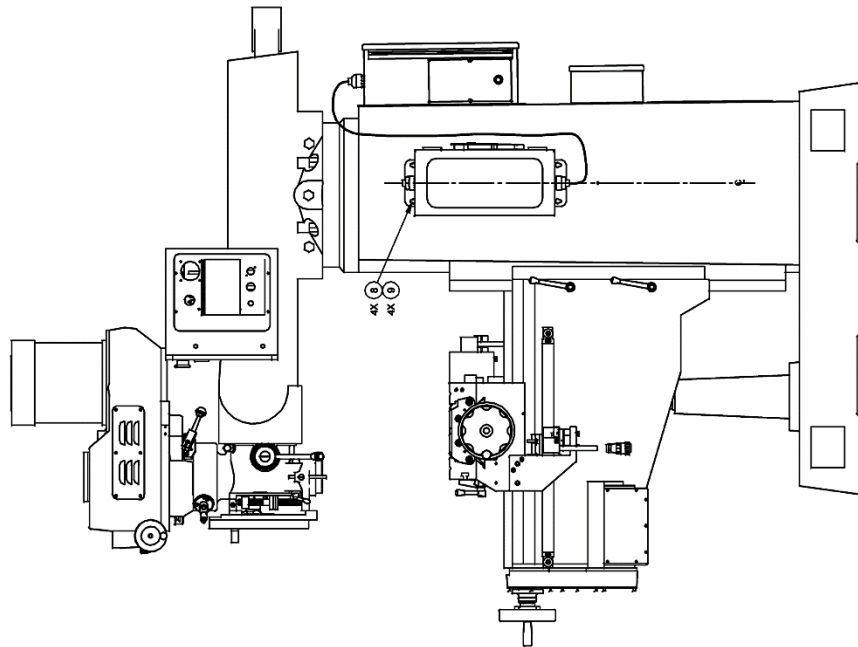
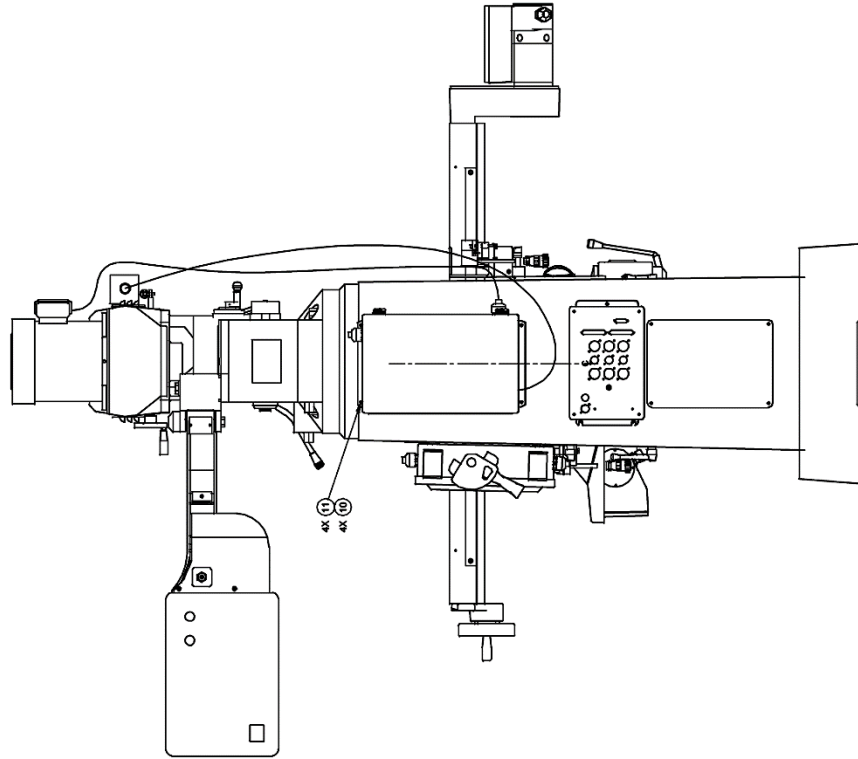


Figure 36 - K3 - Transformer Option 208V & 480V

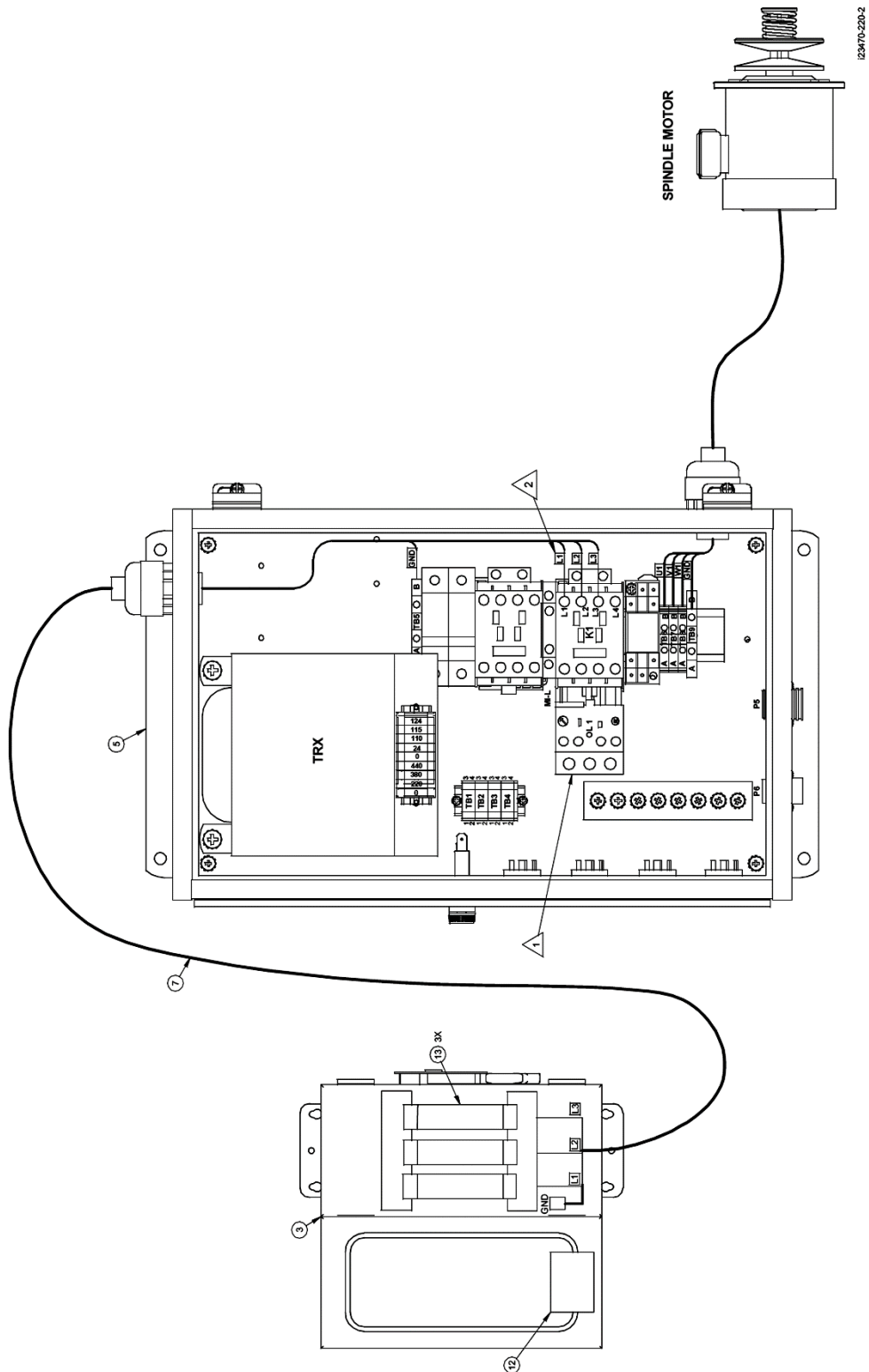


Figure 37 - K3 - Transformer Option 208V & 480V

Parts List - K3 - Transformer Options

Item	P/N	Title
3	23430-M0D	SAFETY SWITCH - 30A - 600VAC - MODIFIED
5	23440-220	ENCLOSURE ASSY-TRANSFORMER OPTION-220V
5	23440-440	ENCLOSURE ASSY-TRANSFORMER OPTION-440V
7	23454-3	CABLE ASSY-SAFETY SWITCH/XFMR MODULE-DPM
8	5/16-18X1/2 25B	SCREW-SHCS-STL-BO
9	5/16 70B	FLAT WASHER 5/16
10	M6-1.0X20 25B	SCREW-SHCS-STL-BO
11	M6 70B	WASHER-FLAT USS-STL-BO
12	24927-10	LABEL-FUSE CHART REPLACEMENT-220V
12	24927-5	LABEL-FUSE CHART REPLACEMENT-440V
13	24910-15	FUSE-TIME DELAY-15 AMPS-220V
13	24910-10	FUSE-TIME DELAY-10 AMPS-440V

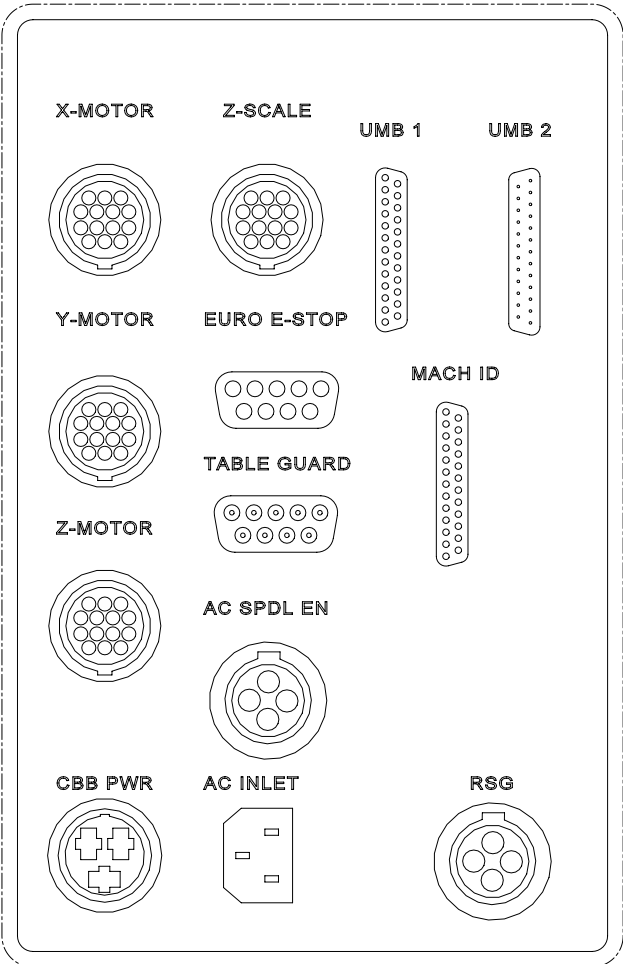
i23470-220

8.0 Drawings

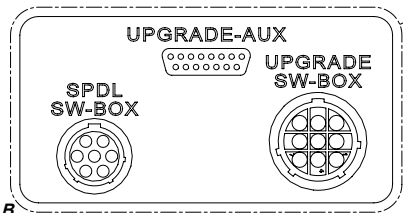
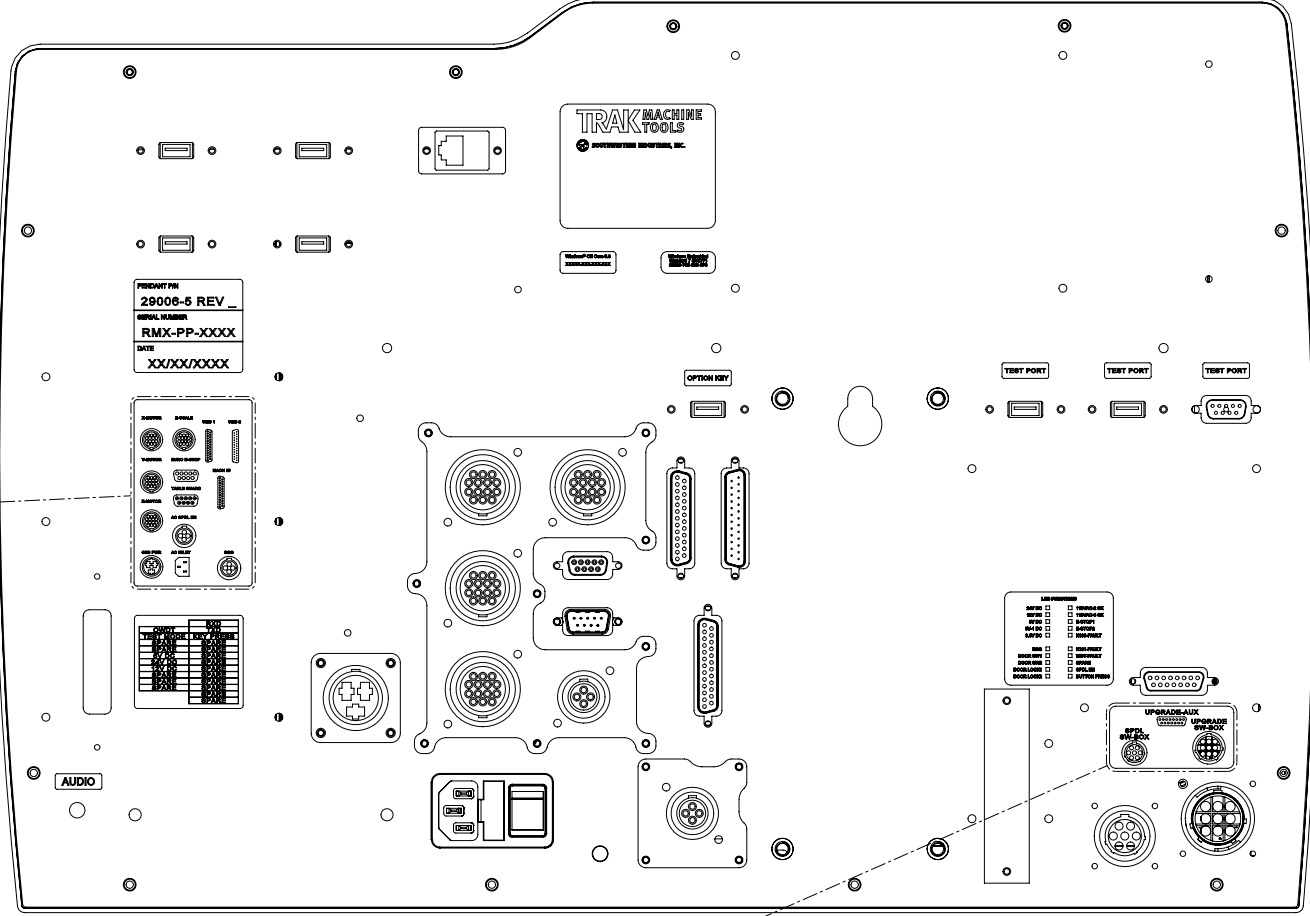
29983-3	SYSTEM DIAGRAM-RMX NEW MACHINES & UPGRADES
29756-6	PENDANT ARM KIT-TOP MOUNT-RMX-K3
29756-8	PENDANT ARM KIT-SIDE MOUNT-RMX RETROFIT
20255-2	DRIVE KIT – X-AXIS
23083-3	DRIVE KIT - Y-AXIS
20586-2	BRACKET ASSY-Z AXIS GLASS SCALE
25000-XX	DRIVE KIT - Z AXIS
25000-10	DRIVE KIT - Z AXIS
16208-1	HARDWARE KIT MX3 Z-AXIS-BP
24230-XX	Z AXIS BALL SCREW - BASEPLATE, BEARING HOUSING & COVERS ASSY
24230-6	PARTS LIST FOR Z-AXIS BALLSCREW- BASEPLATE- BEARING HOUSING & COVERS ASSY
23891	ELECTRONIC HANDWHEELKIT- KNEE MILL-X & Y AXIS
22580-7	POWER DRAWBAR OPTION K2, K3-R8
22380-1	AIR REGULATOR ASSY - DPMV – FILTER
24060-4	ELEC ENCL ASSY-SPINDLE CONTROL-3 HP
23964-XX	HEAD ASSY-SPINDLE CONTROL-3 HP
23964-1	HEAD ASSY-SPINDLE CONTROL-3 HP

REVISION TABLE					
REV	REV DESCRIPTION	ECN/NPI#	DATE	DFT	ENG
B	UPDATED SHEETS 2, 4, 7, AND 9 REGARDING LIMIT SWITCHES INPUTS.	ECN-16968	06-08-23	JM	LG
C	SHEETS 9,10: FWD/REV SWITCH ASSY P/N WAS: 20599-3	ECN-17008	06-27-23	AF	AW

RMX W/ BM PENDANT



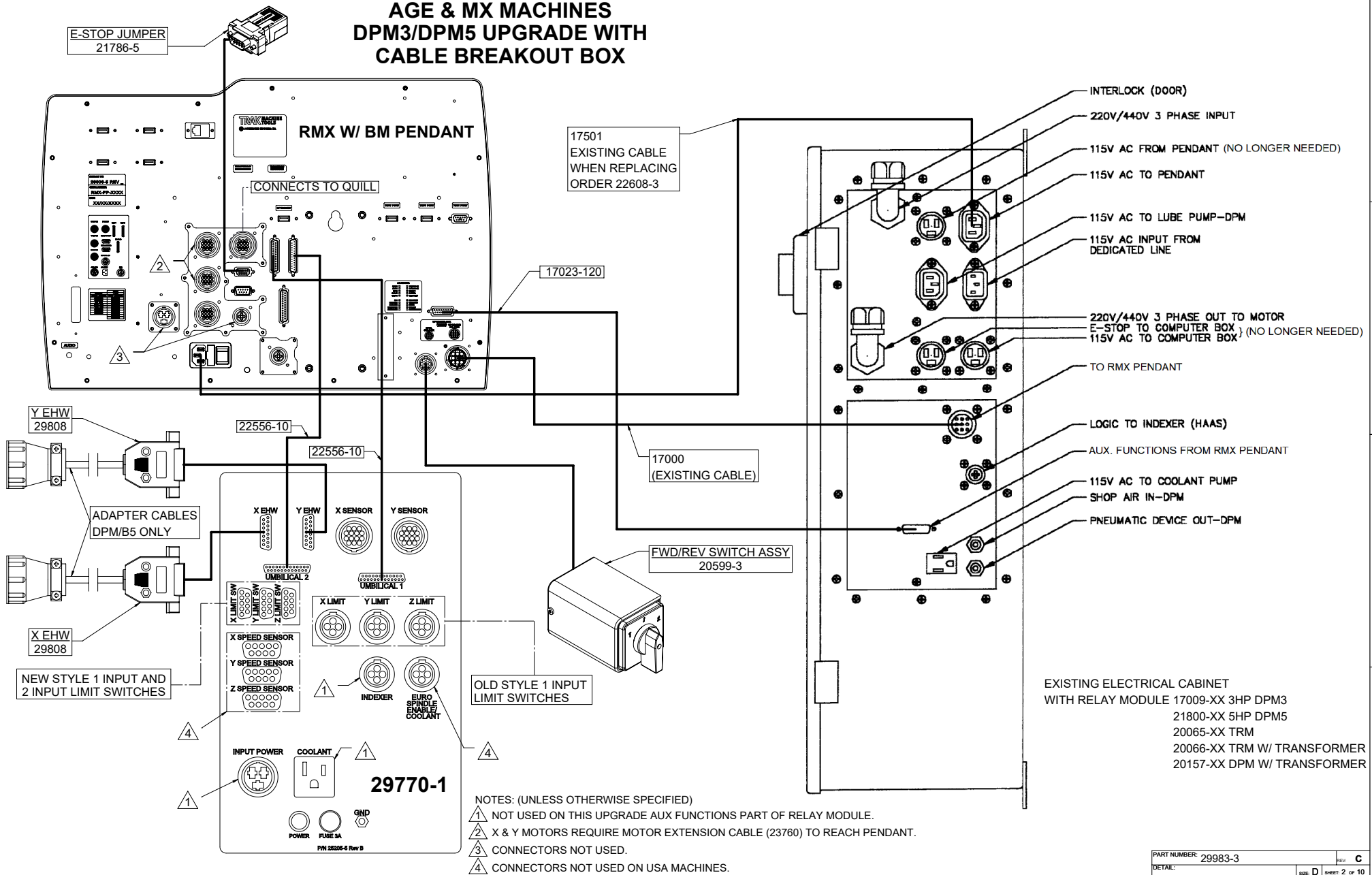
DETAIL A



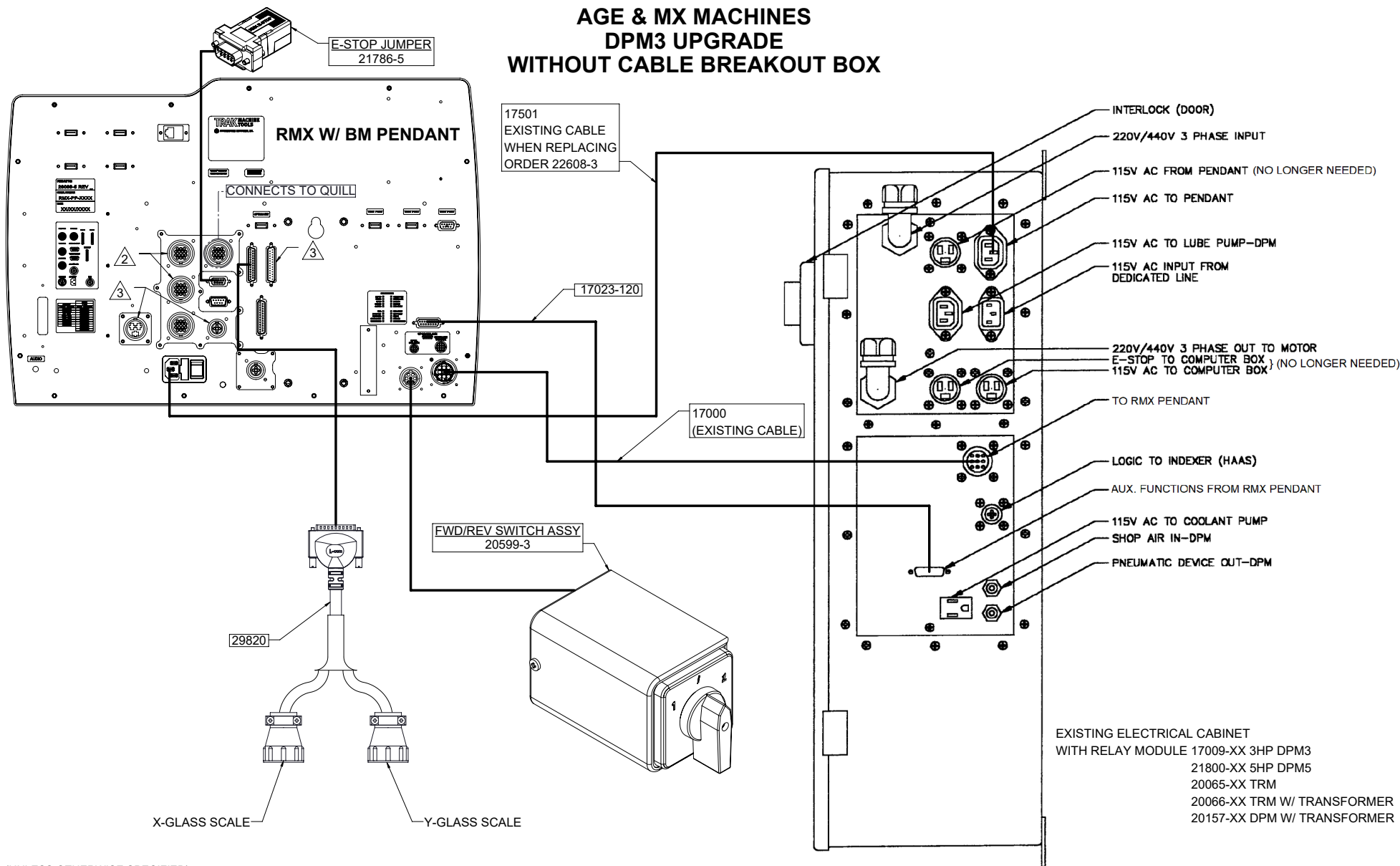
DETAIL B

APPROVALS	DATE	ASSEMBLY-INCH	
DRAWN BY: JM	3/9/2023	DESCRIPTION: SYSTEM DIAGRAM-RMX NEW MACHINES & UPGRADES	
ENGINEER: AW	3/9/2023	PART NUMBER: 29983-3	
MASS (LBS)		DETAIL:	REV: C
THIRD ANGLE PROJECTION		SIZE: D	SHEET: 1 OF 10

AGE & MX MACHINES DPM3/DPM5 UPGRADE WITH CABLE BREAKOUT BOX



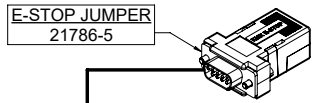
AGE & MX MACHINES DPM3 UPGRADE WITHOUT CABLE BREAKOUT BOX



EXISTING ELECTRICAL CABINET
WITH RELAY MODULE 17009-XX 3HP DPM3
21800-XX 5HP DPM5
20065-XX TRM
20066-XX TRM W/ TRANSFORMER
20157-XX DPM W/ TRANSFORMER

NOTES: (UNLESS OTHERWISE SPECIFIED)
 △ X & Y MOTORS REQUIRE MOTOR EXTENSION CABLE (23760) TO REACH PENDANT.
 △ CONNECTORS NOT USED.

**TRM, SPORT B3/5, DPME2, DPME2, SM & SX
2 AXIS & 3 AXIS KNEE MILL
UPGRADE WITHOUT SPINDLE CONTROL
WITH CABLE BREAKOUT BOX-SWI MACHINES**



RMX W/ BM PENDANT

22585

**Z-AXIS
ELEC HANDWHEEL ASSY
21774**

20676-XX

**POWER CABLE
22608**

Y EHW
29808

22556-10

22556-10

21856

X EHW
29808

**NEW STYLE 1 INPUT AND
2 INPUT LIMIT SWITCHES**

**FWD/REV SWITCH ASSY
20599-3**

**OLD STYLE 1 INPUT
LIMIT SWITCHES**

UMBILICAL 2

UMBILICAL 1

X LIMIT

Y LIMIT

Z LIMIT

X SPEED SENSOR

Y SPEED SENSOR

Z SPEED SENSOR

INDEXER

EURO SPINDLE
ENABLE COOLANT

INPUT POWER

COOLANT

29770-1

POWER

FUSE 3A

GND

PN 25205-8 Rev B

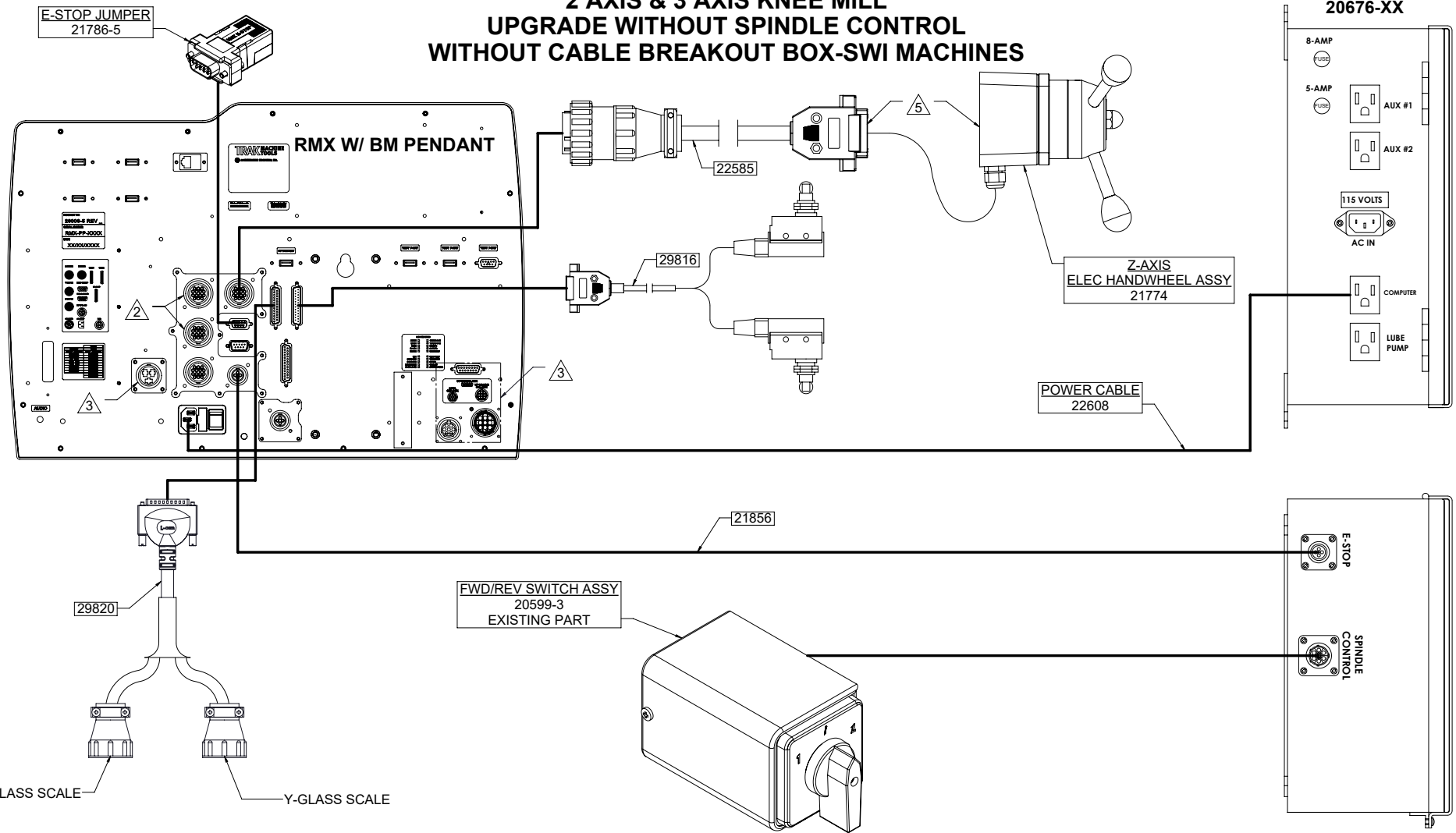
29816

29817

16158-2

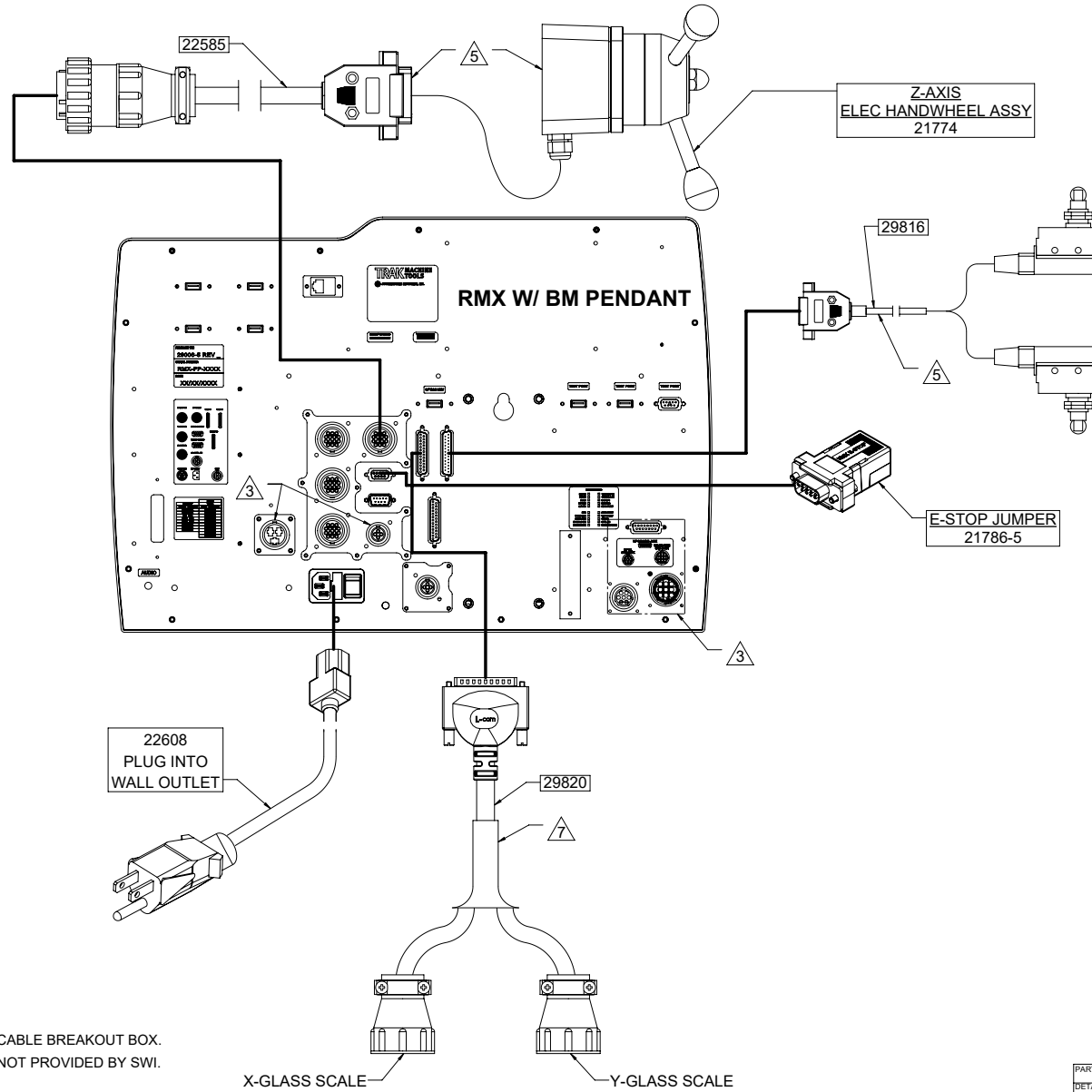
- NOTES: (UNLESS OTHERWISE SPECIFIED)
- ⚠️ X & Y MOTORS REQUIRE MOTOR EXTENSION CABLE (23760) TO REACH PENDANT.
 - ⚠️ CONNECTORS NOT USED.
 - ⚠️ CONNECTORS NOT USED ON USA MACHINES.
 - ⚠️ USE ON 3 AXIS KNEE MILL WITH Z ELECTRONIC HANDWHEEL.
 - ⚠️ CABLE 16158-2 ONLY NEEDED IF CUSTOMER ORDERS AUX FUNCTION OPTION.

TRM, SPORT B3, DPME2, DPME2, SM & SX
 2 AXIS & 3 AXIS KNEE MILL
 UPGRADE WITHOUT SPINDLE CONTROL
 WITHOUT CABLE BREAKOUT BOX-SWI MACHINES



- NOTES: (UNLESS OTHERWISE SPECIFIED)
- 1 X & Y MOTORS REQUIRE MOTOR EXTENSION CABLE (23760) TO REACH PENDANT.
 - 2 CONNECTORS NOT USED.
 - 3 USE ON 3 AXIS KNEE MILL WITH Z ELECTRONIC HANDWHEEL.

RMX 2 AXIS RETRO OR UPGRADE WITHOUT CABLE BREAKOUT BOX-NON SWI MACHINES
RMX 3 AXIS RETRO OR UPGRADE WITHOUT CABLE BREAKOUT BOX-NON SWI MACHINES



NOTES: (UNLESS OTHERWISE SPECIFIED)

3 CONNECTORS NOT USED.

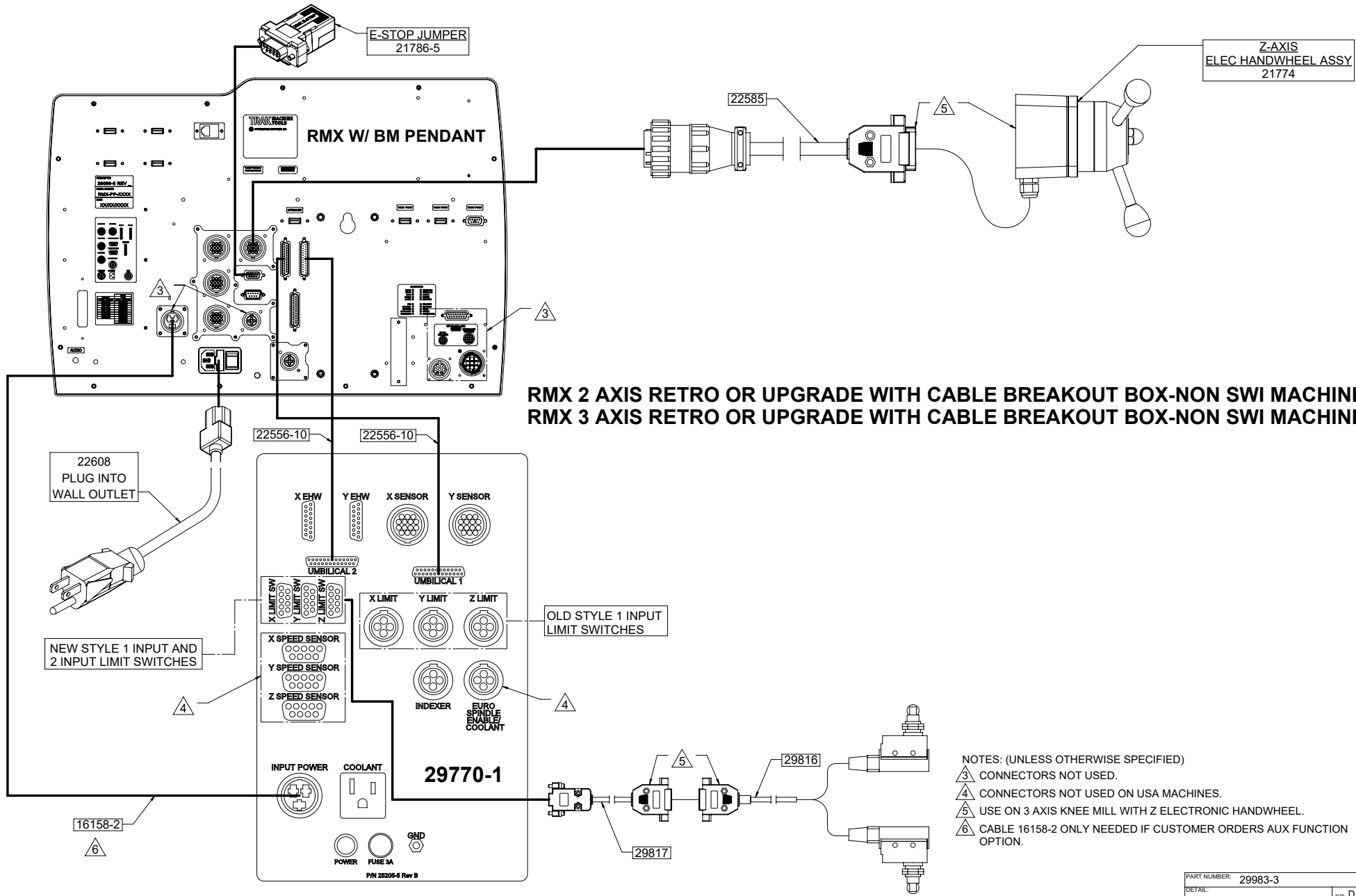
5 USE ON 3 AXIS KNEE MILL WITH Z ELECTRONIC HANDWHEEL.

7 CABLE NEEDED IF USERS ORDER GLASS SCALE OPTION AND NO CABLE BREAKOUT BOX.

8. ELECTRICAL BOX AND FWD/REV SWITCH PART OF MACHINE AND NOT PROVIDED BY SWI.

PART NUMBER: 29983-3
 DETAIL: REV. C
 SIZE: D SHEET 6 OF 10

8 7 6 5 4 3 2 1



RMX 2 AXIS RETRO OR UPGRADE WITH CABLE BREAKOUT BOX-NON SWI MACHINES
RMX 3 AXIS RETRO OR UPGRADE WITH CABLE BREAKOUT BOX-NON SWI MACHINES

RMX W/ BM PENDANT SPINDLE CONTROL

DIGITAL I/O

SPD CTRL

DETAIL C

PENDANT P/N
29006-6 REV _
SERIAL NUMBER
RMX-PP-XXXX
DATE
XX/XX/XXXX

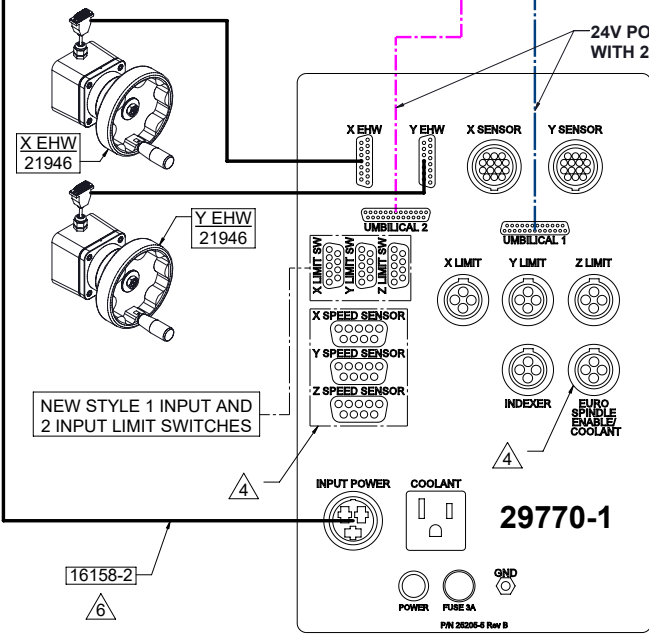
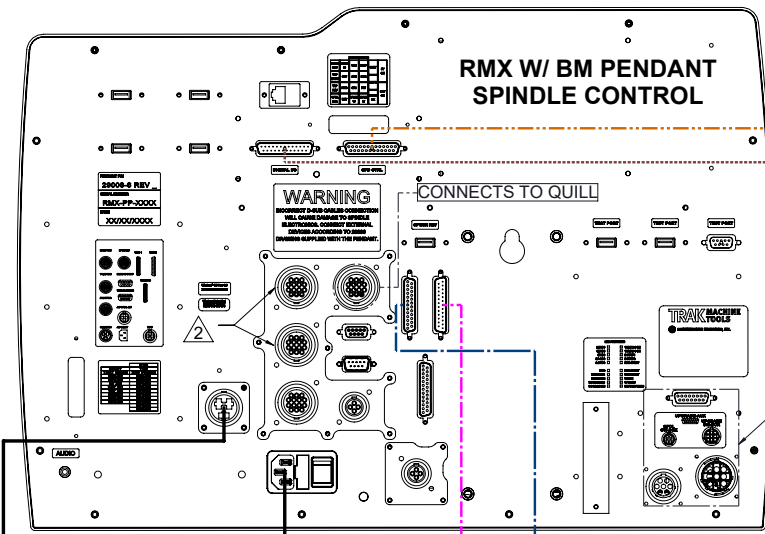
WARNING
INCORRECT D-SUB CABLES CONNECTION
WILL CAUSE DAMAGE TO SPINDLE
ELECTRONICS. CONNECT EXTERNAL
DEVICES ACCORDING TO 29006
DRAWING SUPPLIED WITH THE PENDANT.

- | | |
|-------------------------------|---|
| LED FUNCTIONS | |
| SWAP <input type="checkbox"/> | EMERGENCY STOP <input type="checkbox"/> |
| SWAP <input type="checkbox"/> | EMERGENCY STOP <input type="checkbox"/> |
| SWAP <input type="checkbox"/> | SUPPLY <input type="checkbox"/> |
| SWAP <input type="checkbox"/> | STOP <input type="checkbox"/> |
| SWAP <input type="checkbox"/> | START <input type="checkbox"/> |
| SWAP <input type="checkbox"/> | STOP <input type="checkbox"/> |
| SWAP <input type="checkbox"/> | START <input type="checkbox"/> |

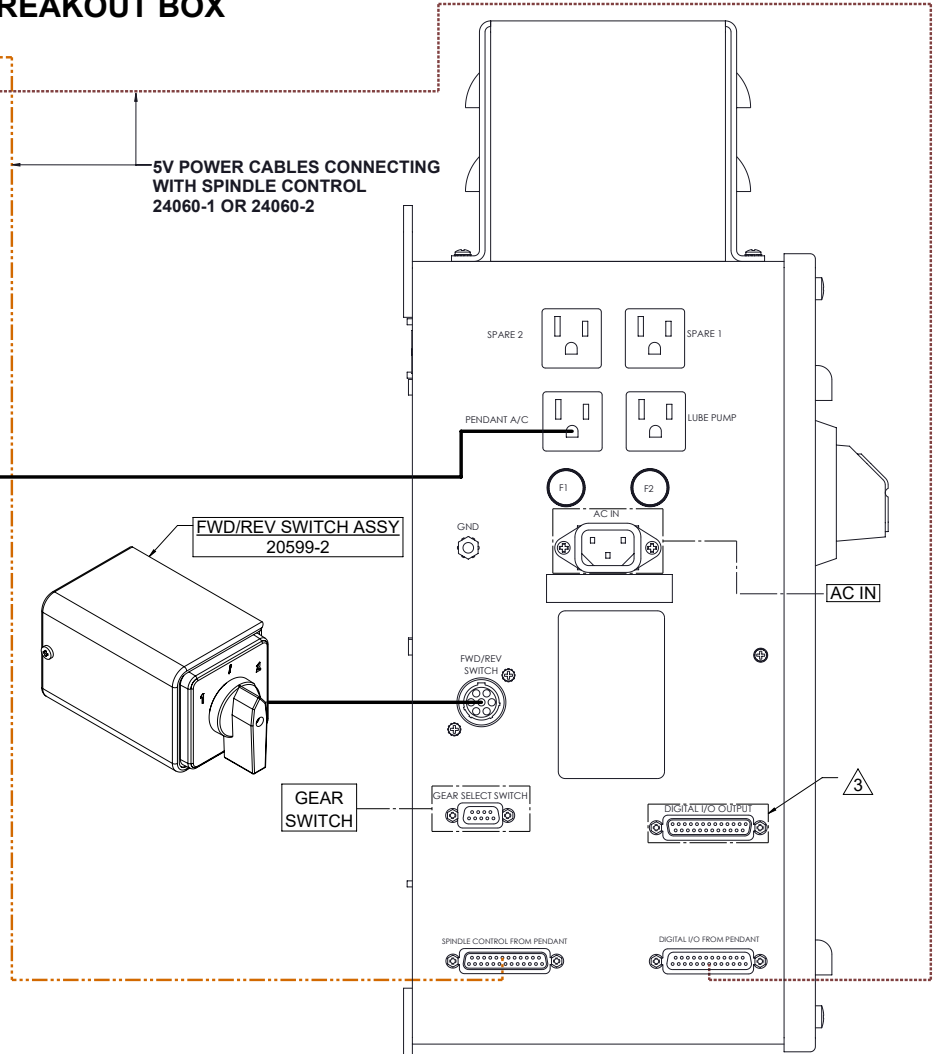
TRAK MACHINE TOOLS
SOUTHWESTERN INDUSTRIES, INC.

UPGRADE AUX
SPD SW-BOX

DPM2/3/5 WITH SPINDLE CONTROL SX TO RMX UPGRADE WITH CABLE BREAKOUT BOX



- NOTES:
- ⚠️ 2 X & Y MOTORS REQUIRE MOTOR EXTENSION CABLE (23670) TO REACH PENDANT.
 - ⚠️ 3 CONNECTORS NOT USED.
 - ⚠️ 4 CONNECTORS NOT USED ON USA MACHINES.
 - ⚠️ 6 CABLE 16158-2 ONLY NEEDED IF CUSTOMER ORDERS AUX FUNCTION OPTION.



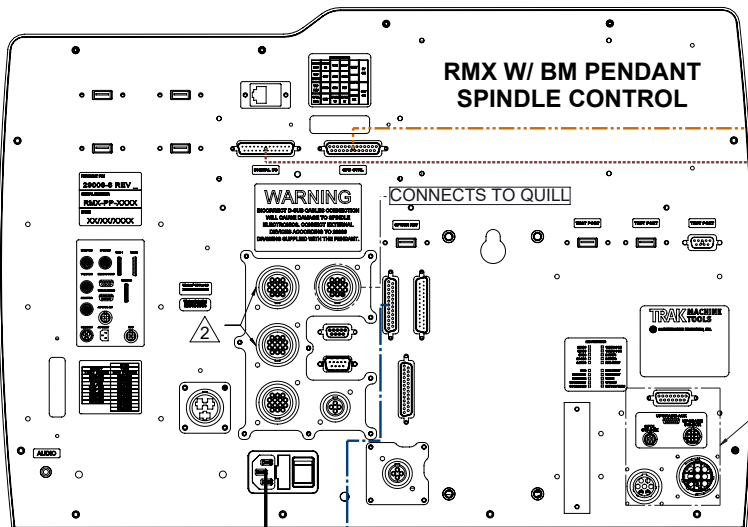
WARNING

INCORRECT CONNECTION WILL CAUSE DAMAGE TO SPINDLE ELECTRONICS AND MAY DAMAGE THE PENDANT. CONNECT EXTERNAL DEVICES AS SHOWN. (24V UMBILICAL 1 & 2 POWER CABLES WILL CAUSE DAMAGE IF CONNECTED TO 24060-XX BOX)

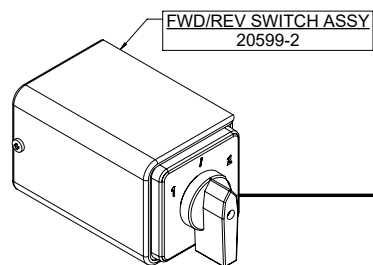
24060-1 (3HP)
24060-2 (5HP)

**DPM2/3/5 WITH SPINDLE CONTROL
SX TO RMX UPGRADE
WITHOUT CABLE BREAKOUT BOX**

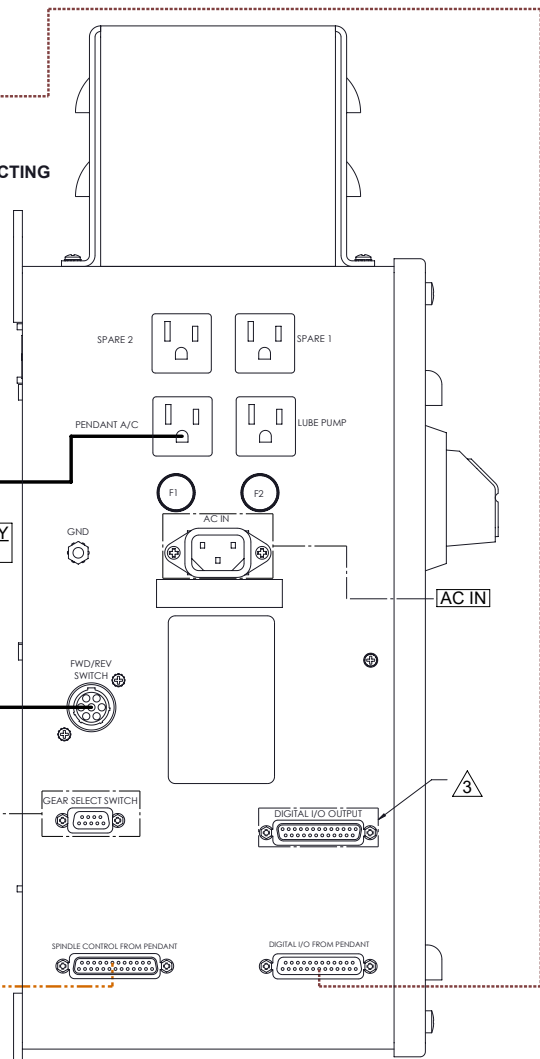
**RMX W/ BM PENDANT
SPINDLE CONTROL**



5V POWER CABLES CONNECTING
WITH SPINDLE CONTROL
24060-1 OR 24060-2



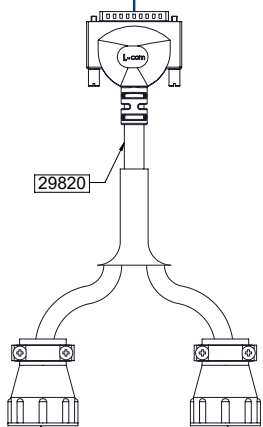
GEAR
SWITCH



**24060-1 (3HP)
24060-2 (5HP)**

NOTES:

- ② X & Y MOTORS REQUIRE MOTOR EXTENSION CABLE (23670) TO REACH PENDANT.
- ③ CONNECTORS NOT USED.



X-GLASS SCALE

Y-GLASS SCALE

WARNING

INCORRECT CONNECTION WILL CAUSE DAMAGE TO SPINDLE ELECTRONICS AND MAY DAMAGE THE PENDANT. CONNECT EXTERNAL DEVICES AS SHOWN. (UMBILICAL 2 CONNECTOR SHOULD REMAIN DISCONNECTED AS IT CARRIES 24V POWER. CONNECTING IT TO 24060-XX WILL DAMAGE THE BOX)

4

3

2

1

TRAK MACHINE TOOLS

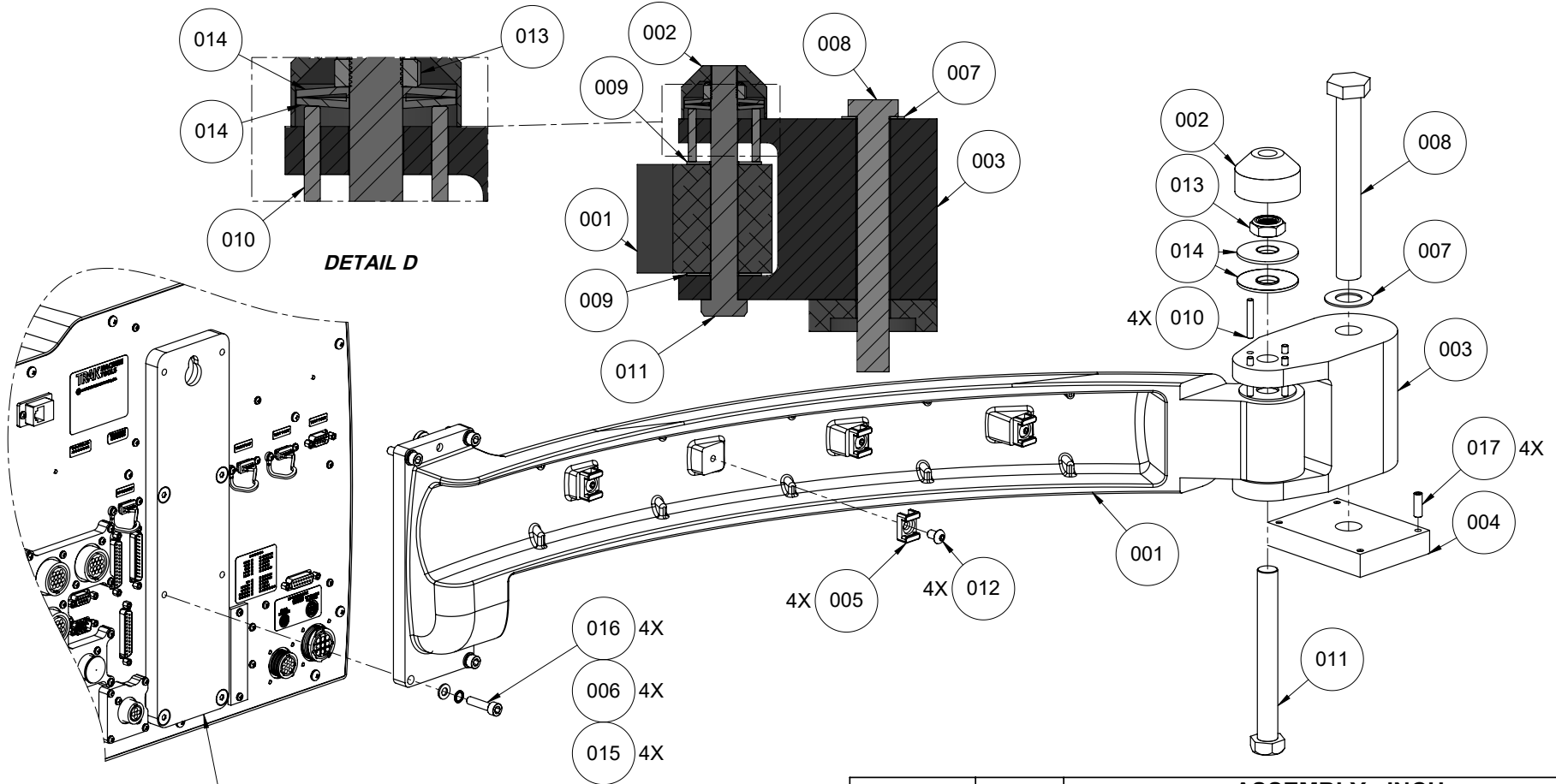
SOUTHWESTERN INDUSTRIES, INC.
2615 HOMESTEAD PLACE
RANCHO DOMINGUEZ, CA 90220

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REVISION TABLE

REV	REV DESCRIPTION	ECN/NPI#	DATE	DFT	ENG
1	PROTOTYPE RELEASE	NPI-821	07-20-21	JJ	AW
2	ADDED BALLOONS 6,15, AND 16	NPI-879	11-19-21	JM	AW
A	PRODUCTION RELEASE	ECN-16952	05-26-23	JM	AW



BRACKET(29094) - PART OF KIT (29952) NEEDED DEPENDING ON CONFIGURATION. BRACKET IS NOT USED WHEN TABLEGUARD OPTION IS ORDERED.

APPROVALS	DATE	ASSEMBLY - INCH	
DRAWN BY: JJ	7/19/2021	DESCRIPTION: PENDANT ARM KIT-TOP MOUNT RMX-K3	
ENGINEER: AW	7/19/2021	PART NUMBER: 29756-6	
MASS (LBS):		REV: A	
THIRD ANGLE PROJECTION		DETAIL:	SIZE: B SHEET: 1 OF 2

4

3

2

1

PART NUMBER: 29756-6	DRAWN BY: JJ	7/19/2021
	ENGINEER: AW	7/19/2021

Item No.	Part Number	Description	Detail	Type	QTY.	Item Length	Category	MFG Part Number	Manufacturer
001	29775-3	PENDANT ARM ASSY-KMX		Normal	1		Manufactured		
002	15896	CAP-PENDANT		Normal	1		Manufactured		
003	16797	RAM SUPPORT MACHINED		Normal	1		Manufactured		
004	16919	PLATE-LEVELING		Normal	1		Manufactured		
005	26050	CABLE TIE MOUNT		Normal	4		Purchased	10079	Avery Dennison
006	24009-3	WASHER-BELLEVILLE SPRING LK-SERRATED	.264 ID X .374 OD X .024 THK-1/4 OR M6	Normal	4		Purchased	WSPESTL025N037P L028S	ATLAS BOLT
007	34 71P	WASHER-FLAT SAE-STL-PLAIN		Normal	1		Purchased		
008	34-10X6 (24P)	SCREW-HEXHCS-STL-PL		Normal	1		Purchased		
009	58 70P	WASHER-FLAT USS-STL-PLAIN		Normal	2		Purchased		
010	3/16X1 1/4 80P	PIN-DOWEL-STL-PLAIN		Normal	4		Purchased		
011	58-18X5 1/2 24B	SCREW-HEXHCS-STL-BO		Normal	1		Purchased		
012	1/4-20X38 (27B)	SCREW-BHCS-STL-BO		Normal	4		Purchased		
013	58-18 57Z	NUT-NYLON LOCK-JAM-STL-ZINC		Normal	1		Purchased		
014	21969	WASHER-BELLEVILLE SPRING LK	.630 ID X 1.875 OD X .086 THK	Normal	2		Purchased	WSPESTL063N188P L086	ATLAS BOLT
015	M6 (70B)	WASHER-FLAT USS-STL-BO	STOCKED	Normal	4		Purchased		
016	M6-1.0X25 (25B)	SCREW-SHCS-STL-BO	STOCKED	Normal	4		Purchased		
017	1/4-20 X 3/4 (40B)	SCREW-SOC SET-STL-BO-CUP		Normal	4		Purchased		

PRODUCTS USED ON:

4

3

2

1

TRAK MACHINE TOOLS

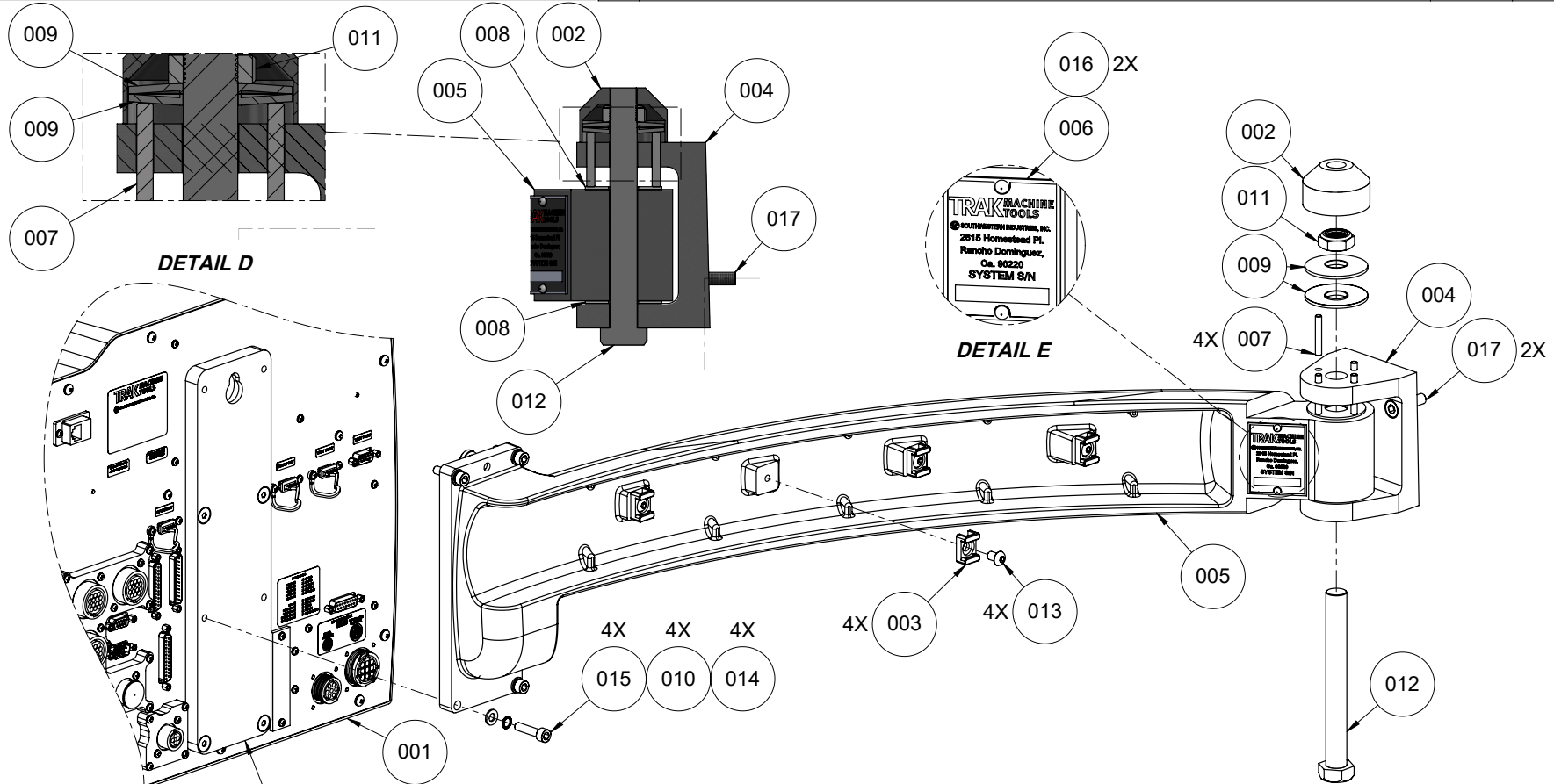
SOUTHWESTERN INDUSTRIES, INC.
2615 HOMESTEAD PLACE
RANCHO DOMINGUEZ, CA 90220

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REVISION TABLE

REV	REV DESCRIPTION	ECN/NPI#	DATE	DFT	ENG
A	PRODUCTION RELEASE	ECN-16491	09-17-21	JJ	AW



DETAIL D

DETAIL E

BRACKET(29094) - PART OF KIT (29952) NEEDED DEPENDING ON CONFIGURATION.

NOTES:

- FOR S/N SEE ES-374
- DRILL 2 HOLES - USE #37 DRILL BIT, FASTEN NAMEPLATE WITH ITEM 016 2X
- BOLT AND WASHER COMBINATION MAY VARY DEPENDING ON THE UNIT BEING REVISED.

APPROVALS	DATE	ASSEMBLY - INCH	
DRAWN BY: JJ	7/19/2021	DESCRIPTION: PENDANT ARM KIT-SIDE MOUNT RMX-K RETROFIT	
ENGINEER: JJ	7/19/2021	PART NUMBER: 29756-8	
MASS (LBS):		REV: A	
THIRD ANGLE PROJECTION		DETAIL:	SIZE: B SHEET: 1 OF 2

4

3

2

1

PART NUMBER: 29756-8	DRAWN BY: JJ	7/19/2021
	ENGINEER: JJ	7/19/2021

Item No.	Part Number	Description	Detail	Type	QTY.	Item Length	Category	MFG Part Number	Manufacturer
001	29952	KIT-PENDANT MOUNT		Reference	1		Manufactured		
002	15896	CAP-PENDANT		Normal	1		Manufactured		
003	26050	CABLE TIE MOUNT		Normal	4		Purchased	10079	Avery Dennison
004	15992	RAM-SUPPORT-MACHINED		Normal	1		Manufactured		
005	29775-3	PENDANT ARM ASSY-KMX		Normal	1		Manufactured		
006	21934	NAMEPLATE-SYSTEM SN		Normal	1		Manufactured		
007	3/16X1 1/4 80P	PIN-DOWEL-STL-PLAIN		Normal	4		Purchased		
008	5/8 70P	WASHER-FLAT USS-STL-PLAIN		Normal	2		Purchased		
009	21969	WASHER-BELLEVILLE SPRING LK	.630 ID X 1.875 OD X .086 THK	Normal	2		Purchased	WSPESTL063N188P L086	ATLAS BOLT
010	24009-3	WASHER-BELLEVILLE SPRING LK-SERRATED	.264 ID X .374 OD X .024 THK- 1/4 OR M6	Normal	4		Purchased	WSPESTL025N037P L028S	ATLAS BOLT
011	5/8-18 57Z	NUT-NYLON LOCK-JAM-STL-ZINC		Normal	1		Purchased		
012	5/8-18X5 1/2 24B	SCREW-HEXHCS-STL-BO		Normal	1		Purchased		
013	14-20X38 (27B)	SCREW-BHCS-STL-BO		Normal	4		Purchased		
014	M6 (70B)	WASHER-FLAT USS-STL-BO	STOCKED	Normal	4		Purchased		
015	M6-1.0X25 (25B)	SCREW-SHCS-STL-BO	STOCKED	Normal	4		Purchased		
016	4 X 3/8 (34J)	SCREW-DRIVE-4-SS		Normal	2		Purchased		
017	M8-1.25X25 (25B)	SCREW-SHCS-STL-BO	STOCKED	Normal	2		Purchased		

PRODUCTS USED ON:

Parts List for Assembly P/N: 20255-2

Printed 10/30/2018

20255-2
DRIVE KIT-X AXIS

Type	PL	Dwg Size	D
Revision	J	Product	PT4
Status	R	Engineer	SPG
Date	6/19/1996	Planner Code	10
By	JM	Comm Code	MANUF

REV	ECN	SIGN	DATE
H	14335	LG	12/5/14
J	14949	LG	10/30/18

Item	P/N	Title	Detail	Reference(t)	Qty	UseA	Rev	Stat	Type
1	15621	DRIVE HOUSING			1	EA	C	R	DWG
4	15624	COVER X-AXIS DRIVE HOUSING-MX			1	EA	C	R	DWG
5	15622	COVER-BACK X AXIS HOUSING			1	EA	-	R	DWG
6	15616	HANDWHEEL ASSY w/ FOLD-AWAY HANDLE			1	EA	E	R	PL
8	15612	BEARING HOUSING ASSY-X AXIS			1	EA	A	R	PL
10	15638	STOP-STEEL-X AXIS			1	EA	D	R	DWG
11	15626	SEAL-BEARING HOUSING			1	EA	A	R	DWG
12	16983-1	PULLEY-SOLID 44 TEETH			1	EA	D	R	DWG
13	16452	NUT CLAMP-X, Y, & Z AXIS			1	EA	E	R	DWG
14	16350	FERRULE-SPROCKET-DRIVE KIT			1	EA	-	R	DWG
15	98481A090	KEY WOODRUFF #404-1/8 X 1/2			1	EA	-	R	PS
16	14772	SPACER-CNC X AXIS HANDLE	.100" THICK		5	EA	B	R	DWG
19	400-5M-15	BELT - TIMING 5MM POWERGRIP			1	EA		R	PS
20	20373	BEARING-ANGULAR CONTACT-7204			2	EA	D	R	DWG
22	14772-2	SPACER - .020" THICK			2	EA	B	R	DWG
23	14772-5	SPACER - .050" THICK			2	EA	B	R	DWG
41	8-32X3/8 25B	SCREW-SHCS-STL-BO			6	EA		R	PS
42	5/16-18X1 25B	SCREW-SHCS-STL-BO			1	EA		R	PS
45	M10-1.5X65 25B	SCREW-SHCS-STL-BO			4	EA		R	PS
46	1/4-20X1 24B	SCREW-HEX HD-STL-BO			7	EA		R	PS
47	8-32X3/8 20B	SCREW-RH-PHIL-STL-BO			3	EA		R	PS
48	10-32X3/4 25B	SCREW-SHCS-STL-BO			1	EA		R	PS

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1-310-608-4422 Fax 1-310-764-2668

Item	P/N	Title	Detail	Reference(t)	Qty	UseA	Rev	Stat	Type
49	1/2-20 51Z	NUT-HEX JAM-STL-ZINC			2	EA		R	PS
52	15759	WASHER-1/4 HARD BLK OX	.281 ID x .625 OD x .125 THK		7	EA	-	R	DWG
54	23082	WASHER-.75 OD x .394 ID x .10 THK-STL			4	EA	-	R	DWG
55	1/2 75Z	WASHER-EXT TOOTH-STL-ZINC			2	EA		R	PS
56	1/2 66Z	WASHER-FLAT-NARROW-ANSI TYPE B			2	EA	-	R	PS

Parts List for Assembly P/N: 23083-3

Printed 12/8/2014

23083-3
DRIVE KIT- Y AXIS

Type	PL	Dwg Size	D
Revision	H	Product	PT4
Status	R	Engineer	SPG
Date	11/19/2001	Planner Code	10
By	SPG	Comm Code	MANUF

REV	ECN	DATE	SIGN
F	13200	1.22.07	LG
G	13602	02/03/10	LG
H	14335	12/5/14	LG

Item	P/N	Title	Detail	Qty	UseAs	Rev	Stat	Type	Mfr	Mfr P/N
1	15626	SEAL-BEARING HOUSING		1	EA	A	R	DWG		
2	20373	BEARING-ANGULAR CONTACT-7204		2	EA	D	R	DWG		
4	15980	BEARING HOUSING ASSY-LARGE FLANGE-Y AXIS		1	EA	A	R	PL		
5	16452	NUT CLAMP-X, Y, Z AXIS		1	EA	D	R	DWG		
6	20623	MOTOR BRACKET-KNEE MILLS-40 DEGR		1	EA	E	R	DWG		
7	16983-1	PULLEY-SOLID 44 TEETH W/O GUIDES		1	EA	C	R	DWG		
8	16350	FERRULE-SPROCKET-DRIVE		1	EA	-	R	DWG		
9	890-5M-15	BELT - TIMING 5MM POWERGRIP (Y AXIS)		1	EA		R	PS		
11	20621	COVER-SPORT 40 DEGREE		1	EA	B	R	DWG		
12	15627-1	DIAL HOLDER		1	EA	G	R	DWG		
13	15836	DIAL NUT		1	EA	A	R	DWG		
14	15614	WASHER-TAB		1	EA	A	R	DWG		
15	15616	HANDWHEEL ASSY	WITH FOLD-AWAY HANDLE	1	EA	E	R	PL		
16	1/2 66Z	WASHER-FLAT-NARROW-ANSI TYPE B		1	EA	-	R	PS		
17	1/2 75Z	WASHER-EXT TOOTH-STL-ZINC		1	EA		R	PS		
18	1/2-20 51Z	NUT-HEX JAM-STL-ZINC		1	EA		R	PS		
19	10-32X3/4 25B	SCREW-SHCS-STL-BO		1	EA		R	PS		
20	M10-1.5X60 25B	SCREW-SHCS-STL-BO		4	EA		R	PS		
21	23082	WASHER-.75X.394X.10-STL		4	EA	-	R	DWG		
22	1/4-20X1 24B	SCREW-HEX HD-STL-BO		4	EA		R	PS		

Item	P/N	Title	Detail	Qty	UseAs	Rev	Stat	Type	Mfr	Mfr P/N
23	15759	WASHER-1/4 HARD BLK OX 1/8 THK		4	EA	-	R	DWG		
24	6-32X3/8 10B	SCREW-PH-PHIL-STL-BO		8	EA		R	PS		
25	23141	SHEET METAL ASSY-MOTOR COVER-COOLANT		1	EA	-	R	PL		
26	10-32X1 25B	SCREW-SHCS-STL-BO		3	EA		R	PS		
27	10 73B	WASHER-SPLIT LOCK-STL-BO		3	EA		R	PS		
30	98481A090	KEY WOODRUFF #404-1/8 X 1/2		1	EA		R	PS		
31	14772-2	SPACER - .020" THICK		1	EA	B	R	DWG		
32	20322	SPACER Y-AXIS- BALLSCREW		1	EA		R	DWG		
33	1/4-20X3/8 10B	SCREW-PH-PHIL-STL-BO		2	EA	0	R	PS		
37	10 70B	WASHER-FLAT USS-STL-BO		3	EA		R	PS		
40	14772	SPACER-CNC X AXIS HANDLE	.100" THICK	1	EA	B	R	DWG		

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TRAK MACHINE TOOLS

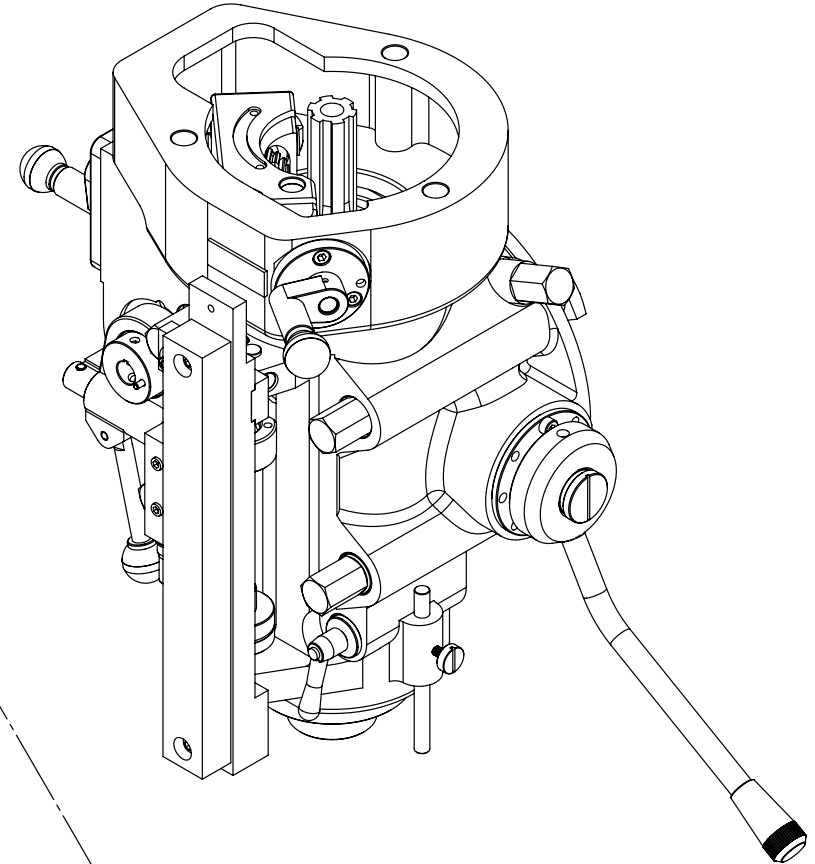
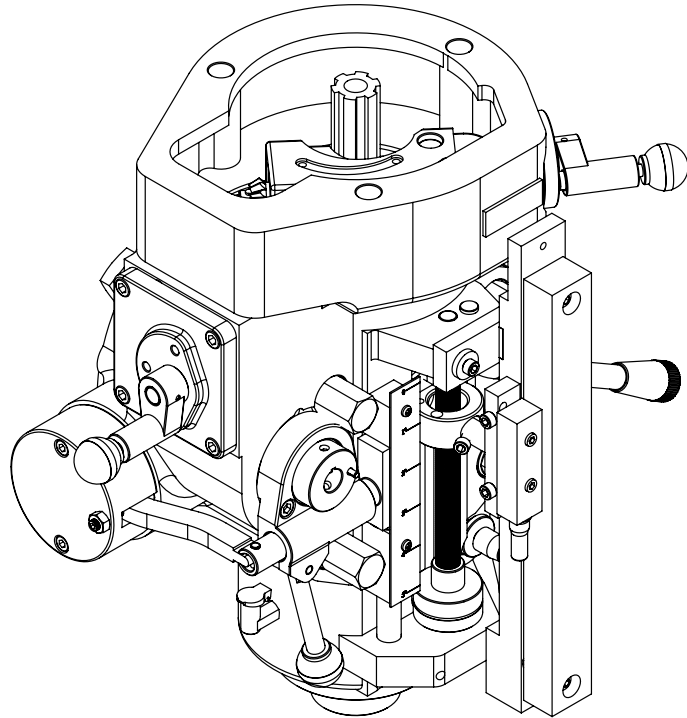
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REVISION TABLE

REV	REV DESCRIPTION	ECN/NPI#	DATE	DFT	ENG
C	PICTORIAL UPDATE	ECN-16801	10-04-22	GP	TO
D	ADDED NOTE 3 - TORQUE SPECIFICATION	ECN-16864	12-20-22	GP	DH
E	PICTORIAL UPDATE	ECN-16885	01-10-23	GP	MS



APPROVALS	DATE	ASSEMBLY - INCH	
DRAWN BY: JJ	8/23/2022	DESCRIPTION:	
ENGINEER: TO	8/23/2022	BRACKET ASSY Z-AXIS ACU-RITE GSO-R8	
MASS (LBS):		PART NUMBER: 20586-2	REV: E
 THIRD ANGLE PROJECTION		DETAIL:	SIZE: B SHEET: 1 OF 3

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C

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A

D

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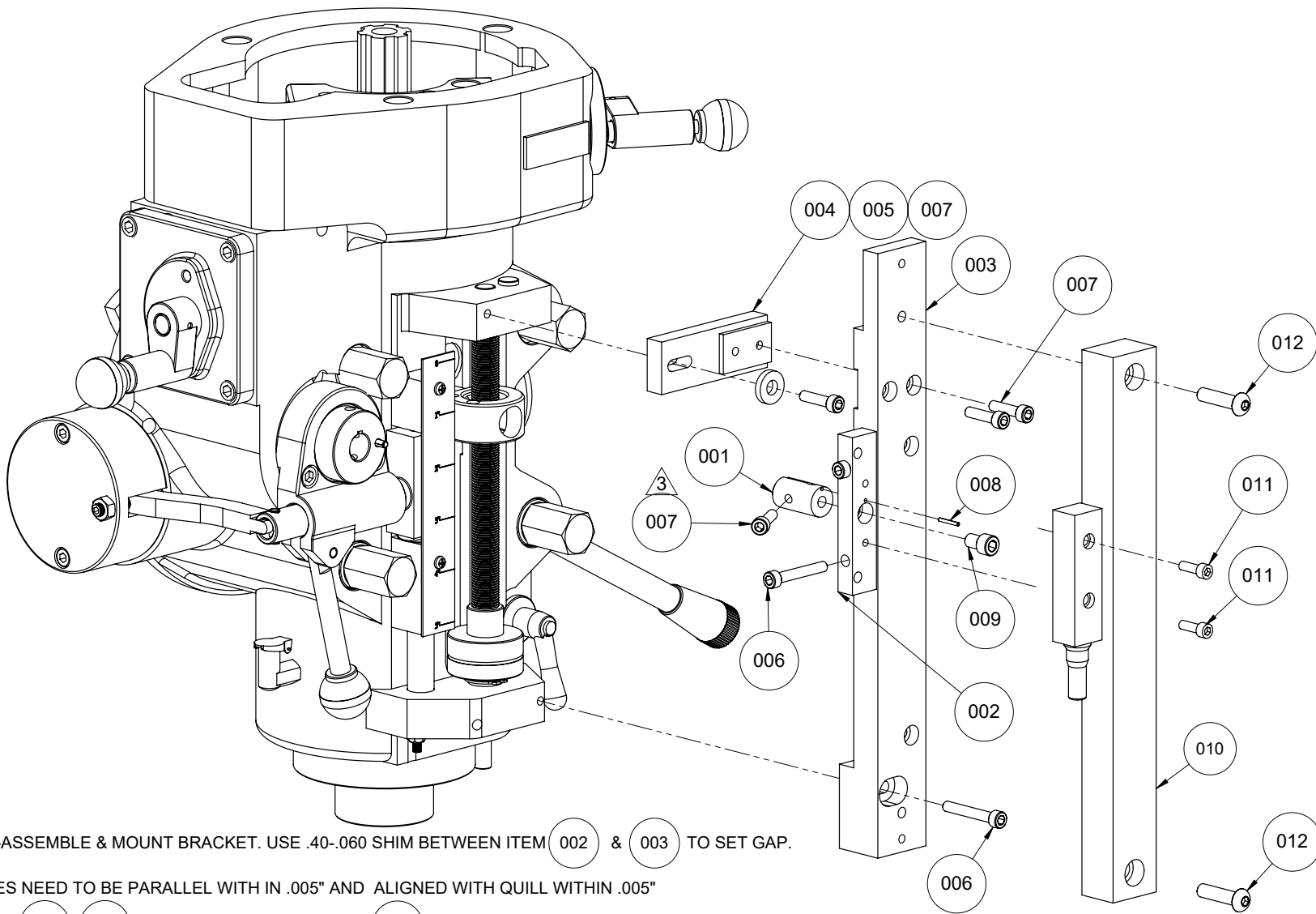
A

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NOTES:

1. PRE-ASSEMBLE & MOUNT BRACKET. USE .40-.060 SHIM BETWEEN ITEM 002 & 003 TO SET GAP.

FACES NEED TO BE PARALLEL WITH IN .005" AND ALIGNED WITH QUILL WITHIN .005"

2. ITEMS 012 011 COME IN GLASS SCALE KIT 010

3 TORQUE 10-32X3/4 25B TO 60IN-LBS; ITEM 007

PART NUMBER: 20586-2		REV: E
DETAIL:		SIZE: B SHEET: 2 OF 3

4

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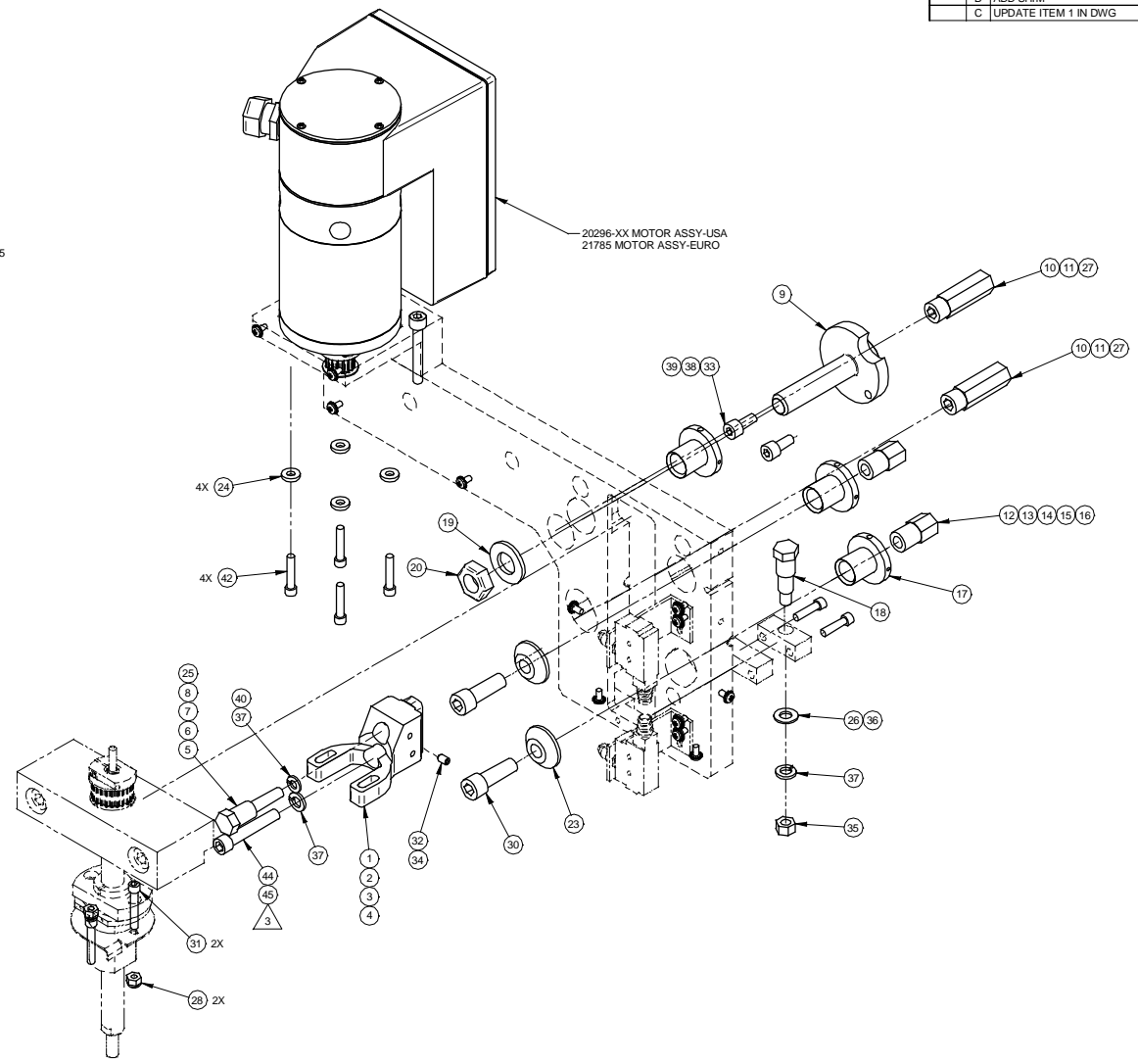
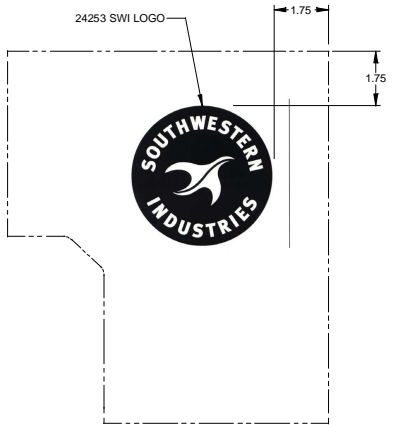
PART NUMBER: 20586-2	DRAWN BY: JJ	8/23/2022
	ENGINEER: TO	8/23/2022

Item No.	Part Number	Description	Detail	Type	QTY.	Item Length	Category	MFG Part Number	Manufacturer
001	20548	ADAPTER - Z-AXIS GLASS SCALE-Ø .571		Normal	1		Manufactured		
002	20549-1	ADAPTER PLATE - Z AXIS GLASS SCALE		Normal	1		Manufactured		
003	20551-1	MOUNTING PLATE - Z AXIS GLASS SCALE		Normal	1		Manufactured		
004	20550	PLATE-MOUNTING-Z AXIS ARM		Normal	1		Manufactured		
005	15759	WASHER-1/4 HARD BLK OX	.281 ID X .625 OD X .125 THK	Normal	1		Manufactured		
006	10-32X1 1/4 (25B)	SCREW-SHCS-STL-BO	STOCKED	Normal	3		Purchased		
007	10-32X3/4 (25B)	SCREW-SHCS-STL-BO	STOCKED	Normal	4		Purchased		
008	1/16X1/2 81B	SPRING PIN		Normal	1		Purchased		
009	1/4-28X3/8 (25B)	SCREW-SHCS-STL-BO	STOCKED	Normal	1		Purchased		
010	22800-4	GLASS SCALE-ENC 150-DIGITAL DIFFERENTIAL OUTPUT	14IN	Reference	1		Purchased		
011	8-32X3/4	SCREW-SHCS-STL-BO-LOW HEAD	NON STOCKABLE	Reference	2		Purchased		
012	1/4-20x1 (27B)	SCREW-BHCS-STL-BO		Reference	2		Purchased		

PRODUCTS USED ON:

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REVISIONS					
ZONE	REV	DESCRIPTION	EON	DATE	APPROV
	-	ORIGINAL RELEASE	12824	12-22-04	JG
	A	ADD ITEMS 24 & 42	12842		JG
	B	ADD SHIM	12894	3-16-05	JG
	C	UPDATE ITEM 1 IN DWG	13026	1-24-06	JG



- NOTES: (UNLESS OTHERWISE SPECIFIED).
- △ COVER 24221 NOT SHOWN
 - △ REFER TO HARDWARE KIT DWG 16208-XX TO IDENTIFY PARTS MARKED WITH ITEM NUMBERS: ① ETC.
 - △ SEE DWG 24468 FOR HOW TO REWORK QUILL FOR ITEM 44/45.

DIMENSIONS ARE IN INCHES DEC. 4 1/4, .XX + .031, .XXK + .005, ANGLES XX ± .0° 30' FRACTIONS 1/16 FIT: H7/g6 REMOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC. 2813 HOMER STREET, PLACE RANCHO DOMINGUEZ, CA. 90238-5810	
Z AXIS		DRAWN BY JRS	12-15-04	TITLE DRIVE KIT - Z AXIS	
NEXT ASSY		ENGINEER JG	12-22-04	SIZE D	CODE IDENT. NO. 06238
APPLICATION		FINISH	THIRD ANGLE PROJECTION	DWG NO. 25000-XX	REV. C
SCALE: 1 : 2			SHEET 1 OF 1		

Part Number: 25000-10

Description: DRIVE KIT-Z AXIS-ACER/K3 KMX

Detail:

Revision: A

Status: Released

Date Created: 04/03/2017

Drawn By: Sal

Engineer: LG

REV	ECN/NPI #	DFT	ENG
A	ECN-14691	Sal	LG
PRODUCTION RELEASE			

Item	Part No.	Description	Detail	Qty	Type	BomUnit	Use As	Rev	Rec Type	MFG	MFG P/N	Status
1	24230-6	Z AXIS BALLSCREW-BASEPLATE-BEARING HOUSING & COVERS ASSY		1	Normal		EA	A	PL			Released
2	20296	MOTOR/ENCODER/SERVO ASSY-DRIVER 4020		1	Normal		EA	M	PL			Released
3	16208-2	HARDWARE KIT MX3 Z-AXIS ARGO		1	Normal		EA	G	PL			Released
4	24256	FOAM BLOCK LAYOUT- Z AXIS DRIVE		1	Normal		EA	A	DWG			Released
5	24253	LABEL-SWI LOGO 4 1/2"		1	Normal		EA	-	DWG			Released
6	28 1/2 X 21 1/2 X 9	BOX-CARDBOARD-HANDLE WITH CARE		1	Normal		EA	-	PS	MASTER FOAM	24R9PH	Released
7	24468-DOC	QUILL MODIFICATION - FB142		1	Normal		EA	-	DOC			Released

Parts List for Assembly P/N: 16208-1

Printed 1/20/2005

16208-1

HARDWARE KIT MX3 Z-AXIS-BP

Type	PL	Dwg Size	C
Revision	F	Product	PT4
Status	R	Engineer	MZ
Date	4/27/1993	Part Type	
By	FM	Comm Code	MANUF

REV	ECN	DATE	SIGN
A	10421	8/25/93	SPG
B	10471	11/30/93	FM
C	10479	1/6/94	SPG
D	10547	5/4/94	SPG
E	10586	8/2/94	SPG
F	12842	1-20-05	JG

Item	P/N	Title	Detail	Mfr	Mfr P/N	UseAs	Qty
1	16215	BRACKET BALLNUT-MACHINED (FORK)				EA	1
5	16355-1	SCREW 3/8-24 BRKT BALLNUT MOUNTING				EA	1
9	16210	POSITIONER LOCATOR				EA	1
11	16212-13	COUPLING SOCKET HEAD				EA	2
12	16213-13	JACKSCREW NUT 1/2-13--1/2-13				EA	2
17	16214	NUT LEVELING 3/4-16				EA	3
18	16216	SCREW HEX HD				EA	1
19	98029A036	WASHER-FINISHED FLAT-CASE HARDENED STL				EA	1
20	3/4-16 51Z	NUT-HEX JAM-STL-ZINC-GRADE 2				EA	1
23	14932	WASHER-LOWER BOLT				EA	2
24	15759	WASHER-1/4 HARD BLK OX 1/8 THK				EA	4
28	1/4-20 56Z	NUT-NYLON LOCK-STL-ZINC				EA	2
30	1/2-13X1 1/2 25B	SCREW-SHCS-STL-BO		PJ		EA	2
31	1/4-20X1 3/4 25B	SCREW-SHCS-STL-BO				EA	2
33	1/4-20X3/4 25B	SCREW-SHCS-STL-BO				EA	2
34	1/4-20X3/8 40B	SCREW-SOC SET-STL-BO-CUP				EA	2
35	3/8-16 50B	NUT-HEX-STL-BO				EA	1
36	3/8 70P	WASHER-FLAT USS-STL-BO				EA	1
37	3/8 73B	WASHER-SPLIT LOCK-STL-BO				EA	2

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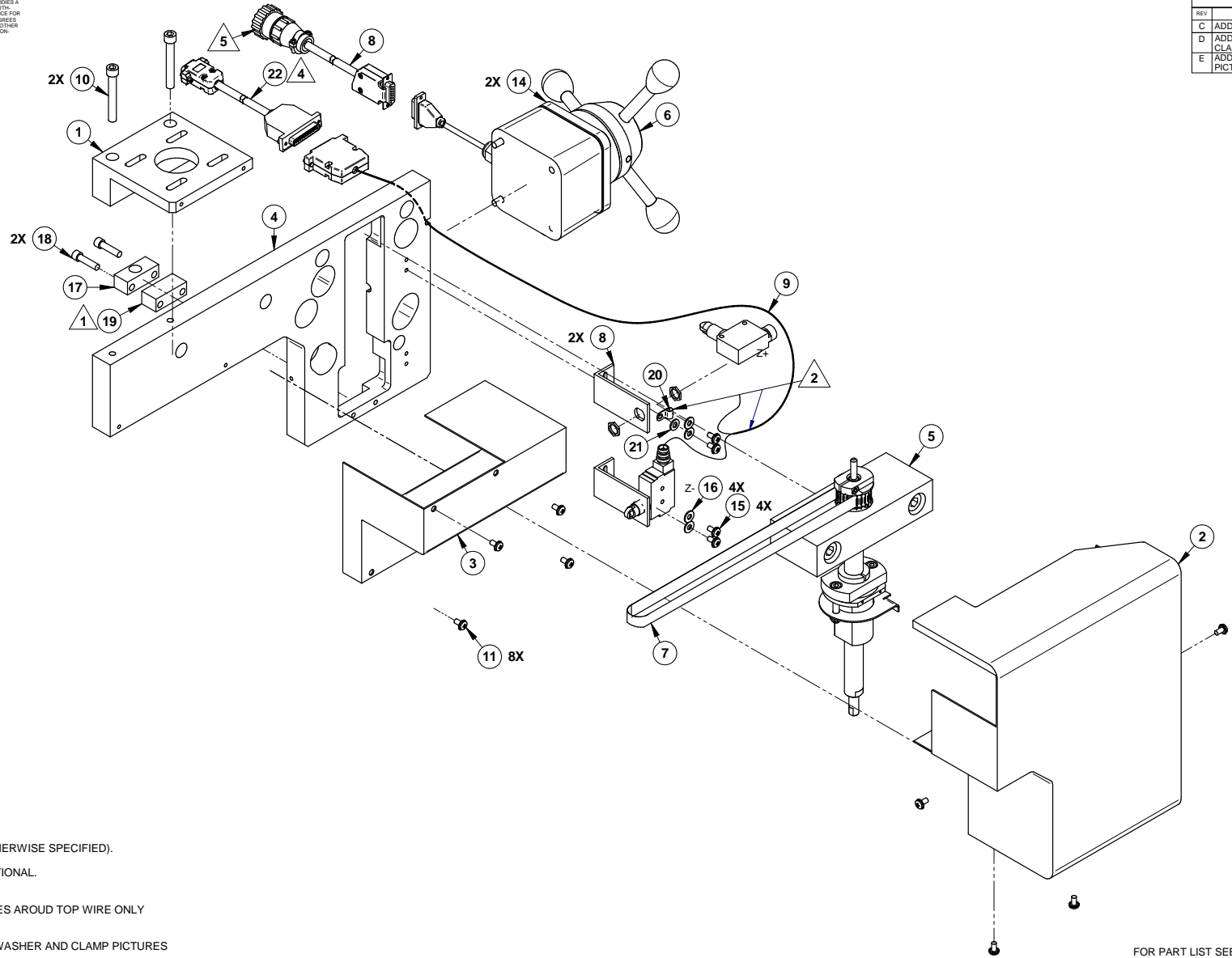
Parts List for Assembly P/N: 16208-1
HARDWARE KIT MX3 Z-AXIS-BP

16208-1
Rev F
Printed 1/20/2005

Item	P/N	Title	Detail	Mfr	Mfr P/N	UseAs	Qty
42	1/4-20X1 1/4 25B	SCREW-SHCS-STL-BO				EA	4

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REVISIONS				
REV	DESCRIPTION	EON	DATE	APPRV
C	ADDED NOTE 1	13091	5/22/06	JG
D	ADDED ITEM 20 & 21, CABLE CLAMP & M6 70B WASHER	13209	2/23/07	TM
E	ADDED NOTE 4 & 5. REVISED PICTORIAL	14691	06/29/17	LG



NOTES: (UNLESS OTHERWISE SPECIFIED).

- △ 1 SHIM (ITEM 19) OPTIONAL.
- △ 2 CABLE CLAMP GOES AROUND TOP WIRE ONLY
- △ 3 SEE PAGE 2 FOR WASHER AND CLAMP PICTURES
- △ 4 ON KMX: THIS CABLE IS REQUIRED ONLY IF A CABLE BREAKOUT BOX IS PRESENT.
- △ 5 CONNECT TO CABLE BREAKOUT BOX ON SMX & Z AXIS SCALE PORT ON KMX PENDANT.

FOR PART LIST SEE SEPARATE "A" SIZE SHEET

DIMENSIONS ARE IN INCHES DEC. 4 1/4", 2X ± 0.01, 30K ± 0.005, ANGLES 30 ± 0.50° FRACTIONS 1/16" FINISH: 1/2 RMB REMOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC. JRS HOMER STADIUM PLACE RANCHO DOMINGUEZ, CA. 90230-5810	
MATERIAL		DESIGNED BY	12-10-04	TITLE	
FINISH		ENGINEER	JG 12-14-04	Z AXIS BALL SCREW - BASEPLATE, BEARING HOUSING & COVERS ASSY	
THIRD ANGLE PROJECTION		CHECKER		SIZE	CODE BENT NO.
SCALE 1:2				D	06238
				DWG NO.	24230-XX
				REV	E
				SCALE	1:2
				SHEET	1 OF 2

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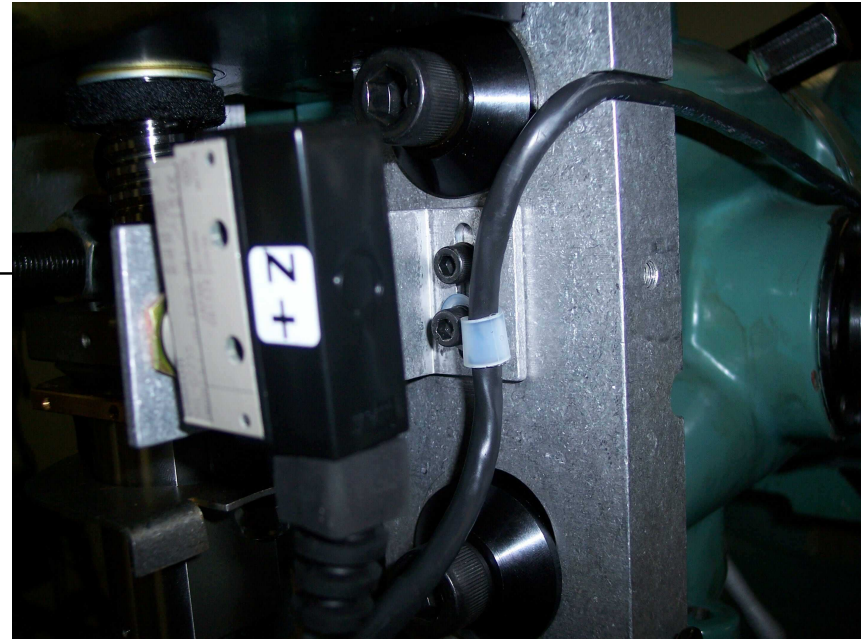
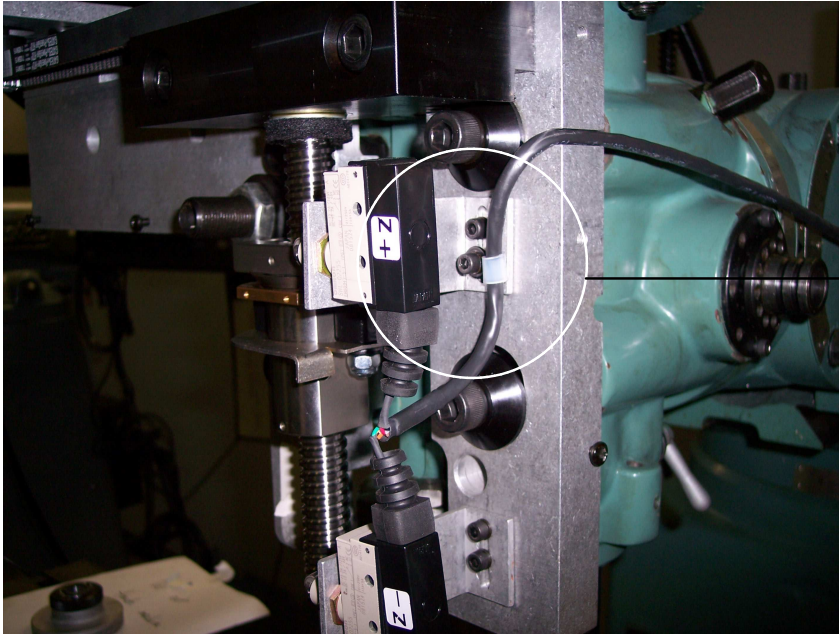
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REVISIONS				
REV	DESCRIPTION	EON	DATE	APPRV
C	ADDED NOTE 1	13091	5/22/06	JG
D	ADDED ITEM 20 & 21, CABLE CLAMP & M6 70B WASHER	13209	2/23/07	TM
E	ADDED NOTE 4 & 5, REVISED PICTORIAL	14691	06/29/17	LG



DIMENSIONS ARE IN INCHES DEC. 4 1/4, .XX ± .01, .XXX ± .005, ANGLES XX ± .07° FRACTIONS 1/16 FINISH: 1/2 RB REMOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC. 3910 HOMER TRAIL PLAZA RANCHO DOMINGUEZ, CA, 90238-5810	
DRAWN BY ENGINEER CHECKER		JRS JG	12-10-04 12-14-04	TITLE Z AXIS BALL SCREW - BASEPLATE, BEARING HOUSING & COVERS ASSY	
MATERIAL	FINISH	FE	THIRD ANGLE PROJECTION	SIZE D	CODE BENT. NO. 06238
			SCALE: 1: 2	DWG. NO. 24230-XX	REV. E
			SHEET 2 OF 2		

8

7

6

5

4

3

2

1

Parts List for Assembly P/N: 24230-6

Printed 6/29/2017

24230-6

Z AXIS BALLSCREW-BASEPLATE-BEARING HOUSING & COVERS ASSY

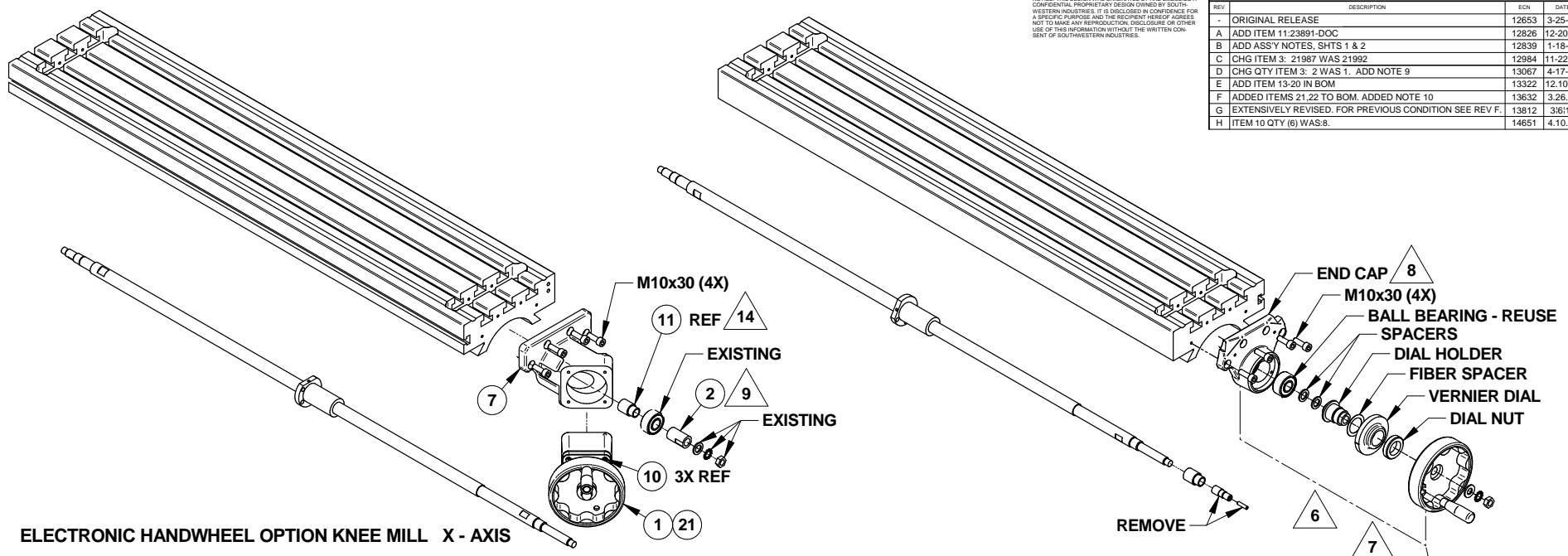
Type	PL	Dwg Size	D
Revision	A	Product	Z AXIS
Status	R	Engineer	LG
Date	4/3/2017	Planner Code	
By	LG	Comm Code	

REV	ECN	DFT	ENG	DATE
A	14655	Sal	LG	06/28/17

Item	P/N	Title	Detail	Qty	UseAs	Rev	Stat	Type	Mfr	Mfr P/N
1	24217	BRACKET-SERVO MOTOR		1	EA	-	R	DWG		
2	24221	COVER - FRONT		1	EA	A	R	DWG		
3	24222	COVER-LATERAL		1	EA	A	R	DWG		
4	24240	BASE PLATE ASSY		1	EA	B	R	PL		
5	24250	BALLSCREW MODULE Z-AXIS		1	EA	B	R	PL		
6	21774	ELEC HANDWHEEL ASSY-Z AXIS-DPMV		1	EA	K	R	PL		
7	710-5M-15	BELT-TIMING		1	EA		R	PS		
8	22585	CABLE ASSY-ADAPTOR TO COMP		1	EA	C	R	PL		
9	29816	LIMIT SWITCH ASSY-Z AXIS-KMX		1	EA	A	R	PL		
10	5/16-18X2 1/4 25B	SCREW-SHCS-STL-BO		2	EA	-	R	PS		
11	10-32X3/8 31B	SCREW-PH-PHIL-EXT SEMS-STL-BO		8	EA	-	R	PS		
12	24231	BRACKET-LIMIT SWITCH		2	EA	-	R	DWG		
14	9688K321	PLUG-BLK		2	EA	-	R	PS		
15	10-32X1/2 25B	SCREW-SHCS-STL-BO		4	EA	-	R	PS		
16	10 70B	WASHER-FLAT USS-STL-BO		4	EA	A	R	PS		
17	16220	PLATE CENTERING		1	EA		R	DWG		
18	1/4-20X1 25B	SCREW-SHCS-STL-BO		2	EA	A	R	PS		
20	24275	CABLE CLAMP-NYLON-1/4"		1	EA	-	R	DWG		
21	M6 70B	WASHER-FLAT USS-STL-BO		1	EA	-	R	PS		
22	29817	CABLE ASSY-6 COND-ADAPTOR-DB25 TO DB9		1	EA	A	R	PL		

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REVISIONS				
REV	DESCRIPTION	EON	DATE	APPROV
-	ORIGINAL RELEASE	12653	3-25-04	LG
A	ADD ITEM 11:23891-DOC	12826	12-20-04	LG
B	ADD ASS'Y NOTES, SHTS 1 & 2	12839	1-18-05	JE
C	CHG ITEM 3: 21987 WAS 21992	12984	11-22-05	LG
D	CHG QTY ITEM 3: 2 WAS 1. ADD NOTE 9	13067	4-17-06	LG
E	ADD ITEM 13-20 IN BOM	13322	12.10.07	LG
F	ADDED ITEMS 21,22 TO BOM. ADDED NOTE 10	13632	3.26.10	LG
G	EXTENSIVELY REVISED. FOR PREVIOUS CONDITION SEE REV F.	13812	3/6/15	LT
H	ITEM 10 QTY (6) WAS:8.	14651	4.10.17	LG



NOTES: UNLESS OTHERWISE SPECIFIED

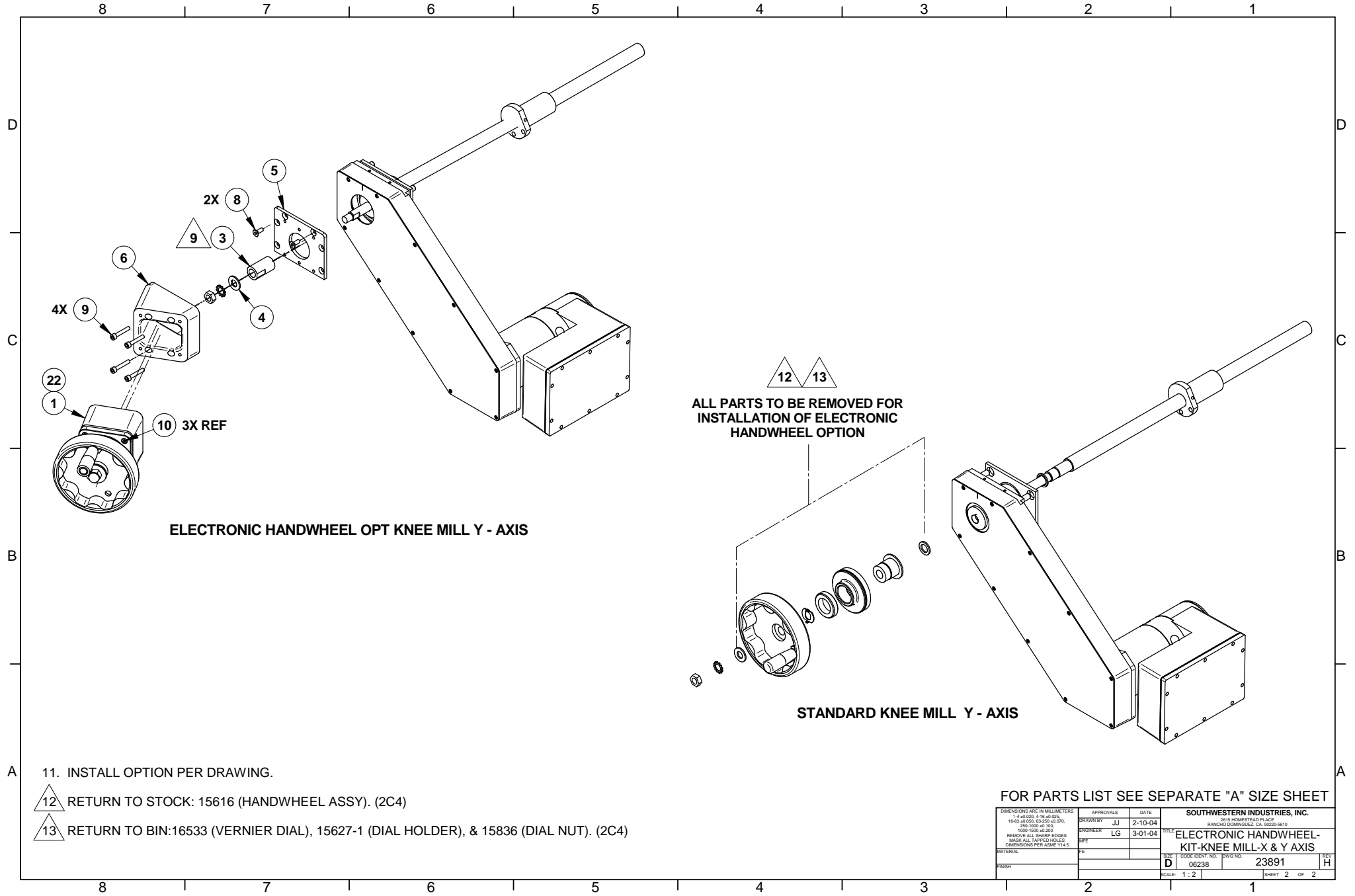
1. RECORD ROLLING TORQUE 3 PLCS BEFORE DISASSEMBLING.
 2. ALIGN RIGHT SIDE OF TABLE WITH SADDLE.
 3. REMOVE PARTS PER DRAWING.
 4. INSTALL PARTS PER DRAWING.
 5. ALIGN BRACKET TO MAINTAIN SAME TORQUE.
 - 6 RETURN TO STOCK: 15616 (HANDWHEEL ASSY), 15057 (SHAFT EXTENSION). (1C2)
 - 7 RETURN TO BINS: 16534 (DIAL HOLDER), 15836 (DIAL NUT), 16533 (VERNIER DIAL). (1B2)
 - 8 RETURN TO DPMS3 BIN FOR REUSE ON DPMS3. (1C1)
 - 9 ON K2 USE BUSHING 21987 (ITEM 3) ON X AND Y.
ON K3 AND K4 USE BUSHING 21992-1 (ITEM 2) ON X AND BUSHING 21987 (ITEM 3) ON Y. (1C5, 2C7)
 10. APPLY LABELS (ITEM 21 & 22) TO HANDWHEEL (ITEM 1) ON CABLE AT THE CONNECTOR END.
- (SEE SHEET 2 FOR ADDITIONAL NOTES)
- 14 15058-7 (ITEM 11) IS PART OF BALLSCREW EXTENSION KIT

STANDARD KNEE MILL X - AXIS

ALL PARTS TO BE REMOVED FOR INSTALLATION OF ELECTRONIC HANDWHEEL OPTION EXCEPT BALL BEARING.

FOR PARTS LIST SEE SEPARATE "A" SIZE SHEET

DIMENSIONS ARE IN MILLIMETERS 14-40/200 4-16 40/205 16-60 40/250 53-250 40/270 250-100 40/300 100-100 40/300 REMOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONS PER ASME Y14.5		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC. 2100 HOMERIDGE PLACE RANCHO DOMINGUEZ, CA. 90220-5610	
DRAWN BY JJ		2-10-04		TITLE	
ENGINEER LG		3-01-04		ELECTRONIC HANDWHEEL- KIT-KNEE MILL-X & Y AXIS	
MATERIAL		FE		SIZE	CODE IDENT. NO.
FINISH				D	06238
				REV	23891
				SCALE	1:2
				SHEET 1 OF 2	



ELECTRONIC HANDWHEEL OPT KNEE MILL Y - AXIS

**ALL PARTS TO BE REMOVED FOR
INSTALLATION OF ELECTRONIC
HANDWHEEL OPTION**

STANDARD KNEE MILL Y - AXIS

- 11. INSTALL OPTION PER DRAWING.
- 12 RETURN TO STOCK: 15616 (HANDWHEEL ASSY). (2C4)
- 13 RETURN TO BIN:16533 (VERNIER DIAL), 15627-1 (DIAL HOLDER), & 15836 (DIAL NUT). (2C4)

FOR PARTS LIST SEE SEPARATE "A" SIZE SHEET

DIMENSIONS ARE IN MILLIMETERS 1:4=30.48; 1:16=40.125; 1:64=25.4; 1:250=40.076; 1:500=100.191; 1:1000=100.191; REMOVE ALL SHARP EDGES MACHINE ALL TAPPED HOLES DIMENSIONS PER ASME Y14.5		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC. 2010 HOMERIDGE PLACE RANCHO DOMINGUEZ, CA. 90220-5810	
DESIGNED BY	JJ	2-10-04	ENGINEER	LG	3-01-04
MATERIAL			FINISH		
SIZE	D	CODE IDENT. NO.	06238	REV'S NO.	23891
				SHEET	2 OF 2

Parts List for Assembly P/N: 23891

Printed 4/10/2017

23891

ELECTRONIC HANDWHEEL KIT-KNEE MILL-X & Y AXIS

Type	PL	Dwg Size	D
Revision	H	Product	K-MILL
Status	R	Engineer	LG
Date	1/30/2004	Planner Code	
By	JJ	Comm Code	

Item	P/N	Title	Detail	Qty	UseAs	Rev	Stat	Type	Mfr
1	21946	ELEC HANDWHEEL-X & Y AXIS		2	EA	K	R	PL	
2	21992-1	BUSHING - BALL SCREW	1.125 LG.	1	EA	C	R	DWG	
3	21987	BUSHING-Y-AXIS		2	EA	B	R	DWG	
4	14772	SPACER-CNC X AXIS HANDLE	.100" THICK	1	EA	B	R	DWG	
5	21984	BRACKET - WAY COVER FRONT Y-AXIS DRIVE		1	EA	F	R	DWG	
6	21985	SPACER ANGLED 30 DEGREE Y-AXIS		1	EA	E	R	PL	
7	22718	SPACER 45° - MACHINED		1	EA	C	R	DWG	
8	1/4-20X5/8 26B	SCREW-FHCS-STL-BO		2	EA		R	PS	
9	M6-1.0X25 25B	SCREW-SHCS-STL-BO		4	EA	A	R	PS	
10	M6-1.0X75 25B	SCREW-SHCS-STL-BO		(6)	EA	-	R	PS	
11	15058-7	BUSHING		(1)	EA	L	R	DWG	
12	23891-DOC	ELECTRONIC HANDWHEEL KIT - KNEE MILL		1	EA	-	R	DOC	
13	15616	HANDWHEEL ASSY w/ FOLD-AWAY HANDLE		-2	EA	E	R	PL	
14	15614	WASHER-TAB		-1	EA	A	R	DWG	
15	22007	END CAP-X AXIS FC006		-1	EA	A	R	DWG	
16	16534	FRU-DPM-DIAL HOLDER DPM X-AXIS		-1	EA		R	DWG	
17	15627-1	DIAL HOLDER		-1	EA	G	R	DWG	
18	16533	VERNIER DIAL		-2	EA	-	R	DWG	PJ
19	15836	DIAL NUT		-2	EA	A	R	DWG	
20	15057	EXTENSION-SHAFT		-1	EA	G	R	DWG	
21	22768-36	LABEL-TEXT-WHITE-1.00W x 1.437H	EHW X	1	EA	AD	R	DWG	

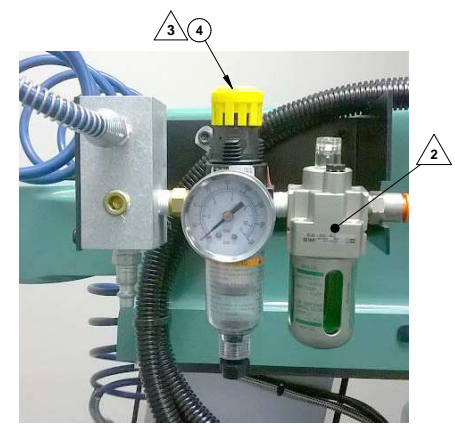
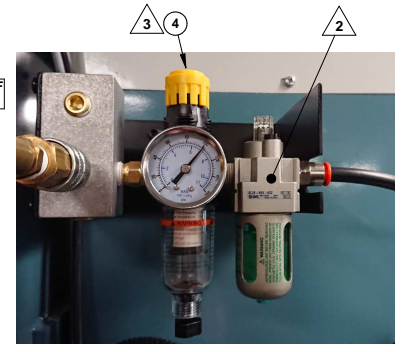
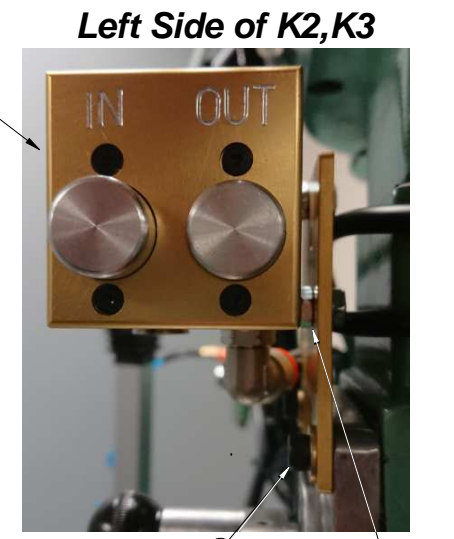
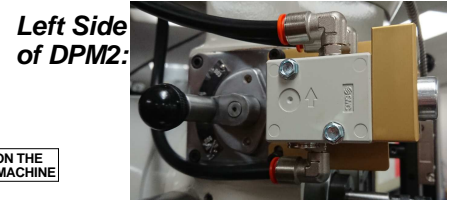
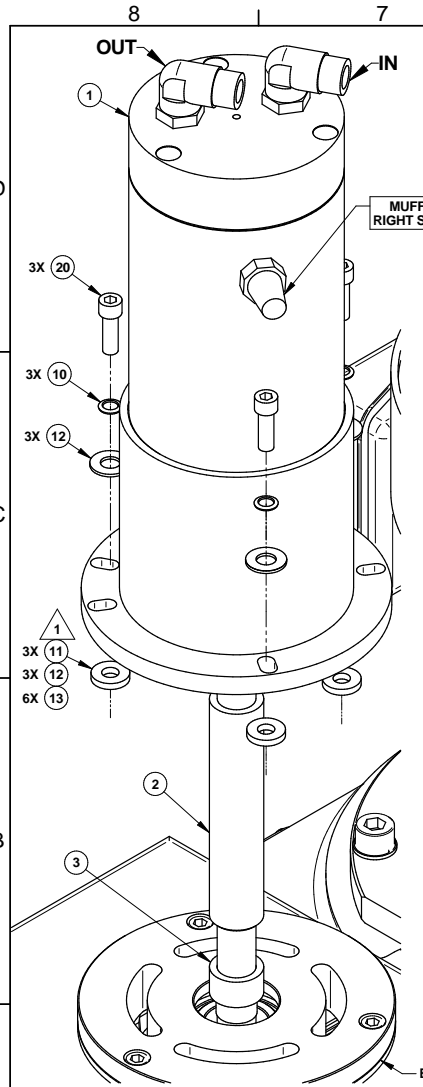
Parts List for Assembly P/N: 23891
ELECTRONIC HANDWHEEL KIT-KNEE MILL-X & Y AXIS

23891

Rev H

Printed 4/10/2017

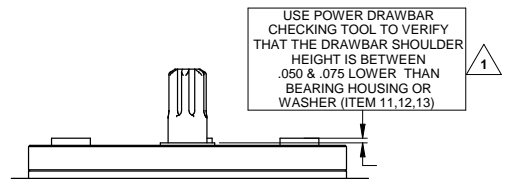
Item	P/N	Title	Detail	Qty	UseAs	Rev	Stat	Type	Mfr
22	22768-37	LABEL-TEXT-WHITE-1.00W x 1.437H	EHW Y	1	EA	AD	R	DWG	



REF	1	15 (4X)
(2X)	23	24 (2X)
(2X)	14	27 (4X)

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- NOTES: (UNLESS OTHERWISE SPECIFIED).
- ADD WASHERS / SHIMS (ITEMS 11, 12 & 13) AS REQUIRED IN ORDER TO OBTAIN PROPER SPACING OF .050" TO .075" GAP BETWEEN BOTTOM OF POWER DRAWBAR / AIR GUN AND TOP OF SHOULDER ON QUILL IS FULLY RETRACTED, USING CHECKING TOOL TO MEASURE. THIS PROVIDES 7/16" OF ENGAGEMENT OF DRAWBAR.
 - ADJUST OILER (PART OF ITEM 1) TO FEED ONE DROP OF OIL EVERY 40-60 ACTIVATIONS. TO PRIME THE OILER TURN ON THE AIR, FILL OILER 2/3 FULL AND PRESS THE IN OR OUT BUTTON ON POWER DRAWBAR CONTROLLER 40 TO 60 TIMES AND TURN KNOB UNTIL 1 DROP OF OIL DROPS INSIDE OILER.
 - USE SOLENOID BRACKET (PART OF ITEM 4) AS TEMPLATE TAPPING TWO M6-1 HOLES, MOUNT AIR REGULATOR (ITEM 4) USING HARDWARE (M6-1x25 SHCS) PROVIDED WITH AIR REGULATOR.
 - NOSEPIECE 22581-4 (PART OF ITEM 1) IS TO BE RECYCLED.



DIMENSIONS ARE IN INCHES DEC. 4 1/4, 1/8, 1/16, 3/32, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/4, 2 1/2, 3, 3 1/4, 3 1/2, 4, 4 1/4, 4 1/2, 5, 5 1/4, 5 1/2, 6, 6 1/4, 6 1/2, 7, 7 1/4, 7 1/2, 8, 8 1/4, 8 1/2, 9, 9 1/4, 9 1/2, 10		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC. 2815 HOMER ROAD, PLAZA RANCHO DOMINGUEZ, CA. 92230-5810	
DRUN BY	CJC	10/02/15	POWER DRAWBAR OPTION- K2,K3,DPM2-R8		
ENGINEER	LG				
DATE			SIZE	CODE BENT NO.	DWG NO.
			D	06238	22580-7
THIRD ANGLE PROJECTION			SCALE	SHEET 1 OF 2	

Parts List for Assembly P/N: 22580-7

Printed 3/26/2018

22580-7

POWER DRAWBAR OPTION -K2,K3.DPM2-R8

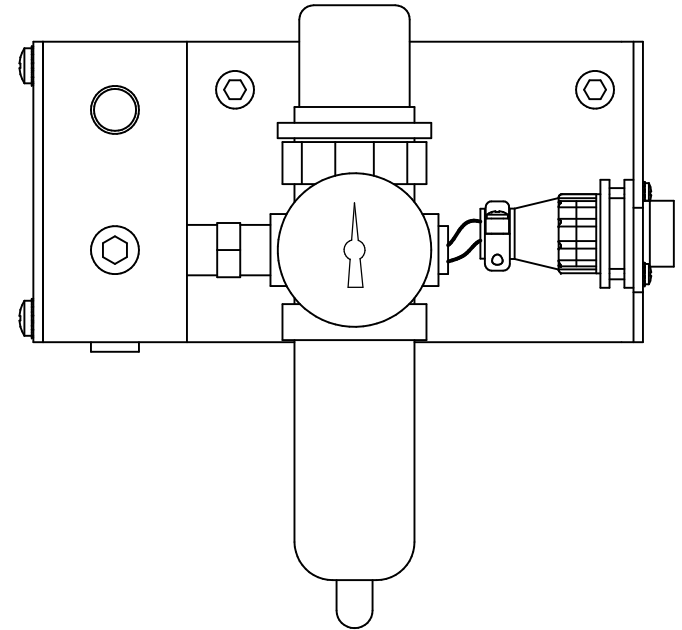
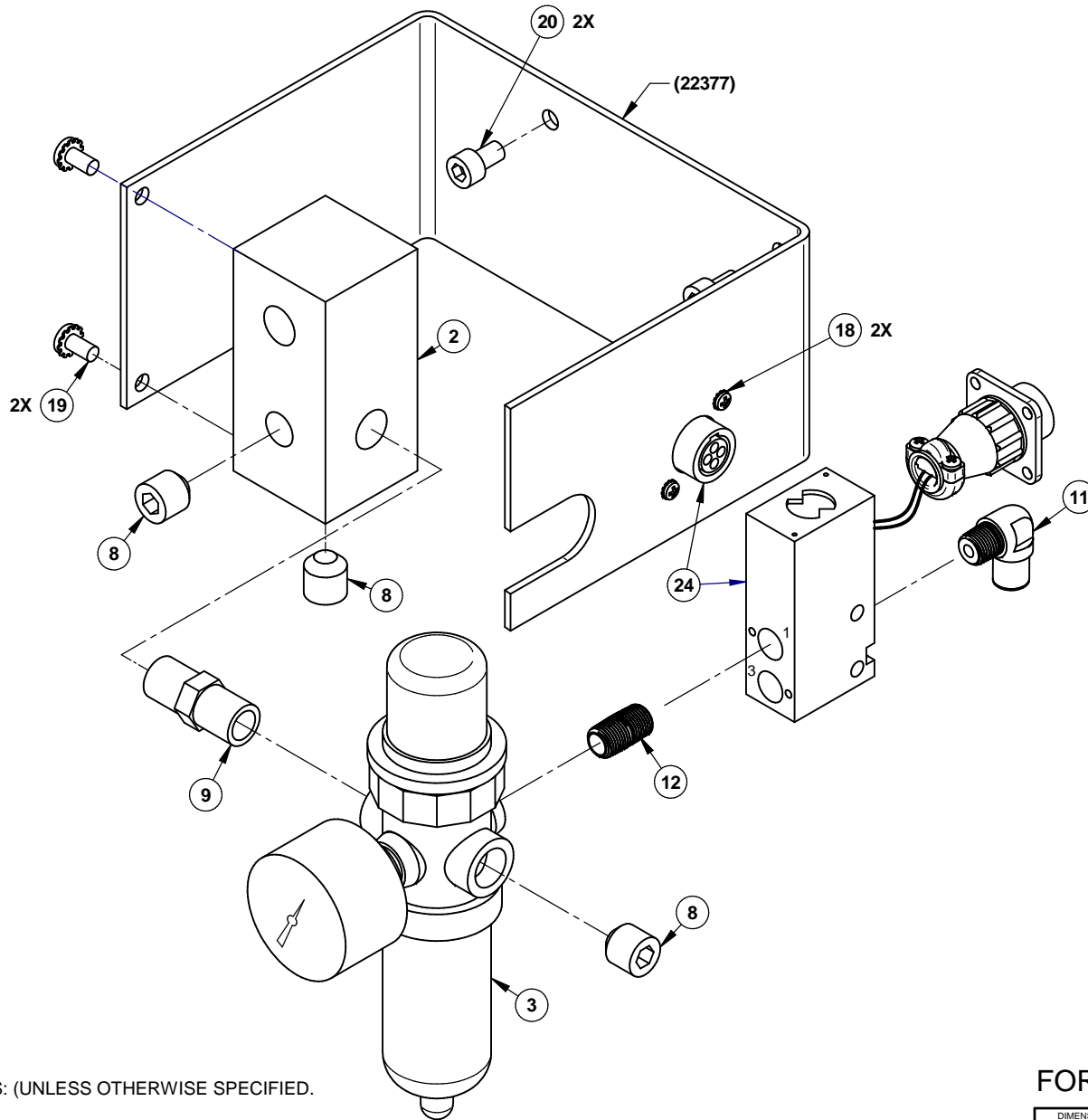
Type	PL	Dwg Size	D
Revision	H	Product	PT4,5,10
Status	R	Engineer	LG
Date	10/27/2000	Planner Code	20
By	SPG	Comm Code	NONE

Item	P/N	Title	Detail	Reference(t)	Qty	UseAs	Rev	Stat	Type
1	22581	POWER DRAW BAR-TORQUE RITE			1	EA	E	R	PL
2	26987-1	DRAWBAR-K2/K3-R8			1	EA	B	R	DWG
3	27007	SPACER-DRAWBAR			1	EA	-	R	DWG
4	22380-2	AIR REGULATOR ASSY-S SERIES-FILTER			1	EA	E	R	PL
10	24009-3	WASHER-BELLEVILLE SPRING LK-SERRATED	.264 ID x .374 OD x .024 THK-1/4 or M6		3	EA	D	R	DWG
11	15759	WASHER-1/4 HARD BLK OX	.281 ID x .625 OD x .125 THK		3	EA	-	R	DWG
12	M6 71B	WASHER-FLAT SAE-STL-BO			6	EA	-	R	PS
13	27339	SHIM-.032 in THICK	5/16 ID X 7/16 OD		6	EA	A	R	DWG
14	M5 71Z	WASHER-FLAT-STL-ZINC	NON STOCKABLE		(2)	EA	-	R	PS
15	10 73Z	WASHER-SPLIT LOCK-STL-ZINC	NON STOCKABLE		(4)	EA	A	R	PS
20	1/4-20X3/4 25B	SCREW-SHCS-STL-BO			3	EA	A	R	PS
23	M5-0.8X20 25B	SCREW-SHCS-STL-BO	NON STOCKABLE		(2)	EA	-	R	PS
24	10-24X2 1/2 02Z	SCREW-MACH-SLTD-INDT HEX WSHR HD-FULLY THD-ZINC	NON STOCKABLE		(2)	EA	A	R	PS
27	10-24 51 Z	NUT- JAM HEX	NON STOCKABLE		(4)	EA	A	R	PS
30	22580-7-DOC	POWER DRAWBAR OPTION -K2,K3-R8			1	EA	E	R	DOC

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REVISIONS

REV	DESCRIPTION	ECN	DATE	APPRV
C	ITEM 12: 22647-2 WAS 22647-4	12052	4/26/01	JRS
D	NOTE 1, 90 PSI WAS 80. REMOVED NOTE 5	12132	9/27/01	JCJ
E	REMOVED ITEM 4 & ITEM 19	12212	1/24/02	JJ
F	ADD ITEM 19 TO P/L	13207	1.31.07	TM
G	ITEM 12 22647-2 WAS: 22645-4. REVISED PICTORIAL.	14616	5.3.17	LG



NOTES: (UNLESS OTHERWISE SPECIFIED.)

1. SET REGULATOR TO 90 PSI DURING TESTING.
2. USE TEFLON TAPE OR PIPE COMPOUND ON ALL FITTINGS.
3. STANDARD ON V SERIES MILLS
4. OILER AND NIPPLE IS ADDED INPLACE OF ITEM 8 IF MACHINE HAS DRAWBAR OPTION. ASSEMBLED AT MACHINE.
5. USE ASSEMBLY ON S SERIES MILLS WITH AUXILIARY FUNCTION OPTION.

FOR PARTS LIST SEE SEPARATE "A" SIZE SHEET

DIMENSIONS ARE IN INCHES DEC. X = ±.1, .XX = ±.01, .XXX = ±.005 ANGLES .XX = ±0°30' FRACTIONS = ±1/8 FINISH = 125 RMS REMOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5		APPROVALS DRAWN BY JRS ENGINEER MZ MFE LG	DATE 11-1-00 11-2-00 11-3-00	SOUTHWESTERN INDUSTRIES, INC. 2615 HOMESTEAD PLACE RANCHO DOMINGUEZ, CA. 90220-5610	
MATERIAL -		THIRD ANGLE PROJECTION		TITLE AIR REGULATOR ASSY - DPMV - FILTER	
FINISH -		SCALE: 1 : 1		SIZE C	CODE IDENT. NO. 06238 DWG NO. 22380-1 REV G
				SHEET 1 OF 1	

Parts List for Assembly P/N: 22380-1

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22380-1

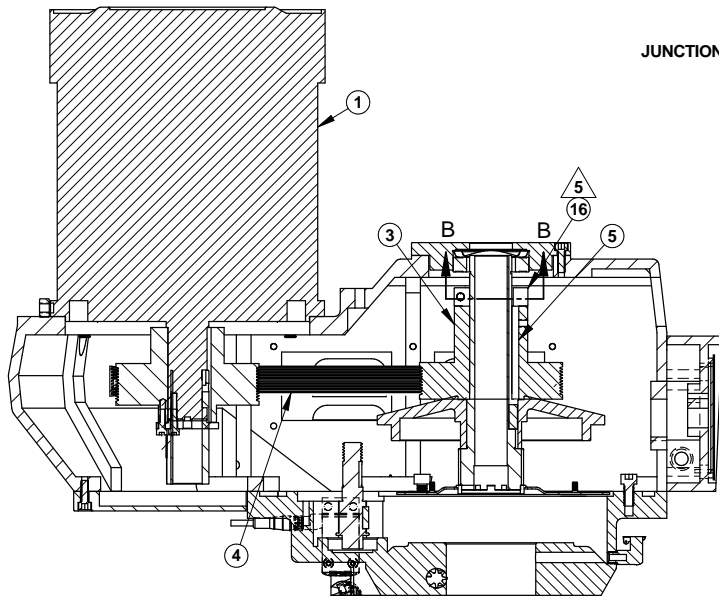
AIR REGULATOR ASSY-DPMV-FILTER

Type	PL	Dwg Size	C
Revision	G	Product	PT4
Status	R	Engineer	MZ
Date	7/26/2000	Planner Code	10
By	JRS	Comm Code	KIT-MISC

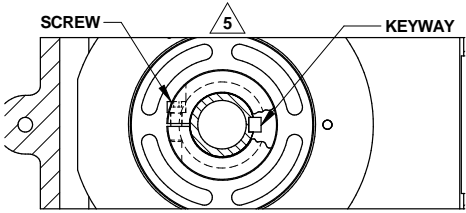
Item	P/N	Title	Detail	Qty	UseAs	Rev	Stat	Type	Mfr
2	22378	MANIFOLD-PT4 AIR		1	EA	B	R	DWG	
3	22607	FILTER/REGULATOR-PT4		1	EA	B	R	DWG	
8	22644-4	PLUG-1/4 NPT HEX SOCKET		3	EA	A	R	DWG	
9	22645-4	NIPPLE-1/4 NPT x 1.37 LG		1	EA	A	R	DWG	
11	22646-4	FITTING-ELBOW-PUSH TO CONNECT-90°	MALE 1/4 x 1/8 NPT	1	EA	B	R	DWG	
12	22647-2	NIPPLE-MALE-BRASS PIPE	1/8 NPT-FULLY THREADED	1	EA	B	R	DWG	
18	4-40X3/8 31B	SCREW-PH-PHIL-EXT SEMS-STL-BO		2	EA		R	PS	
19	10-32X3/8 10B	SCREW-PH-PHIL-STL-BO		2	EA		R	PS	
20	M6-1.0X25 25B	SCREW-SHCS-STL-BO		2	EA	A	R	PS	
24	22772	SOLENOID ASSY- AIR REULATOR		1	EA	-	R	PL	

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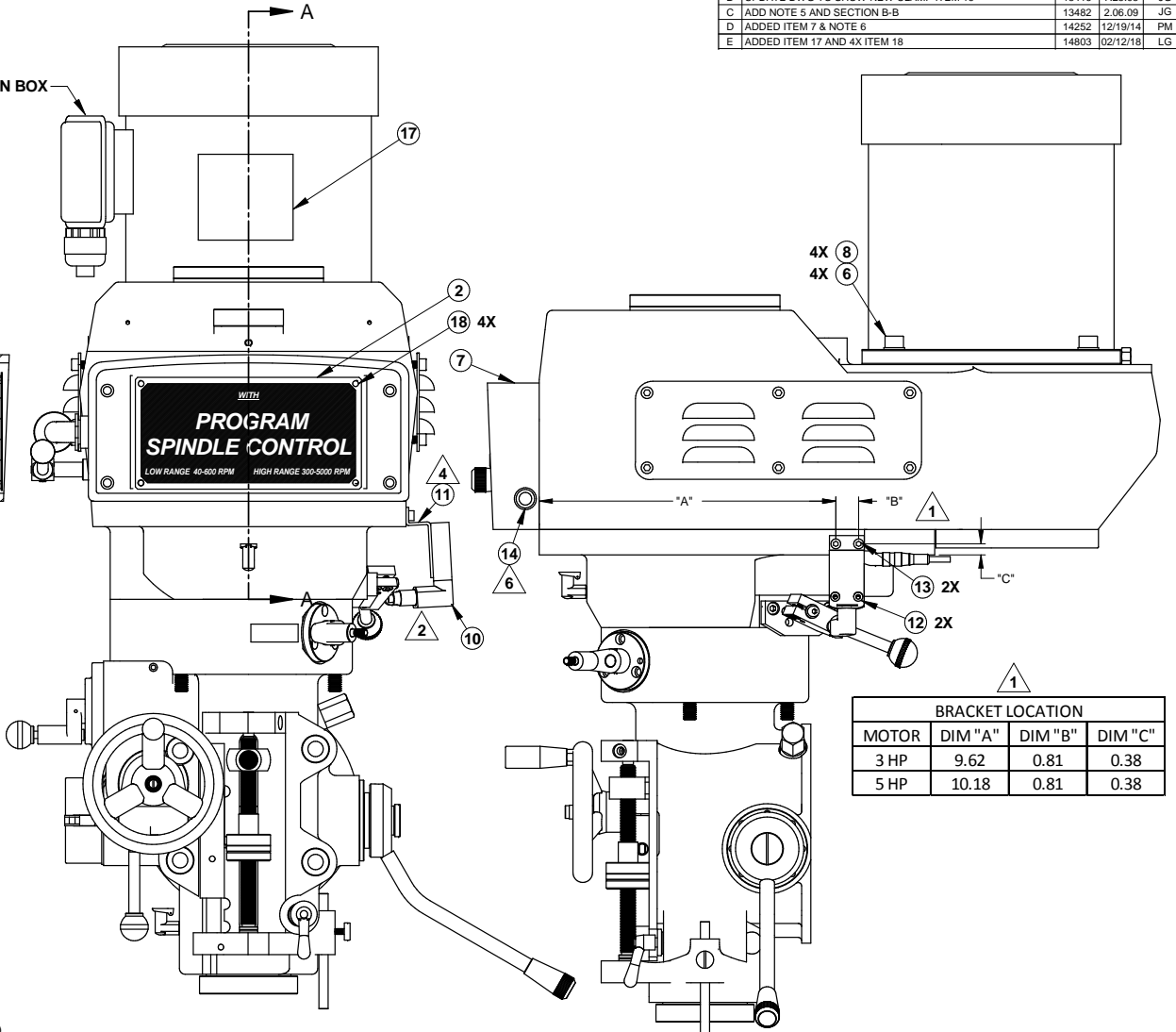
REVISIONS				
REV	DESCRIPTION	EON	DATE	APPROV
A	ADDED NOTES 2,3 & 4.	12839	1-18-05	JG
B	UPDATE DWG TO SHOW NEW CLAMP ITEM 16	13416	7.28.08	JG
C	ADD NOTE 5 AND SECTION B-B	13482	2.06.09	JG
D	ADDED ITEM 7 & NOTE 6	14252	12/19/14	PM
E	ADDED ITEM 17 AND 4X ITEM 18	14803	02/12/18	LG



SECTION A-A



SECTION B-B



BRACKET LOCATION			
MOTOR	DIM "A"	DIM "B"	DIM "C"
3 HP	9.62	0.81	0.38
5 HP	10.18	0.81	0.38

NOTES: (UNLESS OTHERWISE SPECIFIED).

- ① MOUNTING POSITION OF LIMIT-SWITCH ASSY (B1, C2).
- ② CHECK SPEED OF SPINDLE IN HIGH GEAR WITH TACHOMETER TO VERIFY SWITCH IS FUNCTIONING (B4).
- ③ RUN SPINDLE IN HIGH GEAR WITH SWITCH SET TO 'FOR' AND VERIFY SPINDLE RUNS CLOCKWISE (FROM TOP). IF IT DOES NOT RUN CORRECTLY, SWAP T1 & T2 AT MOTOR AND RELABEL CORRECTLY SO T1 - U1 AND T2 - V1.
- ④ BEND BRACKET (ITEM 11) TO ENSURE SWITCH IS TRIPPED (C4).
- ⑤ WHEN TIGHTENING CLAMP (ITEM 16), MAKE SURE SIDE WITH SCREW IS 180° FROM SHAFT KEYWAY SEE SECTION B-B (B6, D6).
- ⑥ ADD PLUG (ITEM 14) WHEN REQUIRED (B3).

FOR PARTS LIST SEE SEPARATE "A" SIZE SHEET

DIMENSIONS ARE IN INCHES DEC. 4 1/4, 1/8, 1/16, 3/16, 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, 3, 3 1/2, 4, 4 1/2, 5, 5 1/2, 6, 6 1/2, 7, 7 1/2, 8, 8 1/2, 9, 9 1/2, 10, 11, 12, 14, 16, 18, 20, 24, 30, 36, 48, 60, 72, 96, 120, 144, 180, 240, 300, 360, 480, 600, 720, 960, 1200, 1440, 1800, 2400, 3000, 3600, 4800, 6000, 7200, 9600, 12000		APPROVALS DRAWN BY: JJ ENGINEER: JG DATE: 6-02-04 10-05-04	SOUTHWESTERN INDUSTRIES, INC. 2915 HOMER ROAD, PLAZA RANCHO DOMINGUEZ, CA, 90230-5810
MATERIAL: - FINISH: -		TITLE: HEAD ASSY - SPINDLE CONTROL SIZE: D CODE IDENT. NO.: 06238 DIM. NO.: 23964-XX	SHEET 1 OF 1

Parts List for Assembly P/N: 23964-1

Printed 2/12/2018

23964-1

HEAD ASSY-SPINDLE CONTROL-3 HP

Type	PL	Dwg Size	D
Revision	E	Product	DPMS2/K2S/K3S
Status	R	Engineer	JG
Date	3/4/2004	Planner Code	10
By	JJ	Comm Code	MANUF

REV	ECN	DFT	ENG	DATE
D	14252		PM	12/19/14
E	14803	AC	LG	02/12/18

Item	P/N	Title	Detail	Qty	UseAs	Rev	Stat	Type	Mfr	Mfr P/N
1	24162	MOTOR ASSY-SPINDLE-3 HP-K2/K3		1	EA	A	R	PL		
2	23965	NAMEPLATE-TRAK E-HEAD OPTION		1	EA	-	R	DWG		
3	23632	PULLEY-SPINDLE-R8		1	EA	E	R	DWG	TOPONE	VS0119
4	23597	BELT-MICRO-V-J PROFILE 10 RIBS "J"	340J (864mm)	1	EA	-	R	PS	TOPONE	340J (864mm)
5	24169	KEY-8 mm X 8 mm		1	EA	-	R	DWG		
6	3/8 70P	WASHER-FLAT USS-STL-BO		4	EA		R	PS		
7	23964-3	HOUSING-PROGRAMMABLE SPEED CHANGE-K3		1	EA	A	R	DWG		
8	3/8-16X1 1/4 24B	SCREW-HEX HEAD-STL-BO		4	EA	-	R	PS		
10	23968	SWITCH ASSY-LIMIT-HI/LOW		1	EA	A	R	PL		
11	23969-1	BRACKET - GEAR SWITCH-3 HP		1	EA	-	R	DWG		
12	M4-0.7X16 25B	SCREW-SHCS-STL-BO		2	EA		R	PS		
13	M5-0.8X12 25B	SCREW-SHCS-STL-BO		2	EA	-	R	PS		
14	24164	PLUG-PRY OUT PLASTIC		1	EA	-	R	DWG	HEYCO	
16	24172-1	COLLAR-CLAMP		1	EA	-	R	PS	WHITTET-HI GGINS COMPANY	CCM-035
17	15964	NAME PLATE-MOTOR		1	EA	A	R	DWG		
18	AD-43-ABS	RIVET- POP- MILL FINISH		4	EA		R	PS		

TRAK Warranty Policy

Warranty

TRAK products are warranted to the original purchaser to be free from defects in workmanship and materials for the following periods:

Product	Warranty Period	
	Materials	Factory Labor
New TRAK/ProtoTRAK	1 Year	1 Year
Any EXCHANGE Unit	90 Days	90 Days

The warranty period starts on the date of the invoice to the original purchaser from Southwestern Industries, Inc. (SWI) or their authorized distributor.

If a product, subsystem or component proves to be defective in workmanship and fails within the warranty period, it will be repaired or exchanged at our option for a properly functioning unit in similar or better condition. Such repairs or exchanges will be made FOB Factory/Los Angeles or the location of our nearest factory representative or authorized distributor.

Warranty Disclaimers

- This warranty is expressly in lieu of any other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liability on the part of SWI (or any producing entity, if different).
- Warranty repairs/exchanges do not cover incidental costs such as installation, labor, freight, etc.
- SWI is not responsible for consequential damages from use or misuse of any of its products.
- TRAK products are precision mechanical/electromechanical/electronic systems and must be given the reasonable care that these types of products require. Evidence that the product does not receive adequate Preventative Maintenance may invalidate the warranty. Excessive chips built up around ballscrews and way surfaces is an example of this evidence.
- Accidental damage, beyond the control of SWI, is not covered by the warranty. Thus, the warranty does not apply if a product has been abused, dropped, hit or disassembled.
- Improper installation by or at the direction of the customer in such a way that the product consequently fails, is considered to be beyond the control of the manufacturer and outside the scope of the warranty.
- Warranty does not cover wear items that are consumed under normal use of the product. These items include, but are not limited to: windows, bellows, wipers, filters, drawbars and belts.