

ANILAM

**3200MK, 3300MK
Kit CNC Installation
for
Bridgeport Machines**

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Section 1 - Introduction

This installation manual describes how to install ANILAM 3200MK and 3300MK CNCs on Bridgeport Series machines.

Where an instruction is applicable to a particular model only, an effectivity icon with the applicable model number appears next to that section. Refer to **Table 1-1**.

Table 1-1, Effectivity Notation

Icon	Product
3200MK	3200MK Systems
3300MK	3300MK Systems

Each installation process includes any or all of the following topics:

- ❑ **Objective:** The primary purpose(s) of the procedure.
- ❑ **Tools:** Equipment needed to perform the installation.
- ❑ **Parts:** A list of the parts referenced in the procedure, including part numbers and descriptions.
- ❑ **Procedure:** Step-by-step installation instructions.

Read and understand the instructions and objectives before performing a procedure.

IMPORTANT: This manual is written for experienced machine tool builders, rebuilders, and factory-trained technicians. Only qualified persons should install components.

Use the drawings at the end of each chapter as references.

IMPORTANT: In the text, you will find references to an automatic oiler system. To maintain a valid warranty on mechanical parts, an automatic oiler must be installed. One can be purchased with the CNC package. Call an ANILAM dealer for price and availability.

CAUTION: The CNC system requires a dedicated 115 V AC line direct from the fuse or panel box to the computer. An isolated step-down transformer connected to the three-phase power source will also suffice. Lines supplying power to other equipment could cause random, intermittent problems and possible irreparable damage to the CNC or associated equipment. Failure to supply a dedicated line to the computer could void the warranty on system electronics.

When the machine is performing to mechanical specification, the CNC is capable of positioning any axis within ± 1 count of accuracy. On a knee mill, this equals 0.0005", 0.0002", or 0.0001" (machine resolution).

These values are absolute and constantly maintained. Most inaccuracies result from machine errors, including linear errors and pitch and yaw errors.

ANILAM CNCs are built to precise standards. However, errors result as components wear with use, bend under load, shift due to oil clearance tolerances, or reverse direction of travel.

Before you begin an installation, carefully unpack the complete assembly in a clean work area with enough room to spread out the kit contents. Check all packing material and cartons for loose hardware before discarding. For easy access, bolts are packaged with the hardware to which they attach. Do not mix hardware kits' parts.

NOTE: Kits include hardware for both SAE and metric installations. Use whichever installation procedure is appropriate for the machine. Installation procedures in this manual reference SAE hardware.

Required Tools

Table 1-2, lists all tools required for Bridgeport machine installation.

Table 1-2, Bridgeport Installation Required Tools

Level	6" Rat Tail File
Center Punch	Drill Motor 3/8 Chuck
Ball Peen Hammer	5/16 Drill
Soft Mallet	1/4" Drill
Tape Measure	#7 Drill
6" Scale	#21 Drill
12" Combination Square	#29 Drill
Magnetic Indicator Base	#36 Drill
Sliding Surface Gauge Base	Small Tap Handle
0.0005" Indicator	Large Tap Handle
Set of Allen Wrenches-English 0.050"-3/8"	3/8-16 Tap
Set of Allen Wrenches-Metric	5/16-18 Tap
Pin Punch	1/4-20 Tap
Dial Calipers	10-32 Tap
8" Adjustable Wrench	8-32 Tap
3/4" Socket	6-32 Tap
1/2" Drive Ratchet	Set of Transfer Punchers
#2 Phillips Screwdriver	Digital Volt Multimeter (3 1/2 Digit)
#1 Phillips Screwdriver	12" 3/8 Drive Extension
Large Flat Blade Screwdriver	Set of Allen (Hex) Sockets 3/8 Drive
Medium Flat Blade Screwdriver	Wire/Spade Crimpers
3/32 x 1 1/2" Flat Blade Screwdriver	Spanner Wrench
Needle Nose Pliers	Scribe
Side Cutters	CRT Adjustment Tools with Plastic Hex Set
8" Mill File	

Drawing Package

For additional details, refer to the drawing package included in your documentation.

Section 2 - Wiring Guidelines and Grounding Concepts

This section contains the following wiring guidelines and grounding concepts:

- ❑ General Wiring and Grounding Guidelines
- ❑ Grounding Procedures Accomplished during the Mounting of the Enclosures
- ❑ Proper Wiring of System Grounds
- ❑ Amplifier Wiring Guidelines
- ❑ Isolation Transformer Installation Guidelines

General Wiring Guidelines

CAUTION: Follow the electrical guidelines described below for any configuration that deviates from a standard CNC configuration. Failure to follow these guidelines can result in damage to the equipment or bodily injury.

IMPORTANT: Do not apply power until instructed to do so.

IMPORTANT: To ensure safe operation, all wiring should conform to local and national codes.

IMPORTANT: The CNC, other control devices, and the enclosure must be properly grounded. An authoritative source on grounding requirements for most installations is the National Electrical Code.

Follow general wiring guidelines as listed below:

- ❑ Do not run signal wiring and power wiring in the same conduit. Where paths must cross, make their intersections perpendicular.
- ❑ Segregate I/O wiring by signal type. Route wiring with different signal characteristics by separate paths whenever possible. To prevent crosstalk, do not run harnesses that contain different signal types parallel to one another.
- ❑ Establish a low-impedance, single-point ground. All noise reduction techniques depend upon proper grounding.
- ❑ Routing and grounding servo wiring is more important than wire length.
- ❑ Make signal wiring as short and direct as possible.

CAUTION: EMERGENCY STOP switches must be installed in the system. Ensure that the relay contacts have a sufficient rating for the application.

- The Emergency Stop button and Overtravel limit switches are wired in series. When any of them open, the servo is de-energized. This will remove power from the machine. Correct installation is vital for safety.

WARNING: Never alter these circuits to defeat their function. Serious injury or machine damage could result. Observe all applicable codes as to the placement and labeling of EMERGENCY STOP switches.

General Grounding Guidelines

This section specifies procedures for grounding an ANILAM CNC package during installation. Proper grounding, the foundation of all noise control techniques, is helpful in limiting the effects of noise due to electromagnetic interference (EMI) and is essential for the proper operation of CNC equipment.

WARNING: The CNC and the enclosure must be grounded properly. Observe all applicable codes and ordinances when wiring the control system.

In addition to the grounding required for the CNC and its enclosure, you must provide proper grounding for all controlled devices in the application. Be sure to provide each device with an acceptable grounding path.

Electrically Bond the CNC System to the Machine

The metallic components of the CNC system servo box and console were designed to provide an equipotential chassis ground when properly bonded to the machine. This will result in a very low resistance from the electrical ground of the CNC system to the metal of the machine tool. The following procedures describe how to establish the electrical bond.

Establish Bonding Points on the Machine

To establish a proper ground, remove all anodizing, paint, and other coatings down to the bare metal. Do this at the points where holes have been drilled into the machine to mount the enclosures. A threaded hole into the machine is not a proper ground. Instead, remove the paint (or coating) around the hole, down to the bare metal. If it is not feasible to use the mounting holes for electrical bond points, establish suitable bond points elsewhere. Connect these later via flat wire braid, at least 3/8" width.

Use Interior or Exterior Tooth Lock Washers between Points of Contact

Use interior or exterior tooth lock washers between each point of metallic contact to ensure a good electrical path. Choose interior or exterior washers based on mechanical concerns.

Clean All Stand-Off and Mounting Assemblies to Bare Metal at Points of Contact

The goal is to create continuous metal-to-metal surface contact from the machine to the two enclosures. This is easier to accomplish at some points in each installation than at others. Again, the threaded holes are not proper grounds, just as the threads of the mounting bolts are not proper ground paths. The best path is two bare metal surfaces with the proper tooth lock washer between them. The closer the installation is to this model, the better the ground.

Clean All Paint to Bare Metal from the Enclosure at the Points of Contact

CNC subpanels and subassemblies are electrically bonded to their enclosures. Since it is impossible to predict which surfaces will be the best bond points to the machine, all surfaces are painted except for those masked off for grounding. Determine the bond points, and remove any paint at these points to enable good contact via internal or external tooth lock washers.

Proper Wiring of System Grounds

Verify that building grounds conform to local codes at the time of installation. The CNC requires two ground paths from the building wiring: one via the 110-V AC line cord, and one via the 3-phase, 230-V AC wiring connected during installation. Each enclosure has an assigned central ground point. The console's CRT also has an assigned ground point on its chassis. It connects to the central ground point of the servo enclosure.

NOTE: If in doubt that a proper building ground exists, consult a qualified electrical technician.
--

Servo Drive Enclosure Central Ground Point

Make electrical grounding from the unpainted tab to the rear of the spacer. Use the ground braid, P/N 33000064, found in Servo Mounting Kit, P/N 32500328. Refer to **Figure 2-1, Central Grounding Buss Bar (Servo Enclosure)**, and **Figure 2-2, Installing the Grounding Harness on the Enclosure**.

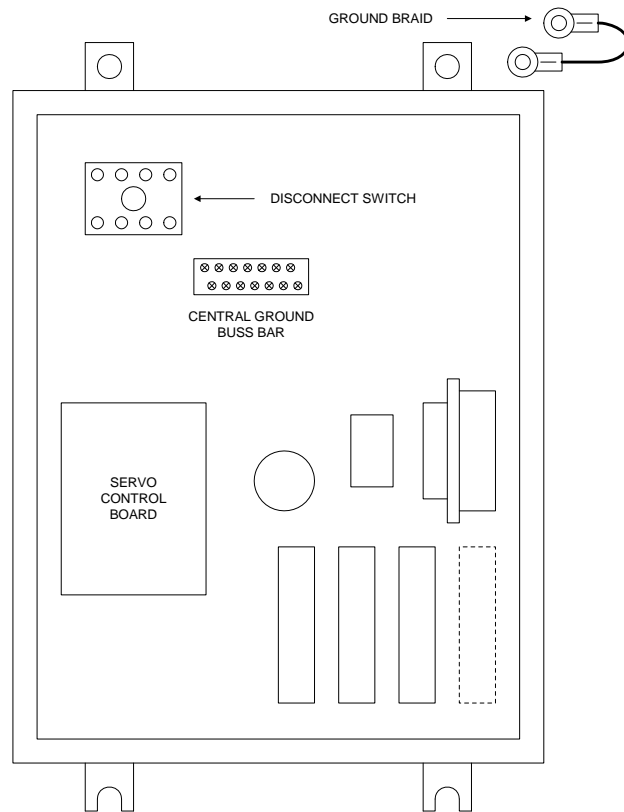


Figure 2-1, Central Grounding Buss Bar (Servo Enclosure)

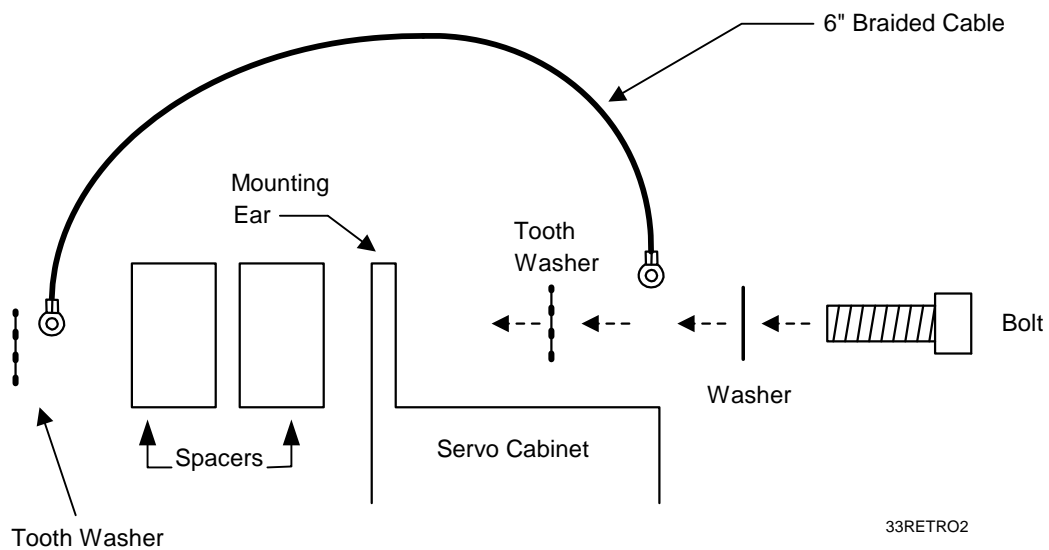


Figure 2-2, Installing the Grounding Harness on the Enclosure

Amplifier Wiring Guidelines

ANILAM cabling is designed and tested to optimize grounding, safety, and noise reduction. Any change to these components could negate or diminish performance. Please check with ANILAM before making design changes.

The following information is offered as reference material:

- ❑ Electrical equipment inherently generates radio-frequency interference (RFI), and wiring acts as antennae that transmit this interference.
- ❑ Motors inherently generate electromagnetic interference (EMI). Unless the wiring is very short, shielding on the motor wires is necessary to meet FCC RFI/EMI guidelines and to protect other equipment from the adverse effects of RFI/EMI.
- ❑ Always use shielded wire. The shield must be connected to the amplifier base plate, which must be earth grounded.
- ❑ To decrease shock hazard, run a conductor of the same gauge as the motor wires, or make another direct metallic connection from the motor case to the amplifier base plate.
- ❑ Earth grounding is required to meet the National Electrical Code (NEC) requirements and to suppress RFI/EMI.

IMPORTANT: The signal wiring to the tachometer and the signal inputs to the amplifier are susceptible to noise pickup. Excessive noise pickup will cause erratic amplifier operation. Run each signal-input line in separate, twisted-pair, shielded cable for optimal performance.

Terminate the tachometer lead at the amplifier. Ground the signal-input lead at the motion board. Keep signal lines as far as possible from any power or motor wires.

Isolation Transformer

An isolation transformer is sometimes used in the AC line to the controller. This type of transformer provides isolation from the power distribution system and is often used as a step-down transformer to reduce line voltage. Any transformer used with the controller must have a sufficient power rating for its load. This power rating is generally expressed in volt-amperes (VA).

- ❑ An electrostatic-shielded isolation transformer with a rating of 2 KVA is recommended for the control system.
- ❑ If output devices are connected through the transformer, add their maximum VA requirements to determine the correct transformer size.

Section 3 - Installation Procedures

Preparing the Machine for Installation

Objective:

- To prepare the machine for installation.

Procedure:

IMPORTANT: Remove all power from the machine.

1. Remove all way covers and way wipers from the axes. Oil the ways by pumping the oiler several times. Move each axis through its range of travel manually. Ensure that the table or saddle leaves a film of oil as it passes over the ways.
2. Remove the lock handles and plungers from both the X and Y axes. To remove plungers, use a magnet to draw them out of their locations. In a later step, you will be instructed to install plastic plugs to protect the ways from contaminants.
3. Remove the hex nuts on both ends of the X Acme leadscrew and the front of the Y Acme leadscrew. Pull off the handles and sleeves.
4. Remove the Woodruff keys on the ends of both screws.
5. Remove the four Allen bolts in each bearing cap.
6. Remove all bearing caps, using a soft mallet.
7. Set aside the left X-axis cap; you will use it again.

NOTE: The bearing caps are usually pinned in place with roll pins. Remove the caps. If the roll pins remain in the table or the front of the knee, remove and discard them.

8. Loosen and remove the X-axis gib. On some machines, there are two gib screws for each gib, one at each end. If there are two, loosen and remove the screw on the wide end of the gib. Tighten the screw on the small end of the gib. The movement will push the gib out. When the gib begins to move outward, take hold of the large end and pull the gib out completely.
9. Slide the table off the end of the saddle and onto a sturdy work surface. Move the table out of the way.
10. Remove the screws that hold the brass split nuts in the yoke. If there is a small screw retaining the lock screw head, remove it. Then, remove the lock screw. Remove the Acme screws from the yoke. These screws will not be reused.

11. Remove the four machine mounting screws that secure the yoke to the saddle. (Usually these are 3/8-16 or 10-mm screws.) Remove all oil lines connected to the yoke. Set aside the mounting screws and oil lines for future use. Note the orientation of the yoke. Lift the yoke slightly (about 1"), and turn it 90°. Then, lift the yoke out of the machine.
12. Some machine manufacturers pin the keys in the bore of the yoke. If there are keys in the bore of the yoke, use a pin punch to remove them.

X- and Y-Axis Ballscrew Installation

Objective:

- ❑ To replace X- and Y-axis Acme leadscrews with the precision ground ballscrews provided in the kit.
- ❑ To supply oil to the ball nut of each ballscrew.

Tools:

#21 Drill	5/16-18 Tap
10-32 Tap	Allen wrenches
1/4" Drill	

Parts:

Part Number	Description
66100423	Ground Brass Shims, 0.006"
86100829	Machine Screws, 5/16-18 x 1-3/4"
66100711	Set Screws, 10-32 x 3/16"
86100318	Machine Screws, 10-32 x 1"
86300125	Lock Washer, 5/16"
86300160	Flat Washer #10 SAE
86300162	Split Lock Washer, #10
86300199	Flat Washer 5/16"
86600100	Plastic Plugs
91400178	Nylon Tubing, 5/32 (4 x 32 mm)

Procedure:

IMPORTANT: This procedure is the foundation of the mechanical installation. Make sure you perform the steps accurately.

Locate the cardboard shipping tubes that contain the X and Y ballscrews. Use hardware kit, P/N 31500984, to install the X- and Y-axes ballscrews. The hardware kit will be taped to one of the shipping tubes.

The hardware kit contains the following parts:

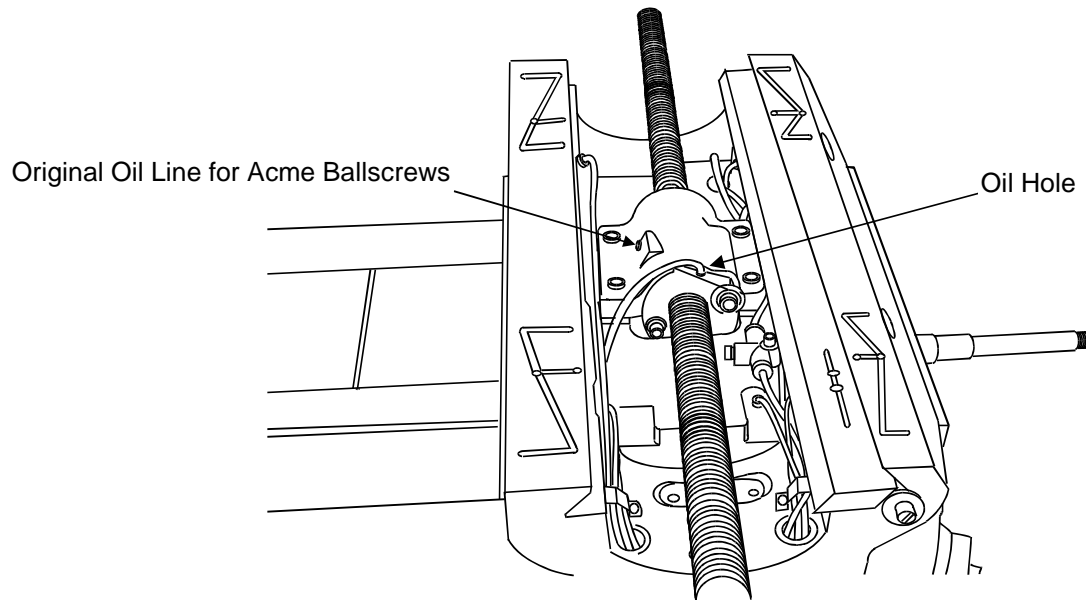
- ❑ Four 5/16-18 x 1-3/4-inch machine screws, P/N 86100829, to attach the ball nut to the yoke
- ❑ Two 10-32 x 3/16-inch set screws, P/N 66100711, to plug the bottom hole of the ball nuts
- ❑ Four plastic plugs, P/N 86600100, to plug the holes from which the lock handles were removed

Each ballscrew comes with a Woodruff key inserted and taped in place.

NOTE: If the oil lines to the removed Acme screws had oil flow meters attached to them, then the ballscrews must also have oil flow meters attached to them. If the Acme screws do not have oil flow meters attached to them neither will the ballscrews.

Oil must be provided to both ballscrews. The kit supplies a selection of oil lines, manifolds, compression sleeves, compression nuts, plugs, and flow meter valves. Some of the parts may not be necessary.

Use these parts to supply oil to both ballscrews, but be careful not to change the flow of oil to other parts of the machine (i.e., saddle, table, and knee). The kit contains enough fittings and sufficient oil line to run the correct combination to the ballscrews. Refer to **Figure 3-1**.



33XAXIS

Figure 3-1, Preparing the Saddle

1. Use the plastic plugs, P/N 86600100, in the hardware kit to plug the holes in the saddle from which the lock handles were removed.

NOTE: Use two brass shims, P/N 66100423, to create a closer fit between the ball nut and the bore of the yoke, if necessary. To adjust the fit, bend the tabs of the shim around the ball nut; then, insert the ball nut into the yoke.

2. With the yoke properly oriented, insert the X ballscrew into the yoke. Make sure that the ball nut flange is on the left side of the yoke and the machined flat is at the 12-o'clock position. Refer to **Figure 3-2**.

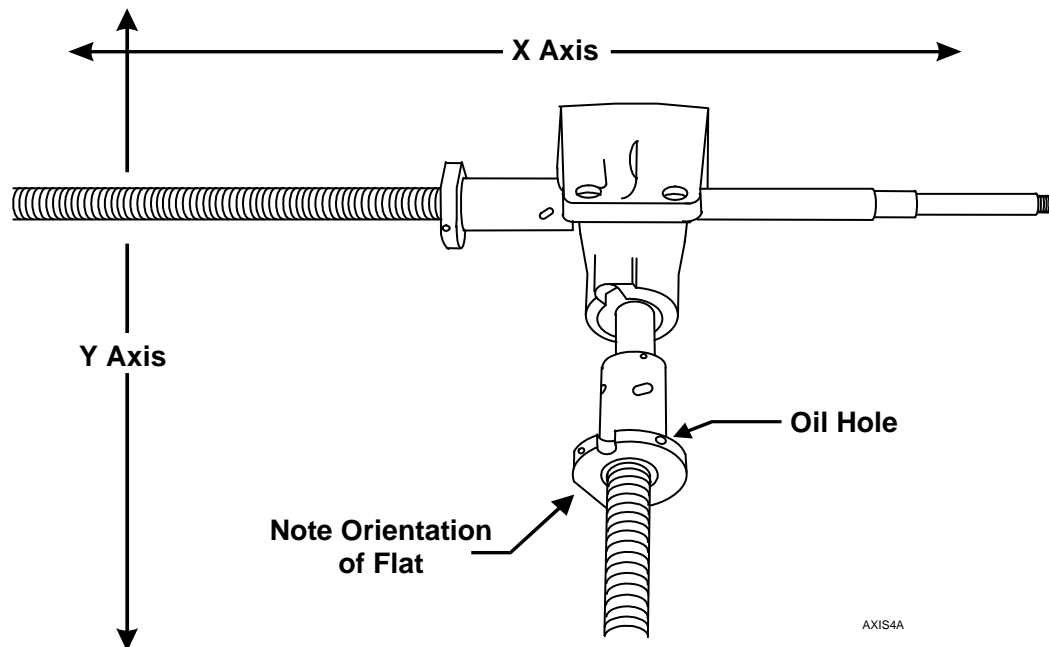


Figure 3-2, Ball Nut Orientation Prior to Installation

3. Align the machined slot in the ball nut flange with the existing tapped hole in the yoke. Locate the 5/16-18 x 1-3/4-inch machine screws, P/N 86100829; lock washer, P/N 86300125; and flat washer, P/N 86300199. Attach the ballscrew to the yoke.
4. Locate two additional holes from the bolt hole pattern on the ball nut and transfer punch these locations. Do not punch any holes below the 4- and 7-o'clock positions. These locations are difficult to reach with a wrench when the yoke is installed in the machine.
5. Insert the Y-axis ballscrew with the ball nut flange in front of the yoke. On all Bridgeport machines, it is critical that you make sure the machined flat on the ball nut is aligned with the flat on the yoke.
6. Use two 5/16-18 x 1-3/4-inch machine screws, lock washers, and washers provided to attach the ballscrew to the yoke.

7. Locate two additional holes from the bolt-hole pattern in the ball nut and transfer-punch these locations. Select the additional drill sites carefully. Verify that the casting is thick enough to drill into at that point.
8. Remove both ballscrews from the yoke and set them aside. Drill and tap 10-32 x 0.750-inch deep in the locations marked by the transfer punch. Clean the yoke. Ensure that there are no burrs on the mounting faces and no chips in the bores.
9. Use the four screws removed when the yoke was taken off the saddle to reinstall the yoke. If the yoke was pinned, remove and discard the pins. Tighten the machine screws lightly.
10. Install the oil line to the Y-axis ballscrew.
11. Hold the ballscrew, as it will be inserted in the yoke. Locate the hole in which the oil line should be inserted, as follows:
12. There are four holes in the ball nut. Two of these holes contain set screws to hold the nylon wiper in place. Do not use these holes. The other two holes are 10-32 tapped. Insert the oil line in uppermost of these two holes. This will allow gravity flow of oil to the ballscrew.
13. Use the 10-32 x 3/16-inch set screw provided to plug the bottom hole. Insert the provided 5/32-inch nylon tubing, P/N 91400178, into the top hole. Seal the oil line in place with epoxy or silicone seal, if necessary.
14. Place a tie-wrap around the vertical shaft of the yoke and use it to secure the oil line to the yoke. This will prevent the sliding Y-axis screw covers from cutting the oil line.
15. Use the 10-32 x 3/16-inch set screw provided to plug the bottom hole on the X-axis ballscrew.
16. Insert the Y ballscrew, with the oil line attached, into the yoke. At the same time, feed the free end of the oil line through the opening in the saddle.
17. Use two 10-32 x 1-inch machine screws, P/N 86100318; washers, P/N 86300160; lock washers, P/N 86300162; one 5/16-18 x 1-3/4-inch machine screw, P/N 86100829; and the washer and lock washer provided to attach the ballscrew to the yoke. Tighten the screws completely.
18. Insert the X ballscrew into the yoke with the flat up. Refer to **Figure 3-3, Ball Nut Orientation**. Orient the ball nut flange to the left of the yoke. Use two 10-32 x 1-inch machine screws, washers and lock washers, and two 5/16-18 x 1-3/4-inch machine screws, washers and lock washers provided, to attach the ballscrew to the yoke. Lash the oil lines together with tie-wraps so that they will not touch the bottom of the table when it is reinstalled. Tighten completely.

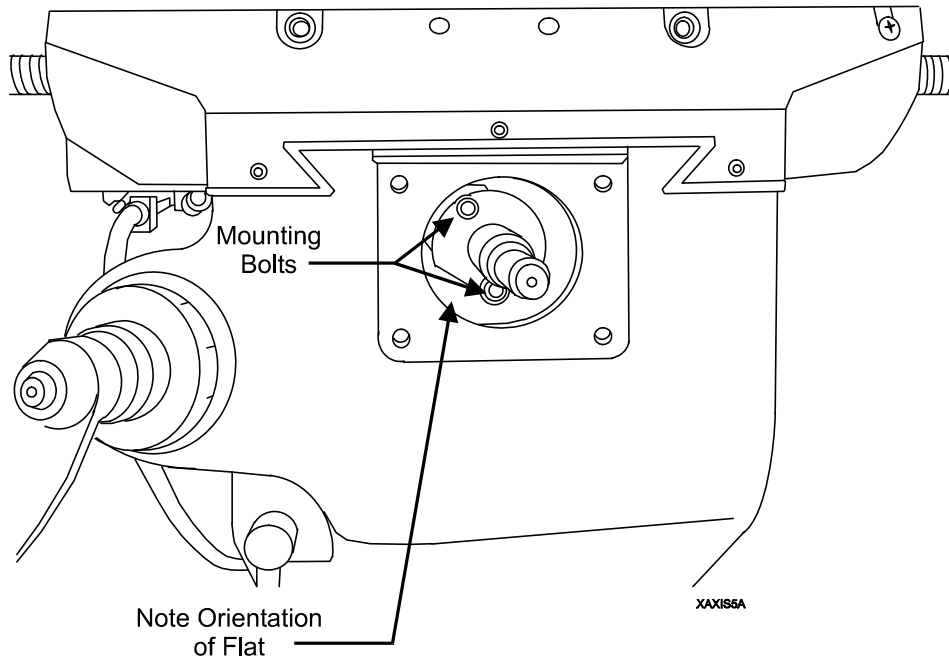


Figure 3-3, Ball Nut Orientation

X- and Y-Axis Ballscrew Alignment

Objective:

- To align the X-axis ballscrew parallel to the X-axis ways. The alignment of the yoke in the X axis automatically aligns the Y axis. However, you must verify the Y-axis alignment.

Tools:

Surface gauge base	Allen wrenches
0.0005" Indicator	

Procedure:

CAUTION: Misalignment of the ballscrews causes excessive wear on both the ballscrews and the bearings, and thus decreases the accuracy of the system.

1. Use a surface gauge and indicator to measure the distance from the back edge of the saddle way to the screw (along the X axis). Take measurements at both ends of the saddle. The difference between the two measurements must be less than 0.002". Refer to **Figure 3-4, Ballscrew Alignment**.
2. Snug the Allen bolts that secure the yoke to the machine.
3. Turn the X-axis ballscrew so that it is approximately in the center of the saddle; this balances the weight on either end of the screw.
4. Place the gauge base near the edge of the saddle on the right rear way of the machine. Make sure that the gauge base pins are firmly against the back of the saddle. Place the indicator point on the ballscrew at the 9-o'clock position. Slide the gauge base slightly to get the highest indicator reading. Set the indicator to 0.
5. Lift the gauge base gently, and move it to the left edge of the saddle. Take another reading. If the indicator reads more than ± 0.002 ", adjust the yoke.
6. To adjust the yoke, tap it gently. Repeat the alignment procedure until the X-axis ballscrew is aligned with the X-axis way (± 0.002 ").
7. Obtain an approximate reading, and tighten the Allen screws completely. Double-check the alignment to ensure the yoke did not move.
8. Use the gauge base and indicator to check the vertical alignment of the X-axis ballscrew. The indicator point should be at the 12-o'clock position on top of the ballscrew. If more than 0.002" of deviation is indicated, shim under one side of the yoke to adjust the ballscrew.

9. To check vertical and horizontal alignment of the Y-axis ballscrew, slide the gauge base in and out along the Y-axis ways while you indicate the top and side of the ballscrew (9 o'clock and 12 o'clock).

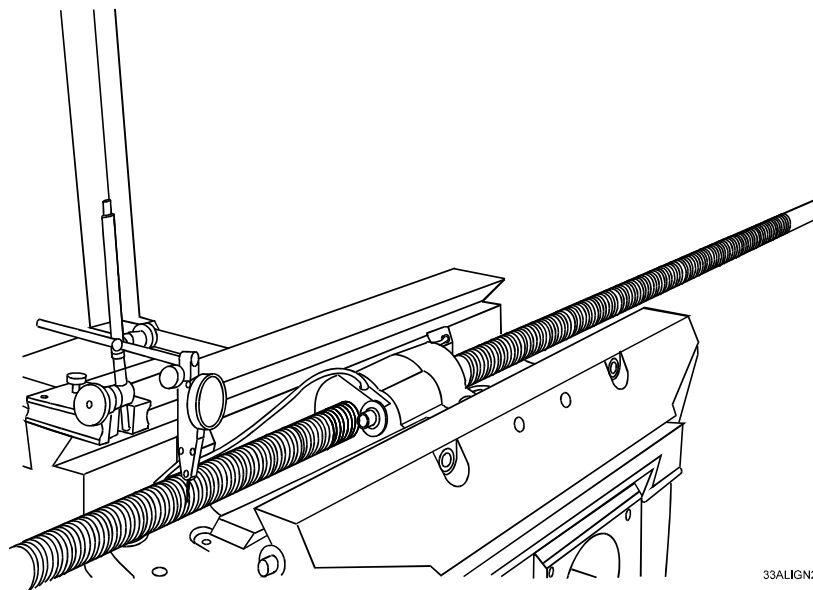
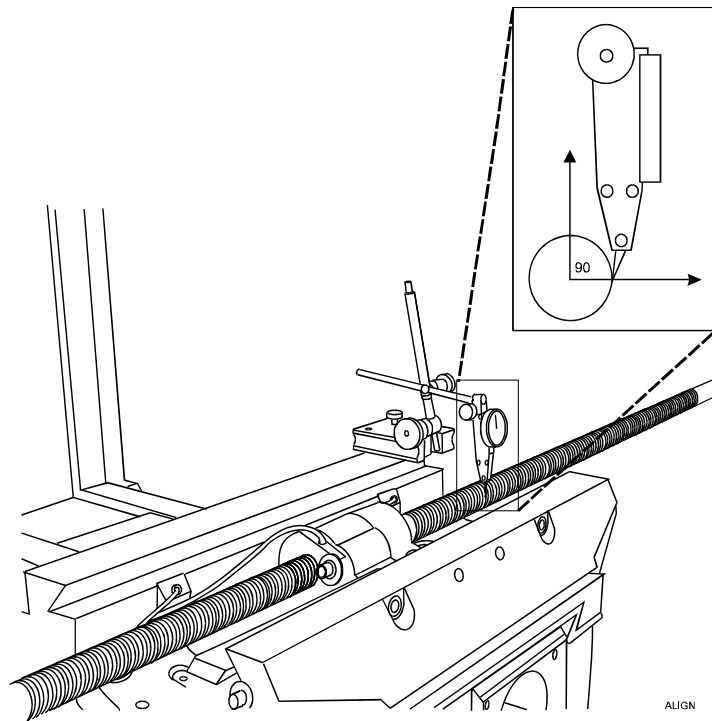


Figure 3-4, Ballscrew Alignment

10. If the ballscrew is out of alignment by more than 0.002" across 6 inches of travel, machine the faces of the yoke to ensure that they are perpendicular to one another.

X- and Y-Axis Limit Switch Installation

Objective:

- To attach the limit switch bracket to the right rear side of the saddle. The bracket holds the X- and Y-axis limit switches and the Sealrite cable that carries the limit switch wires to the servo cabinet.

Tools:

Transfer Punches	1/4-20 Tap
#7 Drill	Allen wrenches

Parts:

Part Number	Description
33000127	Limit Switch Bracket
66100106	Flat Washer, 1/4"
66100112	Split Lock Washer, 1/4"
86100503	Machine Screw, 1/4-20 x 1"

Procedure:

For easy access to the saddle, perform this procedure with the table removed from the machine.

Locate the X- and Y-axis limit switch bracket, P/N 33000127. Use hardware kit, P/N 32500045, to install the bracket. The kit is tie-wrapped to the bracket. Open the hardware kit, and remove two 1/4-20 x 1-inch Allen screws, P/N 86100503; two 1/4-inch lock washers, P/N 66100112; and two 1/4-inch washers, P/N 66100106. Set the remaining items in the kit aside for future use. Refer to **Figure 3-5, Parts Layout**.

1. Hold the limit switch bracket against the right rear side of the saddle. The top limit (X-axis limit) should be against the rear of the saddle. The top of the metal bracket should be between 1/16" to 1/8" below the top of the rear way surface. This will allow clearance when the table is put back on the machine.
2. Use a transfer punch to punch the slots on the bracket. This allows the bracket to be adjusted up and down.
3. Drill and tap (1/4-20) the punched holes to a depth of 1". Clear any chips from the holes.
4. Mount the limit switch bracket to the saddle. Use the two 1/4-20 x 1" Allen screws, P/N 86100503; lock washers, P/N 66100112; and washers, P/N 66100106. Make sure the top of the bracket does not extend above the way surface. Refer to **Figure 3-6, Mounting the Bracket**.

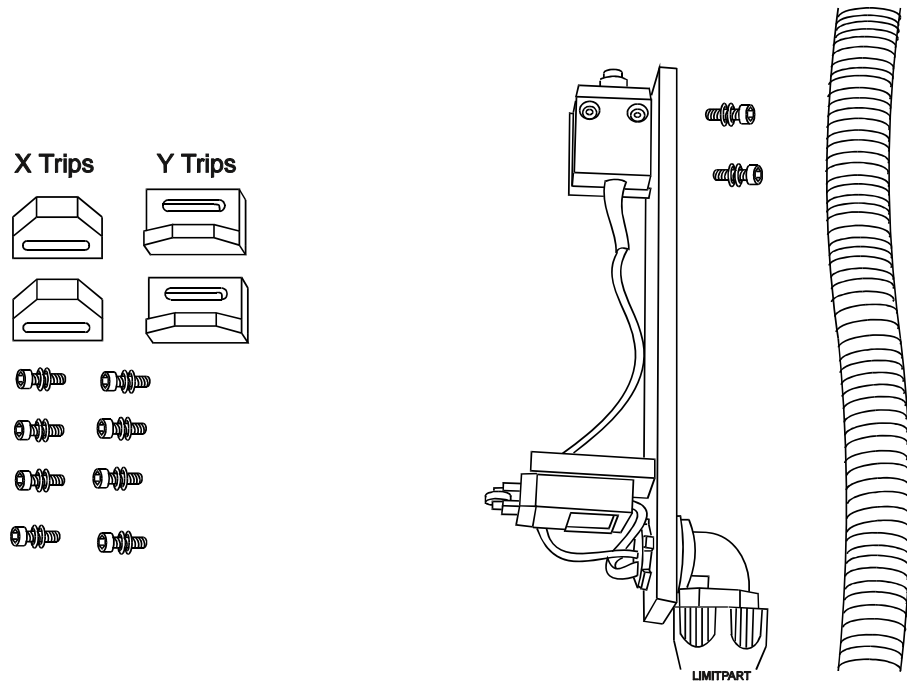


Figure 3-5, Parts Layout

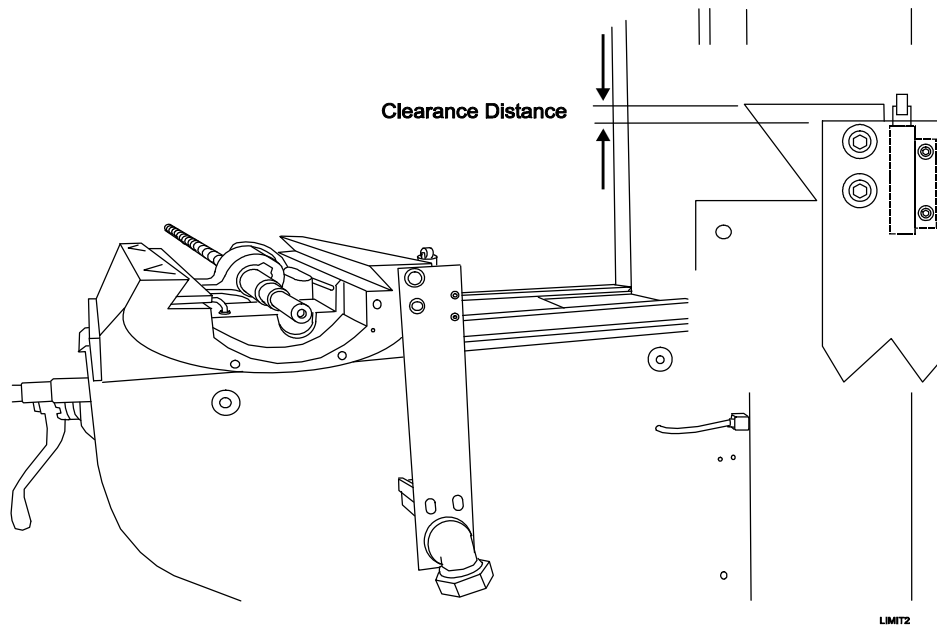


Figure 3-6, Mounting the Bracket

Replacing the Table and Gib Adjustment

Objective:

- To replace the table on the machine and snug the gibs.

Tools:

Flat screwdriver	0.0005" Indicator
Magnetic base	

Procedure:

1. Clean the saddle and the dovetail beneath the table. Pump the oiler several times to get a film of oil on all wear surfaces. Oil the wear surfaces beneath the table.
2. Slide the table onto the saddle.
3. Clean the gib and make sure that all oil grooves and holes are free of dirt or obstructions.
4. Slide the gib into the machine. Make sure it is inserted properly.
5. Tighten the gib with the gib-adjusting screw (the left side screw on most machines) while moving the table slowly back and forth, until the table feels snug.

CAUTION: To prevent the table from coming off the machine, do not push too hard on the table.

NOTE: When the gib is adjusted properly, more effort is required to move the table, but it can still move freely. Make sure the table does not wobble from side to side.

6. Adjust the gibs, starting with the Y axis. Place a magnetic base and 0.0005" indicator on the Y-axis ways, on the right side of the knee. Position the indicator point at the front face of the saddle toward the outside edge.
7. Rock the table and saddle from side to side.
8. Tighten or loosen the Y-axis gib to achieve 0.0005" to 0.0007" of motion at the indicator point.
9. Move the indicator base to the right front face of the saddle, and position the indicator point on the face of the table above the magnetic base.
10. Rock the table and saddle from side to side and adjust the X-axis gib.
11. Tighten or loosen the X-axis gib to achieve 0.0005 to 0.0007" of motion at the indicator point.

X-Axis Drive Housing Installation

Objective:

- ❑ To install the X-axis drive housing on the right side of the table, and center the housing on the ballscrew.
- ❑ To install the sprocket adapter and TAPER-LOCK® pulley.

Tools:

Allen wrenches	3/4" Socket
Adjustable wrench	6-inch Scale

Parts:

Part Number	Description
66100413	Spacer, 0.002 Lam. Brass Shim
66100733	Hex Nuts #1/2-20
66300120	Drive Housing, Universal X Axis
66300127	Adapter, Sprocket, Keyway, X and Y
66600609	Steel Key (Woodruff) 3/16" Sq.
67200947	TAPER-LOCK® Bushing 1108 x 1"
67200948	TAPER-LOCK® Pulley
86100576	Machine Screw, 3/8-16 x 2-1/2"
86300205	Flat Washer, 1/2"
86300174	Lock Washer, 3/8"
86300203	Flat Washer, 3/8" x 0.88" x 1/8"
80300602	Woodruff Key

Procedure:

Use the X-Axis Drive Housing Hardware Kit, P/N 32500154, to install the X-axis drive housing, sprocket adapter, and TAPER-LOCK® pulley. Bolt kits, P/N 31500149 (metric) and P/N 32500035 (SAE), are shipped with the kit.

1. Move the table so that it is flush with the right side of the saddle.

CAUTION: Do not push too hard on the table. The table is not secure and may fall off the machine at this time.

2. Turn the ballscrew until only about 4 inches of the screw protrudes past the table on the right side.
3. Locate the X-axis drive housing, P/N 66300120. Verify that the three button-head screws that hold the bearings in the housing are tight and that the bearing sealing ring is centered on the bearing.

4. Remove the brass shim, P/N 66100413, that is taped to the housing. Set it aside; it will be used later. Refer to **Figure 3-7**, and **Figure 3-8**.

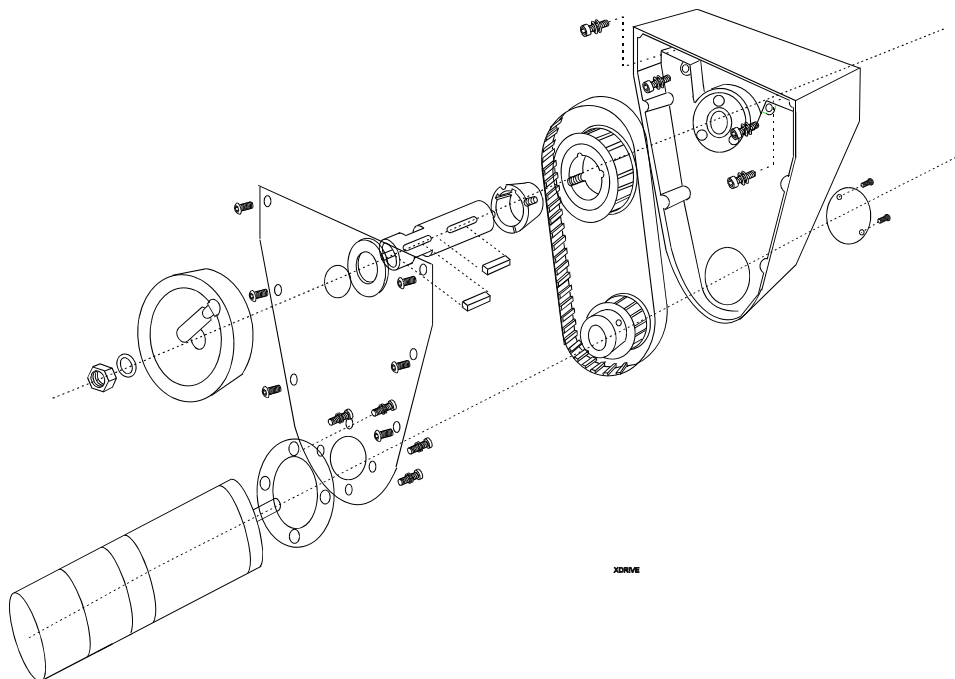


Figure 3-7, Exploded View of X-Axis Drive Assembly

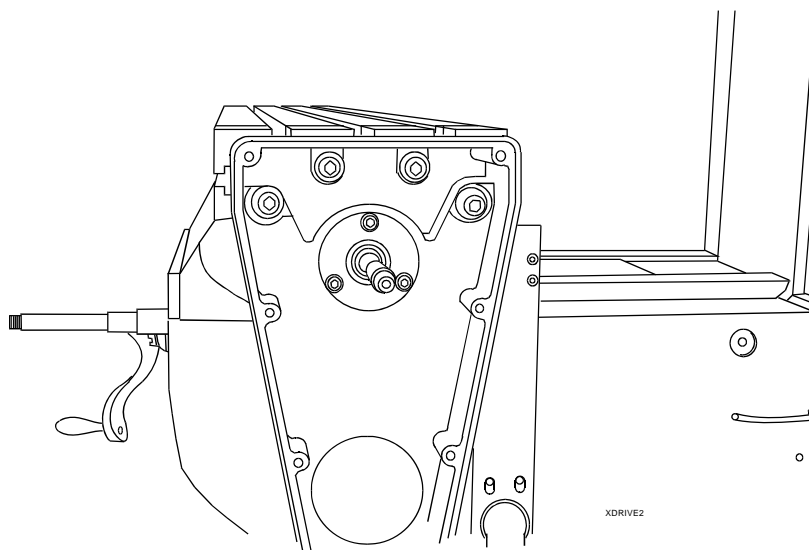


Figure 3-8, Casting Installation

5. From Bolt Kit, P/N 31500149, remove four 3/8-16 x 2-1/2" Allen screws, P/N 86100576; four lock washers, P/N 86300174; and four washers, P/N 86300203. Use this hardware to mount the X-axis drive housing on the table. Snug, but do not tighten, the screws.

6. Turn the ballscrew out until it seats in the bearings. Loosen the screws and retighten them, allowing the drive housing to center itself on the ballscrew.
7. Turn the ballscrew in (clockwise) until it comes completely off the bearings. Then, turn the ballscrew back out into the bearings. Make sure there is no deflection in the ballscrew as it is turned in and out of the bearings. Loosen the Allen screws to adjust the housing. Tap with a soft mallet until the housing is properly aligned and there is no deflection of the ballscrew as it enters the bearings.
8. To achieve proper alignment, you might need to do this several times. When no deflection occurs, tighten the Allen screws completely.
9. From the Ballscrew Hardware Kit, P/N 31500984, remove the Woodruff key, P/N 80300602. Place the key in the slot in the ballscrew.
10. Locate the sprocket adapter, P/N 66300127. Position the end of the sprocket adapter with the counterbore toward the bearings. Slide the sprocket adapter over the ballscrew to align the keyslot in the adapter with the Woodruff key in the ballscrew.
11. Seat the sprocket adapter against the bearings. Make sure the bearing sealing ring does not touch the adapter.
12. Locate the 1/2-inch washer, P/N 86300205, and the 1/2-20 hex nut, P/N 66100733. Use an adjustable wrench on the flats of the sprocket adapter to hold the ballscrew. Place the washer and nut on the end of the ballscrew and tighten to 20 ft/lb.
13. Locate the TAPER-LOCK[®] pulley, P/N 67200948, and the TAPER-LOCK[®] bushing, P/N 67200947. These parts are usually in two cardboard boxes taped together. Use the two 1/4-20 set screws packaged in the box with the bushing to assemble the pulley and bushing.
14. Locate the 3/16 square key, P/N 66600609. Place it in the sprocket adapter. Slide the TAPER-LOCK[®] pulley and bushing over the sprocket adapter and line up the key with the proper key slot in the bushing. There are two key slots in the bushing. Be sure to use the 3/16-inch wide slot.
15. Push the TAPER-LOCK[®] pulley and bushing against the bearings, then withdraw it about 1/4". This will provide clearance between the three button-head screws that secure the bearings to the housing and the TAPER-LOCK[®] pulley and bushing. Tighten the two 1/4-20 set screws alternately until both are completely tight.

X-Axis Backlash Check

Objective:

- ❑ To check X-axis backlash with a magnetic base and 0.0005-inch indicator.
- ❑ To shim between the bearings, thus reducing backlash to under 0.001”.

Tools:

Magnetic Base	3/4” Socket
0.0005” Indicator	Allen wrenches
Adjustable wrench	

Parts:

Part Number	Description
66100112	Lock Washer 1/4” Split
66100413	Spacer, 0.002 Lam Brass Shim
66100733	Hex Nuts #1/2-20
66300127	Adapter, Sprocket, Keyway, X and Y
66300149	Bearing Retainer, Drive Hsg. X and Y
66600123	Thrust Bearing, X and Y Axis
66600622	Sealing Ring, Bearing
86100517	Machine Screw, 1/4-20 x 5/8”
86300205	Flat Washer, 0.876 x 0.516 x 0.062

Procedure:

The following procedure requires parts found in Mounting Kit, P/N 32500154.

Backlash is the distance the ballscrew turns before the table starts to move. In the following procedure, backlash equals the amount of lost motion before the bearing thrust.

1. Measure the amount of backlash currently on the X axis. Set the magnetic base with the indicator attached on the right edge of the table surface. Attach the base so that the indicator tip rests against the end of the ballscrew. Set the indicator to 0. Refer to **Figure 3-9, Typical Indicator Position**.
2. Use an adjustable wrench on the flats of the sprocket adapter to rock the ballscrew back and forth slowly. If the indicator reads less than 0.001” of motion, the backlash is within acceptable limits. No adjustment is necessary.

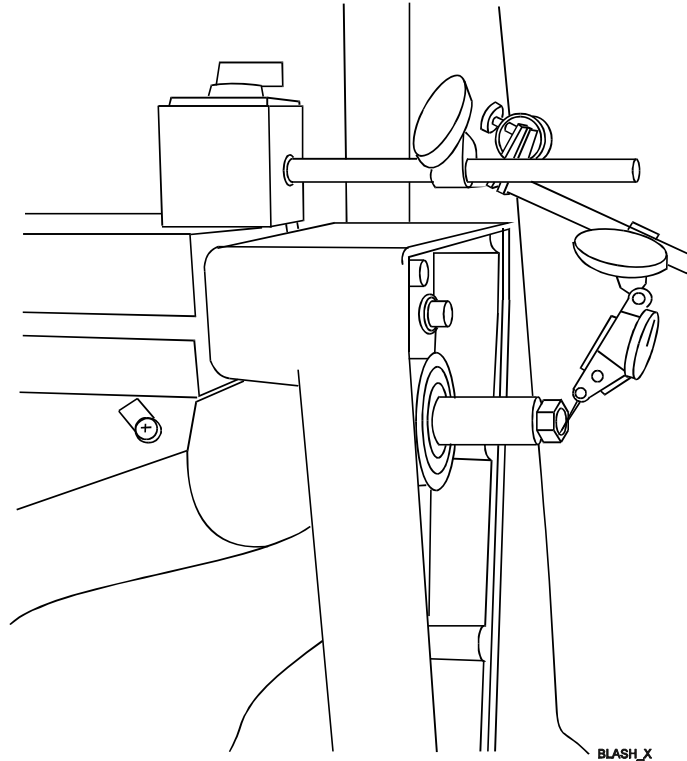


Figure 3-9, Typical Indicator Position

NOTE: If the backlash is less than 0.001", skip the following steps. Excessive preload on the bearings will cause premature bearing failure and make the ballscrew difficult to turn.

3. If the backlash is 0.001" or more, the bearings will need to be shimmed.
4. Remove the 1/2-20 nut and washer. Slide the sprocket adapter off the ballscrew with the pulley attached.
5. Remove the three 1/4-20 button-head screws and lock washers, the bearing retainer plate, and the bearing sealing ring.
6. Turn the ballscrew until the bearings come out of the housing. Do not turn the ballscrew any farther.
7. Note the orientation of the first bearing and pull it off the ballscrew shaft.
8. Locate the brass shims, P/N 66100413, that were taped to the X-drive housing. Table and saddle weight differs from machine to machine. Therefore, the amount of shim may not be in direct relation to the amount shown by the indicator. One 0.002-inch shim is usually sufficient.
9. Slide the shim and bearing back on the ballscrew. Make sure to correctly orient the bearing. Position the shim between the bearings.

NOTE: If the bearing is turned in the wrong direction, the bearings will thrust as a pair and backlash will be impossible to remove.

10. Turn the ballscrew inward (clockwise) until the bearings are seated.
11. Use the three 1/4-20 button-head screws and lock washers to replace the bearing sealing ring and the bearing retainer plate. Make sure the bearing sealing ring is centered before you tighten the screws.
12. Slide the sprocket adapter onto the shaft as an alignment guide. Tighten each screw incrementally to prevent binding the bearings.
13. Slide the sprocket adapter onto the ballscrew and tighten with the 1/2-20 nut and washer. Tighten only to 20 ft/lb. Do not over-tighten.
14. Measure the backlash on the axis again. Verify that it is less than 0.001". If not, add another shim and check again.

NOTE: Do not over-shim the bearings. Some indicator movement is always present, so a **0** reading cannot be attained. The ideal indicator reading is **0.0003"** to **0.0005"**.

X-Axis Motor Installation

Objective:

- ❑ To install the X-axis drive motor and drive belt.
- ❑ To install the felt washer, housing cover, handwheel, and access cover in order to complete the X-axis drive housing.
- ❑ To replace the bearing in the left-side bearing cap and install a cover.

Tools:

Metric Allen wrenches	6-inch Scale
SAE Allen wrenches	Soft mallet

Parts:

Part Number	Description
66100716	Set Screw 10-32 x 1/4"
66100718	Machine Screw, 8mm x 25mm
66300122	X-Axis Drive Housing Cover
66300124	Cover Drive Housing X-Axis Motor.
66300126	Drive Motor Adapter
66300133	Ballscrew End Cover, X Axis
66300158	Machine Sprocket, X and Y Motor.
66600113	Radial Bearing, 6204ZZ
66600609	Steel Key (Woodruff) 3/16" Square X
67200188	Handwheel, Machine X and Y Axis
67200305	Timing Belt, X Axis
86100197	Machine Screw, 8-32 x 3/8"
86100358	Set Screw, 10-32 x 3/8"
86100499	Button-Head Screw, 1/ 4-20 x 3/8"
86100510	Machine Screw, 1/4-20 x 1/2"
86300124	Lock Washer, 8 mm
86300201	Flat Washer, 8 mm
86600293	Felt Washer, 1" x 1.75"

Procedure:

Use hardware kits, P/Ns 3200154 and 32500035, to install the X-axis motor.

1. Locate the X-axis motor with cable attached, P/N 37000231, and the X-axis motor pulley, P/N 66300158.

2. Make sure the pulley slides freely on the motor shaft. The pulley should have two preinstalled set screws in it. Refer to **Figure 3-10**.

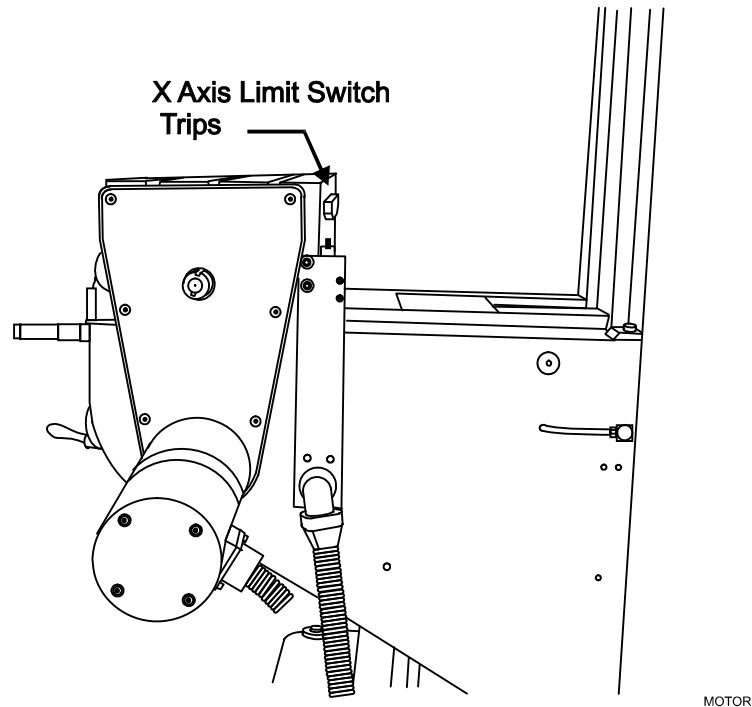


Figure 3-10, X-Axis Motor Housing

3. Locate the housing cover, P/N 66300122; motor adapter, P/N 66300126; four 8-mm Allen screws, P/N 66100718; 8-mm lock washers, P/N 86300124; and 8-mm washers, P/N 86300201.
4. To assemble the motor, perform the following steps:
 - ❑ Put the motor adapter on the motor and align the four holes on the motor adapter with the tapped holes in the motor.
 - ❑ Align the housing cover to the motor so that when the motor and cover are properly installed on the machine, the electrical cannon connector is at the 5-o'clock position.
 - ❑ Use the four 8-mm Allen screws, lock washers, and washers to snug the housing cover to the motor. Slide the pulley onto the motor shaft.
5. At the machine, use a scale to measure the distance from the sprocket adapter pulley to the step where the housing cover will fit. Set that same distance between the motor pulley and housing cover. Tighten the two set screws securely in the motor pulley.
6. Locate the felt washer, P/N 86600293, and slide it onto the sprocket adapter. The felt washer helps to keep chips and coolant out of the drive housing. Leave it on the end of the sprocket adapter. When installed, it will rest against the inside of the housing cover.

7. Locate the X-axis drive belt, P/N 67200305. Drape the belt over the pulley on the sprocket adapter.
8. Slide the motor up in the mounting slots of the housing cover and carry the unit to the machine.
9. Use the six 1/4-20 button-head screws to attach the housing cover to the drive housing.
10. Push down on the motor. This will exert tension on the belt. Turn the ballscrew to verify that the belt is seated in both pulleys.
11. Locate the motor access hole in the back of the drive housing. Use it to access and tighten the four 8-mm Allen screws that hold the motor to the housing cover. Do not put too much tension on the belt. (The belt should be tight but not so tight that it puts a strain on the drive motor shaft.)
12. Locate the motor access hole cover plate, P/N 66300124, and the two 8-32 x 3/8-inch button-head screws, P/N 86100197. Use the two 8-32 button-head screws to attach the cover plate to the motor access hole of the drive housing.
13. Install the handwheel as follows:
 - Locate the handwheel, P/N 67200188; the 3/16" key, P/N 66600609; the 10-32 x 1/4-inch set screw, P/N 66100716; and the 10-32 x 3/8-inch set screw, P/N 86100358.
 - Place the key in the slot on the sprocket adapter. Slide the handwheel onto the sprocket adapter, aligning the key slot in the handwheel with the key in the sprocket adapter. The 10-32 x 3/8-inch set screw should tighten against the wrench flat in the sprocket adapter. The 10-32 x 1/4-inch set screw goes into the remaining tapped hole. Do not over-tighten.
14. Locate the bearing cap, removed earlier, from the left side of the table. Remove the two bearings from the cap. Locate the bearing, P/N 66600113, supplied with the kit and tap the new bearing into the bearing cap. Refer to **Figure 3-11, Bearing Cap Installation**.

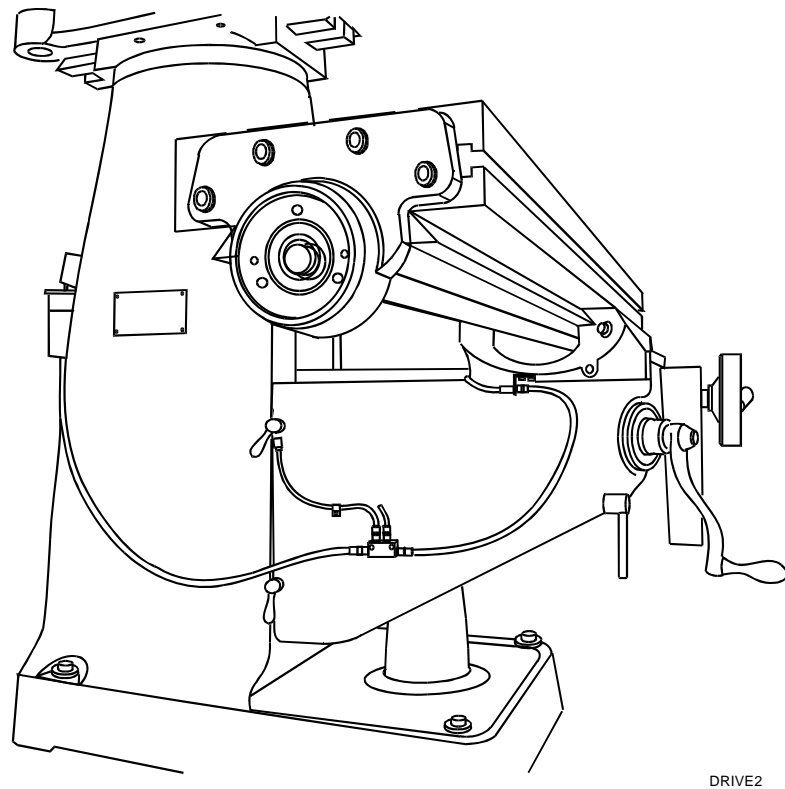
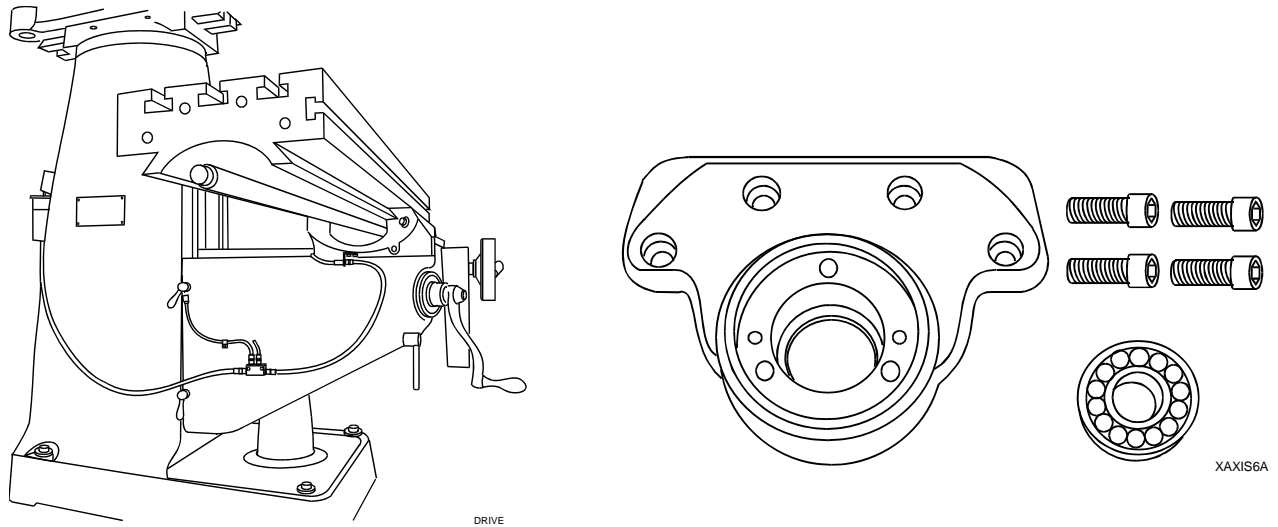


Figure 3-11, Bearing Cap Installation

15. Snug the original four 3/8-16 Allen screws, removed earlier, to mount the bearing cap to the left side of the table. Do not tighten the Allen screws completely. Use the handwheel to move the table until the left side of the table is even with the saddle. Allow the bearing cap to align itself with the ballscrew. Tighten the Allen screws completely. (Make sure there are no pins in the bearing cap or the table.)

16. Locate the cover plate, P/N 66300133, and the three 1/4-20 x 3/8" button-head screws, P/N 86100499. The holes in the cover plate should match the holes in the bearing cap. Use the three button-head screws to attach the cover plate to the bearing cap.
17. On certain machines, you may need to mark, drill, and tap new hole locations. Refer to **Figure 3-12**.

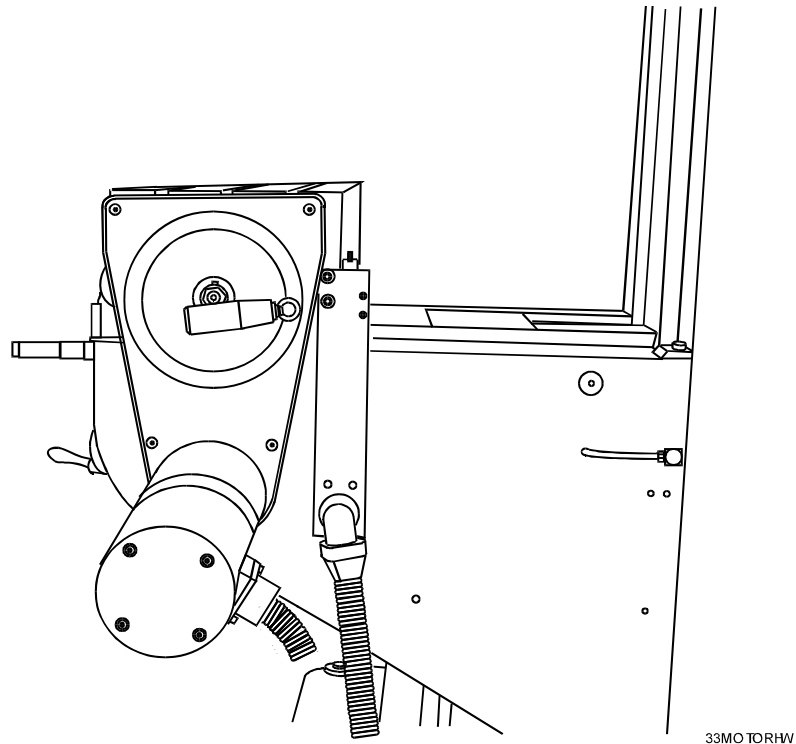


Figure 3-12, X-Axis Motor Drive Installation

Y-Axis Drive Housing Installation

Objective:

- To install the Y-axis drive housing on the front of the machine and center the housing on the ballscrew.
- To install the sprocket adapter and the TAPER-LOCK® pulley.

Tools:

Allen wrenches	3/4" Socket
Adjustable wrench	6-inch Scale

Parts:

Part Number	Description
66100413	0.002 Lam. Brass Shim
66100728	Machine Screw, 3/8-16 x 1-1/4"
66100733	Hex Nut, 1/2-20
66300127	Keyway Sprocket Adapter
66300210	Drive Housing, PTD Univ. Y Axis
66600609	Steel Key (Woodruff) 3/16 Sq.
67200947	TAPER-LOCK® Bushing 1108 x 1"
67200948	TAPER-LOCK® Pulley
80300602	#406 Woodruff Key
86300174	Lock Washer, 3/8"
86300203	Flat Washer, 3/8 x 0.88 x 1/8
86300205	Flat Washer 0.876 x 5/16 x 0.062

Procedure:

Use the Y-Axis Drive Housing Hardware Kit, P/N 32500155, to install the Y-axis drive housing, P/N 66300210; sprocket adapter, P/N 66300127; and TAPER-LOCK® Pulley, P/N 67200948. Bolt kits, P/Ns 31500148 and 32500036, are shipped with the Y-Axis Drive Housing Hardware Kit.

1. Move the table so that it is flush with the front of the knee (farthest from the column).
2. Turn the ballscrew until approximately 4 inches of the screw protrudes in front of the machine.
3. Locate the Y-axis drive housing, P/N 66300210. Ensure that the three 1/4-20 button-head screws holding the bearings in the housing are tight and that the bearing sealing ring is centered on the bearing.
4. Remove the brass shim, P/N 66100413, taped to the housing, and set it aside; you will use it later.

5. From Bolt Kit, P/N 31500148, remove four 3/8-16 x 1-1/4-inch Allen screws, P/N 66100728; four lock washers, P/N 86300174; and four washers, P/N 86300203. Use this hardware to mount the Y-axis drive housing on the front of the machine. Snug, but do not tighten, the screws.
6. Turn the ballscrew outward (clockwise) until it seats in the bearings. Loosen the screws and retighten them to allow the drive housing to center itself on the ballscrew.
7. Turn the ballscrew until it comes completely off the bearings. Then, turn the ballscrew back out into the bearings. Make sure there is no deflection of the ballscrew as you turn it in and out of the bearings.
8. To adjust the housing, tap it until it is properly aligned. You might need to do this several times to achieve proper alignment. When no deflection occurs, tighten the Allen screws completely.
9. If there is no Woodruff key preinstalled in the ballscrew, find the Woodruff key, P/N 80300602 in the Ballscrew Hardware Kit, P/N 31500984. Place the key in the slot in the ballscrew.
10. Locate the sprocket adapter, P/N 66300127. Position the end of the sprocket adapter with the counterbore toward the bearings. Slide the sprocket adapter over the ballscrew, aligning the key slot in the adapter with the Woodruff key in the ballscrew.
11. Seat the sprocket adapter against the bearing. Make sure the bearing sealing ring does not touch the sprocket adapter. Refer to **Figure 3-13**.

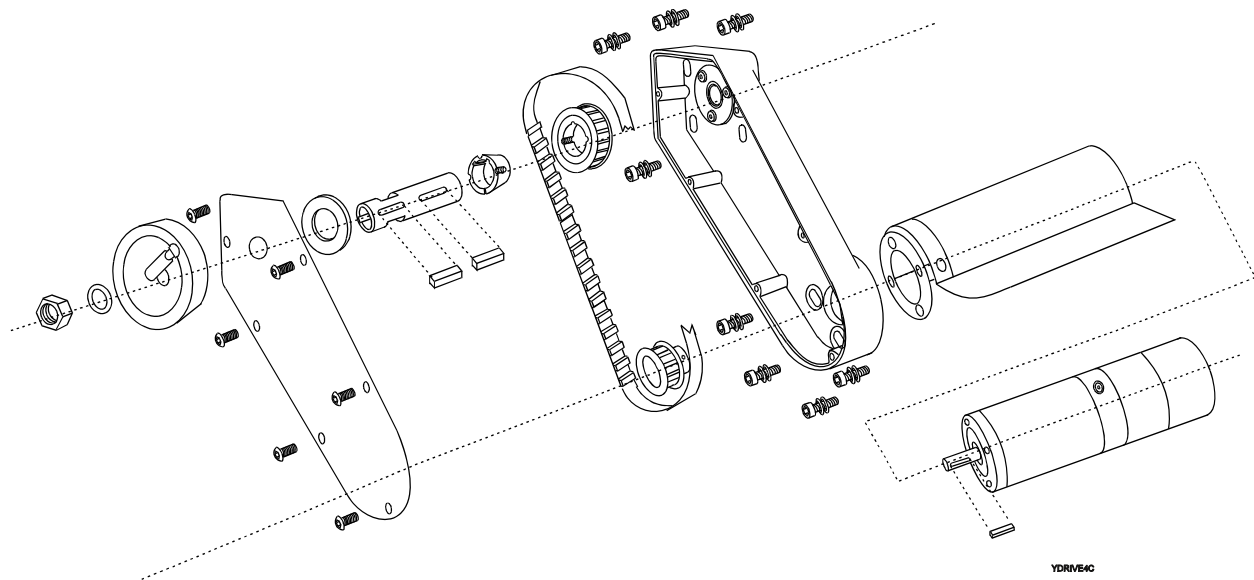
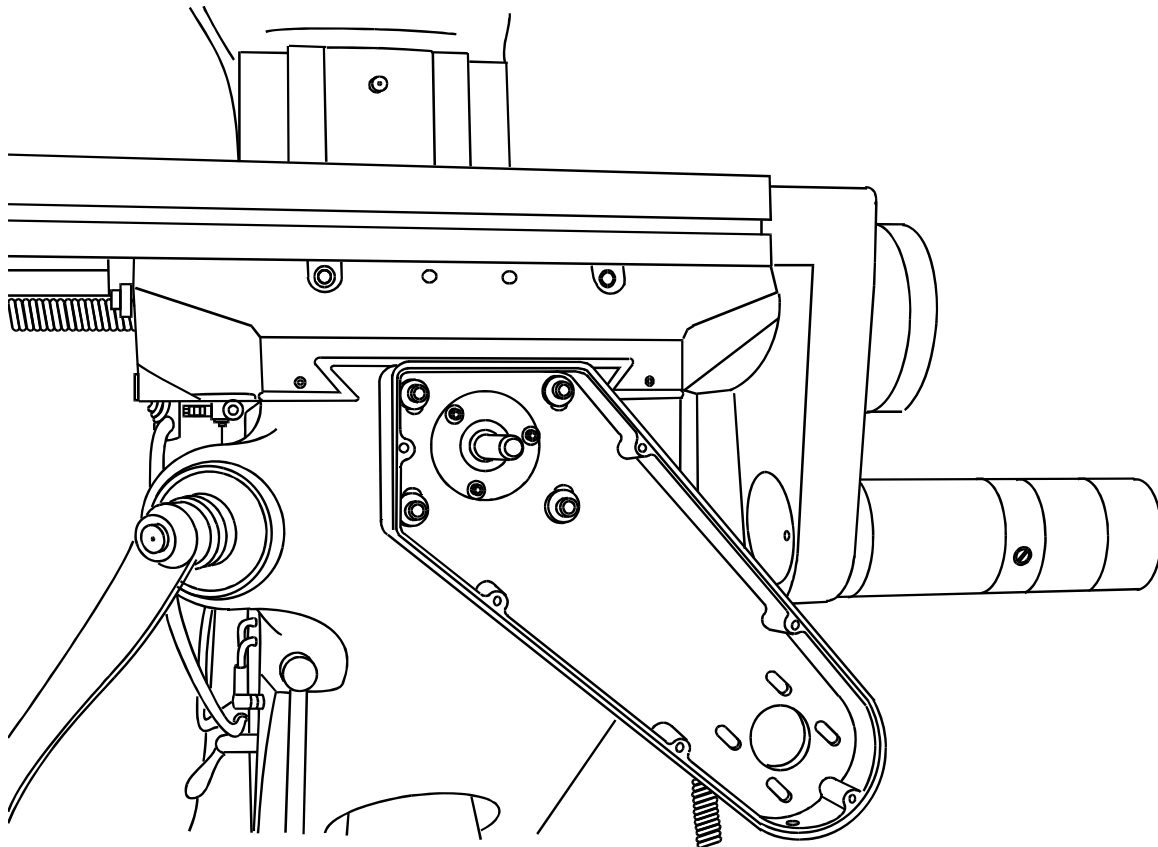


Figure 3-13, Exploded View of Y-Drive Housing

12. Locate the 1/2-inch washer, P/N 86300205, and the 1/2-20 hex nut, P/N 66100733. Use an adjustable wrench on the flats of the sprocket adapter to hold the ballscrew. Place the washer and nut on the end of the ballscrew and tighten to 20 ft/lb.
13. Locate the TAPER-LOCK[®] pulley, P/N 67200948, and the TAPER-LOCK[®] bushing, P/N 67200947. These parts are usually taped together inside two cardboard boxes. Use the two 1/4-20 set screws in the box with the bushing to assemble the pulley and bushing.
14. Locate the 3/16-inch square key, P/N 66600609, in Bolt Kit, P/N 32500036. Place it in the sprocket adapter. Slide the TAPER-LOCK[®] pulley and bushing over the sprocket adapter and line up the key with the proper key slot in the bushing. There are two key slots in the TAPER-LOCK[®] bushing. Make sure to use the proper one.
15. Push the TAPER-LOCK[®] pulley and bushing against the bearings and then withdraw it 1/4 inch. This will provide clearance between the three button-head screws that mount the bearings to the housing and the TAPER-LOCK[®] pulley and bushing. Alternately tighten the two 1/4-20 set screws. Refer to **Figure 3-14**.



YDRIVE

Figure 3-14, Y-Drive Casting Installation

Y-Axis Backlash Check

Objective:

- ❑ To check the backlash of the Y axis with a magnetic base and 0.0005" indicator.
- ❑ To shim the bearings to reduce backlash to under 0.001".

Tools:

Magnetic Base	3/4" Socket
0.0005" Indicator	Allen wrenches
Adjustable wrench	

Parts:

Part Number	Description
66100112	Lock Washer, 1/4 Split
66100413	0.002 Lam. Brass Shim
66100733	Hex Nut, 1/2-20
66300127	Keyway Sprocket Adapter
66300149	Bearing Retainer, Dr, Hsg. X/Y
66600123	Thrust Bearing, X and Y Axis
66600622	Bearing Sealing Ring
86100517	Machine Screw, 1/4-20 x 5/8"
86300205	Flat Washer, 0.876 x 5/16 x 0.062

Procedure:

This procedure requires parts found in Mounting Kit, P/N 32500155, and bolt kit, P/N 32500036.

Backlash is the distance the screw turns before the table starts to move. For purposes of this procedure, backlash equals the amount of lost motion before the bearings thrust.

1. Measure the amount of backlash currently on the Y axis. Set the magnetic base with the indicator attached on the right side of the knee way surface. Attach the base so that the indicator tip rests against the end of the ballscrew. Set the indicator to **0**.
2. Use an adjustable wrench on the flats of the sprocket adapter to rock the ballscrew back and forth slowly. If the indicator reads less than 0.001" of motion, the backlash is within acceptable limits. No adjustment is necessary.

IMPORTANT: Excessive pre-load on the bearings will cause premature bearing failure and make the ballscrew difficult to turn. If the backlash is 0.001" or more, you will need to shim the bearings. If the backlash is less than 0.001", skip the following steps.

CAUTION: Push the saddle all the way to the front of the knee (farthest from the column) so that the ballscrew will not come out of the ball nut. If you turn the ballscrew out of the ball nut, the ballscrew cannot be used and must be replaced.

3. Remove the 1/2-20 nut and washer. Slide the sprocket adapter off the ballscrew with the pulley attached.
4. Remove the three 1/4-20 button-head screws and lock washers, the bearing retainer plate, and the bearing sealing ring.
5. Turn the ballscrew until the bearings, P/N 66600123, come out of the housing. Do not turn the ballscrew any farther.
6. Note the orientation of the first bearing and pull it off the ballscrew shaft.
7. Locate the brass shims, P/N 66100413, taped to the Y-drive housing. Weight of table and saddle differ from machine to machine. Therefore, the amount of shim may not be in direct relation to the amount shown by the indicator. One 0.002-inch shim is usually sufficient.
8. Slide the shim and bearing back on the ballscrew. Make sure you orient the bearing correctly. Position the shim between the bearings.

NOTE: If the bearing is turned the wrong way, the bearings will thrust as a pair, and backlash will be impossible to remove.

9. Turn the ballscrew inward (clockwise) until the bearings are seated.
10. Use the three 1/4-20 button-head screws and lock washers to replace the bearing sealing ring and the bearing retainer plate. Make sure the bearing sealing ring is centered before you tighten the screws.
11. Slide the sprocket adapter onto the shaft as an alignment guide. Tighten each screw incrementally to prevent binding the bearings.
12. Use the 1/2-20 nut and washer to slide the sprocket adapter on the ballscrew and tighten. Tighten to 20 ft/lb. Do not over-tighten.
13. Measure the backlash on the axis again. Verify that it is less than 0.001". If not, add another shim and check again.

NOTE: Do not over-shim the bearings. Some indicator movement will always be present; a 0 reading cannot be attained. The ideal indicator reading is **0.0003"** to **0.0005"**.

Y-Axis Motor Installation

Objective:

- To install the Y-axis drive motor and drive belt.
- To put on the felt washer, housing cover and handwheel in order to complete the Y-axis drive housing installation.

Tools:

Metric Allen wrenches	6-inch Scale
SAE Allen wrenches	

Parts:

Part Number	Description
21500842 and 21500844	Motor Splash Guard Parts
37000232	Y-Axis Drive Motor
66100716	Set Screw, 10-32 x 1/4"
66100718	Machine Screw, 8 mm x 25 mm
66300158	Pulley, X and Y motor
66300211	Drive Housing Cover, Y Axis
66600609	Steel Stock Key 3/16"
67200188	Machine Handwheel, X and Y Axis
67201292	Timing Belt, Y Axis
86100358	Set Screw, 10-32 x 3/8"
86100510	Machine Screw, 1/4-20 x 1/2"
86300124	Lock Washer, 8 mm
86300201	Flat Washer, 8 mm
86600293	Felt Washer, 1" x 1.75"

Procedure:

This procedure requires parts found in Mounting Kit, P/N 32500155, and Bolt Kit, P/N 32500036.

1. Locate the Y-axis drive motor, P/N 37000232. Locate the Y-axis motor pulley, P/N 66300158. Make sure the pulley slides freely on the motor shaft. The pulley should have two factory-installed set screws in it.
2. Assemble the motor as follows:
 - Stand the motor on end, with the electrical cable at the 5-o'clock position.
 - Place the splashguard, P/N 21500842, over the motor with the upturned portion of the splashguard against the cable.
 - Rotate the splashguard until the holes in the splashguard line up with the tapped holes in the motor.

3. Carry the motor and splashguard to the machine. Insert the motor shaft through the access hole in the rear of the Y-axis drive housing. The cable should be at the 5-o'clock position, with the turned up portion of the splashguard over it. Attach the motor and splashguard to the Y-axis drive housing with the four 8-mm Allen screws, P/N 66100718; four 8-mm lock washers, P/N 86300124; and four 8-mm washers, P/N 86300201. Refer to **Figure 3-15**.

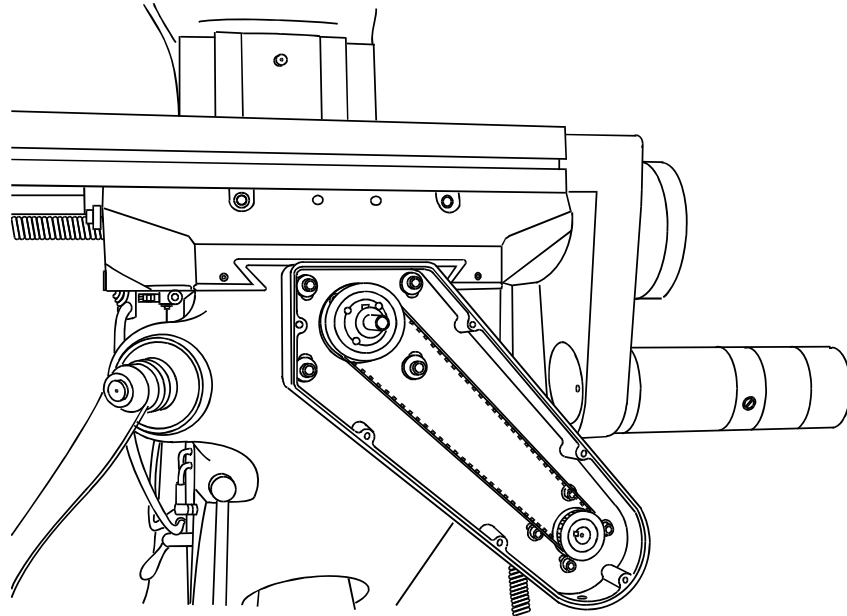
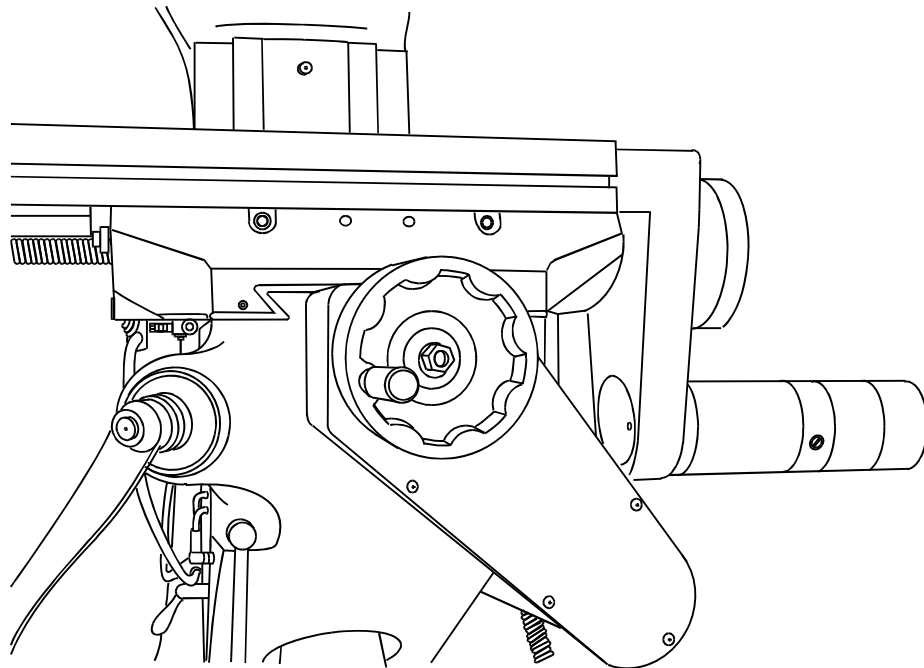


Figure 3-15, Y-Axis Drive Motor and Belt Installation

4. At the machine, measure the distance between the sprocket adapter pulley, P/N 6300158, and the back of the Y-drive housing. Slide the motor pulley to match this distance. Tighten securely the two set screws in the motor pulley.
5. Locate the Y-axis drive belt, P/N 67201292. Slide the motor up into the mounting slots and drape the drive belt over both pulleys.
6. Push down on the motor to exert tension on the belt. Turn the ballscrew to verify that the belt is seated in the pulleys. Push down on the motor and tighten the four 8-mm Allen screws that hold the motor to the drive housing.
7. Do not put too much tension on the belt. (The belt should be tight but not tight enough to cause a strain on the drive motor shaft.)
8. Locate the felt washer, P/N 86600293, and slide it onto the sprocket adapter. The felt washer helps to keep chips and coolant out of the drive housing. Leave the felt washer on the end of the sprocket adapter. It will rest against the inside of the housing cover when the cover is installed.

9. Locate the Y-axis housing cover, P/N 66300211, and the six 1/4-20 button-head screws, P/N 86100510. Use the six button-head screws to attach the housing cover to the drive.
10. Install the handwheel. Locate the handwheel, P/N 67200188; the 3/16 square key, P/N 66600609; the 10-32 x 1/4-inch set screw, P/N 66100716; and the 10-32 x 3/8-inch set screw, P/N 86100358.
11. Place the key in the slot in the sprocket adapter. Slide the handwheel onto the sprocket adapter, aligning the key slot in the handwheel with the key in the sprocket adapter. The 10-32 x 3/8-inch set screw should tighten against the wrench flat in the sprocket adapter. The 10-32 x 1/4-inch set screw goes into the remaining tapped hole. Do not over-tighten. Refer to **Figure 3-16**.



YDRIVE3

Figure 3-16, Y-Axis Motor Drive Installation

X- and Y-Axis Limit Switch Trips Installation

Objective:

- To set hardware limits on the maximum range of travel for the X and Y axes. When the limit switch is tripped, power to the motors drops out to prevent an axis from hitting solidly against a dead stop.

Tools:

Center Punch Hammer	10-32 Tap
#21 Drill	

Parts:

Part Number	Description
67200317	Limit Switch Trip, X Axis
67200318	Limit Switch Trip, Y Axis
86100303	Machine Screw, 10-32 x 5/8"
86300160	Flat Washer, #10 SAE

Procedure:

This procedure requires parts found in the Limit Switch Kit, P/N 32500045.

1. Replace any way covers that were taken off previously.
2. Locate Hardware Kit, P/N 32500045, attached to the limit switch bracket. Locate two X-axis limit switch trips, P/N 67200317; two Y-axis limit switch trips, P/N 67200318; eight 10-32 x 5/8" Allen screws, P/N 86100303; and eight #10 SAE flat washers, P/N 86300160. Trip surfaces are on the bottom of X-axis trips and on the side of the Y-axis trips.
3. Refer to **Figure 3-17, X-Axis Limit Switch Trip Installation**. Install the X-axis trips. Turn the X-axis handwheel until the table edge is flush with the right side of the saddle.

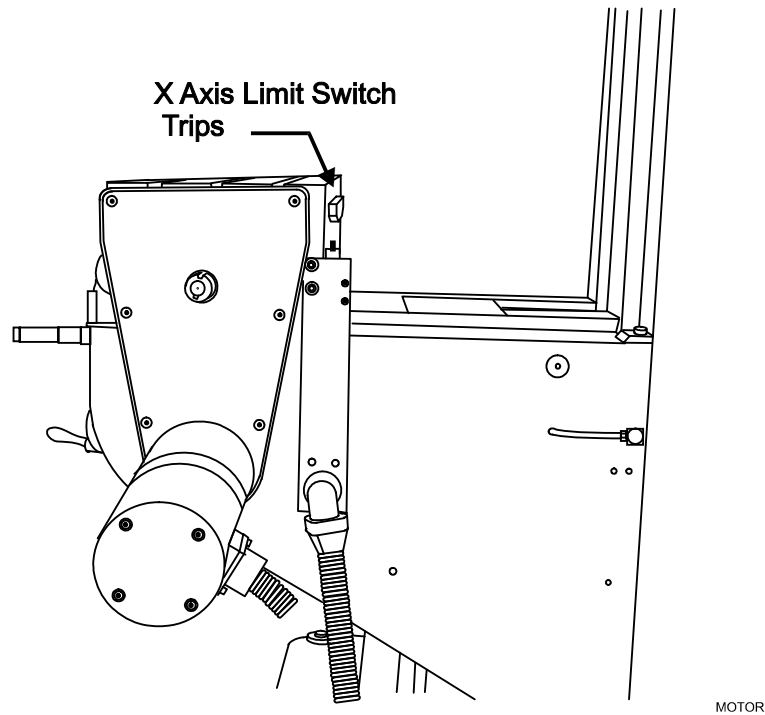


Figure 3-17, X-Axis Limit Switch Trip Installation

4. Hold one of the X-axis trips against the back of the table over the limit switch plunger. Push down 1/8" (half the plunger travel). Make sure the trip is level. Use a pencil to draw a line in the mounting slot.

NOTE: There is usually more travel before hitting a dead stop. You can mount the limit trip so that about 1/3 of the trip protrudes from the right edge of the table.

5. Turn the X-axis handwheel until the table is flush with the left side of the saddle. (This is not dead stop. More travel is available; however, the ways of the X axis would be exposed to chips and coolant.)
6. Hold the remaining X-axis trip against the back of the table, over the limit-switch plunger. Push down about 1/8" (half the plunger travel). Make sure the trip is level. Use a pencil to draw a line in the mounting slot.
7. To install the Y-axis trips, refer to **Figure 3-18, Y-Axis Limit Switch Trip Installation**. Turn the Y-axis handwheel so that the saddle is as far from the column as possible.

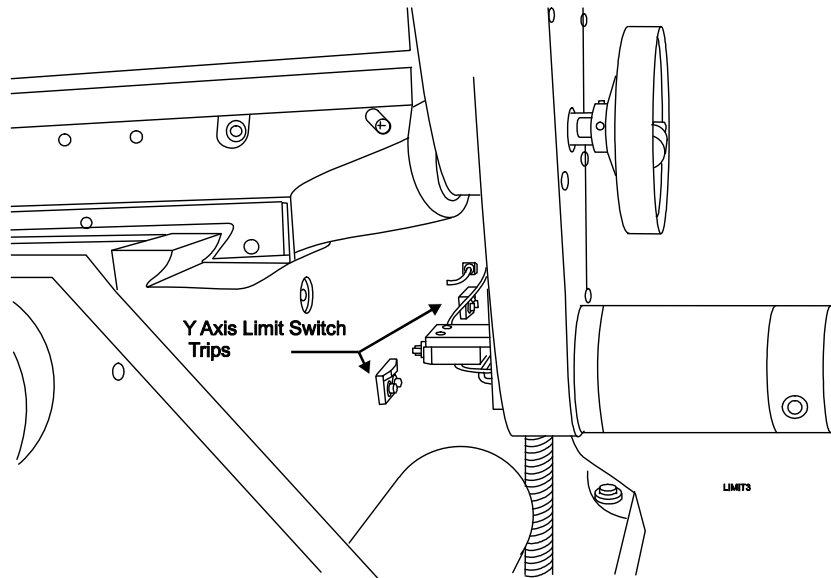


Figure 3-18, Y-Axis Limit Switch Trip Installation

8. Continue slowly turning the handwheel until you reach the extreme end of the Y-axis positive range of travel (dead stop). Turn the handwheel two revolutions to move the Y axis toward the column (negative Y). This provides 0.400-inch clearance from dead stop.
9. Hold one of the Y-axis trips with the trip surface to the top. Slide the trip along the knee until it moves the limit switch plunger in about 1/8" (half the plunger travel). The limit switch may be moved on the bracket to achieve the proper distance. Make sure the trip is level. Use a pencil to draw a line in the mounting slot.
10. Turn the Y-axis handwheel in a negative direction until the saddle is as close to the column as possible. Turn the handwheel slowly until the axis is at its extreme end of travel (dead stop). From the dead-stop limit, move the handwheel two revolutions in the positive Y direction (the saddle moves away from the column). This provides a 0.400-inch clearance from dead stop.
11. Orient the remaining Y-axis trip so that the trip surface faces upward. Slide the trip from the back, along the knee, until it moves the limit switch plunger in about 1/8" (half the plunger travel). Make sure the trip is level. Use a pencil to draw a line in the mounting slot.
12. Center-punch two places at each of the points marked with a pencil. You will insert two 10-32 Allen screws and washers at each point.
13. Drill and tap 10-32 x 0.75-inches deep in all punched locations.
14. Use 10-32 Allen screws and washers to attach the limit trips to the table and knee.
15. Turn the X and Y handwheels to verify the clearances.

Preparing the Z Axis

3300MK

Objective:

- To disassemble and disable the down-feed mechanism of the manual mill.

Tools:

#7 Drill	SAE and Metric Allen Wrenches
1/4-20 Tap	

Parts:

Part Number	Description
31500690	Quill Drive Mounting Kit
31500969	Quill Drive Mounting Kit
31500968	Z-Axis Hardware Kit
67200268	Quill Feed Replacement Lever
67200703	Set Screw 8-32 x 3/16"
67201296	Clutch Cover
86100207	Set Screw 18-32 x 1/2"
86100298	Button-Head Screw 10-24 x 3/8"
86200191	Hex Nut #1/2 x 3

Procedure:

1. Locate Quill Drive Mounting Kit, P/N 31500969, and Quill Drive Mounting Kit, P/N 31500690.
2. Remove the feed gear cover cup (clutch cover), P/N 67210296, from the left side of the head. Remove the gear, arm, spring, and pin. Cover the hole with the clutch cover, using the two 10-24 x 3/8-inch button-head screws, P/N 86100298 from the Z-Axis Hardware Kit. Refer to **Figure 3-19, Parts Removal Diagram**.

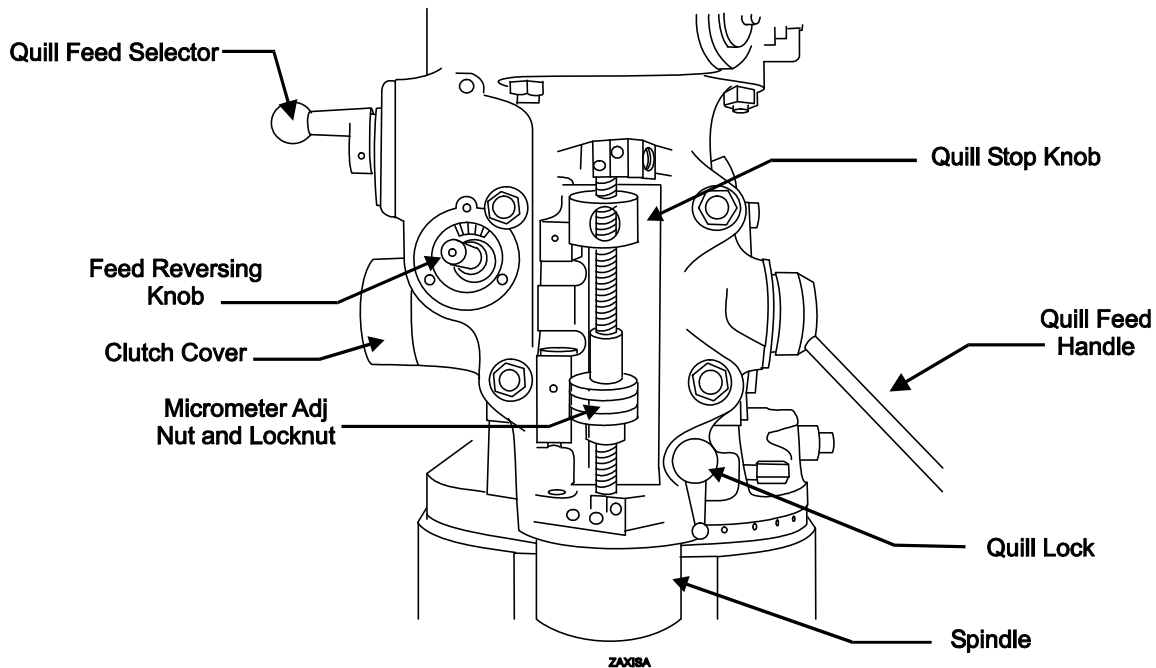


Figure 3-19, Parts Removal Diagram

3. To remove the gear engagement lever from the left front of the head, remove the key, set screw, two Allen screws, and one ball bearing. Slide the lever assembly off the shaft. Remove the gear. Set aside one of the Allen screws. It will be used to attach the cover plate.
4. Remove the measuring scale.
5. Remove the screw, plunger pin, and small lever in the lower flange on the front of the head.
6. Remove the screw, pivot pin, and pin in the upper flange.
7. Remove the snap-ring from the bottom of the feed stop screw.
8. Screw the feed stop off the top of the feed stop screw. Remove the feed stop screw from the bottom.
9. On the front of the head there are four 1/2-13 tram nuts. Replace the nuts, one at a time, with the #1/2 x 3 hex nuts, P/N 86200191, provided.
10. Locate the Engage/Disengage lever on the upper right side of the head. Move the lever to the Disengage (or Out) position. Remove the spring pin and lever.
11. The stub is held in the Disengaged position with the block, P/N 67200268. Locate the block and two 8-32 x 3/16-inch set screws, P/N 66100703, and the 8-32 x 1/2-inch set screw, P/N 86100207. Make sure the stub is in the Disengaged position and position the hole in the block over the stub.

12. Screw the 8-32 x 1/2-inch set screw into the detent on the machine to prevent the block from moving. Use the two 8-32 x 3/16-inch set screws to lock the stub and the set screw into place.
13. Locate the feed selector on the left side of the head for the quill downfeed. Remove the spring pin and lever.
14. Snug the quill lock to prevent the quill from dropping.
15. Remove the Allen screw and quill block from the quill. Refer to **Figure 3-20**.

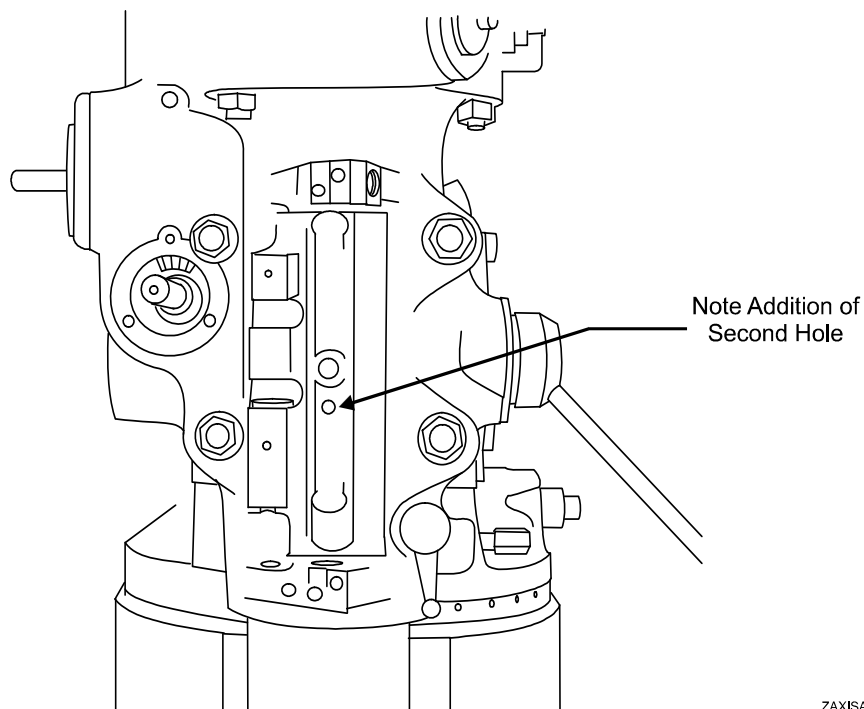


Figure 3-20, Z Axis Prepared for Installation

Quill Drive Block Installation

Objective:

- To mount the quill drive block on the quill.
- To drill and tap an additional hole in the quill.

Tools:

Allen wrenches	#7 Drill
Spanner wrench	1/4-20 Tap
Hammer	Thread-locking compound
Transfer punches	

Parts:

Part Number	Description
67200454	Drive Block/Key
67201137	Ball Nut, Extended Mounting
86100492	Machine Screw, 1/4-20 x 2-1/4" Soc Cap
86100504	Machine Screw, 1/4-20 x 3/4" Hex Soc
86100577	Machine Screw, 3/8-24 x 1-3/4" Hex Soc
86300179	Lock Washer, #3/8 Helical High Collar

Procedure:

NOTE: The following procedure requires you to tap and drill the quill. Take great care. The quill is part of the machine and is not easy to replace.

NOTE: You must remove the spindle before you drill into the quill.

1. Remove the spindle. Keep the quill lock snug to prevent the quill from coming out of the machine. Refer to **Figure 3-21, Z Axis Exploded View**. In the Z-Axis Hardware Kit, P/N 31500690, locate the quill drive block P/N 67201137; the drive block key, P/N 67200454; the 3/8-24 x 1-3/4-inch Allen screw, P/N 86100577; and the 3/8-inch lock washer, P/N 86300179.

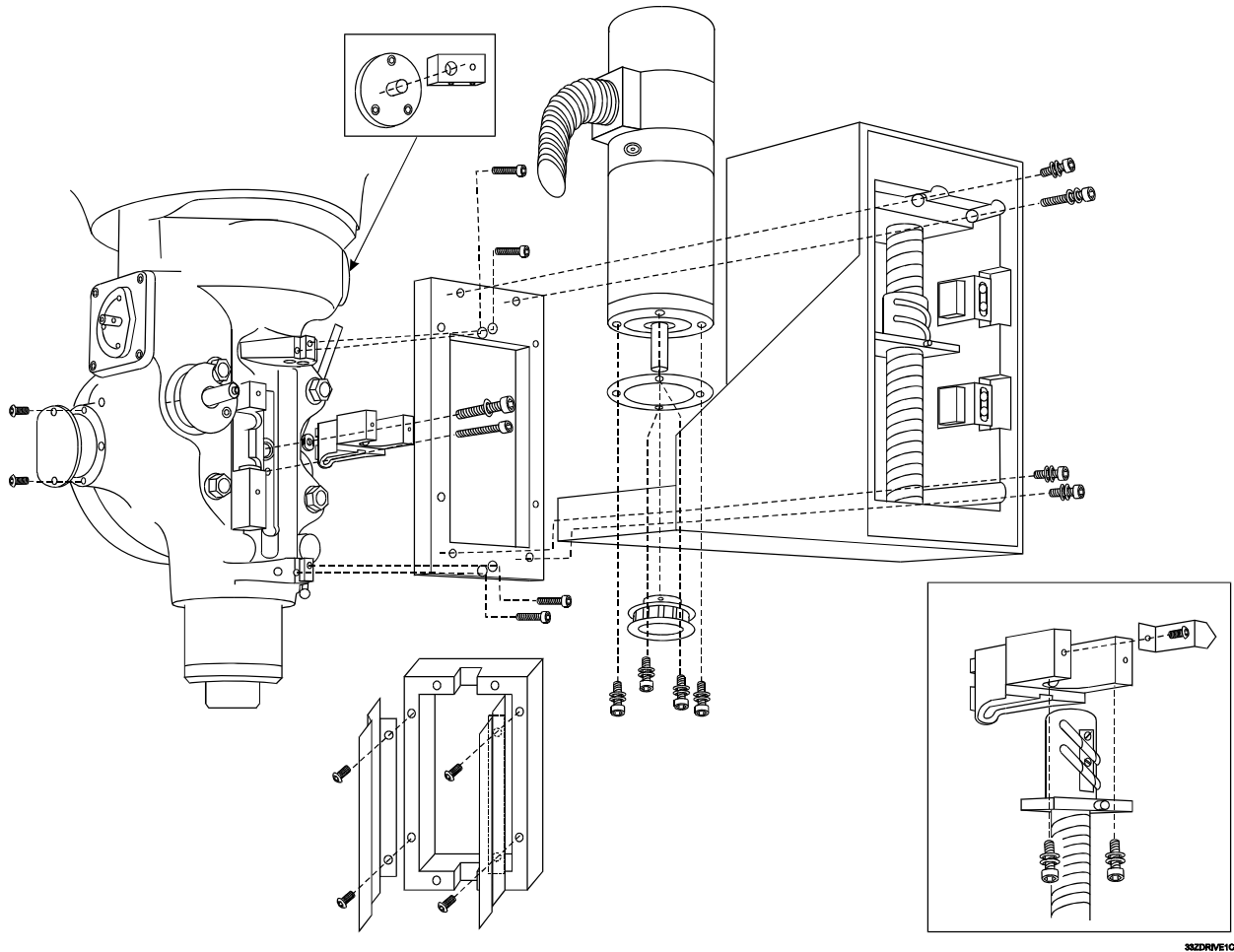


Figure 3-21, Z Axis Exploded View

2. Insert the drive key into the bottom of the drive block. You may need to remove a small amount of material from the flat surfaces of the key to achieve maximal snugness.

CAUTION: Ensure that the two quill-block-mounting screws do not protrude into the quill cavity. It will be impossible to remove or replace the spindle if they do. Grind the screws to better lengths, if necessary.

3. Bolt the drive block and key to the quill with the extension (or foot) down. The radius on the bottom of the drive block must be against the radius of the quill.
4. The drive key will be in the drive block and the counterbore of the quill. It should not be so thick as to prevent the two surfaces from seating. The depth of the counterbore varies from machine to machine. You may need to file or grind the key to the correct size.

5. Loosen the quill lock. Use the quill handle to run the quill up and down the entire Z-axis range of travel (dead stop to dead stop). The drive block should travel freely in the slot.
6. Bring the drive block to the top of the slot. The top of the drive block must be parallel to the top flange of the machine. If necessary, loosen the quill bolt and adjust the drive block.
7. Transfer-punch the quill at the bottom hole of the drive block.
8. Snug the quill lock and remove the drive block and key.
9. Drill and tap 1/4-20 through the quill.
10. Clear the inside and outside of the quill of any chips. Ensure that the screws holding the quill block to the quill do not protrude into the bore. If they do, the spindle cannot be reinstalled. Replace the spindle.
11. Locate one 1/4-20 x 3/4-inch Allen screw, P/N 86100504.
12. Use a thread-locking compound on the threads of the 3/8-24 x 1-3/4-inch Allen screw and the socket cap, 1/4-20 x 3/4-inch Allen screw, P/N 86100504.
13. Use the 3/8-24 Allen screw and lock washer and the 1/4-20 x 3/4-inch Allen screw to attach the drive block and key to the quill.
14. Bring the drive block to the top of the slot. Verify that the top of the drive block is parallel to the top flange of the machine. Tighten the drive block completely.

Z-Axis Mounting Plate Installation

Objective:

- To attach the mounting plate to the front flanges of the machine.
- To use an indicator to align the front plate surface parallel to the quill's direction of travel.

Tools:

0.0005" Indicator	Transfer punches
Magnetic base	Allen wrenches
Hammer	

Parts:

Part Number	Description
67200020	Cover Plate
67200267	Shims, Z-Axis
67200551	Z-Axis Mounting Plate
67200810	Side Cover Plate, Z-Axis
86100325	Machine Screw, 10-32 x 3/8"
86100504	Hex Soc Machine Screw, 1/4-20 x 3/4"

Procedure:

This procedure requires parts included in the Quill Drive Mounting Kit, P/N 31500690.

IMPORTANT: The flanges have very limited surface area to drill and tap. Usually, there is room for only one hole on each surface. Ensure that the locations of the holes are correct and not too close to the top or bottom of the flange.

Take great care when drilling and tapping. It is critical to make a straight hole, perpendicular to the flange, at the precise spot where punched.

1. Refer to **Figure 3-22, Installing the Z-Axis Mounting Plate**. Scrape the paint from the two flanges on the head of the machine where the mounting plate, P/N 67200551, will be attached.

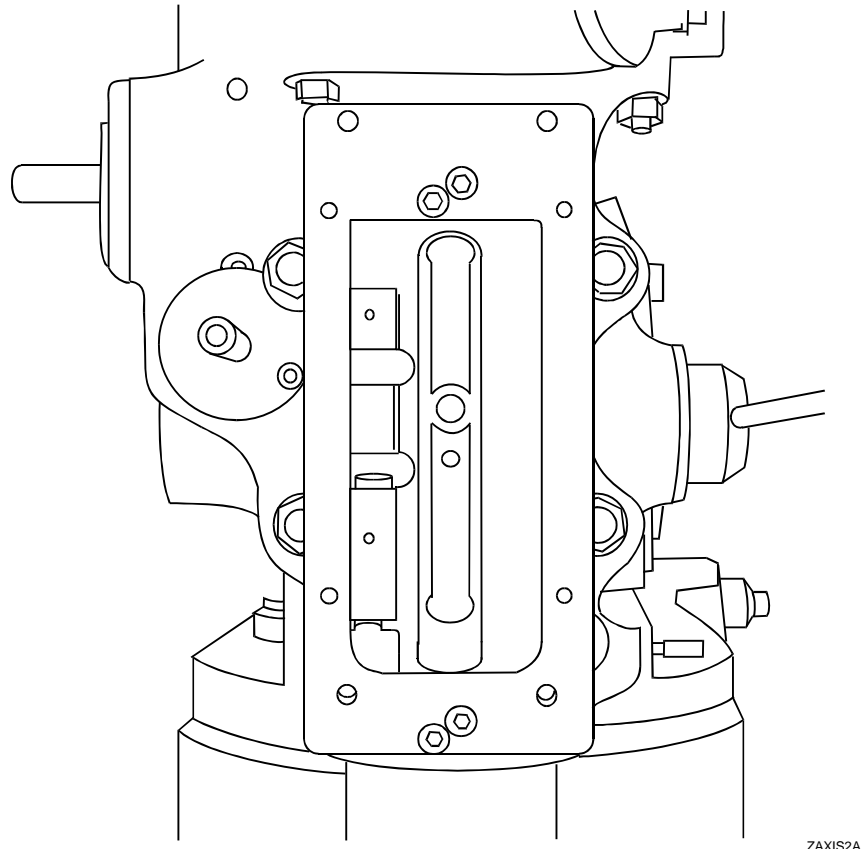


Figure 3-22, Installing the Z-Axis Mounting Plate

2. Hold the Z-axis mounting plate against the flanges so that the step in the plate matches the step in the flanges. The bottom of the plate should be flush with the bottom of the lower flange. Push the plate firmly against the steps and transfer punch one of the top-hole locations.
3. Remove the mounting plate. Carefully drill and tap the punch location 1/4-20 x 3/4-inch deep.
4. Use one 1/4-20 x 3/4-inch Allen screw, P/N 86100504, from the Quill Drive Mounting Kit, P/N 31500690, to snug the mounting plate to the machine.
5. Verify that the bottom of the plate is flush with the bottom of the lower flange and the plate is firmly against the steps of the flanges.
6. Tighten the Allen screw to hold the plate in place and transfer punch the remaining three locations.
7. Remove the plate, and carefully drill and tap the three punch locations.
8. Locate the Z-axis side cover plate, P/N 67200810, and four 10-32 x 3/8-inch Allen screws, P/N 86100325, from the Z-Axis Hardware Kit, P/N 31500690.

9. Use the 10-32 x 3/8-inch button-head screws to attach the Z-axis side cover plate to the back surface of the mounting plate so that they are flush with the sides of the plate.
10. Locate three 1/4-20 x 3/4-inch Allen screws in the Z-Axis Hardware Kit.
11. Use four 1/4-20 x 3/4-inch Allen screws to the mounting plate to the machine. Make sure the Z-axis side-cover plate does not prevent the mounting plate from seating.
12. Refer to **Figure 3-23**. Verify that the front plate surface is parallel to the line of quill travel.

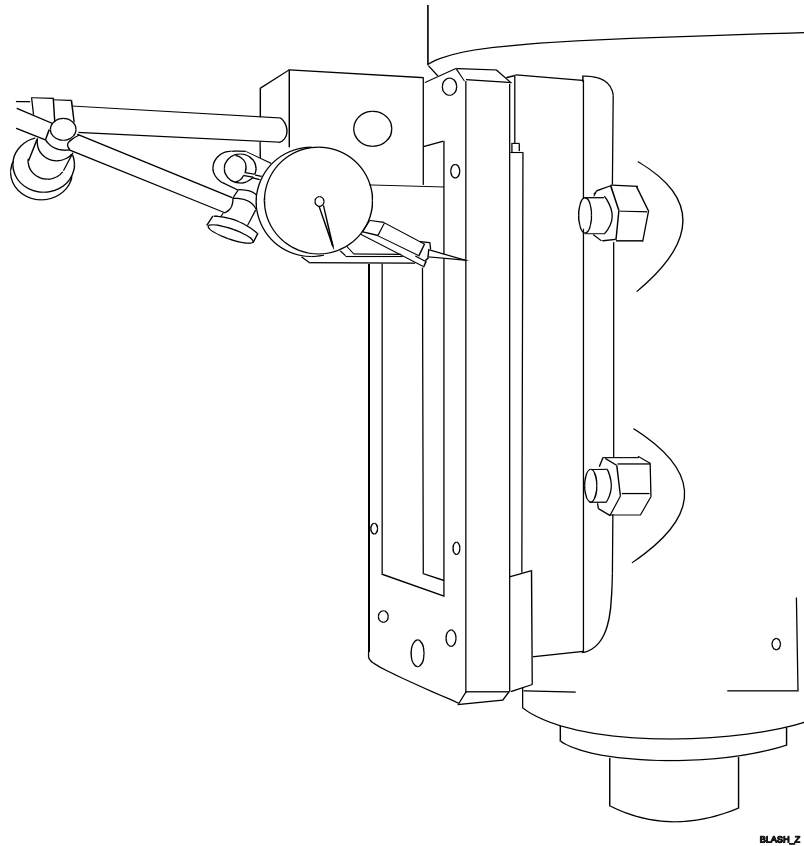


Figure 3-23, Aligning the Z-Axis Mounting Plate

13. Attach a magnetic base and a 0.0005-inch indicator to the bottom of the drive block. Place the indicator tip on the front surface of the plate at the right side. Use the quill handle to move the Z axis (drive block) through the full range of travel. Read the indicator to verify that the mounting plate is parallel to the travel of the quill, within 0.002”.
14. If the mounting plate is not within the acceptable range (± 0.002 ”), use the 0.005-inch shims, P/N 67200267, provided. Place the shims behind the mounting plate to align it parallel to the line of quill travel. The shims have holes through which the mounting screws are inserted to hold them in place.

15. Shim the right and the left side of the plate to achieve squareness. Remove one Allen screw and loosen the others. Place the shims between the back of the mounting plate and the flange, and line up the holes. Replace and tighten the Allen screw and snug the others. Take another indicator reading. Add or remove shims until the indicator reads within 0.002" (the mounting plate is then parallel to the line of quill travel within acceptable tolerances).
16. Place the indicator tip on the right edge of the mounting plate. Use the quill handle to move the Z axis (drive block) through its full range of travel. The mounting plate should be square to the travel of the quill to within 0.002".
17. To adjust the plate, loosen the Allen screws slightly, and tap the mounting plate until you get an acceptable indicator reading.
18. The mounting plate should now be parallel and square to the line of quill travel. Remove one of the mounting screws, and apply a thread-locking compound to the threads.
19. Replace the mounting screw and repeat the process with the other three mounting screws. Make sure you remove only one screw at a time. Tighten each screw completely as you replace it.
20. Locate the cover plate, P/N 67200020, and mount the plate over the feed trip lever shaft. Use the original Allen screw removed while preparing the Z axis. Refer to **Preparing the Z Axis, Step 3**.
21. Unscrew the quill lock handle and remove it. Then, loosen the quill lock by one full turn and reinstall the handle.

<p>NOTE: Allen screw, P/N 86100510, fits Bridgeport machines. For other machines, re-use the original screw to ensure proper fit.</p>

Z-Axis Drive Housing Installation

Objective:

- To attach the Z-axis drive housing to the Z-axis mounting plate.

Tools:

Allen wrenches	Thread locking compound
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Parts:

Part Number	Description
33000130	Z-Axis Limit Switch Cable
66100109	Flat Washer, 1/4 x 9/16"
66100112	Lock Washer, 1/4" Split
67200056	Drive Housing, Univ. Quill Dr.
86100492	Machine Screw, 1/4-20 x 2-1/4 inches
86100503	Machine Screw, 1/4 x 1"
86300198	Washer, 1/4 inch x 1/8"
86600219	Plastic Plug, Threaded

Procedure:

This procedure requires parts found in the Quill Drive Block Kit, P/N 31500968, and Mounting Kit, P/N 31500691.

1. Remove the bottom sheet-metal cover from the Z-axis drive housing, P/N 67200560, and remove the pulley, P/N 67200056.
2. Locate the Z-axis limit-switch cable, P/N 33000130, and mount the cable to the housing in the threaded hole on the back bottom of the housing. Plug the remaining hole with the threaded plastic plug, P/N 86600219, provided.
3. Use the manual quill handle to move the drive block up as far as it will go. Snug the quill lock.
4. Use one 1/4-20 x 2-1/4-inch Allen screw, P/N 86100492; three 1/4-20 x 1-inch Allen screws, P/N 86100503; 1/4-inch lock washers, P/N 66100112, and flat washers, P/N 66100109, to attach the Z-axis housing to the mounting plate. Do not tighten.
5. Turn the ballscrew nut so that the grease fitting is facing forward. Move the drive block onto the ballscrew nut.
6. Locate two 1/4-20 x 1-inch Allen screws; two 1/4-inch lock washers; and two 1/4-inch x 1/8-inch washers, P/N 86300198.

7. Insert the two 1/4-20 x 1-inch Allen screws with the 1/8" lock washers and washers from the bottom. Tighten the ballscrew nut to the drive block.
8. Use the manual quill handle to run the drive block and ballscrew nut up and down through the entire range of travel several times. This allows the Z-axis drive housing to align itself with the mounting plate.
9. Tighten the top two Allen screws while the drive block and ballscrew nut are at the top of the travel. Run the drive block and ballscrew nut to the bottom of the travel and tighten the bottom two Allen screws.
10. Run the drive block and ballscrew nut through the entire range of travel several times. Make sure that the amount of pressure required to turn the ballscrew is constant and that there is no binding of the ballscrew.
11. The Z-axis drive housing should now be aligned correctly with the mounting plate. Remove one mounting screw and apply a thread-locking compound to the threads. Replace the screw and repeat the procedure with the other three screws, one at a time. Tighten the screws completely.

Z-Axis Motor Installation

Objective:

- To install the Z-axis drive motor, motor pulley, and drive belt.

Tools:

Allen wrenches	6-inch Scale
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Parts:

Part Number	Description
37000232	Z-Axis Motor
66100718	Machine Screw, 8 mm x 25 mm
66300126	Adapter Drive Motor
67200056	Z-Axis Motor Pulley
67200552	Sheet Metal Cover, Z-Axis Dr. Hsg.
86300124	Lock Washer, 8 mm
86300201	Flat Washer, 8 mm

Procedure:

This procedure requires parts found in the Quill Drive Block Kit, P/N 31500968.

1. Locate the Z-axis motor, P/N 37000232, and the Z-axis motor pulley, P/N 67200056.
2. Make sure the pulley slides freely on the motor shaft. The pulley should have two factory-installed set screws. Otherwise, the set screws will be in Quill Drive Block Kit P/N 31500968.
3. Locate the motor adapter, P/N 66300126; four 8-mm Allen screws, P/N 66100718; four 8-mm lock washers, P/N 86300124; and four 8-mm washers, P/N 86300201.
4. Refer to **Figure 3-24, Z Axis - Bottom View**. Put the motor adapter on the motor, then mount the motor to the Z-axis housing. Make sure the four holes are aligned with the tapped holes in the motor and the electrical cable connector faces to the left side of the machine. Use the four 8-mm Allen screws, lock washers, and washers to snug, but not fully tighten, the motor to the housing. Slide the pulley onto the motor shaft.

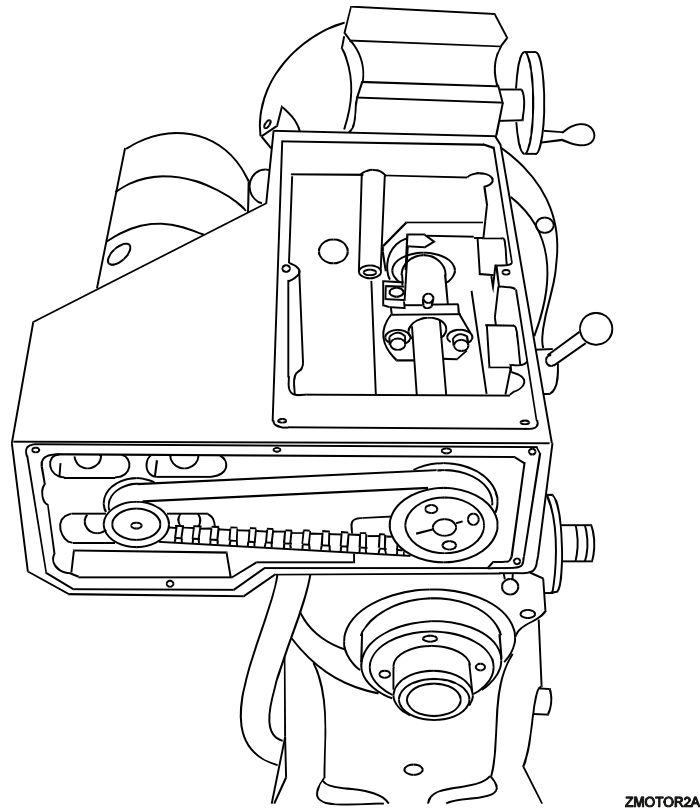


Figure 3-24, Z Axis - Bottom View

5. Use a scale and a straight edge to ensure that the motor pulley is aligned with the existing position of the ballscrew pulley. Tighten the two set screws in the motor pulley.
6. Push the motor to the left, exerting tension on the belt. Turn the ballscrew to verify that the belt is seated in both pulleys.
7. Exert horizontal pressure on the motor while you tighten the four 8-mm Allen screws that hold the motor to the drive housing. The belt should be snug, but not cause a strain on the drive motor shaft.
8. Reinstall the bottom sheet metal cover.

Setting Z-Axis Limit Switches

NOTE: Switches are preinstalled by ANILAM.

Objective:

- To adjust the Z-axis limit switches and install the Z-axis pointer.

Parts:

Part Number	Description
36000088	Limit Switch Jumper (Red)
66100714	Button-Head Screw, 6-32 x 3/8"
67200555	Pointer, BT Quill Drive
67200563	Front Cover, Hsg. Drive
86100325	Machine Screw, 10-32 x 3/8" Hex Soc

Procedure:

This procedure requires parts found in the Mounting Kit, P/N 31500691, and Quill Drive Block Kit, P/N 31500968.

The limit switch will remove power to the motor when tripped to prevent an axis from hitting solidly against a dead stop.

CAUTION: These switches are not set at the factory. You must set them to prevent damage to the ballscrew or quill.

1. Use the manual quill handle to position the Z axis 0.125" from the dead stop in a positive Z direction. Secure the limit switch at this position so that the switch trips 0.125" from the dead stop. The limit switch can be moved on the bracket to achieve the proper distance.
2. Use the manual quill handle to position the Z axis 0.125" from the dead stop in a negative Z direction. Secure the limit switch at this position so that the switch trips 0.125" from the dead stop. Move the limit switch on the bracket to achieve the proper distance. Refer to **Figure 3-25, Z Axis Front View of Completed Assembly**.

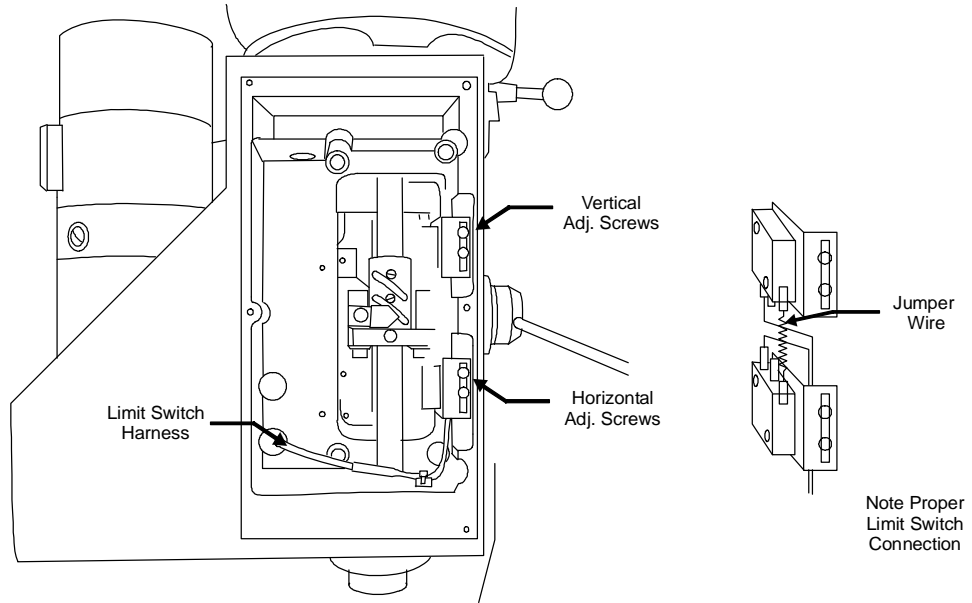


Figure 3-25, Z Axis Front View of Completed Assembly

3. Plug the red wire coming from the Z-axis limit switch cable, P/N 33000130, into the contact labeled NC (normally closed) on the Z+ limit switch.
4. Plug the black wire into the NC (normally closed) contact into the Z- limit switch.
5. Use the supplied jumper wire, P/N 36000088, to plug one end into the Z+ limit switch labeled com (common) and the other end into the Z- limit switch common. The jumper is in the bag of hardware tie-wrapped to the Z-axis limit switch cable. Clamp and tie-wrap the wires to prevent them from rubbing against any moving parts.
6. Move the quill from dead stop to dead stop manually to verify that the limit switches are set correctly. The audible trip should be 0.125" from the dead stop in each direction.
7. Use the 10-32 x 3/8" button-head screw, P/N 86100325, provided to mount the Z-axis pointer, P/N 67200555, in the tapped hole on the left side of the drive block. Set the Z-axis pointer to the **0** setting on the scale.
8. The scale is located on the front cover plate when the quill is fully retracted and just before tripping the limit switch.
9. Move the Z axis in a positive direction to the point just before it trips the limit switch. Place the front cover, P/N 67200563, on the drive housing, and verify that the pointer aligns with **0** on the cover scale. Adjust if necessary.
10. Install the front cover plate with the six 6-32 x 3/8" button-head screws, P/N 66100714, provided.

Servo Cabinet Installation

Objective:

- To attach the servo cabinet to the right side of the column.

Tools:

5/16 Drill	Allen wrenches
3/8-16 Tap	Adjustable wrench
Hammer	Level
Center punches	

Parts:

Part Number	Description
31901070	Ground Harness, Dual Box
66100118	Flat Washer, 3/8"
66100303	Hex Nut, #3/8-16
66100728	Soc Head Cap Machine Screw, 3/8-16 x 1-1/4"
66100745	Soc Head Set Screw, 1/4-20 x 1"
85600013	Spacer, 1.25" x 0.75" x 0.44"
85600058	Spacer, 1/8"
86100576	Hex Soc Machine Screw, 3/8-16 x 2-1/2"
86100580	Hex Soc Cap Machine Screw, 3/8-16 x 1-1/2"
86300174	Lock Washer, #3/8" Split
86300203	Flat Washer, 3/8"

Procedure:

This procedure requires hardware found in Mounting Kit, P/N 32500328.

NOTE: An assortment of spacers is provided to accommodate different machines.

NOTE: You will install the grounding harness, P/N 31901070, during this procedure.

1. Center-punch two locations, both 10-1/2 inches from the floor. The first location must be 5-1/2 inches from the front knee ways; the other location must be 15-1/2 inches from the front knee ways. (Holes must be 10 inches apart).

NOTE: It is important to be at least 5-1/2 inches away from the front knee ways so that the servo cabinet does not interfere with free travel of the table.

2. Drill and tap 3/8-16 at the two punched locations.
3. Install two 3/8-16 x 1-1/4-inch Allen screws, P/N 86100580; two 3/8 washers, P/N 86300174; two flat washers, P/N 86300203; and 1/8-inch spacers, P/N 85600058.
4. Install screw to the base of the machine to a depth of approximately 1/4". Leave the bolts loose enough to allow the tabs of the servo cabinet to slide between the outside washer and the front face of the spacer.
5. Locate the servo cabinet. The servo cabinet has a red ON/OFF disconnect on the front of the cabinet.
6. Unfasten the four thumbscrews on the bottom of the servo cabinet, and remove the filter assembly. This is required to gain access to the mounting tabs.
7. Lift the servo cabinet onto the bottom bolts, allowing the tabs on the bottom of the servo cabinet to slide between the front face of the spacer and the washer on the 3/8-inch Allen screw.
8. Verify that the left side of the servo cabinet does not stick out past the knee ways of the column.
9. Bring the top of the servo cabinet toward the side of the machine until the cabinet is level. Transfer the top holes to the machine. Remove the box. Drill and tap holes to 3/8-16.
10. Refer to **Figure 2-1, Central Grounding Buss Bar (Servo Enclosure)**, **Figure 3-26**, and **Figure 3-27**. For an optimal ground connection, remove a 1/8-inch ring of paint on the machine around the right (rear) hole just tapped.

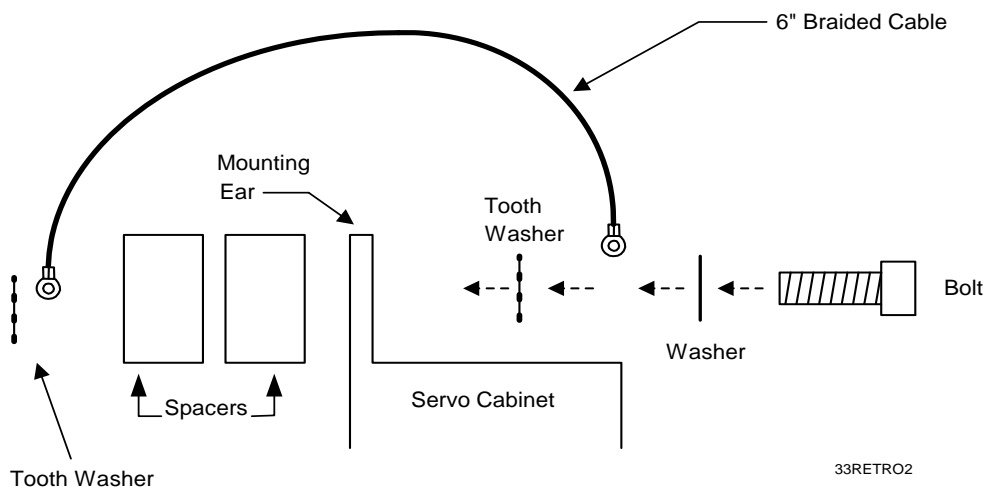


Figure 3-26, Installing the Grounding Harness on the Enclosure

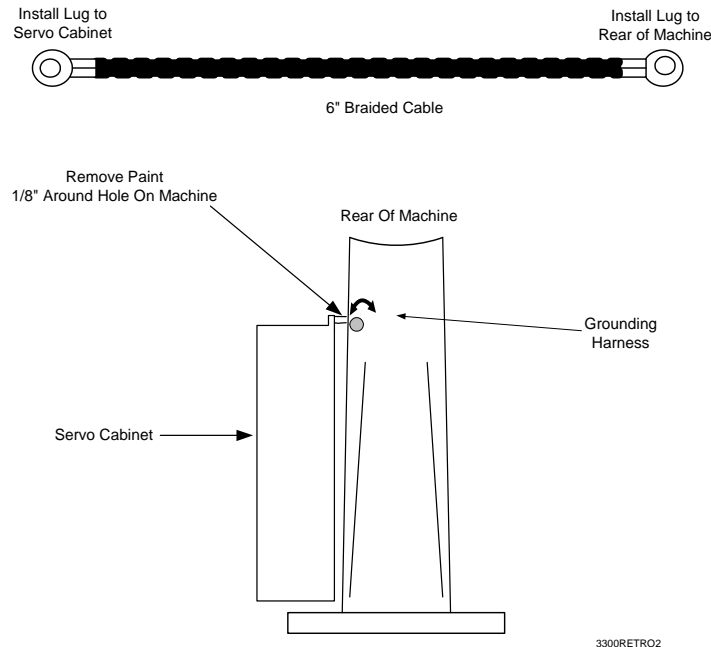


Figure 3-27, Installing the Grounding Harness on the Rear of the Machine

11. Level and square the servo cabinet using the 1/4-20 set screws. Transfer-punch two locations through the top spacer.
12. Lift the servo cabinet back onto the bottom spacers. Attach the top of the cabinet to the machine base with two 3/8-16 x 1-1/2" Allen screws, P/N 86100576; two lock washers, P/N 86300174; two 3/8" flat washers, P/N 86300203; and the proper combination of spacers to keep the cabinet level.

NOTE: For Bridgeport machines, use two spacers, one each, P/Ns 85600058 and 85600013.

13. Locate two 3/8-16 x 1-1/4" Allen screws, P/N 86100580; two 3/8 washers, P/N 86300174; two flat washers, P/N 86300203; and 1/8" spacers, P/N 85600058.
14. Insert two Allen screws and washers through the front of the top mounting tabs of the servo cabinet.
15. Place the spacers over the screws from the back of the mounting tabs. Hold the mounting bar against the spacers so the screws are through the slots in the mounting bar and attach the bar, using a washer, lock washer, and nut on each screw. Do not tighten them.
16. Before installing the last bolt, install the grounding harness lug on the top rear-mounting ear of the cabinet.
17. Level and square the servo cabinet and tighten completely.
18. Reinstall the filter assembly on the bottom of the servo cabinet.

Console Arm and Console Installation

Objective:

- To attach the console to the right side of the ram. The console-mounting bracket will be attached to the console arm.

Tools:

#7 Drill	Level
1/4-20 Tap	Flat screwdriver
Hammer	Phillips screwdriver
Transfer punches	

Parts:

This procedure requires parts found in the Console Arm Mounting Kit, P/N 32500296.

Item	Part Number	Description
1	21900138	Console Arm Mounting Bracket
2	21900165	Console Mounting Arm
3	66100715 or 86100512	Machine Screw, 1/4-20 x 5/8" Soc Cap
4	66100741 or 66100745	Set Screw, 1/4-20 x 1/2" Soc Set or Set Screw, 1/4-20 x 1" Soc Set
5	86100969	Hex Screw 1/2"-13 x 4" Soc Cap
6	86100939	Machine Screw, 1/2-13 x 4" Soc Cap
7	86300205	Flat Washer, 0.876 x 0.516 x 0.062
8	86800109	Handle, Tapped Adjustable
9	23000012	U-Bracket Console Mount

Procedure:

NOTE: Mount the console arm so that it does not interfere with the rotation of the manual quill handle.

1. Locate the Console Arm Mounting Kit, P/N 32500296. This box contains the console arm, P/N 21900165; the console arm mounting bracket, P/N 21900138; two lock handles, P/N 86800109; and the hardware. Refer to **Figure 3-28, Console Arm and Mounting Bracket**.

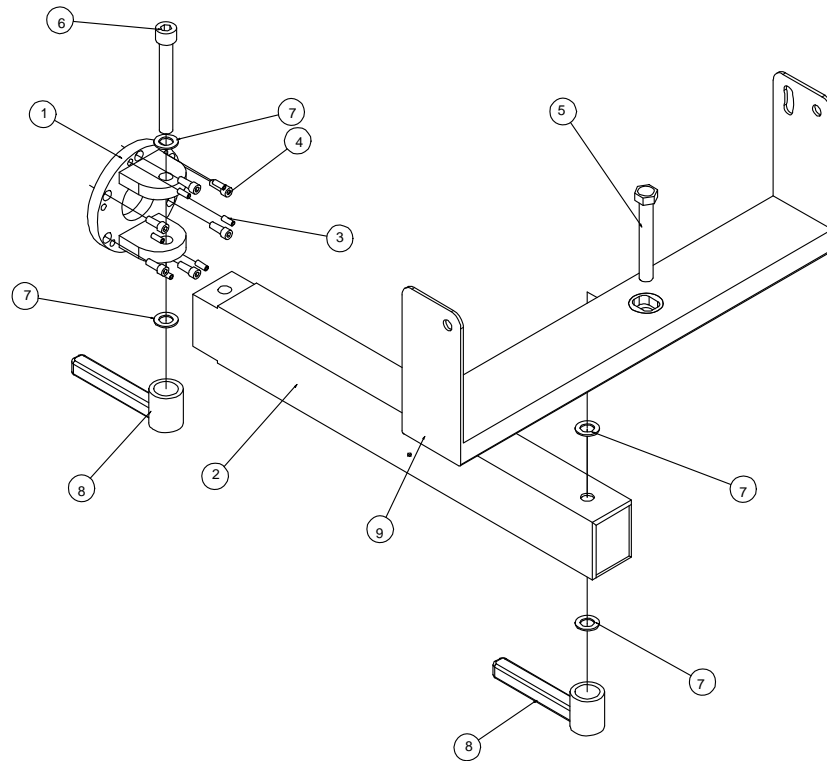


Figure 3-28, Console Arm and Mounting Bracket

2. Hold the mounting bracket, with the tabs parallel to the floor, against the center of the ram and about 6 inches back from the pivot pin in the knuckle.
3. Allow enough distance so that when the console arm is installed and pivoted forward, the manual quill handle will not hit the arm. Transfer punch the top hole.
4. Drill and tap 1/4-20 at the punched location.
5. Locate six 1/4-20 x 5/8" Allen screws, P/N 66100715; six 1/4-20 x 1-1/4" Allen screws, P/N 86100512; six 1/4-20 x 1/2" set screws, P/N 66100741; and six 1/4-20 x 1" set screws, P/N 66100745.

NOTE: Ram shapes differ from round to flat or nearly flat. Short and long 1/4-20 Allen screws and set screws have both been provided to allow the mounting plate to be squared.

6. Attach the mounting bracket, P/N 21900138, to the ram, using one 1/4-20 Allen screw (5/8" or 1-1/4" long, as appropriate). Use six 1/4-20 set screws (1/2" or 1" long, as appropriate) to square the mounting bracket. Level the bracket and transfer punch the remaining holes.
7. Remove the mounting bracket. Drill and tap 1/4-20 at the punched locations.
8. Attach the mounting bracket, using either the long or short 1/4-20 Allen screws. Ensure the plate is level and square. Tighten completely.

9. Locate one 1/2-13 x 4" Allen screw, P/N 86100939; one 1/2" flat washer, P/N 86300205; and one lock handle, P/N 86800109.
10. Insert the console arm between the tabs of the mounting bracket.
11. Insert the 1/2-13 x 4" Allen screw from the top. Attach the washer and lock handle from the bottom and tighten.
12. Unscrew the black knob and two 3/8" button-head screws from the sides of the console. Remove the bracket.
13. Locate one 1/2-13 x 3-1/2" Allen screw, P/N 86100834; two 1/2" flat washers, P/N 86300205; and the lock handle.
14. Place the 3-1/2" Allen screw through the bottom of the bracket, with the threads facing downward.
15. Remount the console on the bracket.
16. Place flat washer, P/N 63000205, on top of the arm, centered on the hole at the end of the arm.
17. Lift the console and set it on the mounting arm so that the 3-1/2" Allen screw goes through the hole.
18. Attach the 3-1/2" Allen screw on the console bracket to the mounting arm with a lock handle, P/N 86800109, and one 1/2" flat washer, P/N 86300205.
19. Attach the interconnect cable, P/N 33000148, (hardwired to the servo box) to the bulkhead connector on the bottom of the console. The connector is keyed and can only be inserted when it is in proper orientation.
20. Lock the retaining latch.

<p>NOTE: Steps 21 and 22 apply only to those consoles that have AC power cables extending from their rear bottoms. If your console does not have such a cable, please ignore the following steps.</p>

21. Refer to **Figure 3-29, Monitor AC Power Connection**. Locate the AC power cord extending from the rear bottom of the console.
22. Secure cable with tie wraps.

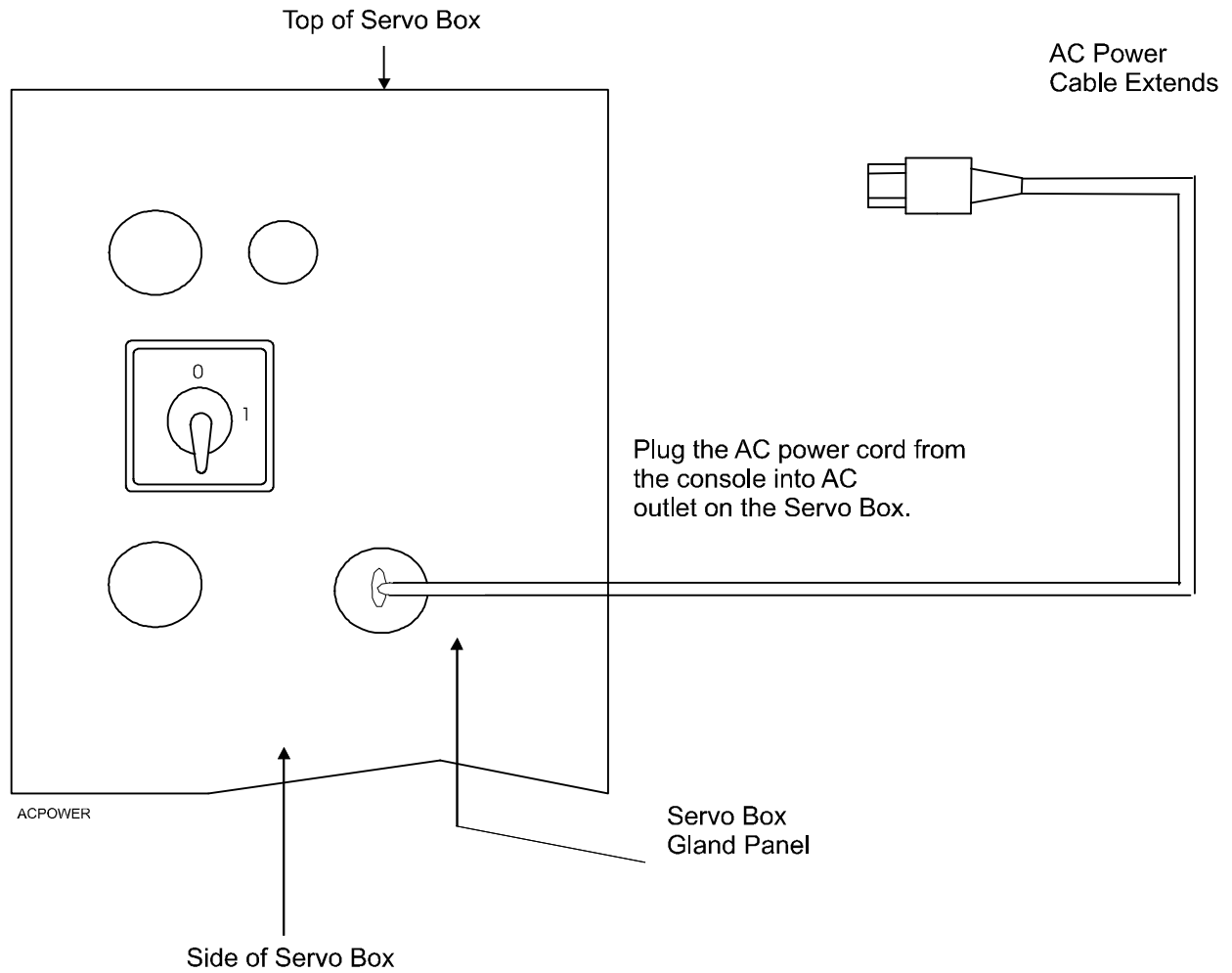


Figure 3-29, Monitor AC Power Connection

Spindle Motor Wiring

Objective:

- To replace the existing spindle motor wiring.

Tools:

Electric tape	Phillips screwdriver
Flat screwdriver	

Parts:

Part Number	Description
31900425	Spindle harness

Procedure:

NOTE: There are two holes provided in the top rear of the servo cabinet for incoming and outgoing three-phase power.

Refer to **Table 3-1** for wiring directions.

Table 3-1, Wiring the Spindle Motor

Type of Cabinet Being Installed	Wiring Directions
3200MK 2-axis single cabinet	Additional wiring may be necessary depending on control configuration
3-axis single cabinet with no M functions	The harness will be wired to the drum switch. The spindle motor cable used is P/N 31900423.
3-axis single cabinet with M functions 3300MK	The harness will be wired directly to the spindle motor, and the drum switch should be removed. The spindle motor cable used is P/N 31900425.

1. For systems without M-functions, wire the spindle motor as follows:
 - Take the existing 4-conductor cable assembly leading out of the drum switch to T1, T2, and T3 of the three-phase contactor in the servo box.
 - Wire the incoming three-phase power to the top side of the disconnect switch as shown in **Figure 3-30, Spindle Motor Configuration Without M-Function**, and **Figure 3-31, Spindle Motor Configuration With M-Function**.
 - Attach all grounds to the central ground buss bar.

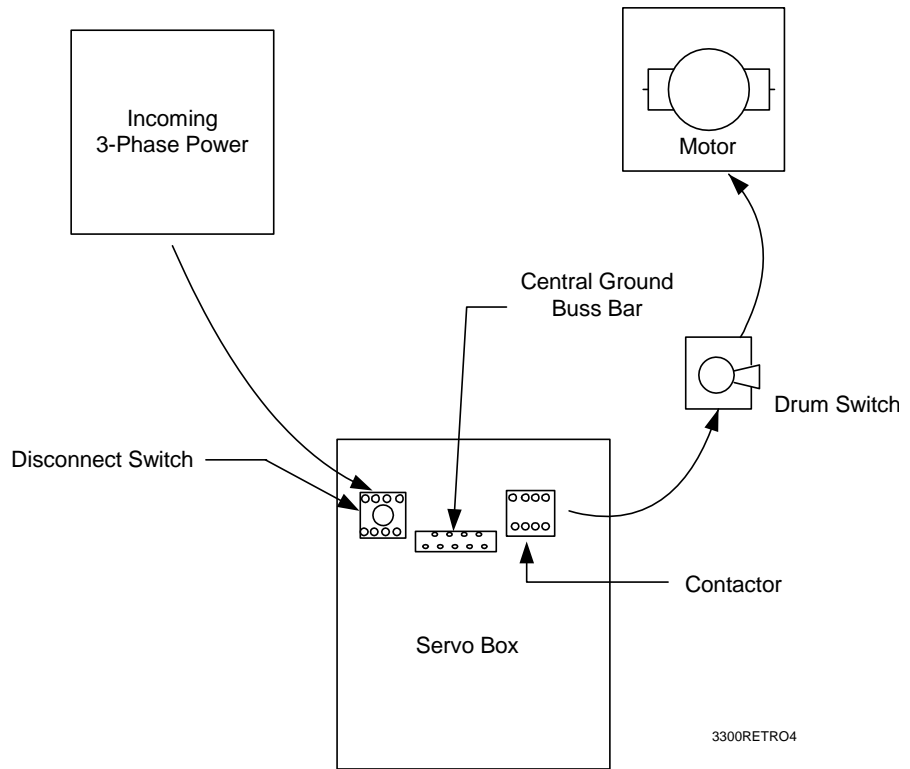


Figure 3-30, Spindle Motor Configuration Without M-Function

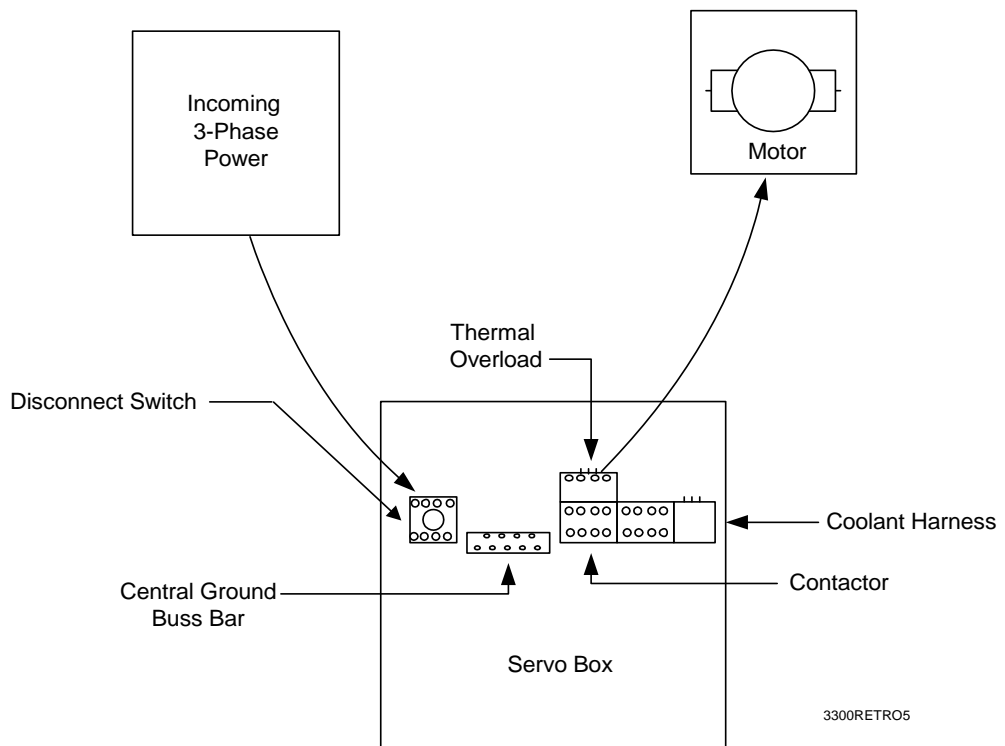


Figure 3-31, Spindle Motor Configuration With M-Function

2. For systems with M-functions, wire the spindle motor as follows:
 - ❑ Remove the assembly, all existing motor wiring, and reversing switch from the machine. Replace them with the spindle harness, P/N 31900425. Insert the end of the harness with the 90° connector into the junction box on the body of the spindle motor and install it.

<p>NOTE: The ends of the cable have one straight and one 90B connector. The 90B connector usually is attached to the drum switch or the motor, but you can use either end.</p>

- ❑ Attach the ground wire from the spindle harness to the existing ground wire site.
 - ❑ Attach the incoming three-phase power leads to the appropriate leads, as specified by the manufacturer.
 - ❑ Install the unterminated end of the harness in the upper right rear hole of the servo cabinet. Secure the harness with the connector.
 - ❑ Connect the three-phase power leads to the three terminals located above the thermal overload. Attach the ground wire to the central ground buss bar located beneath the fuse block.
 - ❑ Attach the incoming three-phase power to the three top right terminals of the disconnect switch.
3. For systems with coolant pumps, wire the coolant pump as follows:
 - ❑ Remove the existing wiring from the pump, and attach the coolant pump harness, P/N 31900426, to the electrical junction box on the coolant pump.
 - ❑ Connect the coolant pump harness as specified by the manufacturer.
 - ❑ Insert the opposite end of the harness into one of the lower holes on the servo cabinet.
 - ❑ Secure the Sealtite connector and connect wires to the coolant contactor T1, T2, and T3.

System Cabling

Objective:

- ❑ To attach the motor cables to the servo cabinet.
- ❑ To install the limit switch cables and console to the servo box interface cable.
- ❑ To attach tie-wrap anchors to the ram of the machine.

Tools:

#21 Drill	Center punch
10-32 Tap	Phillips screwdriver
Hammer	Metric Allen wrenches

Parts:

Part Number	Description
33000130	Z Limit Switch Cable
37000232	Z-Axis Motor with Cable
85900003	Tie-Wrap Anchors
85900006	Tie-Wraps, 15-1/2"
86100305	Phillips Head Screws, 10-32 x 1/4"

Procedure:

Parts required for this procedure can be found in X- and Y-Axis Limit Switch Kit, P/N 33000127.

Refer to the appropriate drawing from **Drawing Package, P/N 70000441**, at the end of this manual. For 3-axis systems, refer to **Drawing, P/N 33000085**. For standard 4-axis systems, refer to **Drawing, P/N 33000162**. For 3-axis systems with M-functions, refer to **Drawing, P/N 33000086**.

1. Locate the tie-wrap anchors, P/N 85900003, and the 10-32 x 1/4" Phillips head screws, P/N 86100305.
2. On the left side of the ram along the center, punch three locations 10 inches apart.
3. Drill and tap 10-32 x 1/2" deep at the punched locations.
4. Use the Phillips head screws, P/N 86100305, in the punched locations, and attach the tie-wrap anchors to the ram.
5. Locate the Z-axis motor with cable, P/N 37000233.
6. Screw the straight end of the cable to the labeled Z-axis connector on the bottom of the servo cabinet.
7. Locate the black 15-1/2-inch tie-wraps, P/N 85900006.

8. Arrange the Z-axis motor cable, the Z limit switch cable, and the spindle motor cable neatly along the left side of the ram. Attach them to the ram using the tie-wraps and tie-wrap anchors. Leave enough cable to allow the head of the machine to be rotated.
9. Insert the Z limit switch cable, P/N 33000130, into the hole in the bottom of the servo cabinet.
10. Refer to **Figure 3-32**. Remove the metal 1/2" NPT nut from the X and Y limit switch cable.

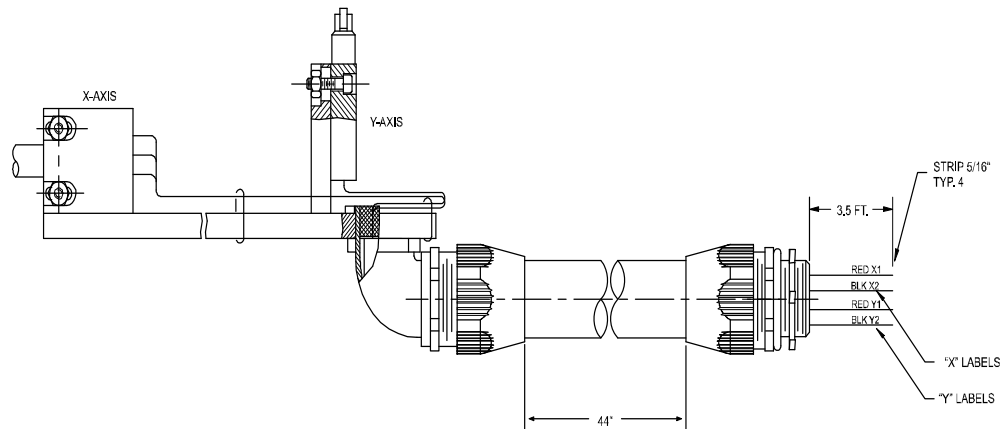


Figure 3-32, X and Y Limit Switch Harness Assembly

11. Connect the red and black Z-axis leads to screw terminals 7 and 8 of terminal block 14 of the servo control board.
12. Insert the X and Y limit switch cable into the hole in the servo cabinet behind the Y-axis motor connector. Secure the connection.
13. Connect the red and black X-axis leads to screw terminals 3 and 4 of terminal block 14 of the servo control board.
14. Connect the red and black Y-axis leads to screw terminals 5 and 6 of terminal block 14 of the servo control board.
15. Locate the Y-axis motor assembly with attached cable, P/N 37000232.
16. Screw the end to the Y-axis connector in the bottom of the servo cabinet. The Y-axis connector is labeled on the inside of the servo cabinet.
17. Locate the X-axis motor assembly with attached cable, P/N 37000231.
18. Screw the end to the X-axis connector in the bottom of the servo cabinet. The X-axis connector is labeled inside the servo cabinet.

NOTE: The standard motor connections and fittings for the U axis are identical to the X, Y, and Z axes.

Servo Cabinet Wiring

Objective:

- To wire the servo cabinet.

Tools:

Small flat screwdriver	Phillips screwdriver
------------------------	----------------------

Procedure:

Refer either to the *3200MK Drawing Package*, P/N 70000378, or *3300MK Drawing Package*, P/N 70000379 at the back of this manual. Use the appropriate drawing package for your CNC:

3200MK

For systems without M-functions, use P/N 33000056.

For systems with M-functions, use P/N 33000095.

3300MK

For systems without M-functions, use P/N 33000002.

For systems with M-functions, use P/N 33000003.

Use the wire ways whenever possible.

Refer to **Figure 3-30, Spindle Motor Configuration Without M-Function**, and **Figure 3-31, Spindle Motor Configuration With M-Function**. Route incoming 3-phase power wires to the disconnect switch and tighten them securely. The ground conductor of the three-phase cable should be terminated with a ring lug and attached to the Servo Enclosure Central Ground Buss Bar.

There is a wire way attached to the top of the servo cabinet. It is reserved for the incoming three-phase power and the outgoing three - phase power to the spindle.

Check all of the existing connectors, boards, relays, and wires to ensure nothing has come loose during shipping.

Installing the Z-Axis Readout

3200MK

Objective:

- To install the Z Axis Readout.

Tools:

Allen wrenches	6-32 Tap
Hammer	Magnetic base
Transfer punches	0.0005" Indicator
#29 Drill	

Parts:

Part Number	Description
20000706	Micron QE-5
67200001	Quill Stop Block
67200751	Mounting Block
67200752	Z-Axis Backer Bar
67200753	Z-Axis Bracket
86100127	Machine Screw, 8-32 x 1" Socket Head
86100141	Machine Screw, 6-32 x 1" Socket Head
86100310	Machine Screw 10-32 x 3/4" Socket Head
86300121	Lock Washer, #8 Split
86300127	Flat Washer, #8 0.31" x 0.187" x 0.03"

Procedure:

Parts required for this procedure are included in the Z-Axis Mounting Kit, P/N 32500207.

If your system is a two-axis system, the kit will contain a linear encoder assembly kit for the Z axis. The linear encoder acts as a digital readout for the Z axis and allows you to control tool depth. The linear encoder displays its measurements in 0.0002" increments (0.0002"/5 micron resolution).

Unpack the Z-Axis Mounting Kit and place the contents on a clean workbench. Ensure that all listed parts are included. Refer to **Figure 3-33, Pre-Installation Machine View**.

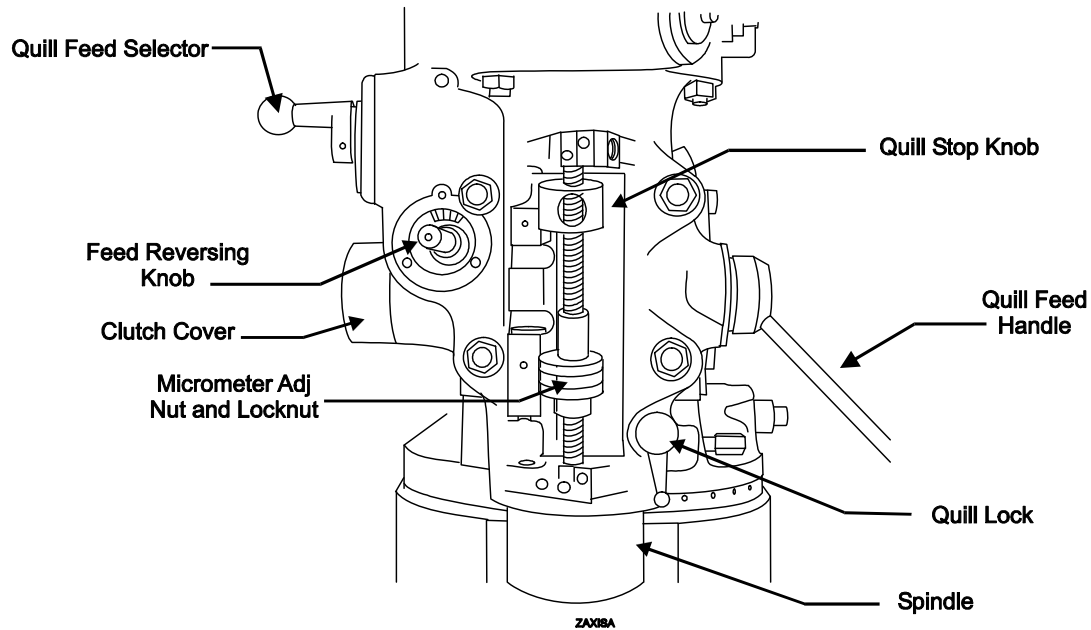


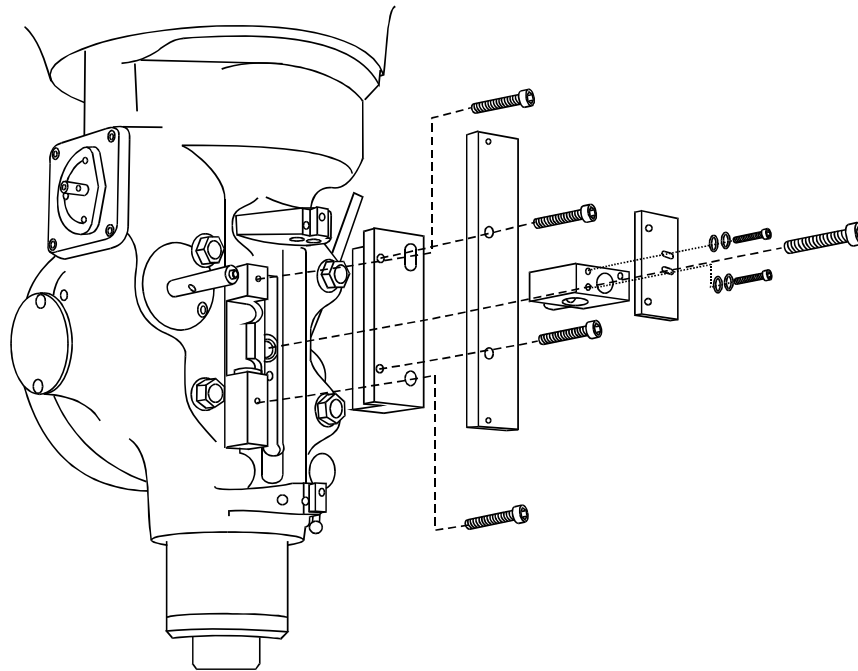
Figure 3-33, Pre-Installation Machine View

1. Fit the stop block on the machine. Do not mount the stop block at this time. Remove the quill stop screw and stop block. You will install a new quill stop block, P/N 67200001. Remove the ruler (located where the linear encoder will be mounted). Fit the stop block into its slot on the machine. The block must have as little side clearance as possible. You might need to weld the block on one side and regrind it to fit correctly.

CAUTION: A loose stop block will result in incorrect linear encoder readings.

2. Mount the backer bar mounting block, P/N 67200752, to the machine where the ruler was removed earlier. If necessary, enlarge the tapped mounting holes.
3. Mount the stop block using the appropriate screws provided in the kit. Make sure the two tapped holes in the front face of the block face to the left.
4. Start the spindle and check the Z-power feed. The feed engagement handle should snap to the **OFF** position when the stop block contacts the adjustable stop nuts. If the handle does not function properly, repair it and continue the installation.
5. Use the provided screws to install the linear encoder backer bar on the mounting block. Install the reader head mounting bracket on the front face of the stop block, using two 8-32 x 1/2" socket-head cap screws, P/N 86100127, provided with the linear encoder kit. Place flat washers under the screw heads.

6. Use the two 10-32 socket-head screws, P/N 86100310, to attach the backer bar to the front of the backer bar mounting bracket. Refer to **Figure 3-34**.



325-207

Figure 3-34, Installing the Z-Axis Mounting Bracket, Linear Encoder Backer Bar, and Mounting Block

7. Attach an indicator to the stop block. As you move the quill up and down its entire travel, indicate the edge of the backer bar. Ensure that the backer bar's vertical alignment is parallel to quill travel. Any misalignment will be visible when the installation is completed. Refer to **Figure 3-35, Aligning the Z-Axis Linear Encoder**.
8. Use two 6-32 x 1" socket head screws, P/N 86100141, provided to mount the linear encoder on the backer bar **Figure 3-36, Installing the Z-Axis Linear Encoder**. Indicate the edge of the scale. Ensure that it is aligned with the quill's vertical travel, $\pm 0.002"$. Next, indicate the face of the scale to $\pm 0.002"$.
9. Place shims behind the backer bar to correct any misalignment. Remove the indicator base from the reader head bracket.
10. Move the quill until the bracket is behind the reader head. Locate the slots on the mounting bracket where the attachment screws secure it to the stop block. The slots allow extra in-and-out movement to align the reader head. Place the mounting screws through the holes in the mounting bracket. Do not tighten them yet. If the screws are centered in the holes, tighten the mounting bracket to the stop block with mounting screws. Leave $1/16"$ of clearance between the back face of the reader head and the bracket.

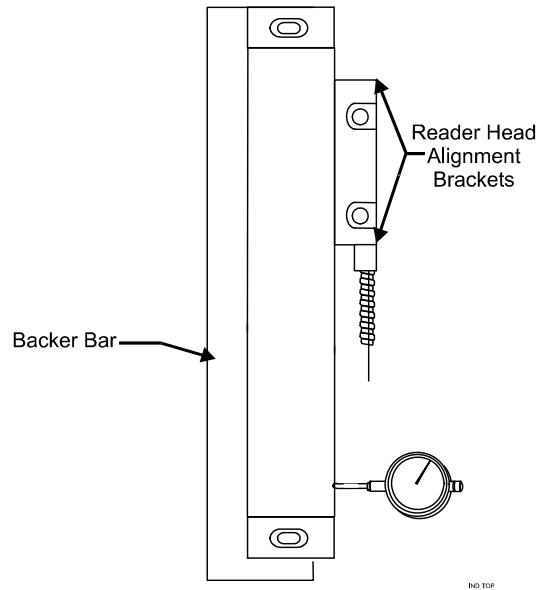


Figure 3-35, Aligning the Z-Axis Linear Encoder

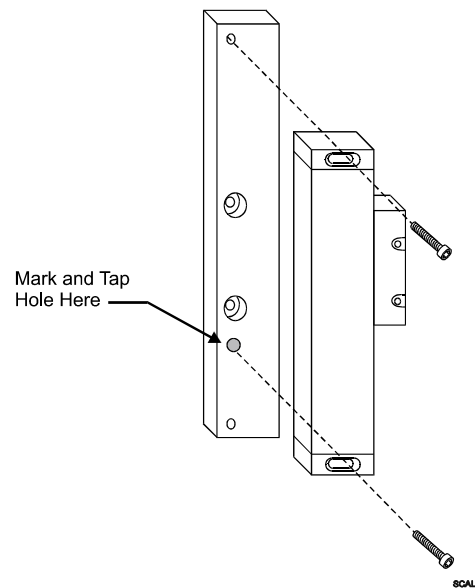


Figure 3-36, Installing the Z-Axis Linear Encoder

11. Locate a surface for the magnetic base and place it so that the indicator point rests against the face of the reader head.
12. Locate the three jack screws next to the reader head mounting screws. Tighten them one at a time. Tighten the first screw until the indicator reads **0.002**. Tighten the next screw until you see movement (indicator reading changes). Then, back off slightly until the indicator reads **0.002** again. Perform the same procedure for the third jack screw.

13. Tighten the mounting screws to secure the reader head.

CAUTION: Do not over-tighten the screws. Doing so will warp the head casting. Use 2 ft/lb. of torque.

14. Remove the screws that attach the orange alignment brackets to the reader head on each end of the head. Slide the brackets away from the head about 1/2" and turn them sideways to remove them. Set them aside for future use. If you will be shipping the reader head for service, replace the screws.

15. Tie-wrap the cable to the machine head. Leave enough slack for free quill travel. Run the reader head cable along the ram and attach it with tie-wraps. The cable plugs into the rear end of servo amp cabinet using a PTO connector.

CAUTION: Do not tie the cable too tightly. Excessive strain could break the conductors in the cable.

X- and Y-Axis Linear Encoder (Option) Installation

Objective:

- To install the X- and Y-axis linear encoders (option).

Tools: Allen wrenches

Procedure:

NOTE: Perform steps 1 through 6 only if you are retrofitting the linear encoders option.

Parts required for this procedure are found in Harness Assembly for Servo Drive Kit, P/N 33000266.

To install the harnesses necessary to use linear encoders, follow the instructions in the linear encoder installation manual provided with this manual.

1. Open the servo cabinet normally located on the right side of the machine (viewed from the front of the machine). Locate the interconnect plugs labeled X and Y on the right side of the cabinet.
2. Disconnect the two white Molex plugs labeled **X** and **Y** from the right inside of the cabinet.
3. Install the jumper harness, P/N 33000266, through the right wall of the servo cabinet.
4. Plug the linear encoder cable into the DE9 connector on the rear of the servo cabinet.
5. Attach the white Molex plug on the X jumper harness to the mating end of the X harness previously disconnected.
6. Attach the white Molex plug on the Y jumper harness to the mating end of the Y harness previously disconnected.

Linear Encoder Connection and Setup

Objective:

- To connect and setup the linear encoders.

Perform the following steps to connect and setup the linear encoders:

1. Locate the X-axis cable and plug it into the X receptacle on the rear of the servo box. Move the X axis manually. Look at the X-axis display to verify that the connection is correct.
2. Locate the Y-axis cable and plug it into the Y receptacle on the rear of the servo box. Move the Y axis manually. Look at the Y-axis display to verify that the connection is correct.

3. Secure all cables properly to prevent damage to the linear encoders or cables during machine movement.
4. Prior to running the machine, verify the phasing of the scales. Move the table to the left and the saddle towards the operator. This should result in a positive motion display for both axes. If not, change the encoder phase setting. Refer to the **Setup Utility** section of this manual.
5. In the Setup Utility, the default configuration is for encoders. Set the system for scale input, then set proper resolution, gains, and phasing. Refer to the **Setup Utility** section of this manual for more details.

Z- and U-Axis Linear Encoder (Option) Installation

Objective:

- To install the Z- and U-axis linear encoders (option).

Tools: Allen wrenches

Procedure:

Parts required for this procedure are in the Harness Assembly for Servo Drive Kit, P/N 33000267. Refer to **Figure 3-37**.

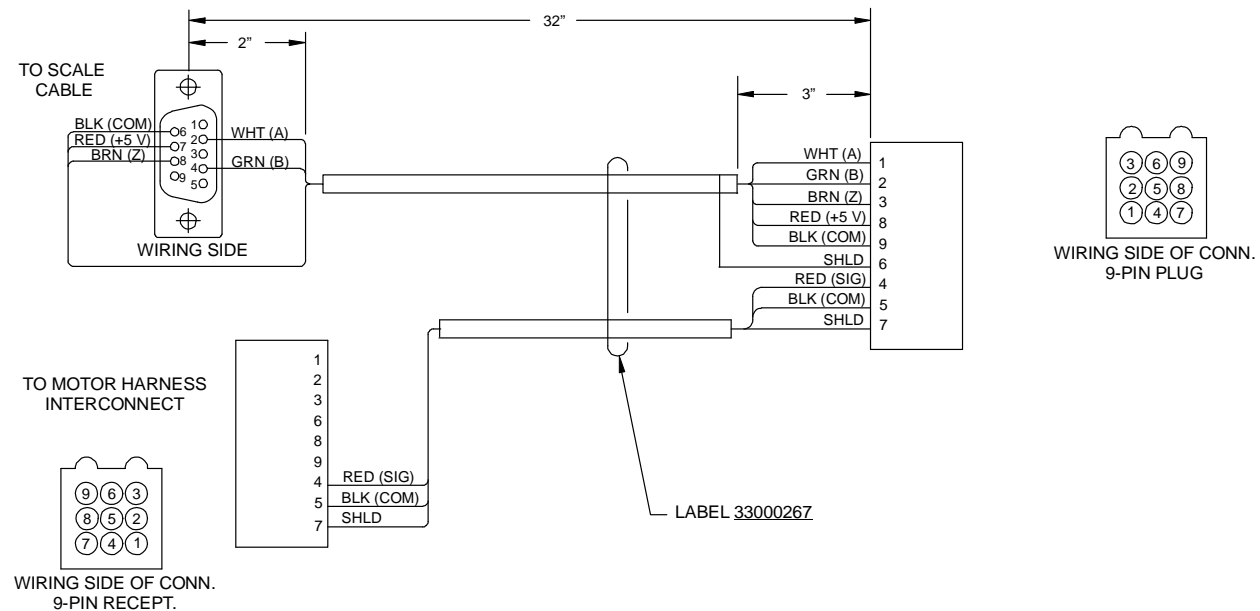


Figure 3-37, Harness, Dwg. 33000267

To install the linear encoders, follow the instructions in the linear encoder installation manual provided along with this manual.

1. Open the servo cabinet normally located on the right side of the machine (viewed from the front of the machine). Locate the interconnect plugs labeled Z and U on the right side of the cabinet.
2. Disconnect the two white Molex plugs labeled Z and U from the right inside of the cabinet.
3. Install the jumper harness, P/N 33000267, through the right wall of the servo cabinet.
4. Plug the linear encoder cable into the DE9 connector on the rear of the servo cabinet.
5. Attach the white Molex plugs on the Z jumper harness to the mating end of the Z harness previously disconnected.
6. Attach the white Molex plugs on the U jumper harness to the mating end of the U harness previously disconnected.

Linear Encoder Connection and Setup

Objective:

- To connect and setup the linear encoders.
1. Locate the Z-axis cable, and plug it into the Z receptacle on the rear of the cabinet. Move the Z axis manually. Look at the Z-axis display to verify that the connection is correct.
 2. Locate the U-axis cable, and plug it into the U receptacle on the rear of the cabinet. Move the U axis manually. Look at the U-axis display to verify that the connection is correct.
 3. Route each harness through the provided wireways:
 - Route each harness through the long center wireway.
 - Route each harness from the long center wireway to the wireway above the servo modules.
 - Route each harness from the wireway above the servo modules to the wireway down the right side of the servo modules.
 4. Secure all cables properly to prevent damage to the linear encoders or cables during machine movement.
 5. Prior to running the machine, verify the phasing of the scales. Move the table to the left and the saddle towards the operator. This should result in a positive motion display for both axes. If not, change the encoder phase setting. Refer to the **Setup Utility** section of this manual.
 6. In the Setup Utility, the default configuration is for encoders. Set the system for scale input, then set proper resolution, gains, and phasing. Refer to the **Setup Utility** section of this manual for more details.

Coupled Axis (Option) Connection

Objective:

- To connect the coupled axis (option).

Parts:

Part Number	Description
33000266	Harness

Procedure:

The control can support one coupled axis. A coupled axis can take the feedback from a knee, or similar device, to provide correct positioning depth for the Z axis. For example, if a knee fitted with a feedback device is moved in a negative direction, the Z axis would also move in the same negative amount of direction to compensate.

Harness 33000266 provides connection for feedback. Refer to

Figure 3-38.

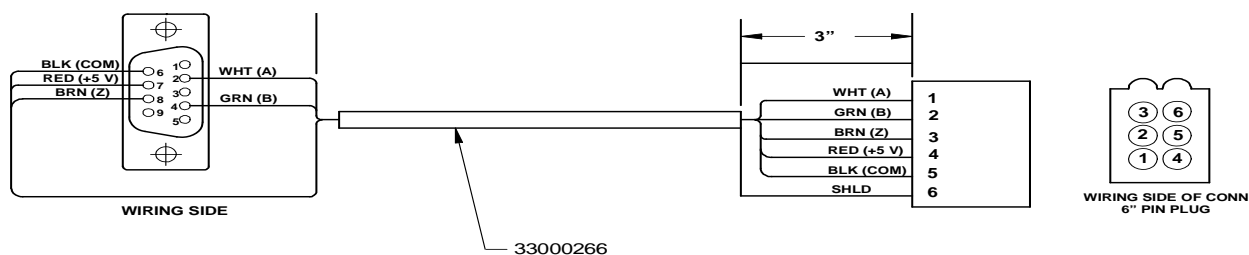


Figure 3-38, Harness, Dwg. 33000266

1. Connect the Molex connector to the axis labeled R/O (Readout).
2. Mount the DE9 connector through the right cabinet side.
3. Install and route the harness through the provided wireways:
 - Route the harness through the long center wireway.
 - Route the harness from the long center wireway to the wireway above the servo modules.
 - Route the harness from the wireway above the servo modules to the wireway on the right side of servo modules.

See the *3200MK/3300M/3300MK Motion Setup/Testing Utility* manual, P/N 70000418, for information on how to configure R/O for coupled axis use.

Spindle Inverter or External Servo Axes (Option) Connection

Objective:

- To connect the spindle inverter or external servo axes (option).

Parts:

Part Number	Description
33000098	Cable

Procedure:

Cable 33000098 is available for connection of spindle drives or external servo axes. See **Figure 3-39**. The cable is open ended and 8-feet long. If a longer cable is required, contact ANILAM.

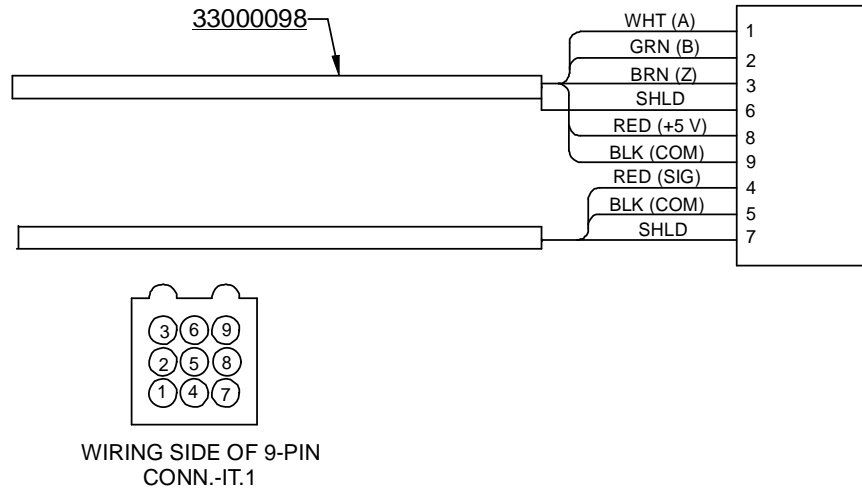


Figure 3-39, Cable, Dwg. 33000098

See **Table 3-2** for DAC command signal outputs and encoder signal inputs. DAC output is +10 V DC to –10 V DC; encoder inputs must be 5 V DC, TTL quadrature with zero marker pulse.

Table 3-2, Cable Pinout

Pin	Name
1	WHT (A)
2	GRN (B)
3	BRN (Z)
4	RED (SIG)
5	BLK (COM)
6	SHLD
7	SHLD
8	RED (+5 V)
9	BLK (COM)

Vector/Home Switches Connection

Objective:

- To connect the vector/home switches to the SCB and the CAN I/O boards.

Procedure:

The CAN I/O systems hard code the vector/home switch connection to node 0. This can be node 0 on the SCB or an individual CAN I/O addressed as node 0. Connection is to node 0 only.

Connection of vector/limit switches is hard coded to individual input bit. See **Table 3-3**.

Table 3-3, CAN I/O Systems Vector/Limit Switches

Bit	Pin	Input	Bit	Pin	Input
0	1	X+	5	6	Z-
1	2	X-	6	7	N/A
2	3	Y+	7	8	N/A
3	4	Y-	8	9	N/A
4	5	Z+	9	10	N/A

Connect vector/home switches to SCB using **P3** Phoenix Block, pins 1 through 10. Connect vector/home switches to CAN I/O boards using **P5 DB25**, pins 1 through 10. SCB inputs must be **+24 V DC** (source) input. Depending on the board type, CAN I/O board inputs can be either **24 COM** (sink) or **+24 V DC** (source).

If vector limits are used, enable them in the **Setup Utilities, Vector Limits Setup**. If home switches are used, select the proper type of homing in the **Setup Utilities, Homing Setup**. You can enable either or both types of switches at the same time.

CAUTION: Take care not to assign Input Functions or IPI inputs to the same input bits as vector or home switches.

Automatic Oiler (Option) Installation**Objective:**

- To install an automatic oiler that can provide oil to the ballscrew and the machine ways.

Tools:

Allen wrenches	10-32 Tap
Transfer punches	Wire Strippers
#21 Drill	Crimping Tool
1/4-20 Tap	

Parts:

Part Number	Description
15700013	Lube Pump
86000154	Sealtite Fitting (1/2" – Straight)
86000158	Sealtite Fitting (1/2" – 90°)
86100345	Button-Head Screw, 1/4-20 x 1"
86600042	18-22 AWG Spade Lug
86600049	18-22 AWG Butt Splice
91000925	1/2" Dia. Sealtite
91400149	48" Oil Line
91400156	27" Oil Line
91400157	Compression Sleeve
91400158	Compression Bushing
91000352	20 AWG Black Wire
91000355	20 AWG Green Wire
91000358	20 AWG White Wire

Procedure:

Parts required for this procedure are found in Autolube Kit, P/N 15700090.

Autolube Kit

NOTE: It is assumed that a manual oiler and its oil line have been previously removed from the machine.

1. Unpack the parts provided with Autolube Kit, P/N 15700090. Locate the 6-foot piece of black 1/2-inch diameter Sealtite, P/N 91000925; the 48-inch oil line, P/N 91400149; and the oil pump assembly, P/N 15700013.
2. Determine a mounting site for the oil pump on the base of the machine. Normally, this would be the rear of the machine base.

The electrical connections are made through one of the lower holes in the rear of the servo cabinet.

Connect the oil line to the top of the oiler and run to the existing oil manifold on the machine where the line from the manual oiler was removed.

3. Hold the oiler level against the machine base and mark two holes for hardware to install the pump, P/N 15700013, to the machine. Drill and tap 1/4-20. Use two button-head screws, P/N 86100345, to attach the oiler to the machine.
4. Slide one compression bushing, P/N 91400158, and one compression sleeve, P/N 91400157, onto one end of the 48-inch oil line. Insert this end of the assembly into the threaded fitting on top of the oil pump and tighten. Place one compression bushing and one compression sleeve on the unterminated end of the oil line and insert it into the open hole in the existing oil manifold from which the original oil line was removed. Tighten the bushing.
5. Remove the existing oil line that feeds oil from the manifold on the knee to the manifold under the edge of the saddle. Use the 27-inch oil line, P/N 91400156, with two compression bushings and two compression sleeves to replace the original oil line.
6. Remove the motor cover from the top of the oil pump assembly to gain access to the electrical connections. Consult the documentation provided with the oil pump to determine proper electrical connections.
7. Cut the black plastic Sealtite harness, P/N 91000925, to the appropriate length to run between the electrical junction box on the oiler and the hole in the rear of the servo cabinet. Place a 90° Sealtite fitting, P/N 86000158, on the servo cabinet side of the harness and one straight Sealtite fitting, P/N 86000154, on the oil pump end of the harness.

8. Run the white, green, and black wires provided, P/Ns 91000352, 91000355, and 91000358, respectively, through the Sealtite harness. Remove the 1/2-inch NPT lock nut from the straight Sealtite fitting and attach it to the oil pump. Connect the black and white leads from the Sealtite harness to the appropriate wires on the pump motor according to the oiler documentation. Butt splices, P/N 86600049, and spade lugs, P/N 86600042, are included in the kit to facilitate this. Be sure to connect the green wire to the ground lug inside the junction box. Reinstall the cover on the junction box.
9. Feed the unterminated end of the Sealtite harness through one of the lower holes in the rear of the servo cabinet. Use three spade lugs, P/N 86600042, on the ends of the wires to attach the black and white wires to screw terminals 5 and 6 of the P1 connector on the servo control board as shown in the wiring diagrams later in this manual. Refer to the drawing package, P/N 70000379, at the end of this manual. Attach the green wire to the central ground buss bar in the servo box.
10. Close the servo box door, and power up the system. Press **SERVO RESET** and verify that the servo motors have power to them.
11. To confirm that the oiler is working, look inside the oil reservoir and note that the worm gear on the bottom of the motor shaft is turning.
12. Route all wires neatly inside of the servo box. Use the wire ways provided.

Network Connection (Option) Installation

Objective:

- To install the network connection (option). The CNC provides access to network drives via Ethernet.

Tools:

Phillips screwdriver	Adjustable wrench
----------------------	-------------------

Parts:

Part Number	Description
80300507	Lock Nut, Preinstalled, 1/2" NPT Steel
86000118	Strain Relief, Preinstalled, T&B 2520

Procedure:

1. Remove the three Phillips screws on each side of the console.
2. Remove the top of the console.
3. Remove the three Phillips screws that hold the top half of the rear cover in place.
4. Remove the lock nut, P/N 80300507, that holds the strain relief in place.
5. Pass the unterminated end of the 10-Base T network cable through the strain relief, P/N 86000118. Terminate the end, leaving 18 inches of cable through the strain relief.
6. Feed the network cable through the appropriate hole in the rear cover of the console. Refer to **Figure 3-40**.

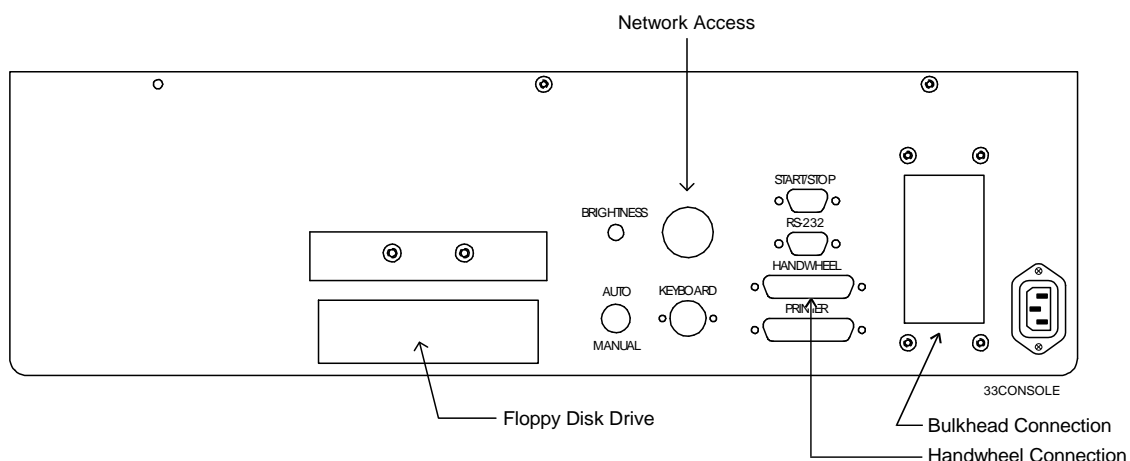


Figure 3-40, Console Lower Rear Panel

7. Slide the lock nut over the network cable and attach it to the strain relief. Tighten the lock nut securely.
8. Plug the 8-pin, RJ-45 connector into the single-board computer. Refer to **Figure 3-41**.

NOTE: A qualified networking engineer must set up the networking software. Software varies based on the type of network operating system used.

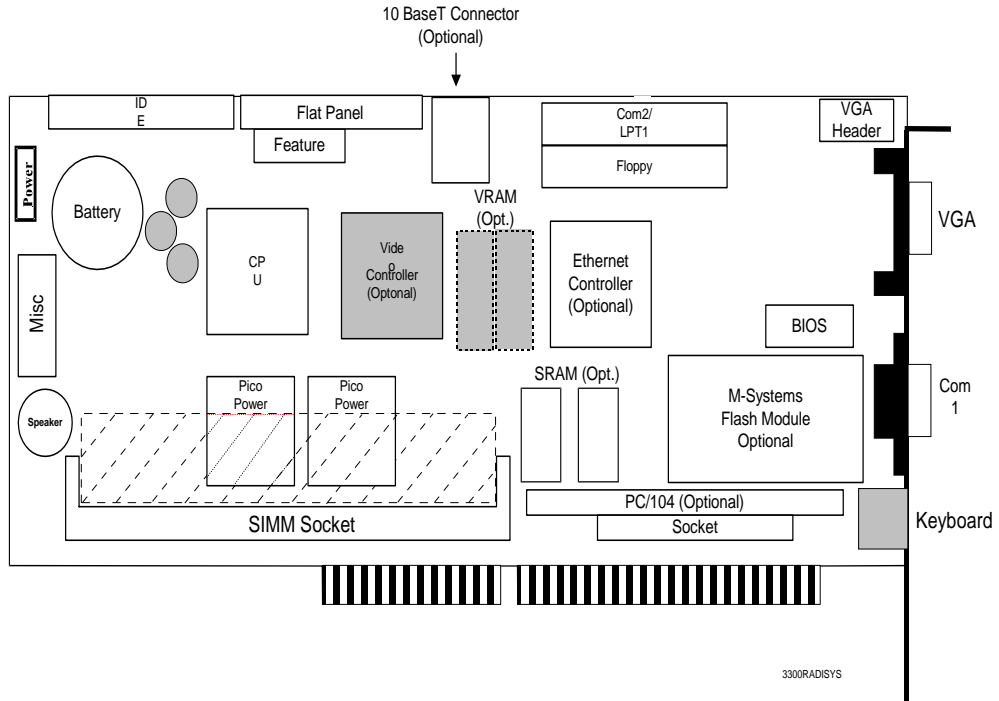


Figure 3-41, Single-Board Computer Layout

Remote Start/Stop (Option) Installation

Objective:

- To install a remote start/stop pushbutton station on the console.

Tools: Small Flat Screwdriver

Kit:

Part Number	Description
33000122	Remote start/stop kit, including preassembled pushbutton station and a 10-32, 3/8" shoulder bolt, P/N 86100853.

Procedure:

NOTE: Changes to Setup Utility parameters are necessary before operation is possible.

To install the Remote Start/Stop (Option), perform the following steps:

1. Locate the Start/Stop pushbutton station and the shoulder bolt, P/N 86100853.
2. Remove one of the 10-32 black Phillips head screws on the right side of the console and replace it with the shoulder bolt.
3. Plug the remote start/stop cable into the back of the console at the START/STOP connector. Refer to **Figure 3-40, Console Lower Rear Panel**.
4. Hand-tighten both screws on the connector.
5. Mount the pushbutton station on the bolt.

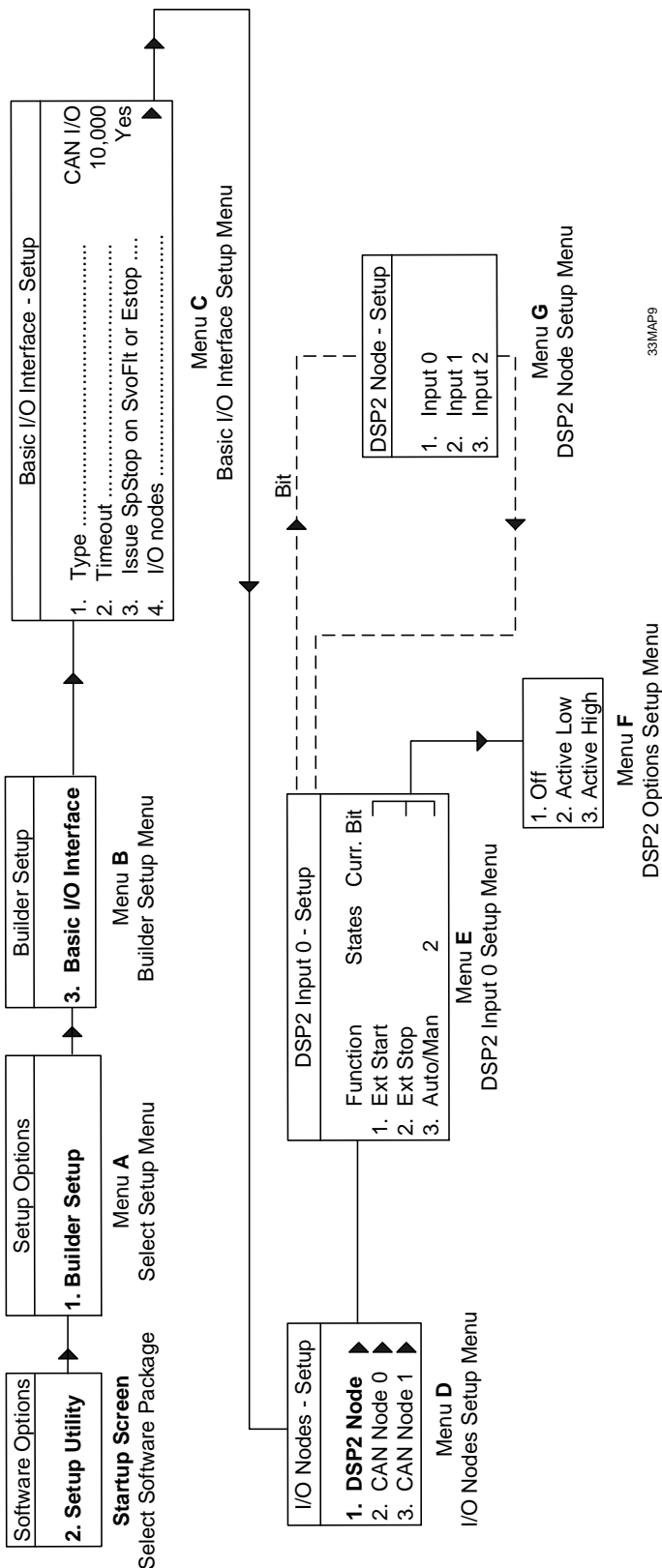
Remote Start/Stop Configuration

Refer to **Figure 3-42, Remote Start/Stop Setup Map**. To configure the Remote Start/Stop (Option), perform the following steps:

1. In Manual Mode and with the control turned on, press the red Emergency Stop button; then, press **EXIT (F10)** to display the **Software Options Menu**.
2. Highlight **Setup Utility** and press **ENTER** to activate the **Setup Options Menu, Menu A**.
3. Highlight **Builder Setup** and press **ENTER** to activate the **Builder Setup Menu, Menu B**.
4. Highlight **Basic I/O Interface** and press **ENTER** to activate the **Basic I/O Interface Setup Menu, Menu C**.

5. Select **I/O Nodes** and press **ENTER** to activate the **I/O Nodes Setup Menu, Menu D**.
6. Select **DSP2 Node** and press **ENTER** to activate the **DSP2 Input 0 Setup Menu, Menu E**.
7. Select **Ext Start** and press **ENTER** to activate the **DSP2 Options Setup Menu, Menu F**. (The CNC may prompt for a password. If necessary, enter the service level password, and press **ENTER**. Refer to **Setup Utility, Password Restricted Parameters**, for more information.)
8. Select **Active High** and press **ENTER** to activate the **DSP2 Input 0 Setup Menu, Menu E**.
9. Select **BIT (F1)** and press **ENTER** to activate the **DSP2 Node Setup Menu, Menu G**.
10. Select **Input 1** and press **ENTER** to activate the **DSP2 Input 1 Setup Menu, Menu E**.
11. Select **Ext Stop** and press **ENTER** to activate the **DSP2 Options Setup Menu, Menu F**.
12. Select **Active Low**.
13. Press **EXIT (F10)** successively until the **Save Changes?** prompt appears in the middle of the screen.
14. Select **Yes (F1)** to save the configuration changes.
15. Enter control software and verify that the **Start** and **Stop** button on the push button station function the same way as the green and red **START** and **STOP** keys on the keyboard.

<p>NOTE: The Start/Stop device must be plugged in. If it is not, the inputs activated above must be set to Off.</p>



33MAP9

Figure 3-42, Remote Start/Stop Setup Map

Handy Pulser (Option) Installation

Objective:

- ❑ To install a Handy Pulser on the console.
- ❑ To configure the Handy Pulser.
- ❑ To setup the interface.
- ❑ To setup the handwheel.

Tools: Small, Flat Screwdriver

Kit:

Part Number	Description
33000087	Handwheel Kit, including preassembled handwheel and a 10-32 x 3/8" shoulder bolt, P/N 86100853.

Procedure:

NOTE: Changes to Setup Utility parameters are necessary before operation is possible.

1. Facing the console, use the small, flat screwdriver to remove the 10-32, black, Phillips-head screw on the right side of the console.
2. Take the shoulder bolt, P/N 86100853, and place it through the mounting bracket, P/N 23000109, and the washer, P/N 86300090.
3. Screw the shoulder bolt into the hole on the right side of the console and hand-tighten.
4. Hang the Handy Pulser on the bracket. Refer to **Figure 3-43**.

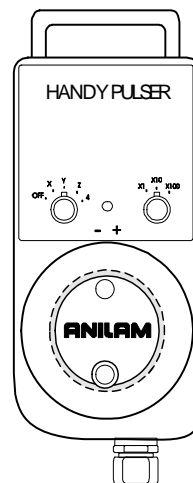


Figure 3-43, Handy Pulser

5. Plug the Handy Pulser cable into the Handwheel connector on the console. Refer to **Figure 3-40, Console Lower Rear Panel**. Hand-tighten both screws on the connector.
6. The Handy Pulser combines the functionality of axis selection, jog resolution, and a handwheel in a remote device. Refer to the programming manual for operating instructions on these features.

Handy Pulser I/O Configuration

NOTE: Some steps in these procedures may require you to enter a service-level password. Refer to Setup Utility, Password Restricted Parameters.

Refer to **Figure 3-44, Handy Pulser Setup Menus**, for the menus referenced in this procedure.

1. In Manual Mode or Power-Up Mode, press EXIT (F10) to display the **Software Options Menu**.
2. Select **Setup Utility** and press ENTER to activate the **Setup Options Menu, Menu A**.
3. Select **Builder Setup** and press ENTER to activate the **Builder Setup Menu, Menu B**.
4. Select **Basic I/O Interface** and press ENTER to activate the **Basic I/O Interface Setup Menu, Menu C**.
5. Select **I/O Nodes** and press ENTER to activate the **I/O Nodes Setup Menu, Menu D**.
6. Select **CAN Node 1** and press ENTER to activate the **CAN Node # Setup Menu, Menu E**.
7. Select **Installed** to verify that CAN Node 1 is installed. If necessary, press ENTER to toggle from **No** to **Yes**.
8. Select **Inputs** and press ENTER to activate the **CAN Input # Functions (Node #) Setup Menu, Menu F**.
9. Select **Remote Resolution Selector** (option 29).

Perform steps 10 through 13 on **CAN Inputs 6, 7, and 8**:

10. Press **F1** to display the **CAN Inputs (Node #) Setup Menu, Menu F**.
11. Select the BIT (Input) number (**6, 7, and 8**) and press ENTER to activate the **Options Setup Menu, Menu H**.
12. Select **Active High**, and press ENTER.
13. Select **Remote Axis Selector**.

Perform steps 14 through 16 on **CAN Inputs 0, 1, and 2**:

14. Press **F1** to display the **CAN Inputs (Node 1) Setup Menu, Menu G**.
15. Select the bit (Input) number (**0, 1, and 2**) and press ENTER to activate the **Options Setup Menu**.
16. Select **Active High**.

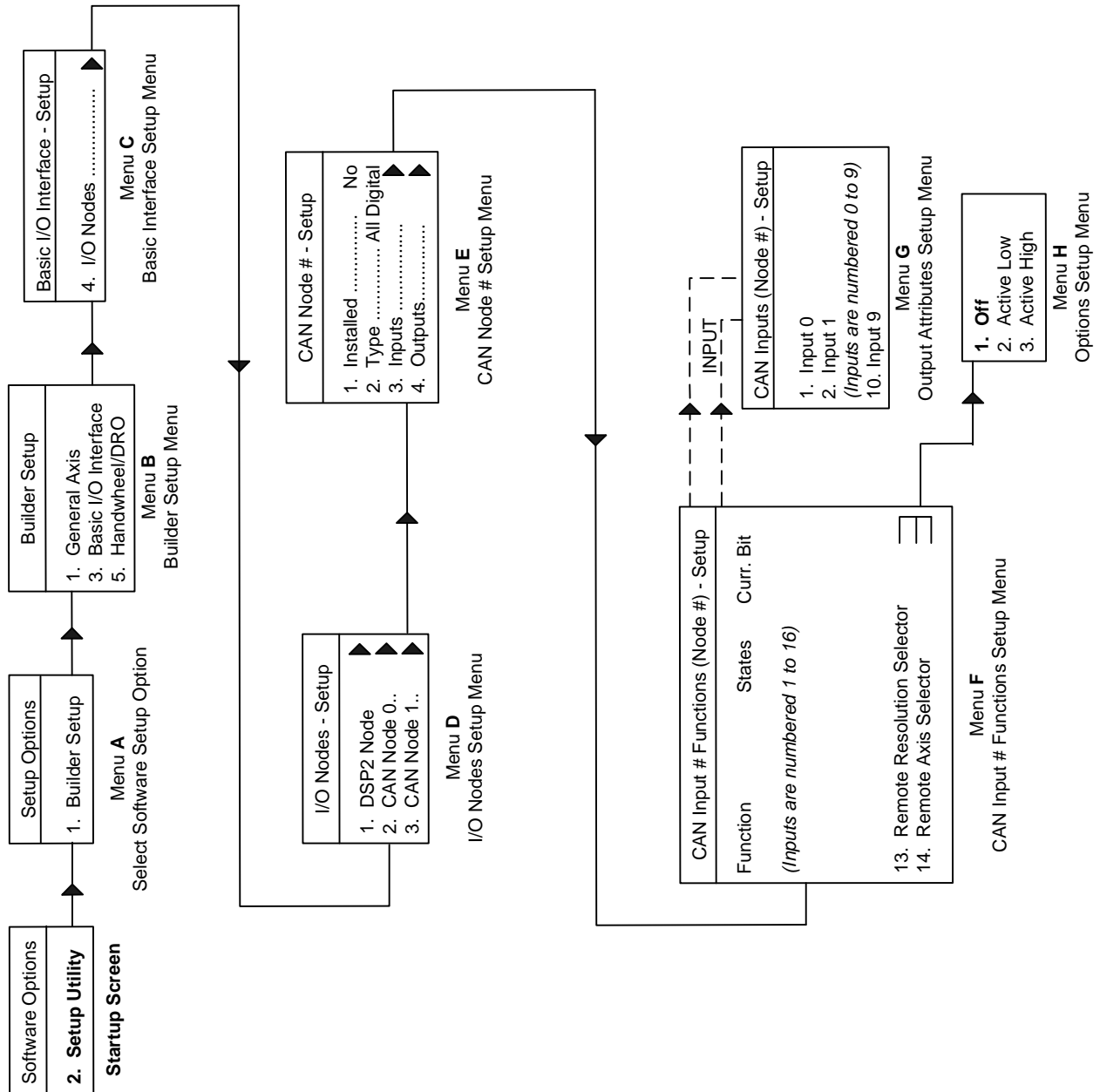


Figure 3-44, Handy Pulser Setup Menus

Handwheel Setup

Refer to **Figure 3-45, Handwheel Setup Menus**. Perform the following steps to configure **Handwheel #1**:

1. In **Manual Mode** or **Power-Up Mode** press **EXIT** (F10) to display the **Software Options Menu**.
2. Select **Setup Utility** and press **ENTER**.
3. When you gain access to the **Setup Utility** select **Builder Setup** and press **ENTER** to activate the **Builder Setup Menu, Menu B**.
4. Select **Handwheel/DRO** and press **ENTER** to activate the **Handwheel/DRO Setup Menu, Menu C**.
5. Select **Handwheel/DRO #1** and press **ENTER** to activate the **Handwheel/DRO #1 Setup Menu, Menu D**.
6. Select **Type** to verify the option is set to **Handwheel**. (If necessary, press **ENTER** to display the **Options Setup Menu, Menu E**.)
7. Select **Handwheel** (option 3) and press **ENTER** to activate the **Handwheel Setup Menu, Menu F**.
8. Select **Resolution** and press **ENTER** to activate the **Options Setup Menu, Menu G**.
9. Select **MP Switch** and press **ENTER**.
10. Enter the **Scaling Factor** (usually **1.00**).
11. Press **EXIT** (F10) until the **Save Changes?** prompt displays in the middle of the screen.
12. Select **Yes** (F1) to save the changes.

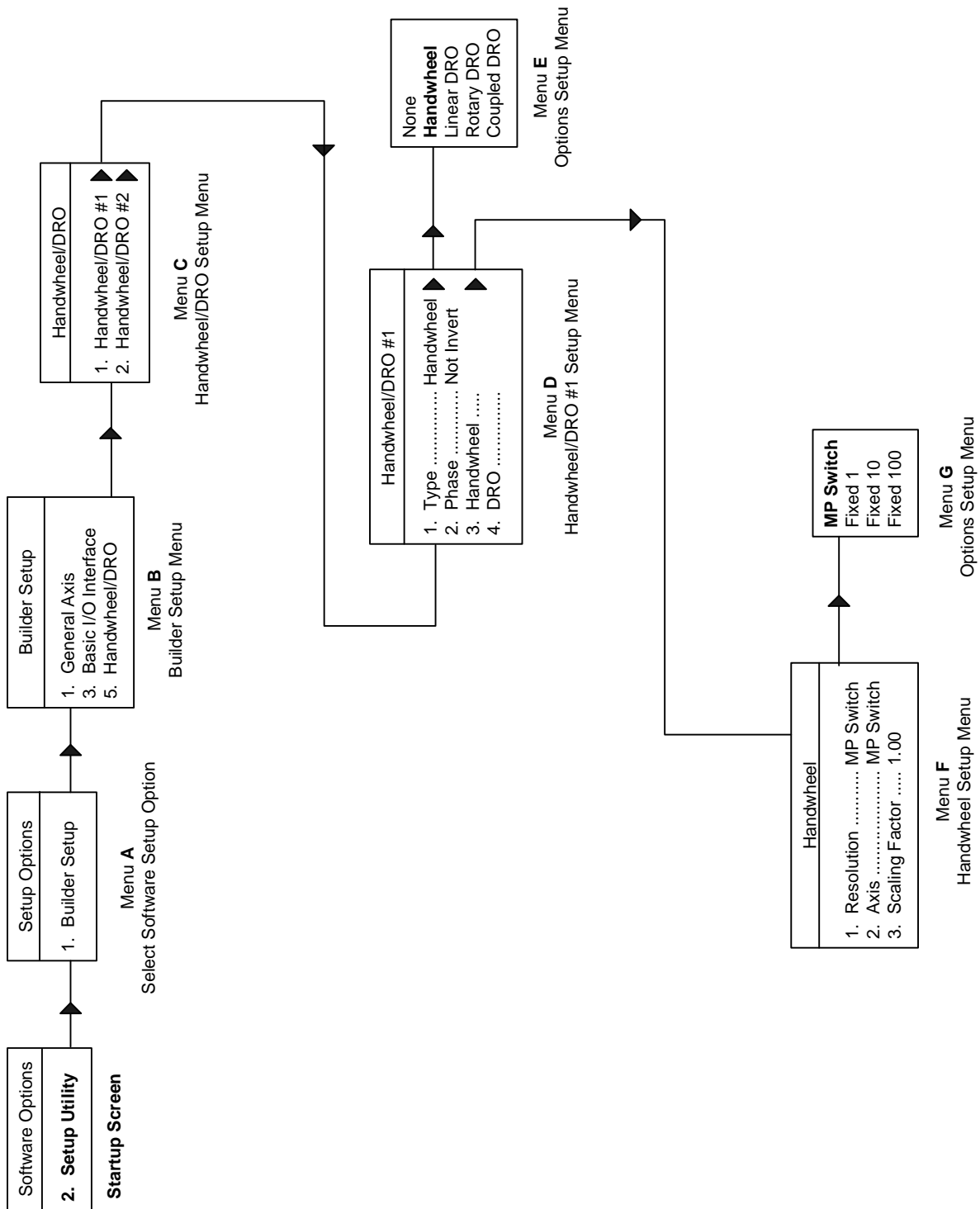


Figure 3-45, Handwheel Setup Menus

Peripherals Installation

Printer Installation

Refer to **Figure 3-40, Console Lower Rear Panel**. To install a printer, plug the printer cable into the DB-25 connector located on the back of the console.

Keyboard Installation

Refer to **Figure 3-40, Console Lower Rear Panel**. Plug any standard PC keyboard into the 5-pin DIN socket on the back of the console. (Use a size adapter, if required.) Installing a keyboard deactivates the console keypad. To reactivate the keypad, unplug the keyboard.

You cannot activate the E-STOP function or reset the servos using an external keyboard. These functions require the corresponding keys on the console keypad.

NOTE: ANILAM recommends industrial grade keyboards.
--

Maintenance Procedures

Objectives:

- ❑ To replace the servo cabinet fan filter.
- ❑ To replace the servo cabinet vent filter.
- ❑ To replace the console fan filter.
- ❑ To replace the console vent filter.

Tools: Phillips screwdriver

Parts:

The following table lists the parts needed to replace the servo cabinet fan filter and vent filters.

Part Numbers	Description
P/N 85300008 or NAPA P/N 2133	10" x 5" Paper Filter
P/N 85300009	5" x 5" Polyurethane Filter

Table 3-4, Top Rear Console Panel Parts, lists the parts needed to replace the console fan filter and vent filter.

Procedure:

Perform the procedure for the appropriate filters you need to replace.

NOTE: ANILAM provides replacement filters P/N 85300009, P/N 85300012, P/N 85300013, and P/N 85300010 with each 3200MK and 3300MK.

Replace the Servo Cabinet Fan Filter, P/N 85300008

NOTE: The paper servo cabinet fan filter, P/N 85300008, is the same filter as NAPA P/N 2133. It replaces AC Delco, P/N A751C; Fram, P/N CA3441; Motorcraft, P/N FA752; WIX, P/N 42136; and Volkswagen, P/N 049-139-848.

To replace the servo cabinet fan filter, P/N 85300008, perform the following steps:

1. Remove the four wing nuts that secure the paper air filter frame to the bottom of the servo cabinet.
2. Replace the servo cabinet fan filter.
3. Reattach the frame and hand-tighten the four wing nuts.

Replace the servo cabinet fan filter annually.

Replace the Servo Cabinet Vent Filter, P/N 85300009

Refer to **Figure 3-46**. To replace the servo cabinet vent filter, P/N 85300009, perform the following steps:

1. Remove the four Phillips screws that secure the vent panel to the side of the servo cabinet.
2. Remove the vent panel, and replace the servo cabinet vent filter.
3. Reattach the vent panel.

Replace the servo cabinet vent filter every three months.

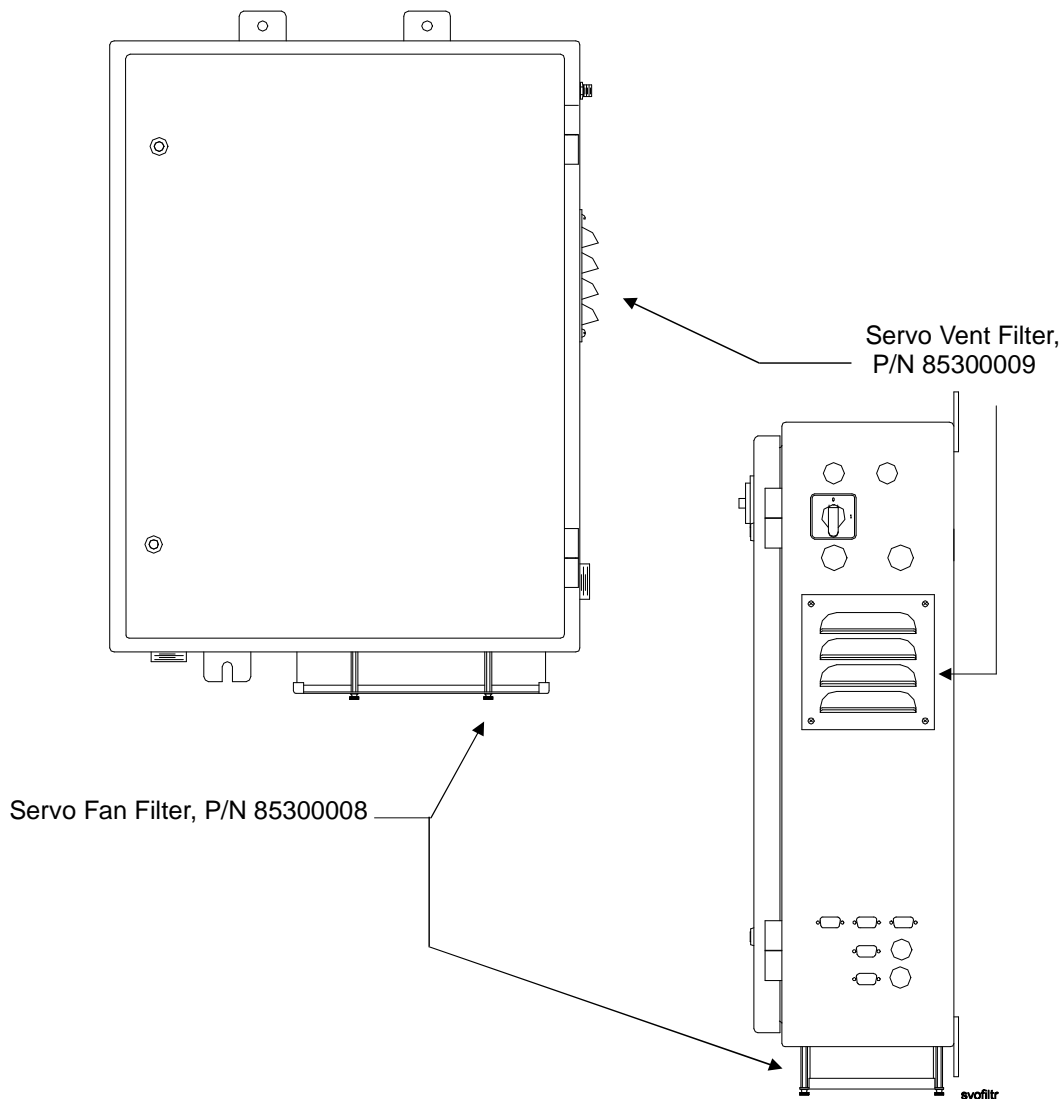


Figure 3-46, 3200MK and 3300MK Servo Cabinet - Front and Side View

Replace the Console Filters, P/N 85300012 and P/N 85300013

Refer to **Figure 3-47** and **Figure 3-48, Top Rear Console Panel**. **Table 3-4, Top Rear Console Panel Parts**, lists the parts shown in **Figure 3-48**.

To replace the console filters, perform the following steps:

1. Remove the four screws that hold the frame to the rear panel of the console.
2. Replace the console fiberglass filter and expanded metal filter, and reattach the frame.

Inspect rear panel filters and verify the fan's airflow monthly. Anilam recommends that you replace the console filters every three months. However, under some adverse environmental conditions, such as oil vapor contamination and/or high levels of particulate, more frequent filter changes may be required. The suggested interval in such cases is once a month.

Replace the Rear Panel Filter, P/N 85300010

To replace the rear panel filter, perform the following steps:

1. Remove the screws from the top cover of the console, and lift off the top cover.
2. Replace the rear panel filter, and reattach the top cover.

Anilam recommends that you replace the rear panel filter every three months.

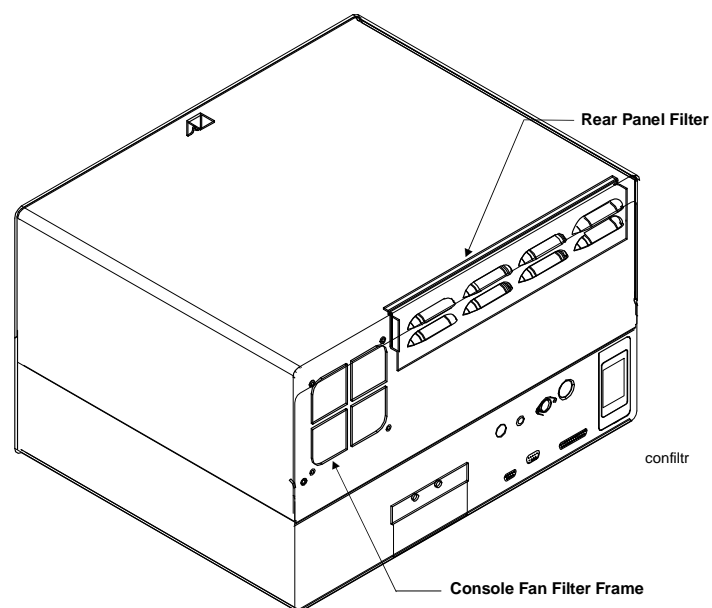


Figure 3-47, 3200MK and 3300MK Console Rear Panel

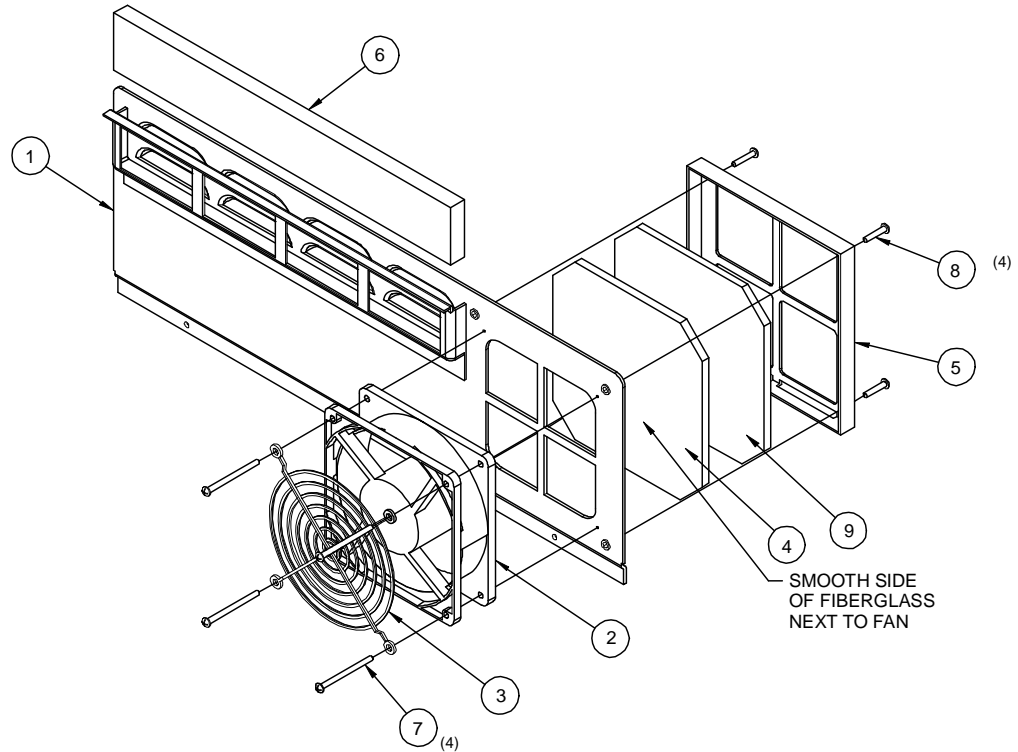


Figure 3-48, Top Rear Console Panel

Table 3-4, Top Rear Console Panel Parts

Item	Part No.	Description	QTY.
1	23000002	SHT Metal, Top Console Rear Panel	1
2	85400012	24-V DC Fan 105 CFM	1
3	85400013	Fan Finger Guard	1
4	85300013	Fiberglass Filter	1
5	21900112	Console Fan Filter Bracket	1
6	85300010	Rear Panel Filter 1.81" x 12.38" x 5"	1
7	86100238	Screw, #6-32 x 1-7/8" LG PHL PAN HD	4
8	86100123	Screw, #6-32 x 3/4" LG PHL PAN HD	4
9	85300012	Expanded Metal Filter	1

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