CENTROID Retrofit Of Hardinge Lathe

Procedure Manual

Rev. 041104

Table of Contents

Retrofit Overview

The first step of the Hardinge retrofit is the removal of the old control (may be Allen Bradley, GE etc.). Depending on which model you have (HNC or CHNC) first go to Chapter 1 HNC or Chapter 2 CHNC. When you have completed the HNC vs CHNC specific tasks go to Chapter 4 to complete tasks common to both models.

Figure 1.1.1 - Before

Figure 1.1.2 - After

HNC and CHNC Retrofit Overview

Centroid introduces the first total solution for completing a retrofit on a Hardinge HNC or CHNC. No more long hours of engineering and machining adapter plates for the encoders and spindle motors. Every wire location and terminal block is mapped out. There is a total pictorial guide to show how to retrofit step by step. Within minutes you can be making money retrofitting instead of inventing. There has never been a more precise and simple manual to follow.

The control is auto loading ready, which streamlines installation and saves using a complicated peripheral PLC. These models of Hardinge machines come with the spindle headstock machined for automation add on.

Features everything you need to retrofit a Hardinge CHNC or HNC:

- Total Solution
- Spindle Encoder & Retrofit adaptors included
- Spindle Motor & plate, pulley and belt included
- Another Centroid first “total pictorial easy to follow manual”
- Auto loading Ready Control
- Runs on Single Phase Power (option)
- Multiple AC voltage input 220/240/440/480 choices
- Motor encoders and adaptors included
- Motors and drives are matched for performance
- The entire turret PLC logic is provided

Lists of Retrofit Steps

The following is a list of the steps in a Hardinge retrofit:

1. Disconnect all wires going to the lathe frame. Remove the old control cabinet.
2. Remove the old magnetics cabinet, if present. Otherwise remove the old back panel assemblies from both end cabinets (HNC only).
3. Install the new terminal strips and connect the old Hardinge wires to the new terminal strips.
4. If the machine has the DC spindle drive, the old belt will be reused. For the vari-drive spindle, remove the old spindle belt now. Cut the old belt. Or, if the customer wants to save the old belt, add additional labor charges and remove the collet closer, the spindle feedback covers, the spindle feedback assembly, the spindle end covers, and the old spindle belt.
5. Remove the old spindle motor.
6. Remove the vari-drive assembly, if present.
7. Remove the motor mounting plate. Using the supplied template, mark and drill the new spindle motor mounting holes.
8. Reinstall the spindle motor mounting plate.
9. Remove the old spindle feedback system. It may be necessary to remove the collet closer first, depend ing on model (mainly necessary with HNC models.)
10. Install the new spindle motor.
11. If the unit has the vari-drive spindle, install the new spindle drive belt. Remove the spindle end covers to install the new spindle drive belt. Reinstall the spindle end covers, if they were removed.
12. Install the new spindle encoder. Reassemble the collet closer, if the collet closer was removed.

13.Remove the X axis feedback assembly.

14.If replacing the servo motors, remove the old X axis servo motor now.

15.If replacing the servo motors, install the new X axis servo motor.

16.If replacing the servo motors, wire the new X axis servo motor.

17. Install the new X axis encoder

18.Remove the Z axis feedback assembly.

19.If replacing the servo motors, remove the old Z axis servo motor now.

20.If replacing the servo motors, install the new Z axis servo motor.

21.If replacing the servo motors, wire the new Z axis servo motor.

22.Install the new Z axis encoder.

23.Check all splices, heat shrink tubing, cable routing and cable ties, etc.

24.Connect the new control wires to the new terminal strips, TB3-TB7.

25.Test the new system:

- Limit switches
- Axis jogging
- Spindle
- Turret
- Collet closer
- Cutoff tool, if present
- Parts chute, if present
- Door interlock(s)
- Program test
- Threading test

26.Check all splices, heat shrink tubing, cable routing and cable ties, etc.

27.Reinstall all remaining covers.

28.Train the customer.

29.Collect the check.

HNC Specific Tasks

This chapter applies only to HNC models. If you have a Hardinge CHNC, go to Chapter 3.

Warning

!! Do Not Randomly cut wires !!
some need to be as long as possi-
ble for it will be used again.

Figure 2.1.1

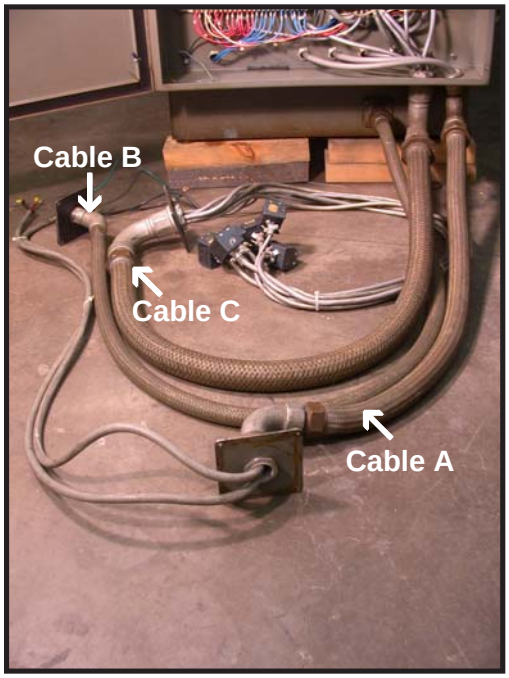

Figure 2.1.2

Before removing conduit cables A, B & C (Figure 2.1.2), make sure all wires are labeled and the labels are secured. Only remove conduit cables A, B & C from the G.E. control cabinet going to the Lathe (Figure 2.1.1). The wires in conduit cables A, B & C will be used, the G.E. control cabinet will not.

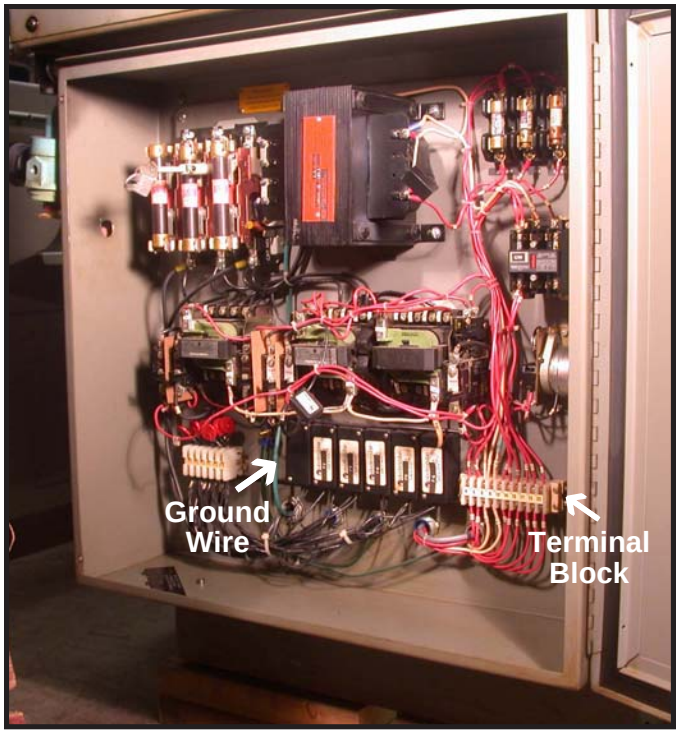

Figure 2.1.3

At the tailstock end of the lathe, remove the wires from the bottom side of the terminal block for reuse. Disconnect the coolant pump power and ground wires leaving them as long as possible. Also disconnect the ground wire for reuse (Figure 2.1.3). Remove the subpanel assembly. Subpanel will not be reused.

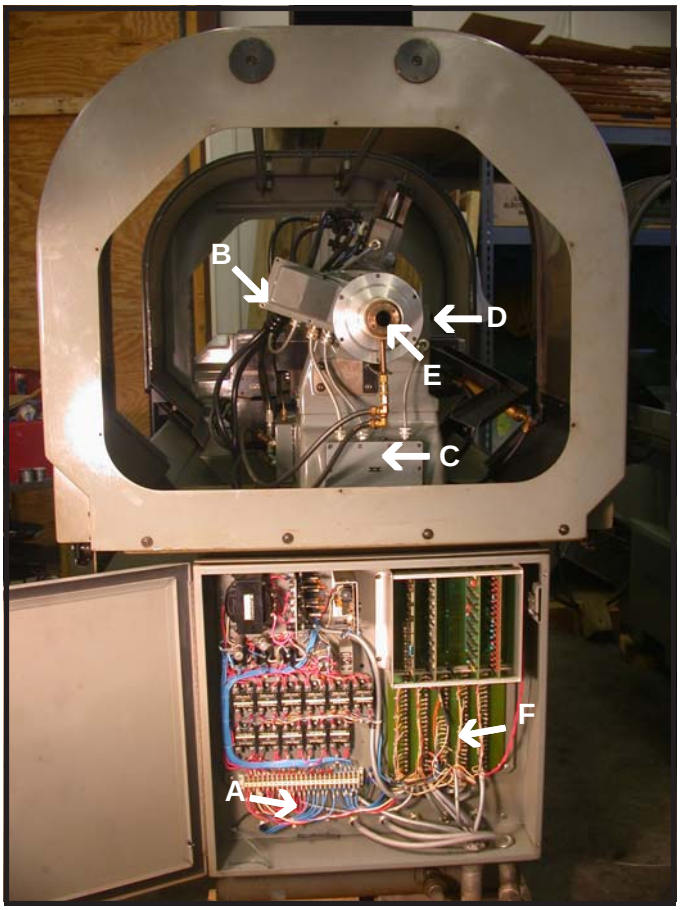

Figure 2.1.4

Spindle End of Lathe - Disconnect wires that connect to the terminals at location F and go to the lathe. Wires that connect to the terminals at F and go out through the conduits can be cut. Disconnect the wires at (A) going to the lathe for reuse. Remove the sub panel assembly.

This picture also shows, the spindle feedback cover (B), the cable access cover to be removed if more slack is needed in the spindle feedback cable (C), Spindle lock button (D), and Spindle collet closer (E).

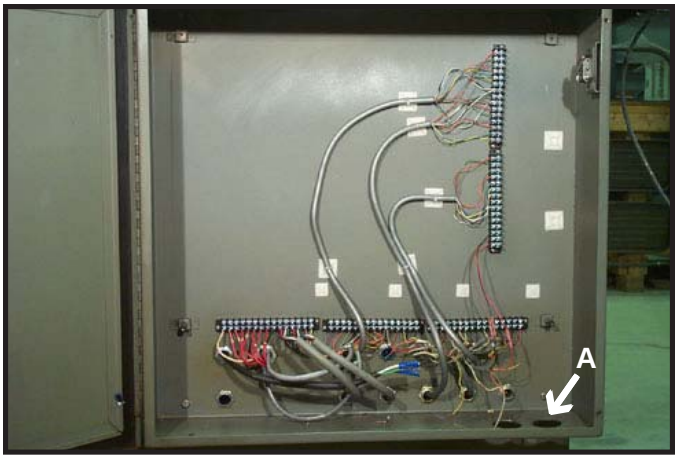

Figure 2.2.1 Spindle End

Figure 2.2.2 Tailstock End

After removal of the subpanels in the magnetic cabinets, at each end of the lathe, install the terminal strips per schematic drawing provided with the kit. Attach the Hardinge wiring to the terminal strips per schematic drawing in the magnetic cabinets at the spindle end of the lathe.

Caution: The wire color coding on the schematic is for a lathe that is in original condition and has been unaltered. If the wiring has been altered, color coding will be different.

The right hand conduit hole (Fig 2.2.1 A) must be opened up to accept a 1 1/4" conduit. This is best done with a chassis punch. A 22-12 cable for the inverter control must be pulled through the same conduit hole that the red wire's are located. Not all of the red wires are used. After connecting the one's that are used, a spare one can be used to pull the inverter cable through.

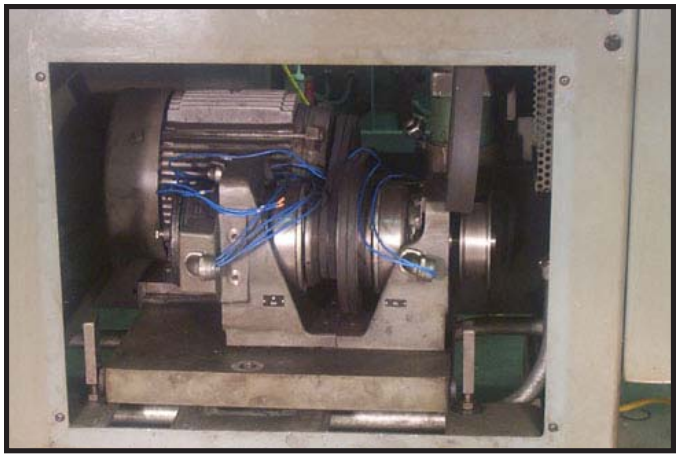

Figure 2.3.1

Remove the old spindle motor belt and the vari-drive belt by cutting the belt. To remove the belts without cutting, thread it over the spindle pulley and around the end of the vari-speed pulley shaft, then remove the spindle belt from the spindle. See Figures 2.5.6 through 2.5.8 for instructions to remove belt without cutting and installing new belt from the spindle.

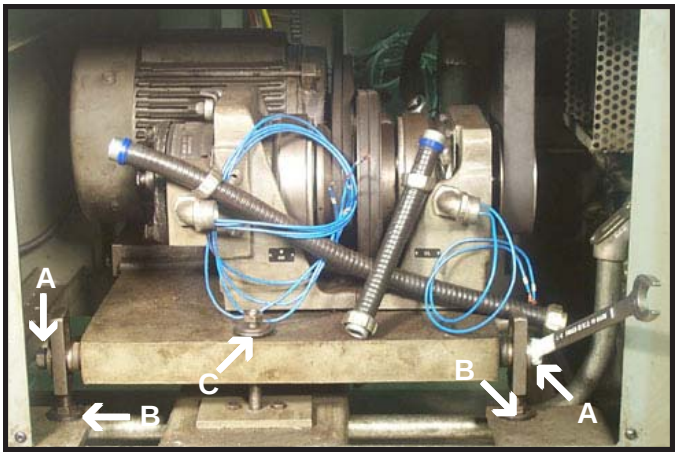

Figure 2.3.3

At the back side of the lathe loosen the (2) bolts (Figure 2.3.3 - A) on the side of the motor mounting plate that are for the levelers. Loosen the two top nuts (B) on the levelers and remove the two square plates underneath (B). Remove the center lock nut (C) and screw the jack bolt out to raise the plate up.

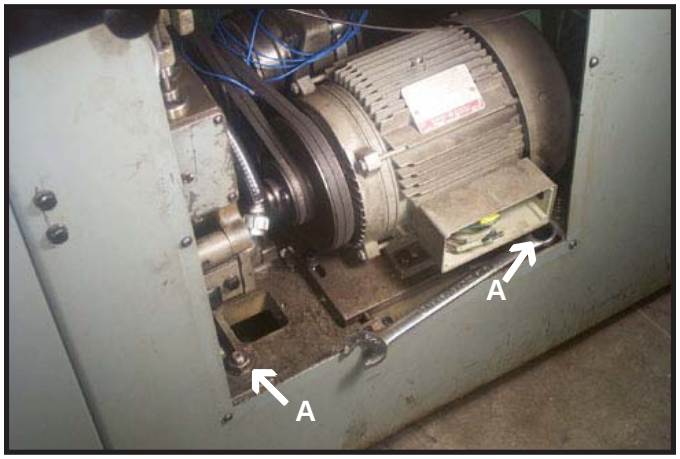

Figure 2.3.2

At the front of the lathe, unwire the spindle motor. Remove the nuts from the two front side jack bolts at the front of the lathe (Figure 2.3.2 - A). After the spindle motor mounting plate is removed, there are (2) nuts on the bottom side that need to be removed.

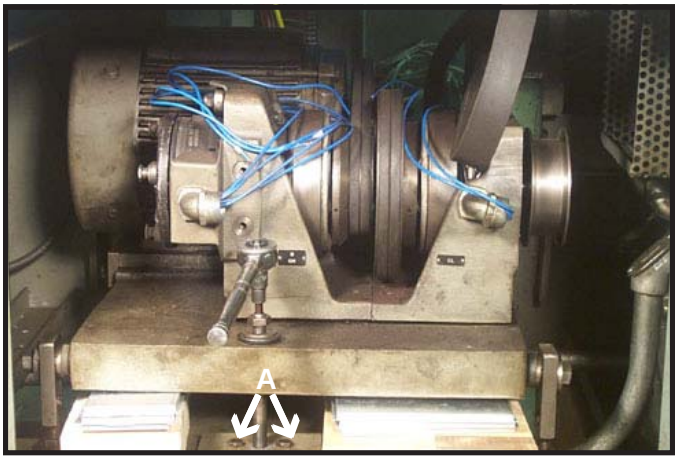

Figure 2.3.4

Block up the motor base plate. Remove the two bolts (Figure 2.3.4 - A) holding the center jack plate, lower the jack bolt, and remove the jack bolt assembly (see Figure 2.3.5 - B).

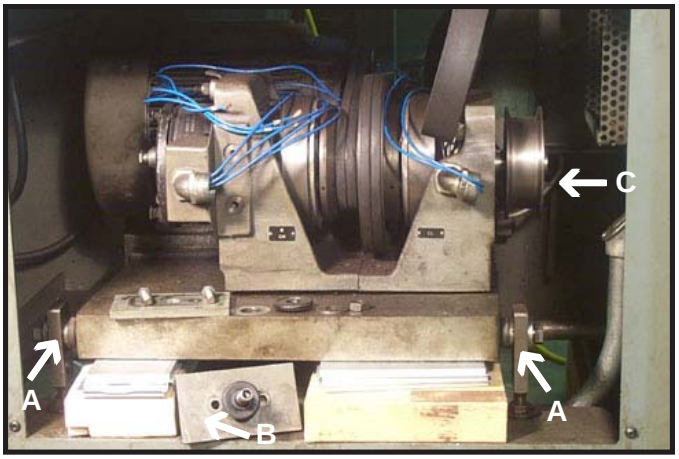

Figure 2.3.5

Pivot the side arms (A) toward the back of the lathe and pull the motor base assembly out of the back of the lathe. Remove the clutch assembly and the old motor from the motor base plate.

Remove pulley from end of the clutch assembly shaft (C). Re-bore pulley to 1.375" (-0.000 / +0.0005) and broach 0.312 for a keyway.

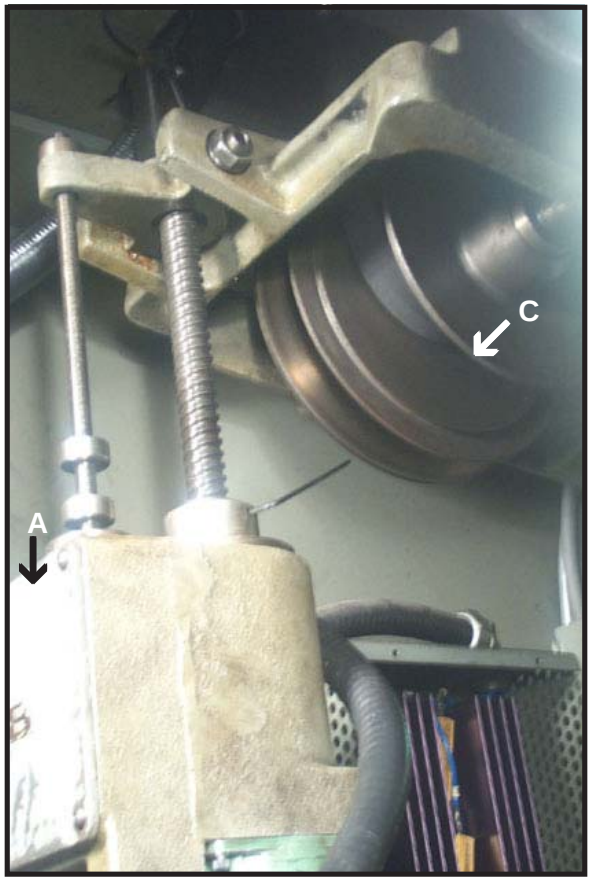

Figure 2.3.6

Remove the vari-speed assembly (Figure 2.3.6 -A).

Figure 2.3.7

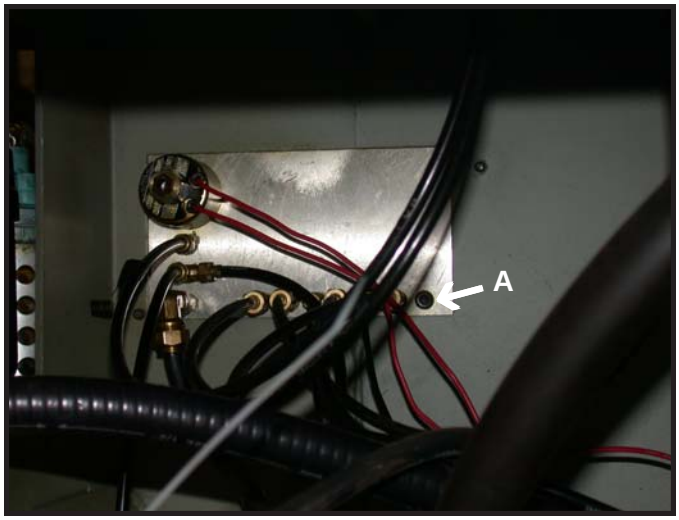

Figure 2.3.8

Remove varidrive lube line (Figure 2.3.7) and plug the hole in the back of the lube pump with a 1/8" NPT plug (Figure 2.3.8 - A).

Figure 2.3.9

Remove the two bolts holding the vari-speed pulley assembly (Figure 2.3.9 - B) to the machine frame. This will allow the vari-speed pulley (Figure 2.3.6 -C) to be reomved.

Remove the motor mounting plate then drill and tap the motor mounting plate with the supplied template for 3/8-16 X 4 S.H.C. screws.

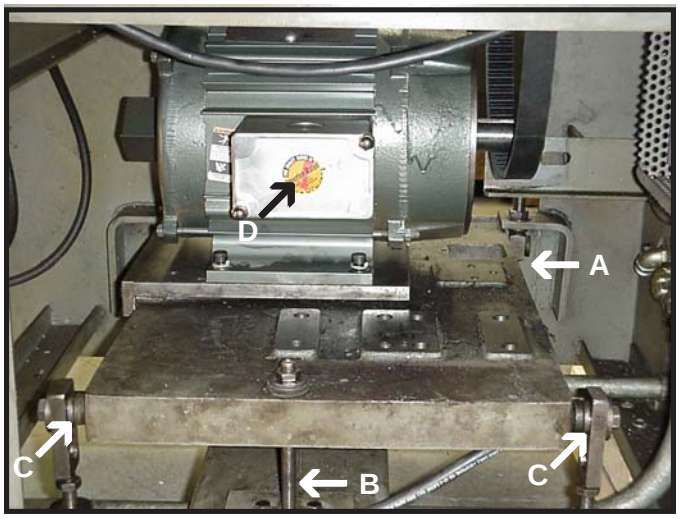

Figure 2.4.1

Remove the bottom nuts from the front 2 leveler bolts (Figure 2.4.1 -A). You will only reuse the washers. Reinstall center jack bolt assembly (Figure 2.4.1 - B). Reinstall the 2 rear side leveler bolts and washers (C). Remove the blocking that was put in earlier when the motor was being removed. Install the motor mounting plate. Mount the new motor to the motor base plate. Connect the spindle motor cable to the motor before installing it in the lathe (Figure 2.4.1 - D).

Installing new belt can be done after the removal of the feedback unit (See Figures 2.5.1 through 2.5.5).

Feed the new spindle belt in from the top, over the spindle pulley (See Figure 2.5.8). Install the rebored motor pulley (from section 2.3.5) and belt, tighten to the proper tension.

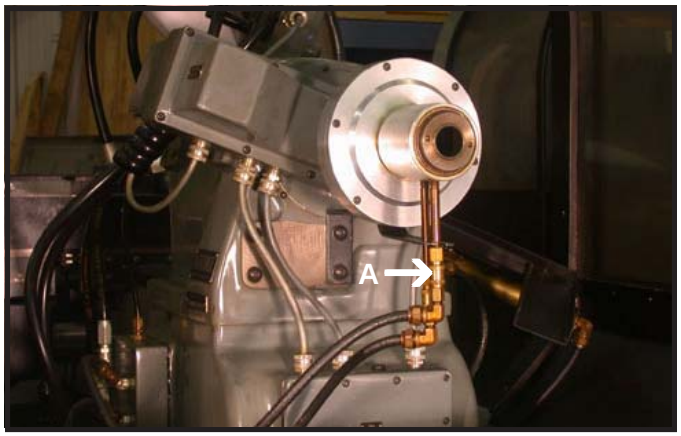

Figure 2.5.1

The collet closer needs to be removed, so the feedback unit can be replaced and the new spindle belt can be installed. The spindle lock button (Figure 2.1.4 - D), locks the spindle so that the collet closer can be removed.

Removal of the collet closer and the collet closer back plate. Tag which air line is connected to which fitting and then disconnect the two air lines from the collet closer by pulling up on the quick disconnect (A). Loosen the four socket head cap screws on the back of the collet closer (see Figure 2.5.2 - A). Make sure the collet has been removed from the spindle. Rotate the collet closer slightly clockwise, when looking at the collet closure from view in Figure 2.5.1and pull it toward you to remove the screw heads from the keyhole slots in the collet back plate. Keep pulling the collet closer toward you until the end of the draw tube clears the hole in the collet closer back plate (See Figure 2.5.2).

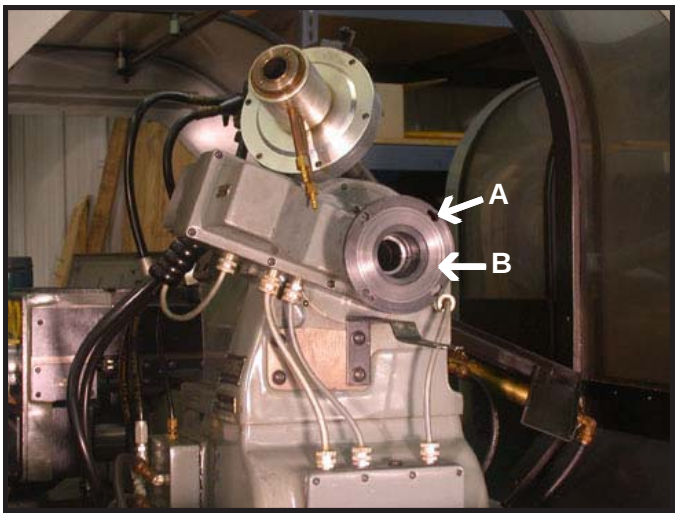

Figure 2.5.2

Now remove the collet closer back plate (B). Loosen (2) locking screws (see Figure 2.5.3 - A). With the spindle lock button engaged, turn the collet closer back plate counterclockwise to remove it.

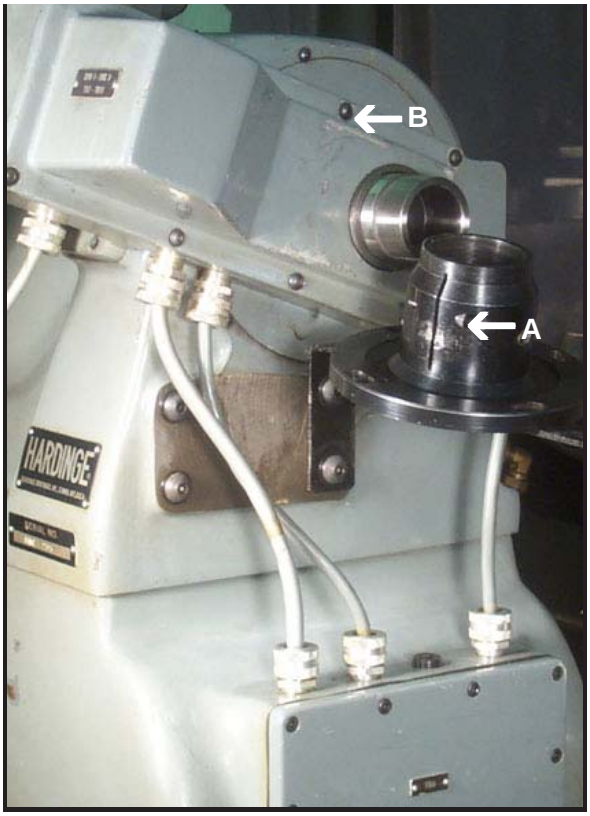

Figure 2.5.3

Remove the spindle feedback cover now that the collet closer back plate is removed by removing the 8 mounting screws (B).

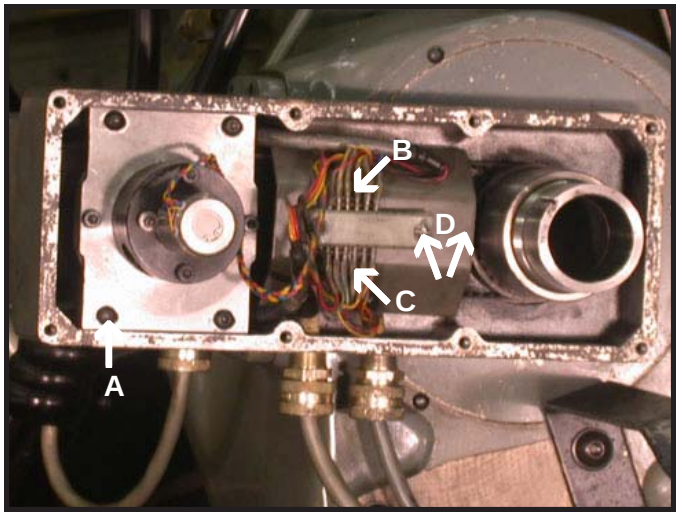

Figure 2.5.4

- On the upper side of the spindle feedback terminal strip, cut the (8) wires from the spindle feedback unit to the terminal strip (B).
- On the lower side of spindle feedback terminal strip, cut the (8) wires coming into the spindle feedback terminal strip. (C).
- Remove screws holding the terminal strip and guard (D).
- Remove (4) SHC screws (Figure 2.5.4 - A) to remove spindle feedback unit.

Be careful not to damage the other wires on the terminal strip. The old feedback cable (C) will have the connector for the new spindle encoder butt spliced to it. The wiring diagram is in Table 2.5.1. If additional cable length is needed remove the cable access cover (see Figure 2.1.4 - C). The original Hardinge cable sometimes has the 4th pair of wires cut off short. The outer insulation on the cable will need to be stripped back to reveal these wires.

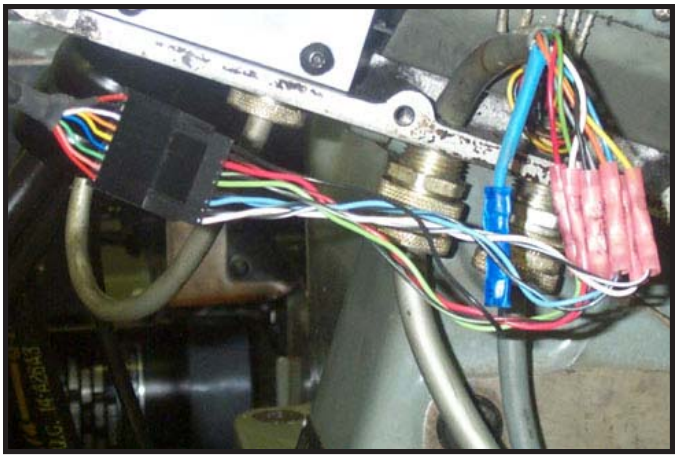

Figure 2.5.5

All the wire colors and information to install the encoder plug wire is on the schematic.

Table 2.5.1

	Machine Wire Color	Encoder Plug Wire
A	Blue	White
A_	Yellow	Black/White
B	Grey	Blue
B_	Orange	Blue/Black
Z	Red	Green
Z-	Green	Black/Green
+ 5 volts	White	Red
Common	Black	Black/Red
Shield	Shield	Black

Figure 2.5.6

To remove and/or install the motor belt, the spindle feedback housing and pully access cover will need to be removed.

Looking from the back side of the spindle, remove the (2) S.H.C. screws holding the spindle feedback housing.

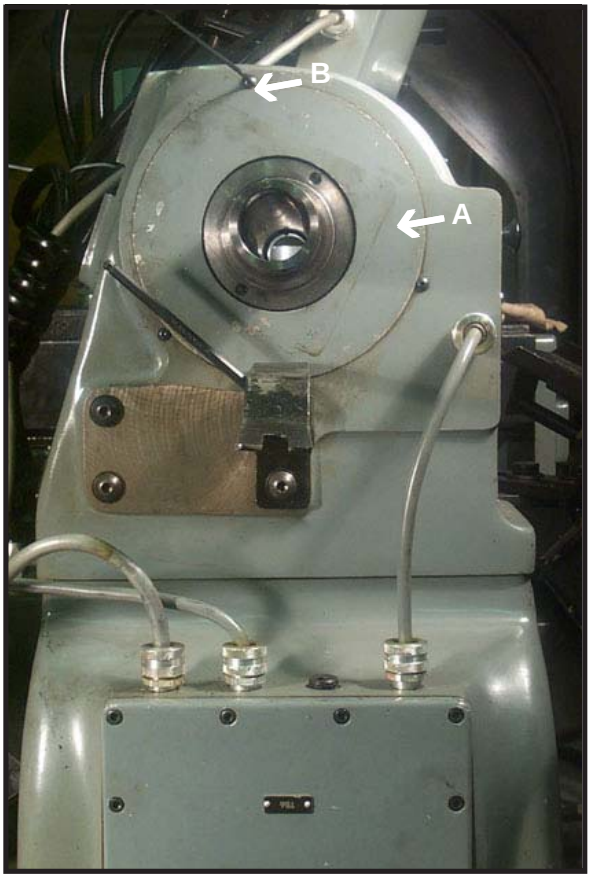

Figure 2.5.7

Remove the pulley access cover (A) by removing screws (B).

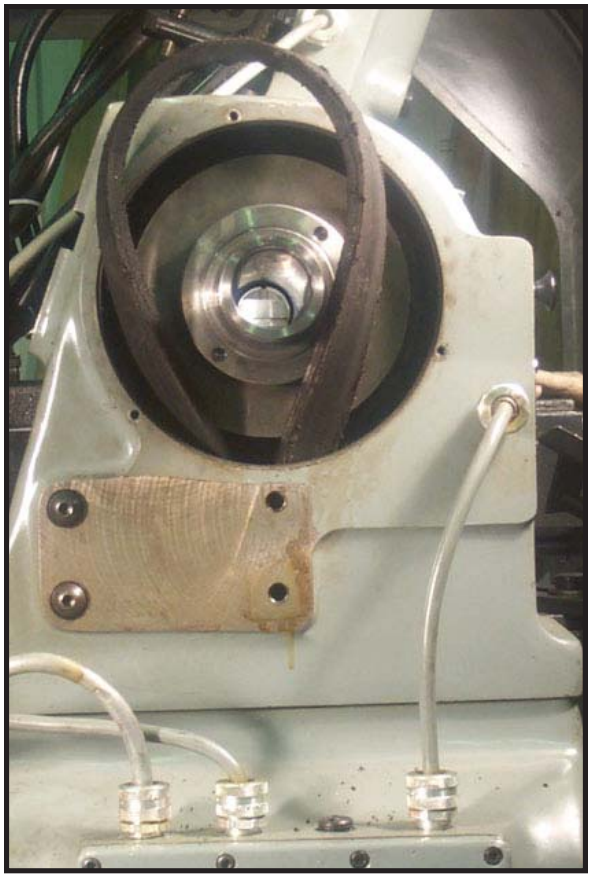

Figure 2.5.8

If the old belt is to be saved, remove the old belt now by pulling up the old belt through after being removed from vari-drive (See chapter 2.3). If belt is not being saved, cut belt and remove from underneath, if not already down. Feed new belt down through pulley access hole. Put belt over spindle pulley. Then put belt over pulley on motor, align, tighten the set screws in motor pulley, and tighten belt to proper tension. After spindle belt is in place, reinstall pulley access cover with 3 screws (see Figure 2.5.7 - B). Now reinstall the spindle feedback housing (see Figure 2.5.6).

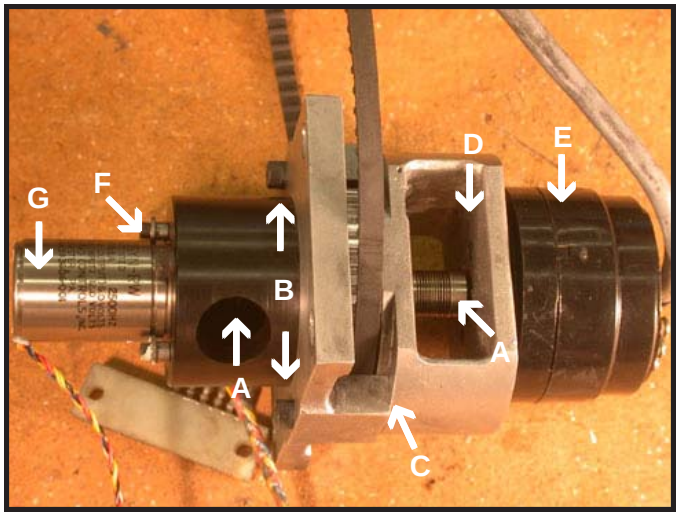

Figure 2.6.1

As shown in Figure 2.6.1, loosen (2) set screws on each end of the (2) couplers (A) (8 set screws total between (2) couplers). Next remove (2) S.H.C. screws (B). Feedback unit will come apart at (C). Now you have access to S.H.C. screws (D). Remove S.H.C. screws and discard Feedback unit (E) and coupler. Remove S.H.C. screws (F) and then discard encoder (G) and coupler.

Figure 2.6.2

Once the coupler is removed, the pulley shaft can be removed from the mounting block. Remove the shaft nut (Figure 2.6.2 - A) by turning counterclockwise, and pull the shaft out of the pulley and bearings. Retain the pulley, 2 bearings, nut, and spring washer for reuse with the new shaft and new encoder. Discard old pulley shaft.

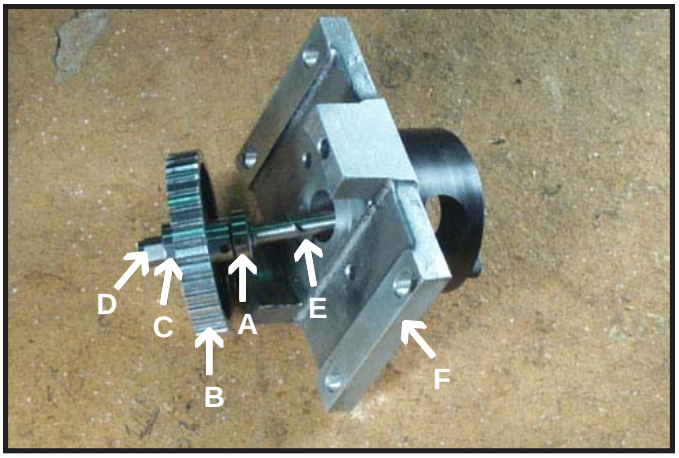

Figure 2.7.1

Install bearing (A) on new pulley shaft up against shoulder on new shaft. Next install pulley (B) in the shaft. Install bearing (C) then tighten nut (D) into shaft. Install spring wash (E) before pressing shaft assemble into Housing (F).

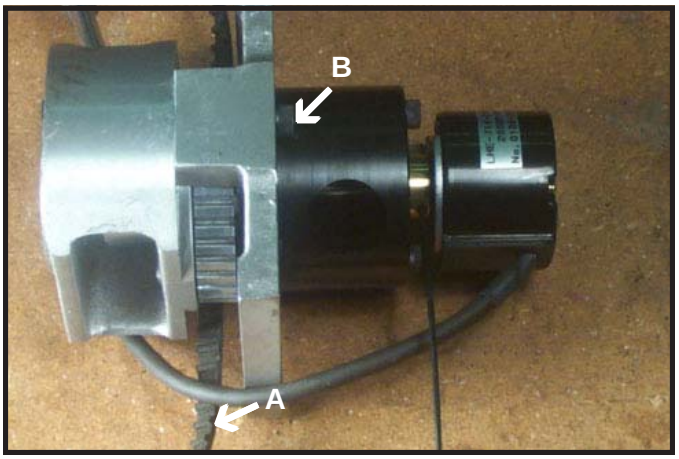

Figure 2.7.2

Assemble the attach mounting block to the encoder bearing block, reusing the two allen bolts (B). Caution: the belt is only under 1 leg of the assembly and is actually around the other leg (see figure 2.6.1). Make sure the encoder belt (A) is in the place on the pulley before assembly. Mount the encoder on the end of the new encoder shaft. Tighten the set screws in shaft coupling and mark the encoder mounting hole location.

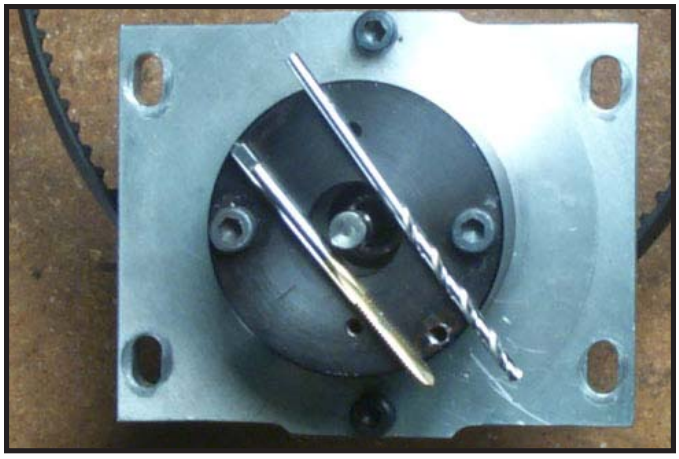

Figure 2.7.3

Remove the encoder. Center punch the hole, then drill (#35) and tap for a 6-32 machine screw. DO NOT CENTER PUNCH HOLE WHILE ENCODER IS MOUNTED. The shock could damage encoder.

Figure 2.7.4

Remount the new encoder to the shaft. Tighten the (2) set screws (A) on the encoder to the shaft coupling, then install the 6-32 screw (B) in the new mounting hole.

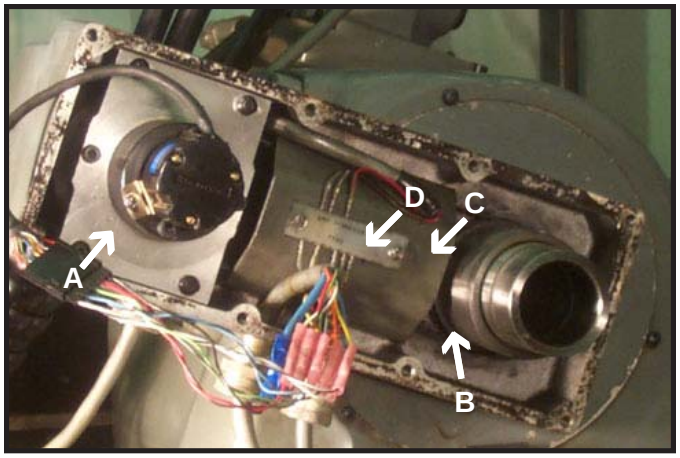

Figure 2.8.1

Install encoder housing assembly (A) and encoder belt (B) and tighten encoder belt to proper tension. Install belt guard (C) and (1) terminal strip (D).

It is recommended waiting until after you have the Centroid control wired into lathe before putting feedback cover on and installing collet closure. You will be able to turn the spindle by hand and watch the spindle encoder feedback in PID abs POS to make sure it is wired correctly. This procedure is explained in Chapter 5. After you are sure the spindle encoder is installed correctly and working you can install the feedback unit cover and the spindle collet closure.

CHNC Specific Tasks

This chapter applies only to CHNC models. If you have a Hardinge HNC, go to Chapter 2.

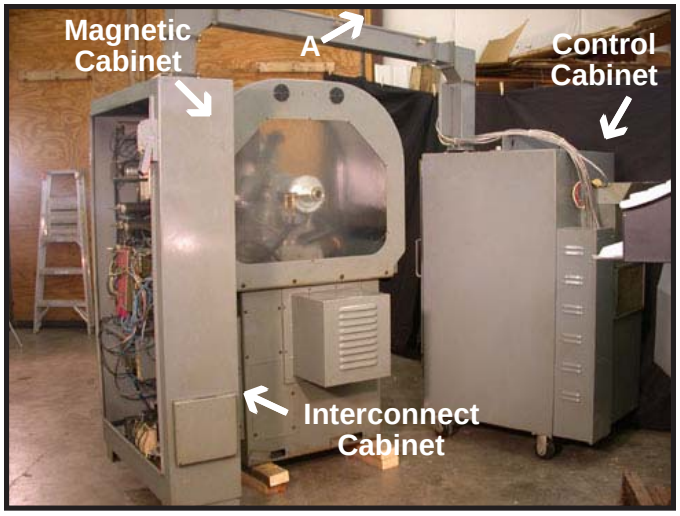

Figure 3.1.1

Open the lid on top of the wire race way (A). Pull the wires from the control cabinet through the race way and into the magnetic cabinet. Remove the empty race way. The wires can be cut at the top of the interconnect cabinet, but you will need to check the cables with a meter to determine what they connect to.

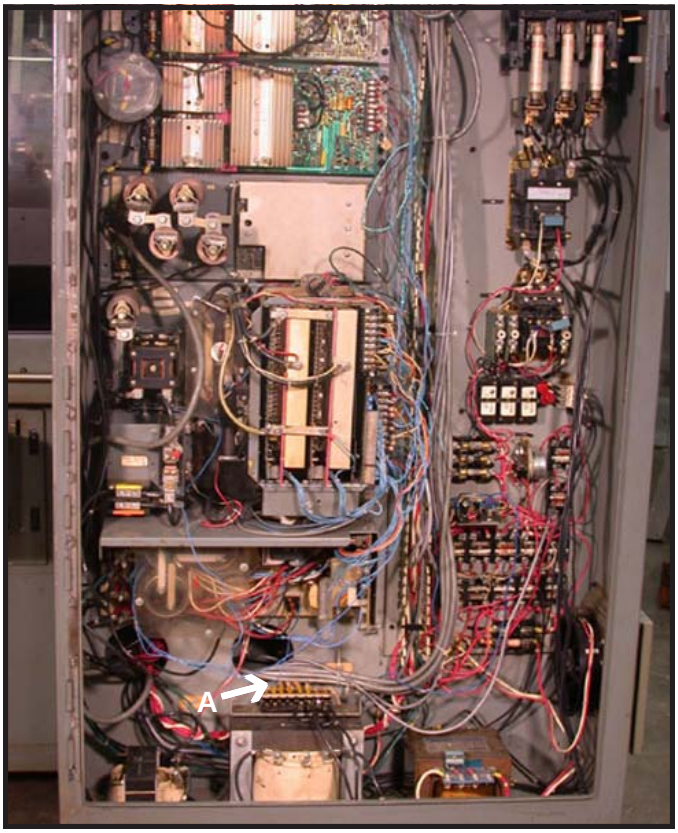

Figure 3.1.2

All cables that go through the interconnect cabinet (A) must be unlaced so the magnetic cabinet can be removed. Make sure all cables have labels before they are disconnected. Remove the magnetic cabinet.

Note: Before you remove the bolts that hold the magnetic cabinet make sure you block the magnetic cabinet up and support it properly. The magnetic cabinet is held only by these (10) bolts.

Figure 3.1.3

This is what your machine should look like after you have removed the old control. This view displays all the wires to be reused.

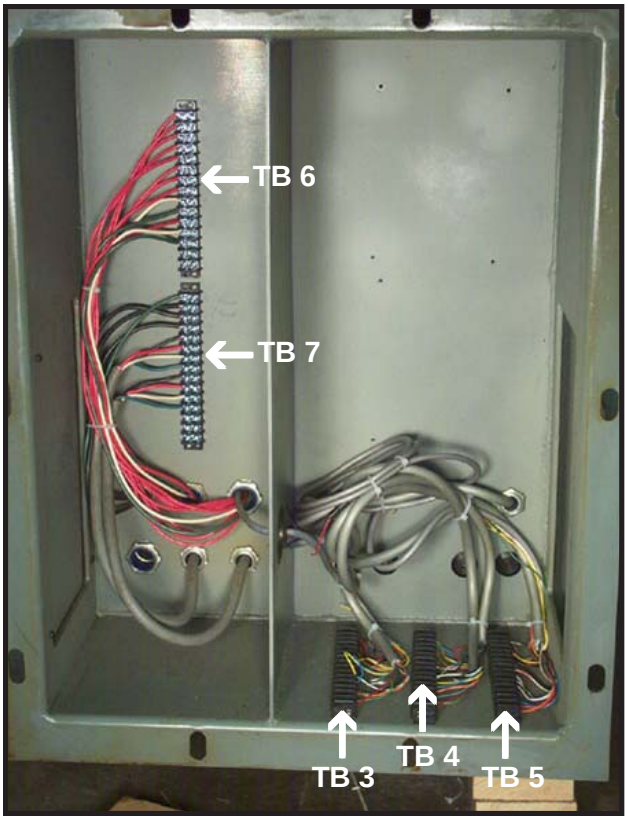

Figure 3.2.1

Figure 3.2.2

This is the interconnect cabinet that will now be called the CHNC Magnetic Cabinet. Mark holes for the (5) terminal strips. Drill (#36) and tap for 6-32 X 1/2" screws.

Drill and tap holes for inverter, braking resistor, flood contactor and disconnect bracket. Drill and punch 1 1/4” conduit hole in center divider and two side plate holes.

Make sure that the inverter is far enough to the right to leave space for the braking resistor.

When drilling holes in the center divider, remove the right side cover plate and drill the hole for the top disconnect bracket screw first. Drill the hole as high as possible (3.2.2 - A), then measure and drill the second screw hole for the disconnect bracket.

Prep wires and connect as per the schematic provided with your kit, keeing the wiring as neat as possible.

Mount inverter and flood contactor as shown in Figure 3.2.2.

Do not mount the disconnect bracket or connect the power cables at this time.

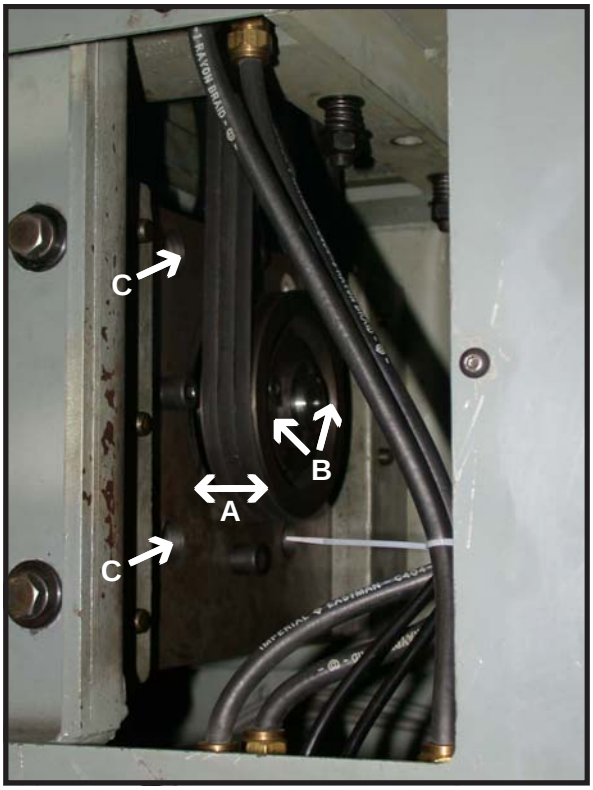

Figure 3.3.1

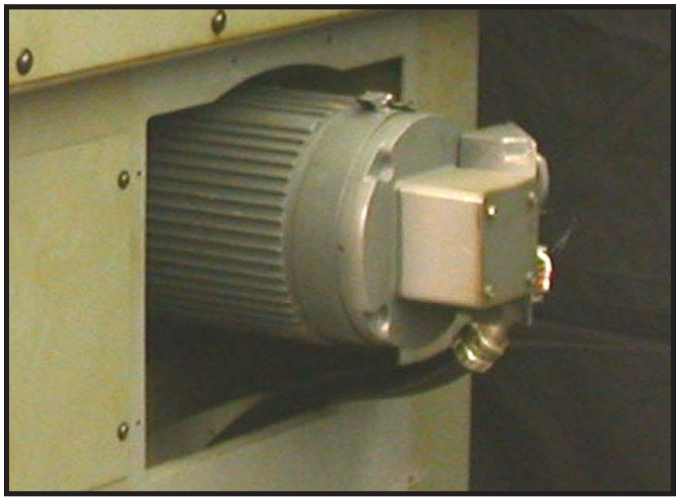

Figure 3.3.2

Before removing D.C. spindle motor, measure how far the pulley is from mounting plate (Figure 3.3.1 - A), so when the motor is reinstalled, it is easier to align the pulley. Loosen (2) bolts (Figure 3.3.1 - B) to remove pulley. Properly block motor before loosening the (4) bolts that hold the motor to the mounting plate. Unwire D.C. spindle motor. This motor is heavy, recommend (2) people when removing to prevent injury. Save the plastic bushing and washers that the D.C. motor mounting bolts go through. These are used to help align template that is used to drill the (4) 17/32 holes to mount the new A.C. motor and to mount the new A.C. motor.

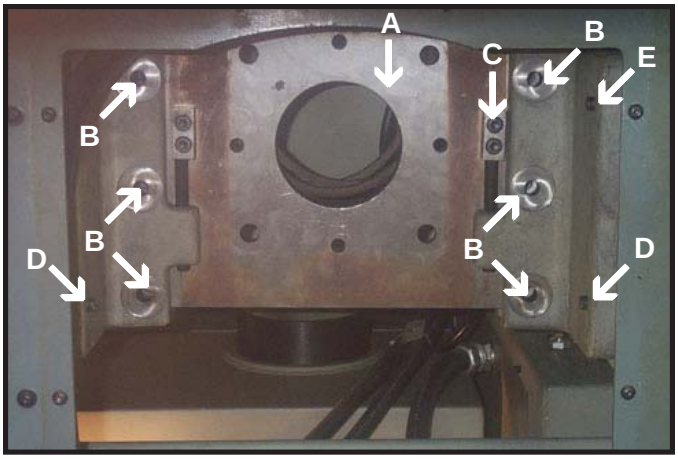

Figure 3.3.3

After D.C. spindle motor is removed, mounting plate (A) has to be removed to drill (4) 17/32 holes to mount new A.C. motor. Remove the (6) bolts (B) that hold the mounting plate to the mounting bracket. Do not remove the adjusting bolts (C). As shown in Figure 3.3.3, remove the lower 2 bolts at (D) level and the front bolt at (E) level on each side. Next loosen the 4th bolt on each of the mounting bracket at the back of (E) level. Do not remove these 2 bolts.

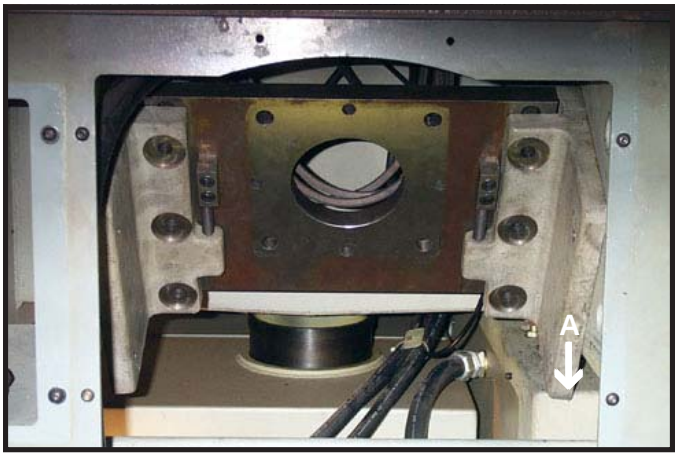

Figure 3.3.4

With the 4th bolt loose on each side of the mounting bracket, swing the mounting brackets down until mounting bracket rests at (Figure 3.3.4 - A). You may have to pry the brackets because there is a rubber gasket behind each mounting bracket. Once the brackets are loose, remove the rubber gaskets and discard them. After you have swung the brackets down, remove the fourth bolt on the right mounting bracket only.

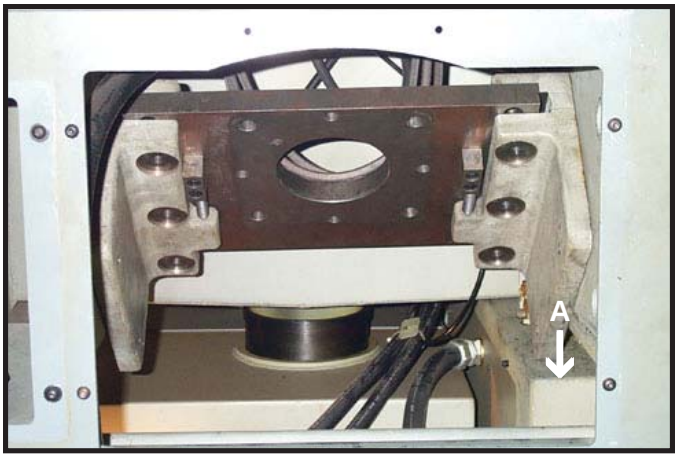

Figure 3.3.5

Slide the right mounting bracket up so you can swing the mounts pass the ledge (A). Reinstall the fourth bolt in the right mounting bracket after you have the motor mounting brackets in position as shown in Figure 3.3.5.

Note: Use extra care at this point. There are hydraulic lines behind the right bracket that could be damaged.

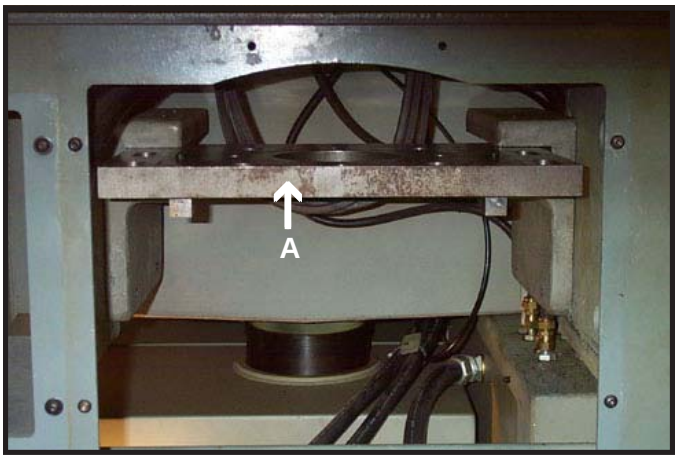

Figure 3.3.6

Swing motor mounting brackets to a horizontal position shown in Figure 3.3.6. Tighten the fourth bolt on each bracket so the motor mounting bracket assembly will stay in this position. Motor mounting plate (A) can be removed now by sliding it towards you.

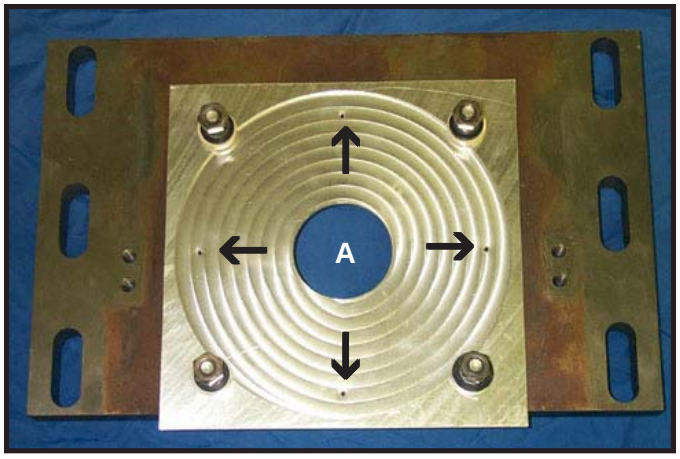

Figure 3.4.1

Mount aluminum template using the 3/8" mounting bolts and plastic bushings used to mount the old D.C. motor. Drill (4) 17/32" holes in the motor mounting plate from the pre-punched holes in the template shown in Figure 3.4.1-A. To reinstall motor mounting plate, reverse the procedures for removing motor plate. After motor mounting plate is back into position (Figure 3.3.3), reinstall (6) bolts that were removed in Figure 3.3.3. Tighten all (6) bolts at D and E level on Figure 3.3.3. Reinstall template using the 3/8" mounting bolts and plastic bushing as done in Figure 3.4.1. The template will help align the new A.C. motor.

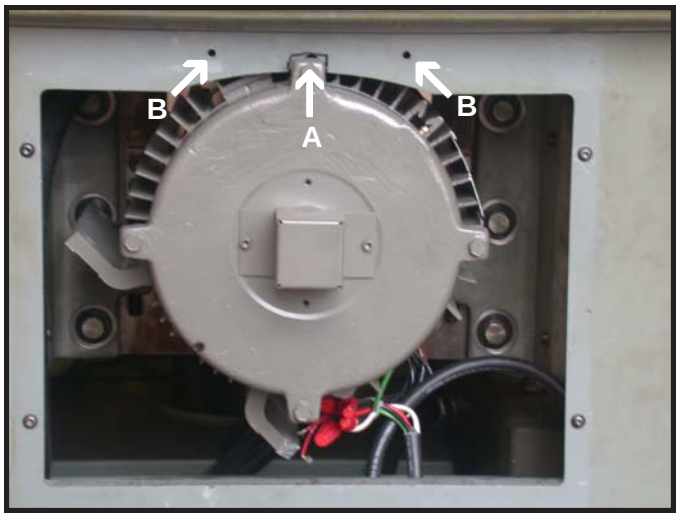

Figure 3.4.2

Before new A.C. motor can be installed, cut a notch in the lathe frame as shown to allow clearances for motor. Centering between bolt holes (Figure 3.4.2 - B), cut notch (A) one inch wide by one half inch high.

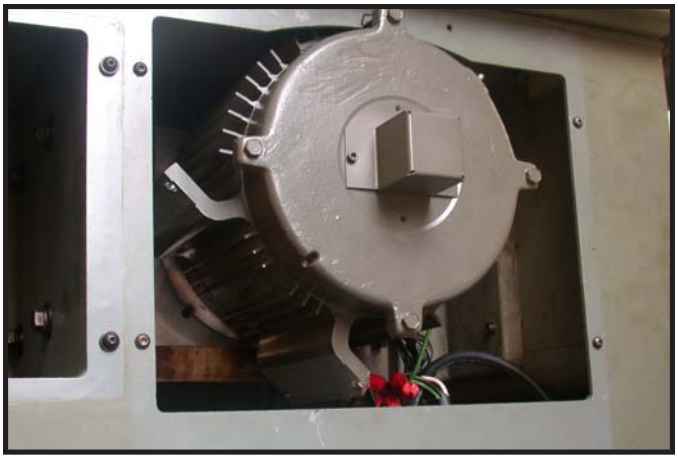

Figure 3.4.3

Installing the new A.C. motor will take two people to work the motor into place. The motor will be rotated 45 degrees clockwise so the mounting holes line up. The second person will install the (4) bolts while the motor is held in place. Remove the 4 bolts and bushing that were installed to hold template.

The new A.C. motor is prewired and can be installed without removing the connection box.

Reinstall the pulley the same distance from the face plate as measured before it was taken off. Reinstall the belts. Make sure the belts are aligned correctly with the grooves on the spindle pulley. If new belts are to be installed, see Chapter 3.6 - Disassembly of Feedback Unit, for complete removal of the feedback housing to replace belts.

For a CHNC4 lathe, go to section 3.10.

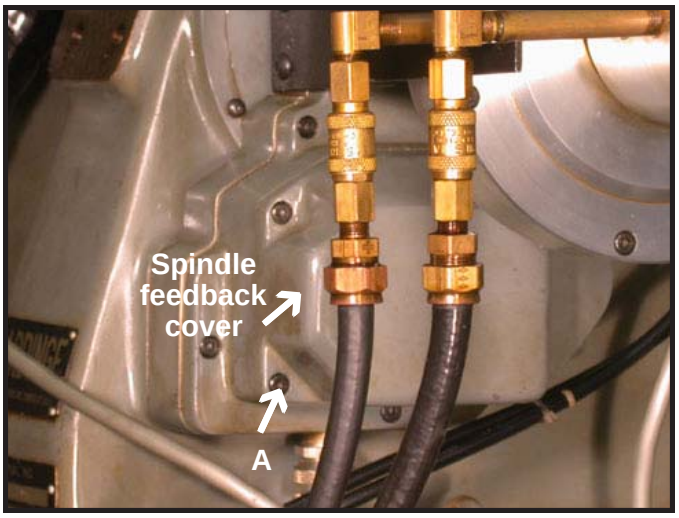

Figure 3.5.1

Remove the spindle feedback cover by removing (4) S.H.C. screws (Figure 3.5.1 - A).

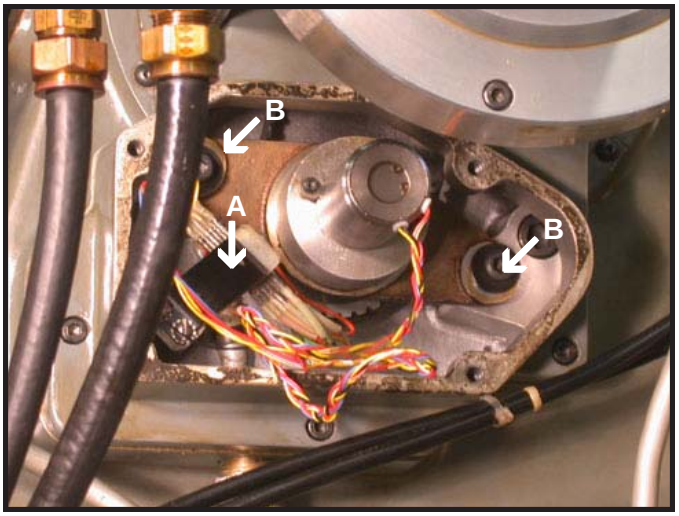

Figure 3.5.2

Cut the wires on each side of the terminal block (A) and remove the terminal block. Remove the (2) S.H.C. screws (B) to remove the encoder feedback unit assembly.

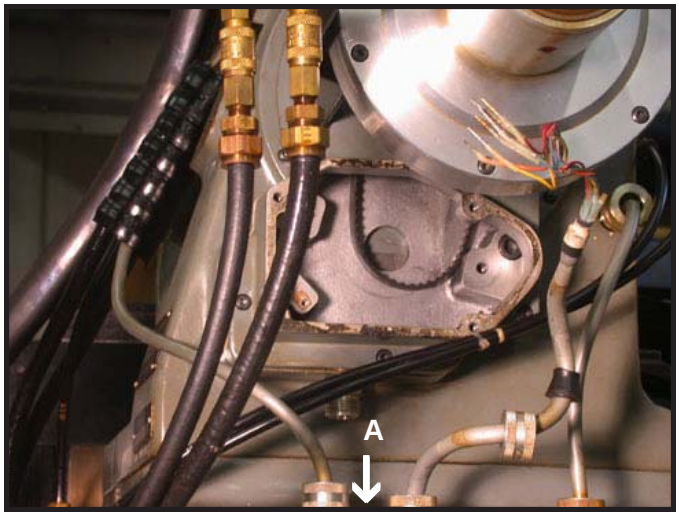

Figure 3.5.3

If any more wire is needed take off the cover below (Figure 3.5.3 - A), loosen the strain relief connectors and pull the wire to obtain the needed length. Retighten the stain reliefs.

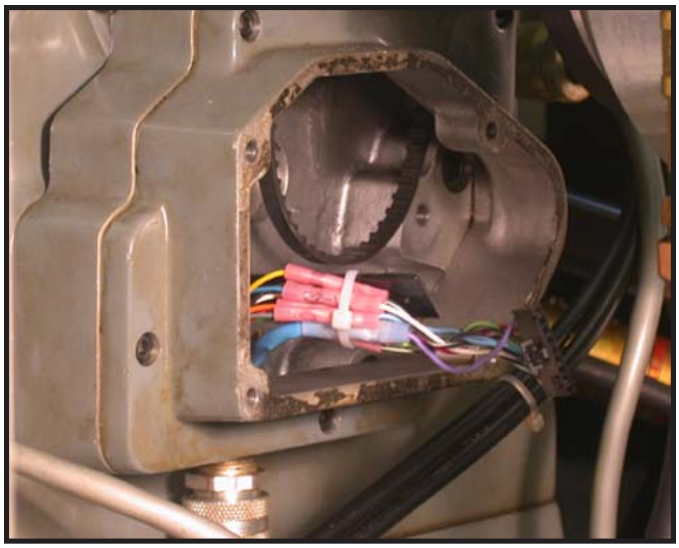

Figure 3.5.4

All the wire colors and information to install plug is on the schematic. Use butt splice connector to attach the encoder connector to the spindle feedback cable.

Table 3.5.1

	Machine Wire Color	Encoder Plug Wire
A	Blue	White
A_	Yellow	Black/White
B	Grey	Blue
B_	Orange	Blue/Black
Z	Red	Green
Z-	Green	Black/Green
+ 5 volts	White	Red
Common	Black	Black/Red
Shield	Shield	Black

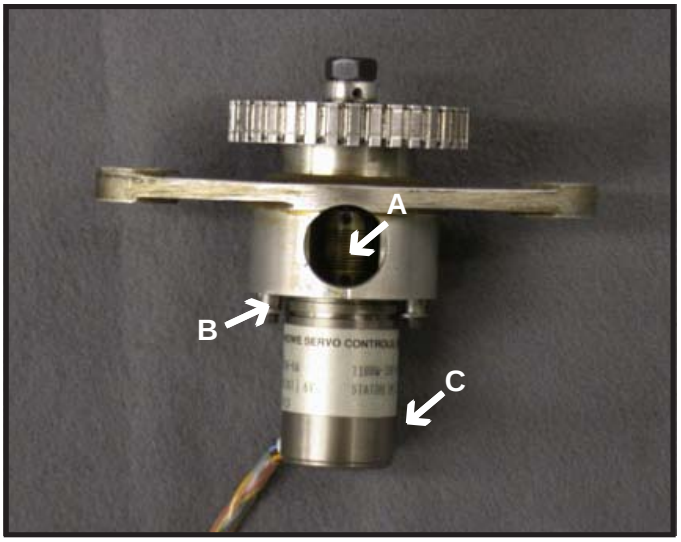

Figure 3.6.1

Before removing the resolver loosen the 2 set screws (A) for the coupling. Then loosen the (2) S.H.C. screws holding the cam locks (B). Discard the resolver (C), which will not be reused.

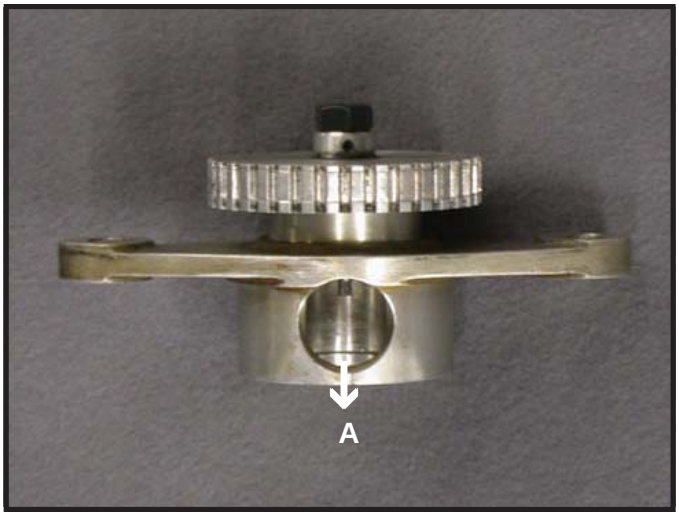

Figure 3.6.2

The resolver is removed. Now the shaft has to be replaced for the new encoder. Remove the nut on the end of the shaft. Loosen the set screw and press the shaft out of the pulley in the (A) direction on Figure 3.6.2. The bearings may stay inside the mounting bracket.

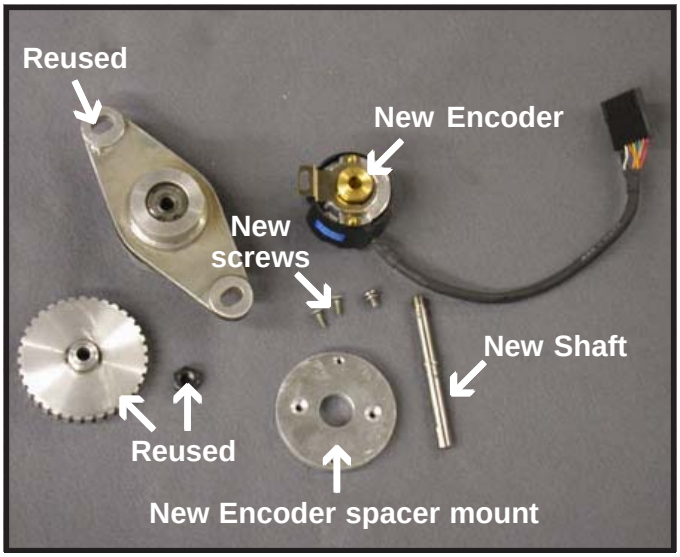

Figure 3.7.1

This is a view of the new encoder, new shaft, new spacer, 3 new screws, and parts that are being reused.

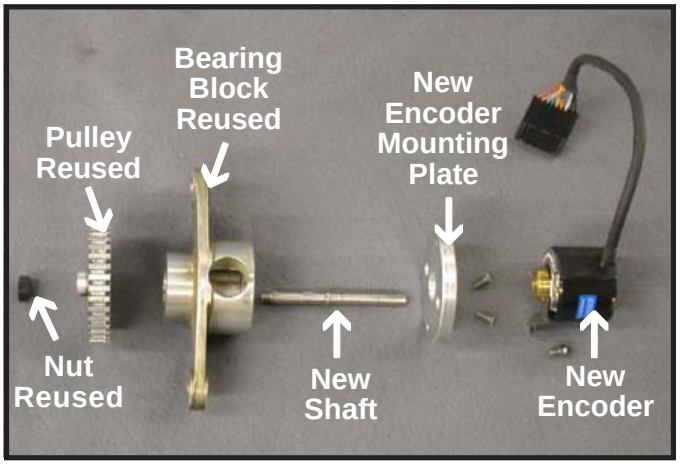

Figure 3.7.2

If bearings have been removed, reinstall the bearings in bearing block. Install the new shaft into bearing block. Install pulley, align set screw with flat, lightly tighten set screw, tighten nut, and tighten set screw. Install new encoder mounting plate with 6-32 flat head screw. Install encoder and align 2 set screws with flats on shaft, put encoder into position, tighten (2) set screws, and install 6-32 encoder mounting screw.

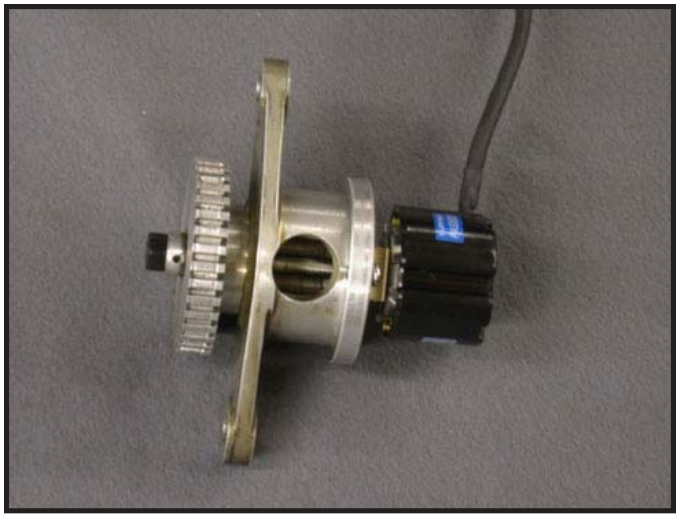

Figure 3.7.3

New encoder mounted on the Feedback bearing block.

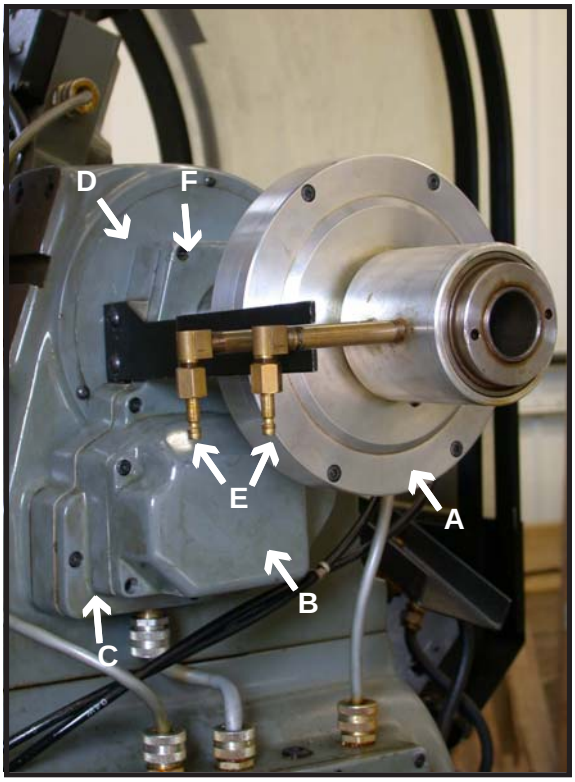

Figure 3.8.1

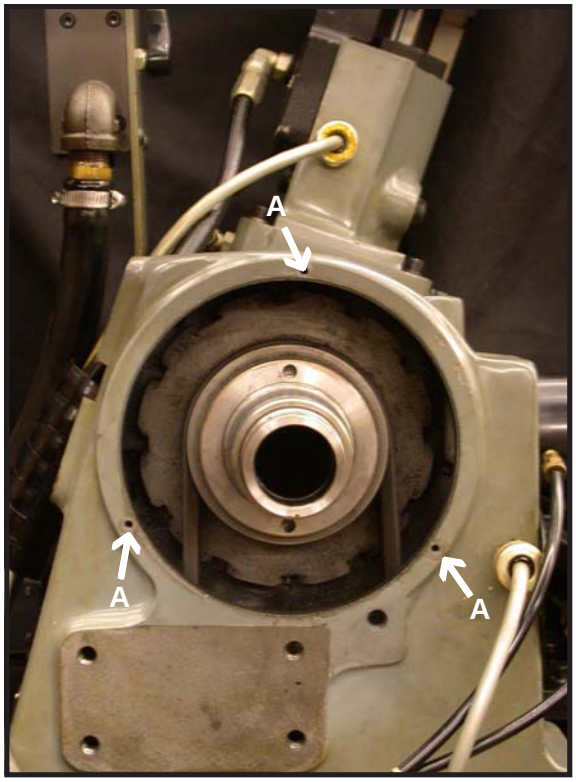

Figure 3.8.2

Collet closer (Figure 3.8.1 - A) and feedback cover (B), and feedback housing (C) have to be removed to remove the cover plate (D) to get to the spindle belts. Mark air lines (E) before removing, push the lock pin so the spindle will not turn. To remove collet closure, see chapter 2.5, figures 2.5.1, 2.5.2 and 2.5.3. If feedback unit has not already been removed see Chapter 3.5.

Remove (6) S.H.C. screws (3.8.1 -F) from the middle feedback housing. Remove feedback unit belt. Remove (3) S.H.C. screws to remove housing. Remove (3) S.H.C. screws (Figure 3.8.2 - A) to remove cover plate. Remove old belts and feed new belts down through. Align belts on spindle pulley and motor pulley. Tighten belts to proper tension. Reverse the above procedures to reassemble.

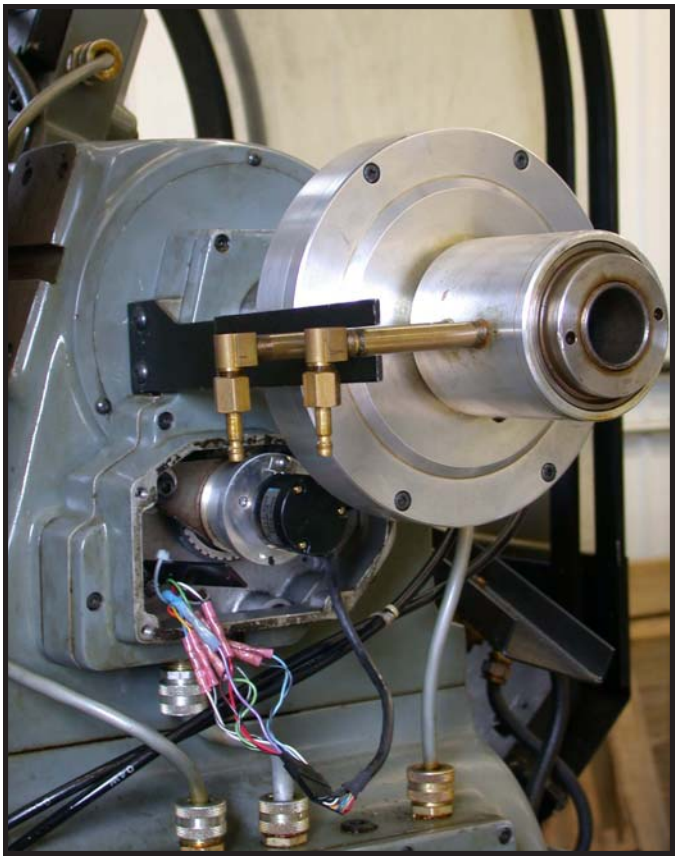

Figure 3.9.1

Mount encoder assembly over encoder belt and install S.H.C. screws and tighten to proper tension. Plug encoder in. Leave cover off until Centroid control is installed and encoder feedback is checked in the P.I.D. screen.

1. Remove encoder mount, two screws, pivot and adjustment

2. encoder wires done the same as the CHNC ... see Section 3.5, figures 3.5.2, 3.5.3 and 3.5.4

3. Loosen coupler and remove old resolver.

4. Remove spanner nut. Loosen set screw on pulley. Push old shaft out. Replace with new shaft. Tighten spanner nut and pulley set screw.

5. Place encoder in position on shaft and mark the location of the mounting hole. Remove the encoder.

6. Drill and tap 1 6-32 hole. Be sure to protect the bearings from metal chips.

7. Install encoder.

HNC/CHNC Common Tasks

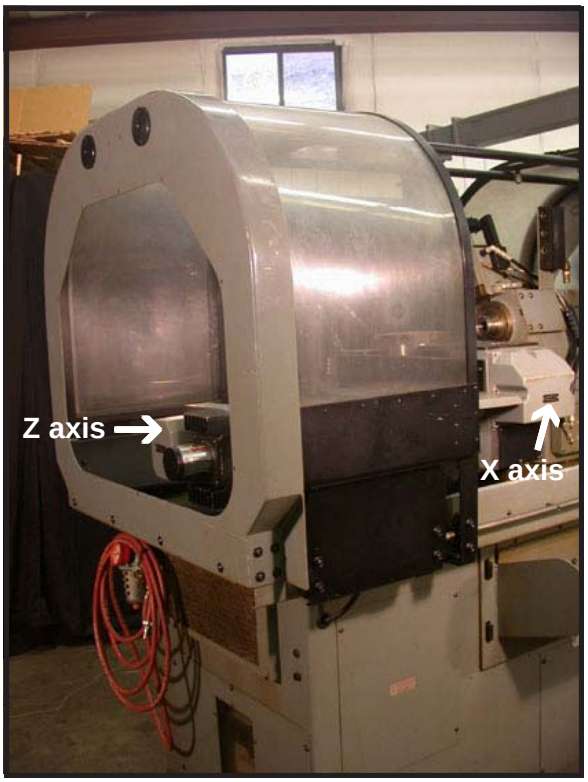

Figure 4.1.1

The replacement of the Hardinge X and Z Feedback Unit with encoder is very similar between the HNC and CHNC. There is only a minor difference in the routing of the wires for the X axis. The difference in the wire routing between the two machines will be noted when the wires are run for the X axis. If replacing the X and Z axis motors, do so after the feedback unit is removed and before installing the new encoder.

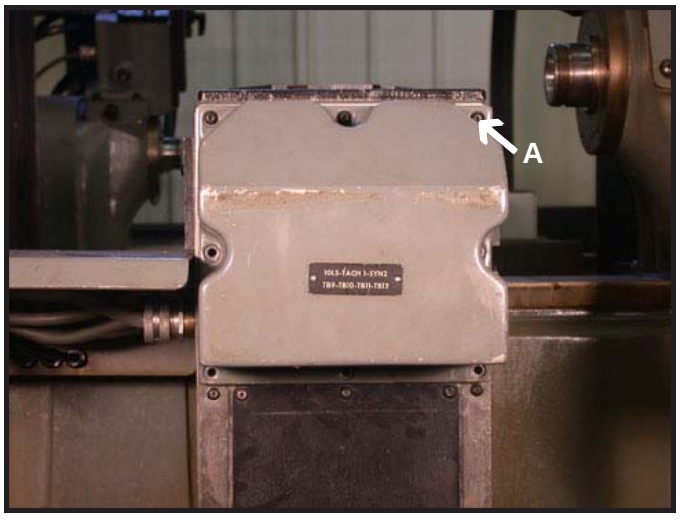

Figure 4.1.2

At the back side of the lathe, remove the (8) SHC screws (Figure 4.1.2 - A) from the cover for the X axis.

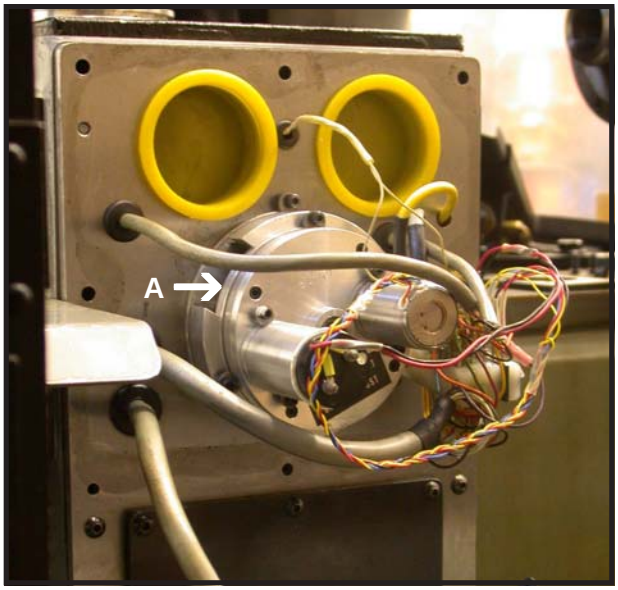

Figure 4.1.3

Before the feedback unit can be removed, the set screws in the coupler attaching the feedback to the ball screw need to be loosened. Look down through the opening in the feedback unit (See Figure 4.1.3 - A) to see how far the ball screw needs to be turned.

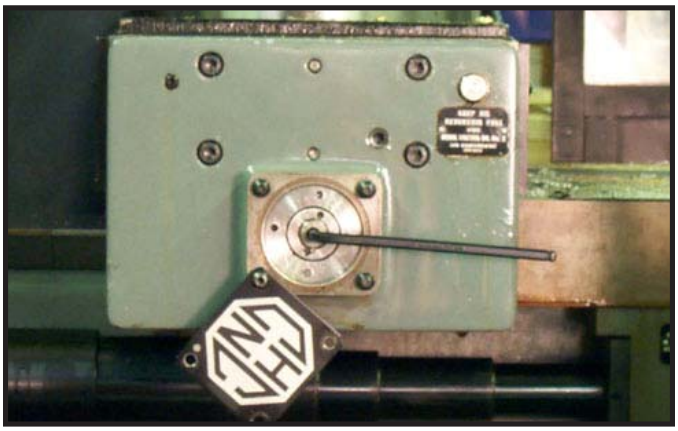

Figure 4.1.4

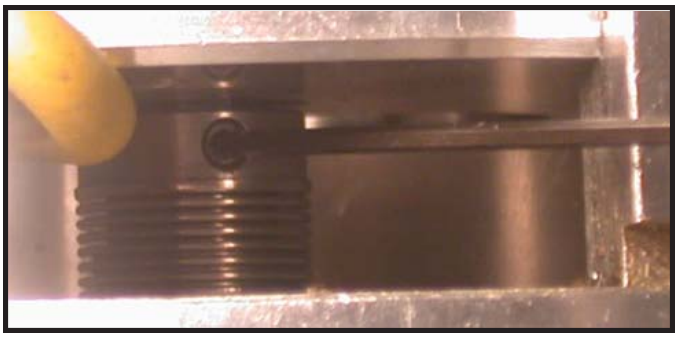

Figure 4.1.5

At the front of the lathe remove the ball screw cover and insert a allen wrench (Figure 4.1.4) to turn the ball screw to align set screws in the coupler on the feedback unit (Figure 4.1.5) so the (2) set screws can be loosened. At this time you can turn the X axis ball screw and check how it feels.

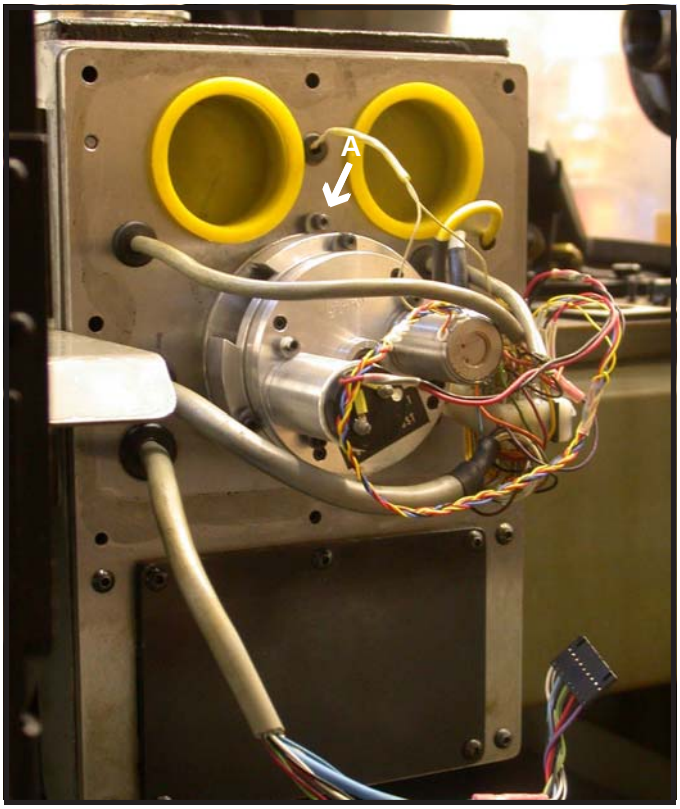

Figure 4.1.6

After the (2) set screws in the coupler have been loosened the X axis feedback unit can be removed by loosening the (3) cam lock screws (Figure 4.1.6 A).

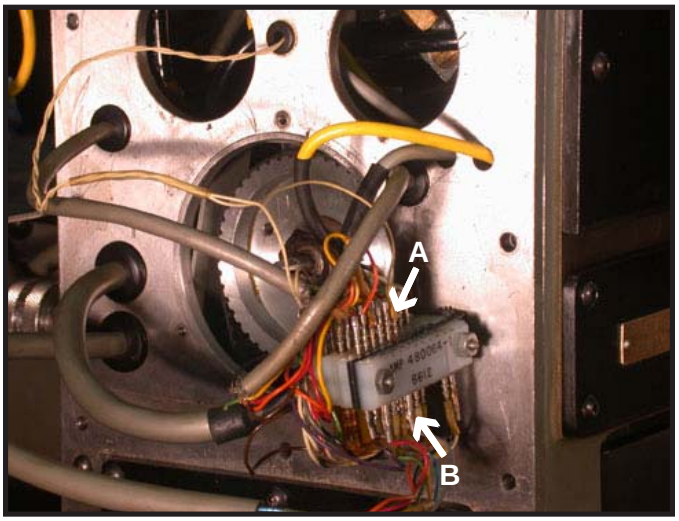

Figure 4.1.7

Cut the X axis resolver wires just above (Figure 4.1.7 - A) and just below (B) the pins on the connector. The cable below the terminal block will have the X axis encoder connector butt spliced to it.

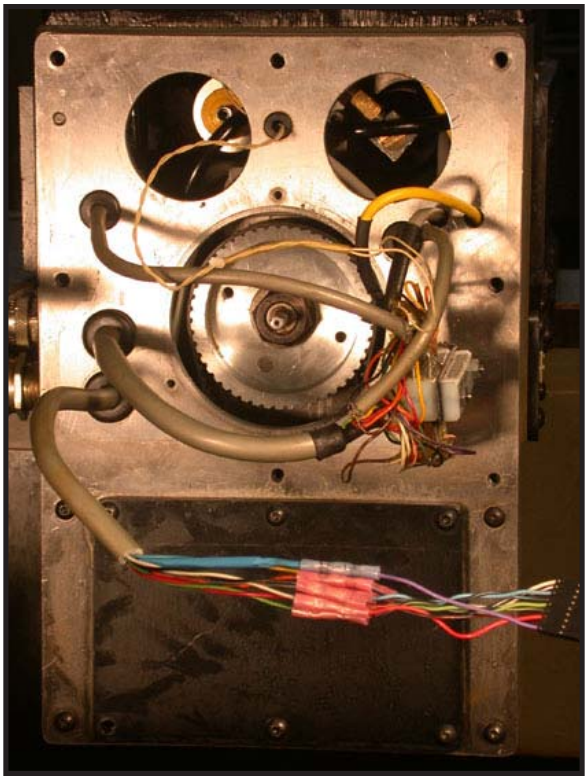

Figure 4.1.8

The X axis encoder connection can be butt spliced at this time (see Table 4.1.1).

Table 4.1.1

	Machine Wire Color	Encoder Pigtail Wire
A	Blue	White
A_	Yellow	Black/White
B	Grey	Blue
B_	Orange	Blue/Black
Z	Red	Green
Z-	Green	Black/Green
+ 5 volts	White	Red
Common	Black	Black/Red
Shield	Shield	Black

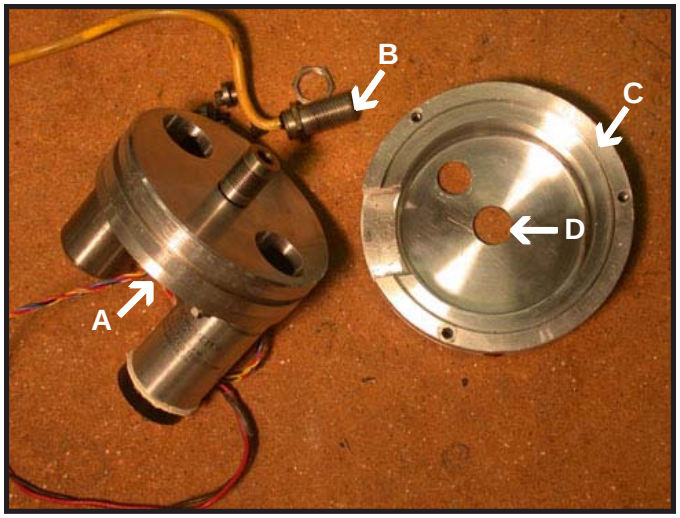

Figure 4.1.9

Remove feedback assembly unit (A) and sensor (B) from mounting plate (C) and discard feedback unit and sensor.

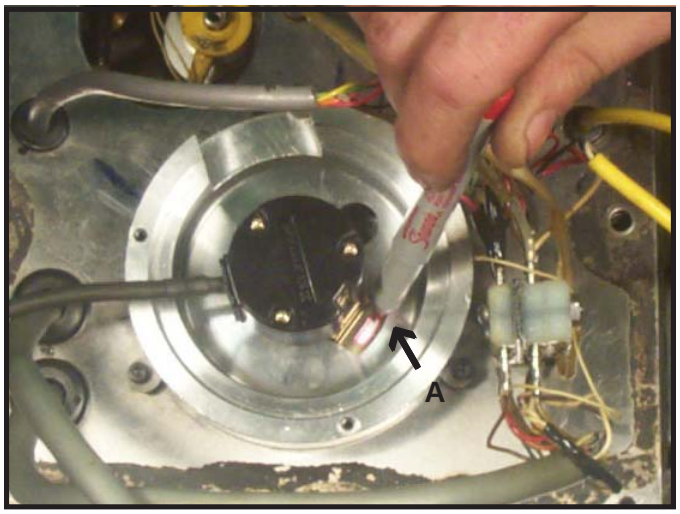

Figure 4.1.10

Reinstall mounting plate (Figure 4.1.9 - C) and slide encoder over the end of the ball screw until it is properly seated. Using a marker, mark the mounting slot (A). DO NOT USE A CENTER PUNCH TO MARK HOLE WHILE ENCODER IS IN PLACE. Remove encoder and mounting plate. Center punch and drill (#36) and tap for a 6-32 screw in the center of the area marked earlier. If X axis motor is being replaced, refer to Chapter 4, HNC/CHNC Common Tasks 4.3.

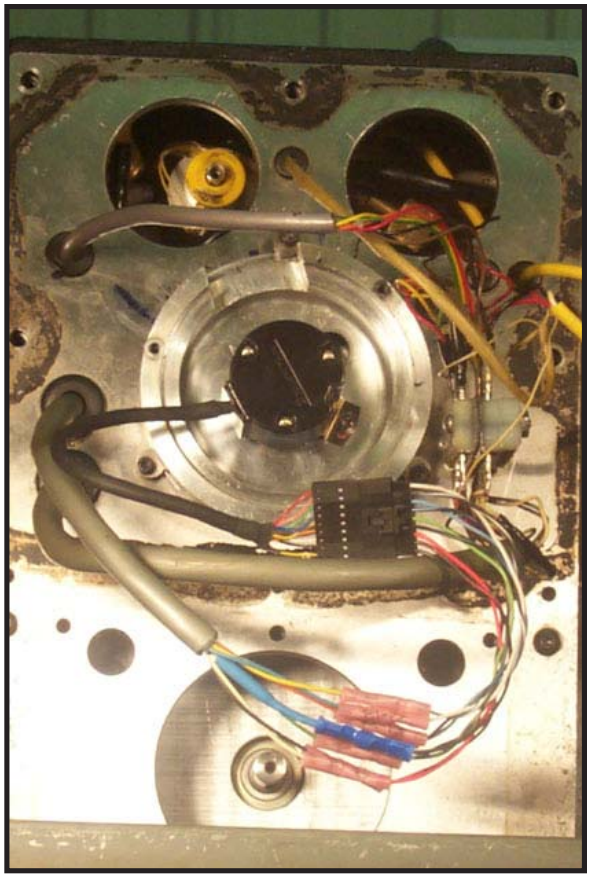

Figure 4.1.11

Reinstall the X encoder mounting plate to the back plate using the 3 cam lock screws previously loosened. Put the new encoder on the end of the ball screw shaft and loosely insert the 6-32 screw. Align the encoder, then tighten the (2) set screws onto the ball screw shaft, then tighten the 6-32 mounting screw for the encoder to the base plate. Plug the encoder connector into the new connector that was butt spliced onto the existing X feedback cable (Figure 4.1.8). Do not replace the feedback covers until proper axis motion has been verified.

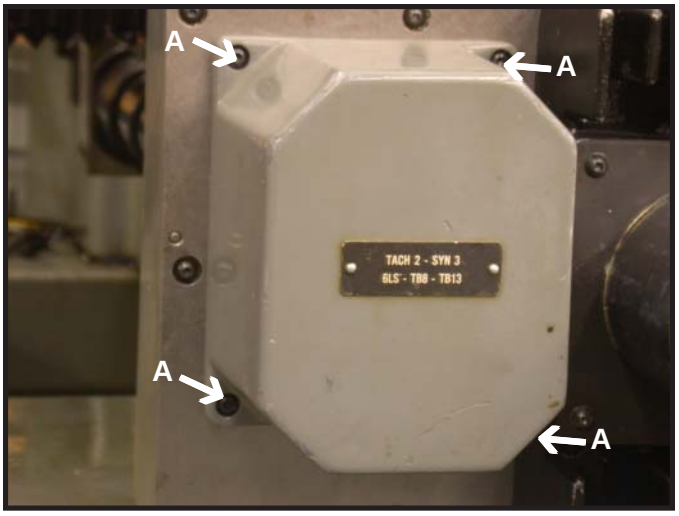

Figure 4.2.1

At the Tail stock end of the lathe, remove the (4) SHC screws (Figure 4.2.1 - A) and feedback cover for the Z axis feedback unit.

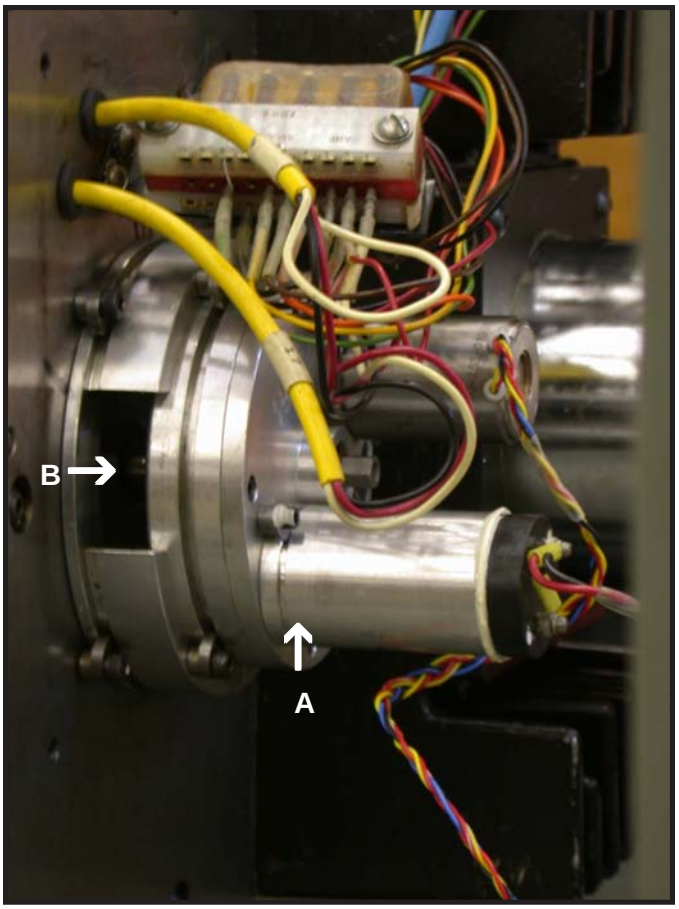

Figure 4.2.2

Before the feedback unit (A) can be removed, the (2) set screws in the coupler attaching the feedback unit to the ball screw need to be loosened. Look down through opening in the feedback unit (B) to see how far the ball screw needs to be turned.

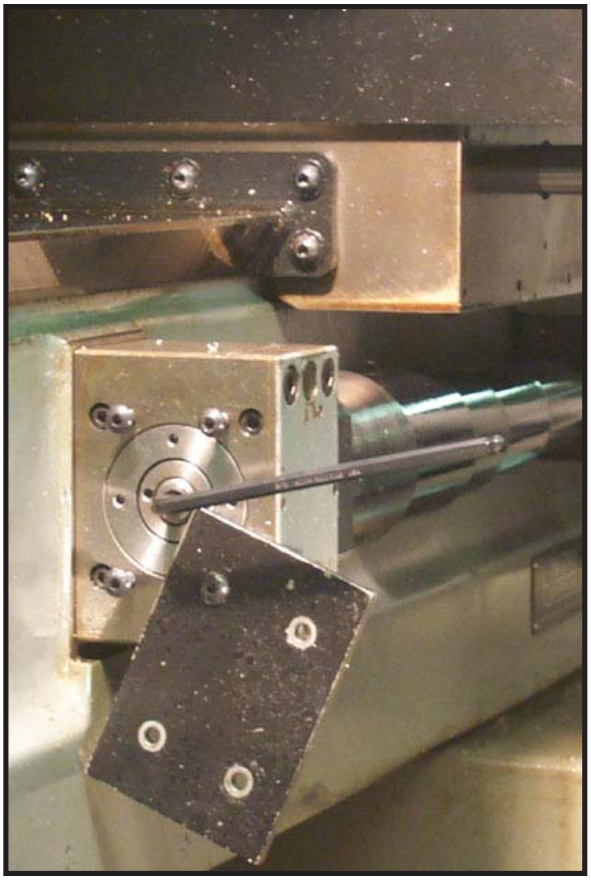

Figure 4.2.3

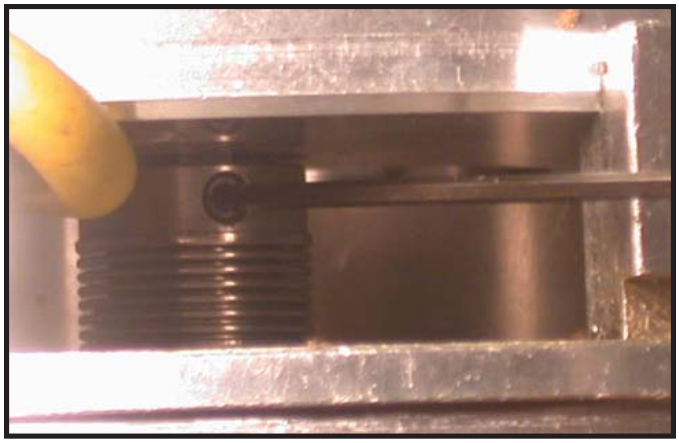

Figure 4.2.4

At the front of the lathe remove the Z axis ball screw cover (Figure 4.2.3) and insert a allen wrench to turn the ball screw to align set screws in the coupler on the feedback unit (Figure 4.2.4) so the (2) set screws can be loosened. At this time you can turn the Z axis ball screw and check how it feels.

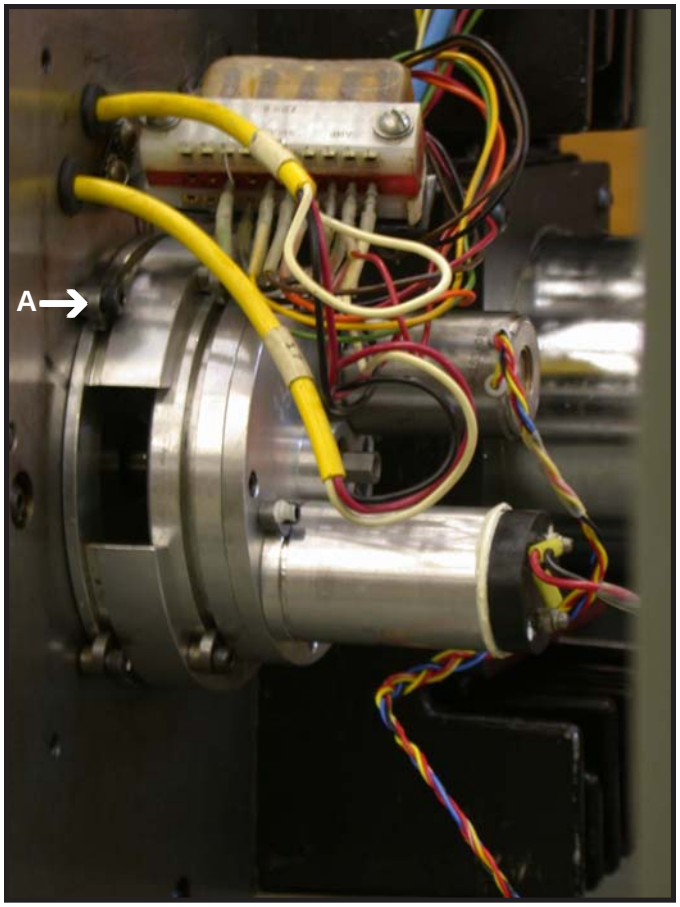

Figure 4.2.5

After the (2) set screws in the coupler have been loosened the Z axis feedback unit can be removed by loosening the (4) cam lock screws (Figure 4.2.5 - A).

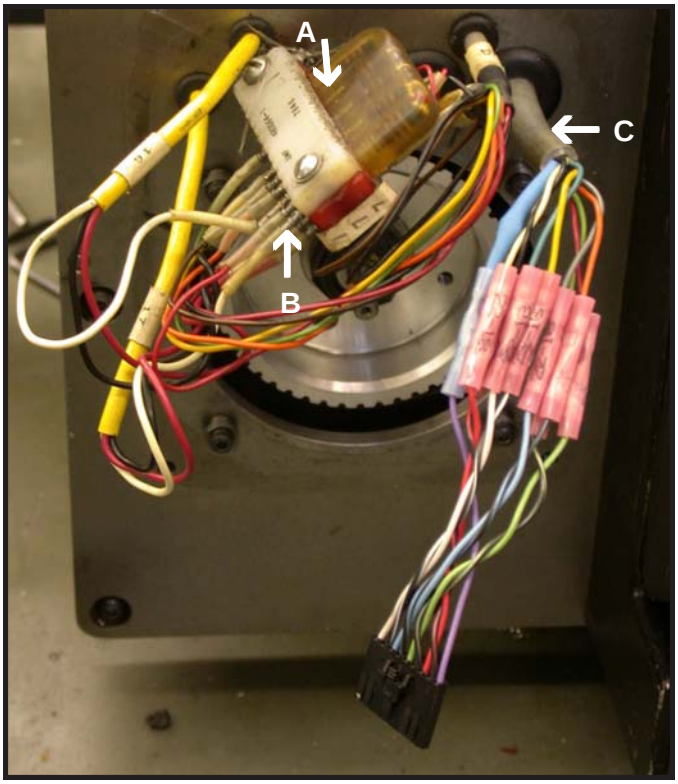

Figure 4.2.6

Cut the Z axis resolver wires just above (A) and just below (B) the pins on the connector. The cable (C) that was attached to the terminal block will have the Z axis encoder connector butt spliced to it.

The Z axis encoder connection can be butt-splitted at this time (see Table 4.2.1).

Table 4.2.1

	Machine Wire Color	Encoder Pigtail Wire
A	Blue	White
A_	Yellow	Black/White
B	Grey	Blue
B_	Orange	Blue/Black
Z	Red	Green
Z-	Green	Black/Green
+ 5 volts	White	Red
Common	Black	Black/Red
Shield	Shield	Black

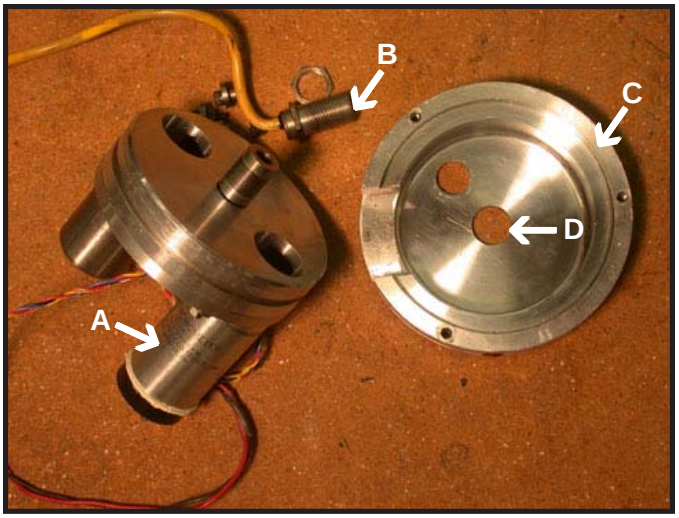

Figure 4.2.7

Remove feedback unit (A) and sensor (B) from mounting place (C) and discard feedback unit and sensor.

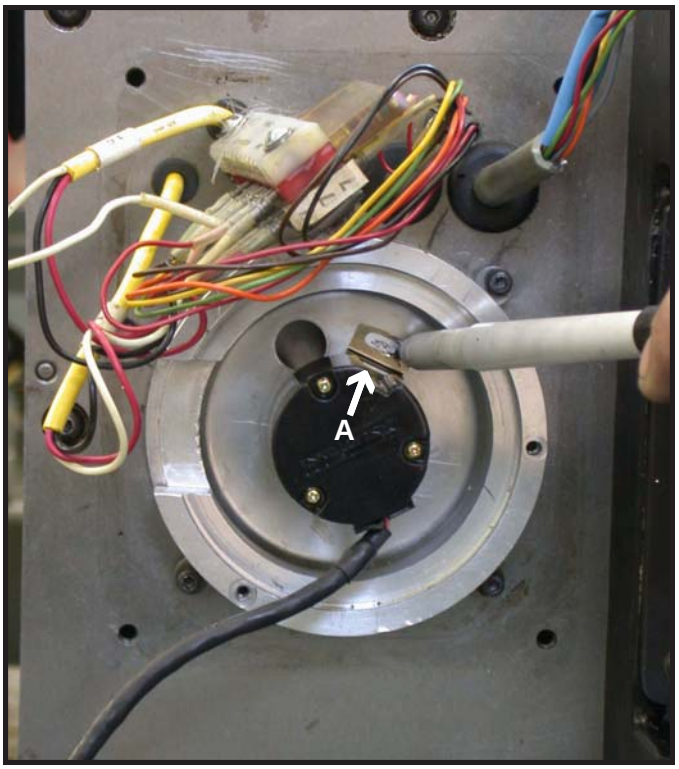

Figure 4.2.8

Reinstall mounting plate (Figure 4.2.7 - C) and slide encoder over the end of the ball screw until it is properly seated. Using a marker, mark the mounting slot (A). DO NOT USE A CENTER PUNCH TO MARK HOLE WHILE ENCODER IS IN PLACE. Remove encoder and mounting plate. Center punch, drill (#35) and tap for a 6-32 screw in the center of the area marked earlier. If Z axis motor is being replaced, refer to Chapter 4, HNC/CHNC Commmon Tasks 4.4.

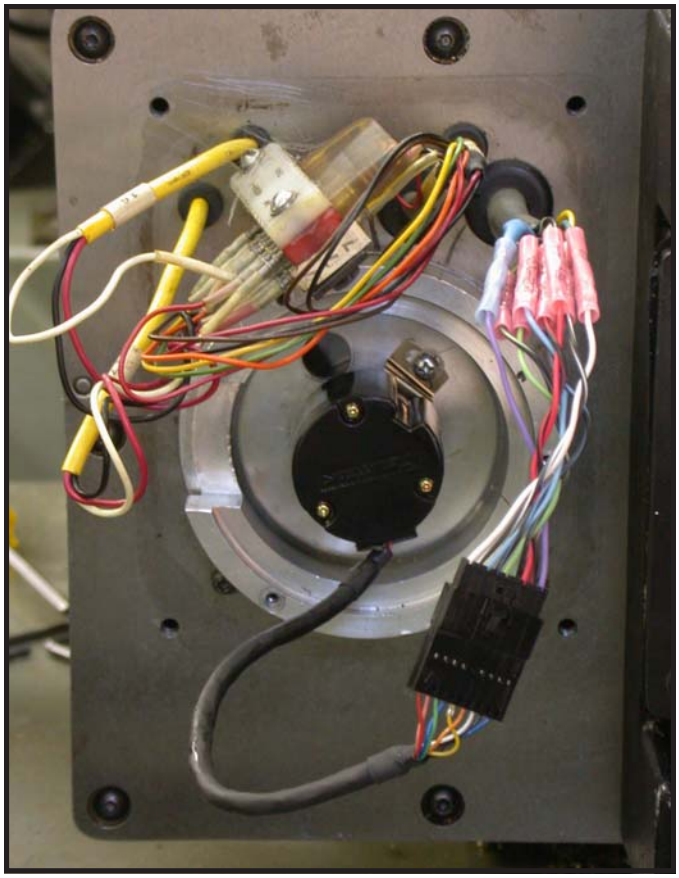

Figure 4.2.9

Mount the Z encoder mounting plate to the back plate using the 4 cam lock screws previously loosened. Put the new encoder on the end of the ball screw shaft and loosely insert the 6-32 screw. Now tighten the (2) set screws onto the ball screw shaft, then tighten the 6-32 mounting screw for the encoder to the base plate. Plug the encoder connector into the new connector that was butt spliced onto the existing Z feedback cable (Figure 4.2.6). Do not replace the feedback covers until proper axis motion has been verified.

If it is determined that the X axis motor needs to be replaced, this is to be done after the X feedback assembly is removed, and before the new encoder installation.

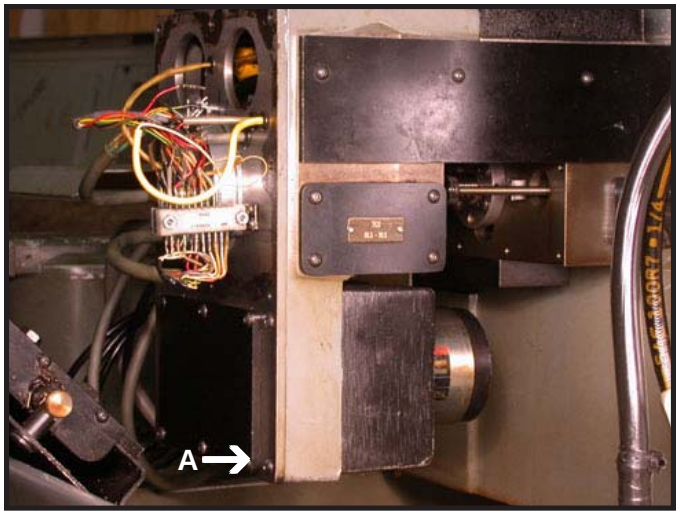

Figure 4.3.1

Remove the six bolts (A) and remove the X axis pulley access cover.

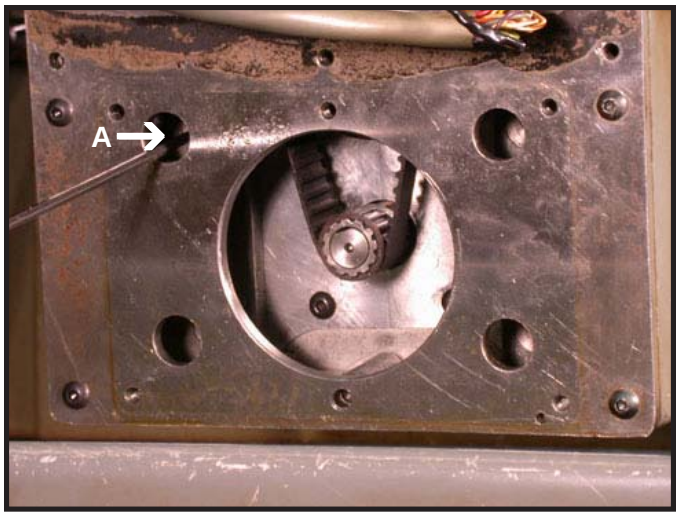

Figure 4.3.2

Remove the four X axis motor mounting bolts (A). Remove the old motor.

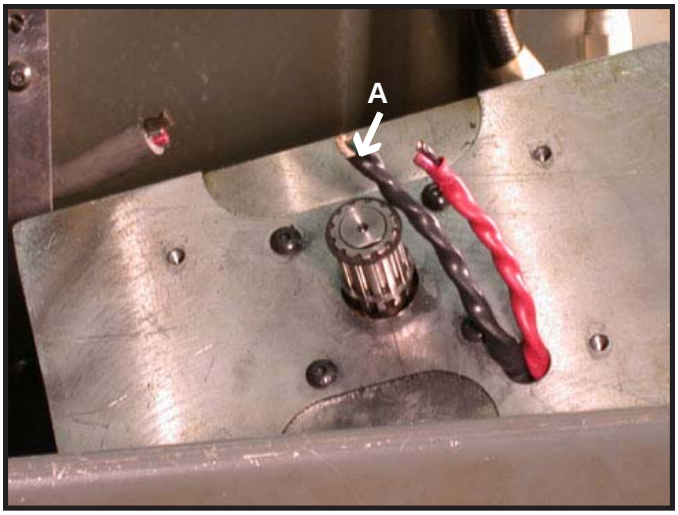

Figure 4.3.3

Cut the motor cable near the motor (A).

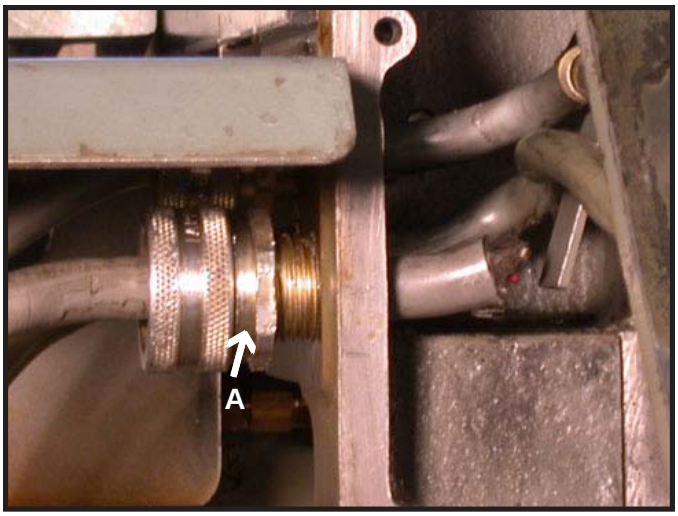

Figure 4.3.4

Remove the X motor cable from the strain relief (A), then remove the stain relief and plug the hole with a 3/4 inch pipe plug.

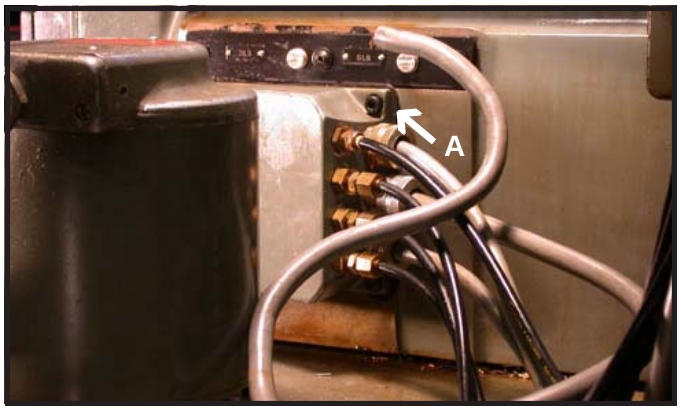

Figure 4.3.5

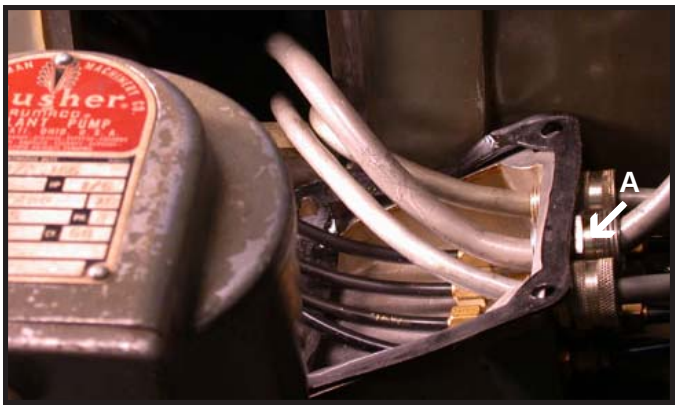

Figure 4.3.6

Remove the cable mounting cover (4 screws, see Figure 4.3.5 - A). Loosen the strain relief and pull the old motor cable out of the strain relief (Figure 4.3.6).

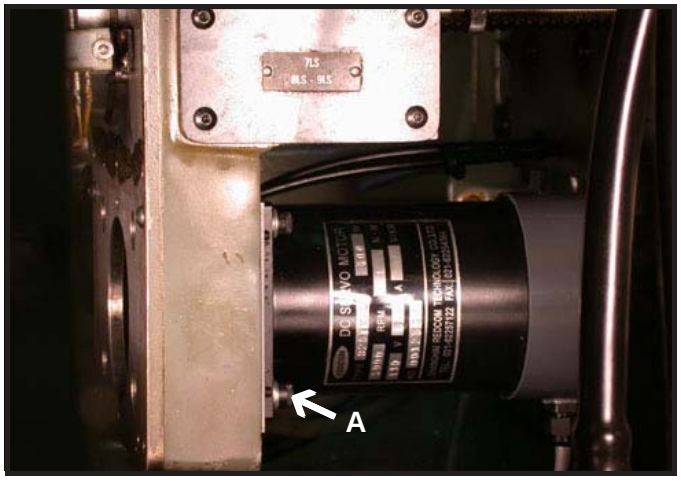

Figure 4.3.7

Mount the new X motor to the adapter plate with 4 SHCS with lock and flat washers. Mount the X adapter plate to the cross slide with 4 each 10-32 X 3/4 screws, 8 flat washers, 4 lock washers, and 4 nuts (see Figure 4.3.7 or assembly drawing). Install the new X axis motor belt and pulley for 2-to-1 ratio, and set to proper tension.

Figure 4.3.8

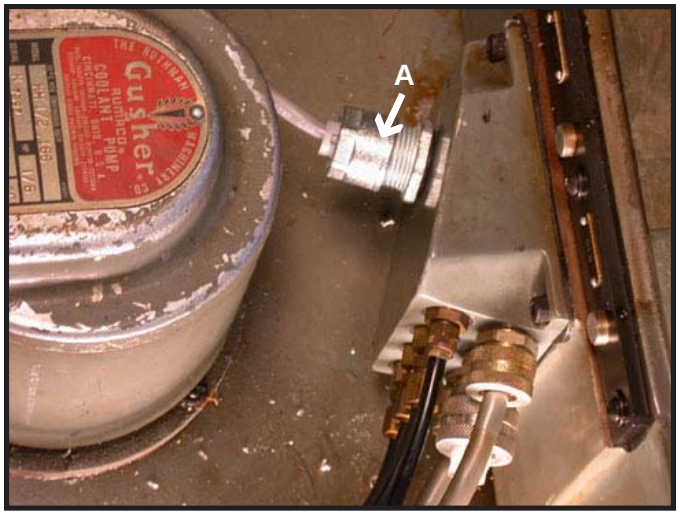

Figure 4.3.9

On a HNC, route the new X motor cable through the strain relief (Figure 4.3.8 - A) in the cable mounting cover. Allow enough slack for maximum Z-travel and tighten up the strain relief. Cable tie the cable under the cross slide or reinstall the cable wrap to protect the cable. Before installing the cable mounting cover, drill a 7/8 inch hole in the cable mounting cover (Figure 4.3.9 - A) and install the strain relief for the Z motor cable. Z motor cable will be installed later. After both X and Z axis have been tested the cable mounting cover can be replaced.

On a CHNC, the X axis cable will be run through the caterpillar track.

Figure 4.3.10

Cut the new cable to length under the machine, if necessary. Put heat shrink tubing over the cable and butt splice the new cable to the old X motor cable (Figure 4.3.10). Test the servo motor before shrinking the heat shrink tubing.

If it is determined that the Z axis motor needs to be replaced this is to be done after Z feedback assembly removal, and before new encoder installation.

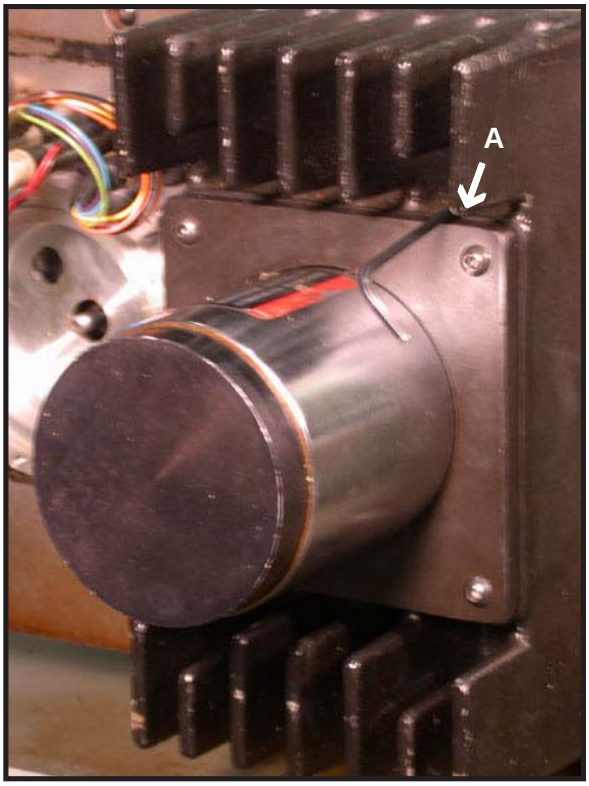

Figure 4.4.1

Remove (4) S.H.C. screws that hold the Z axis motor and Z axis heat sink. The (4) screws are down in the heat sink fins (Figure 4.4.1 - A).

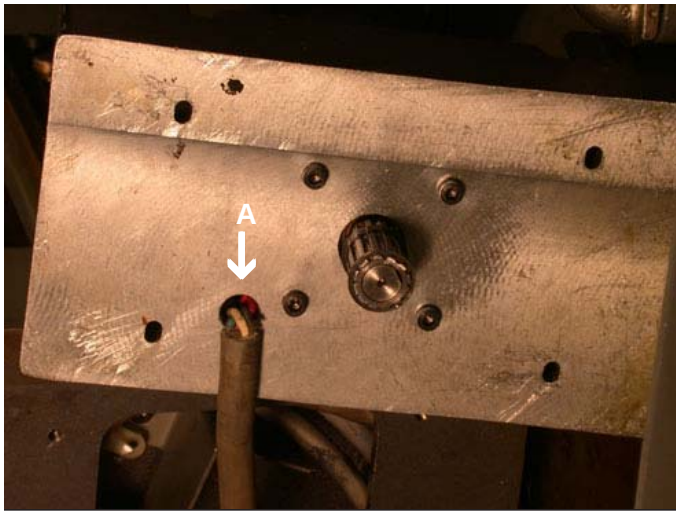

Figure 4.4.2

Cut the motor cable near the motor (A).

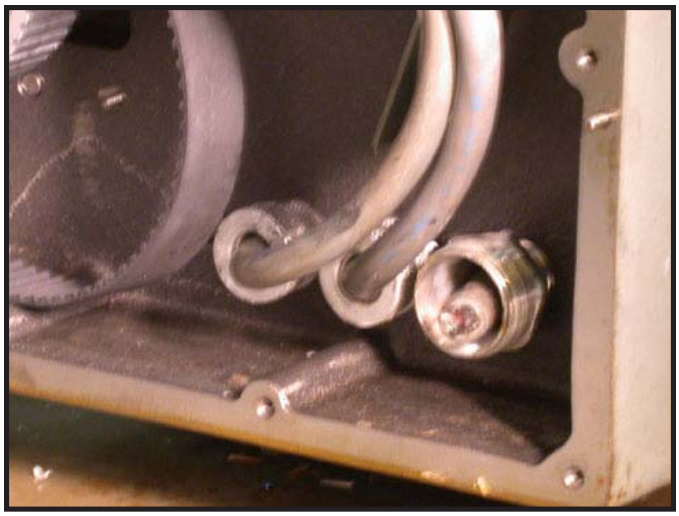

Figure 4.4.3

Loosen the strain relief, pull the old Z motor cable down under the machine frame and retighten the strain relief. The Z axis motor cable will not be fed through this strain relief.

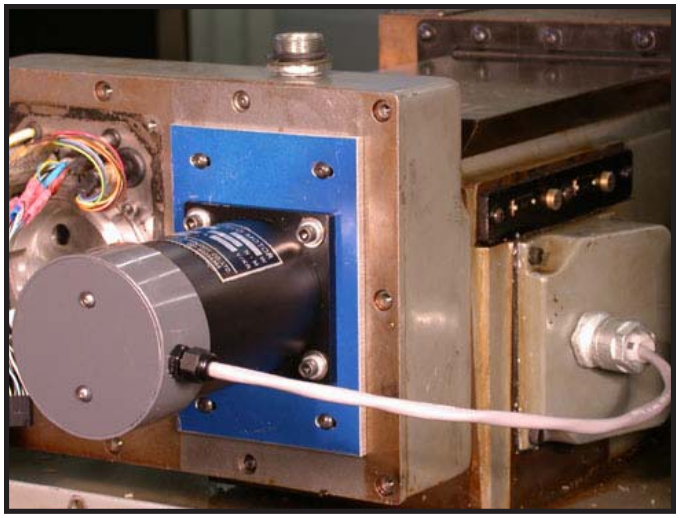

Figure 4.4.4

Mount the new Z motor to the adapter plate with 4 SHCS with lock and flat washers. Mount the new Z motor assembly to the Z axis end plate, Install the new pulley for 2-to-1 ratio, insuring that the timing belt is properly seated on both pulleys. Reuse the original button head screws for mounting.

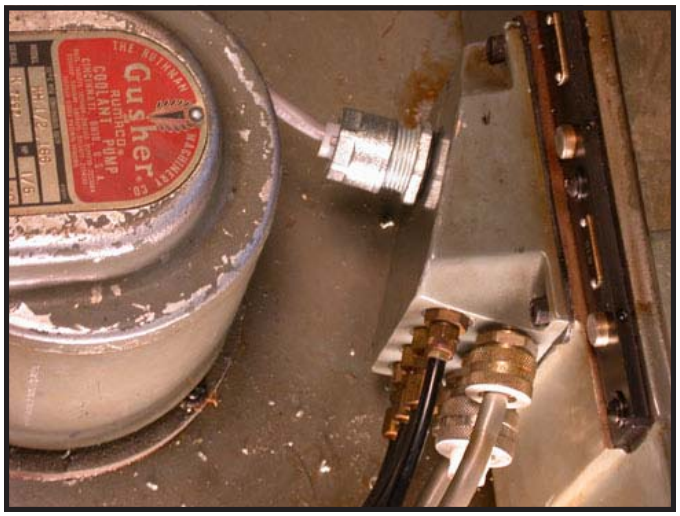

Figure 4.4.5

Route the new Z motor cable through the strain relief in the cable mounting cover. After both X and Z axis have been tested the cable mounting cover can be replaced.

Figure 4.4.6

Cut the new cable to length under the machine, if necessary. Put heat shrink tubing over the cable and butt splice the new cable to the old Z motor cable (Figure 4.4.6). Test the servo motor before shrinking the heat shrink tubing.

Installing Centroid Control and Check Out

Figure 5.1.1

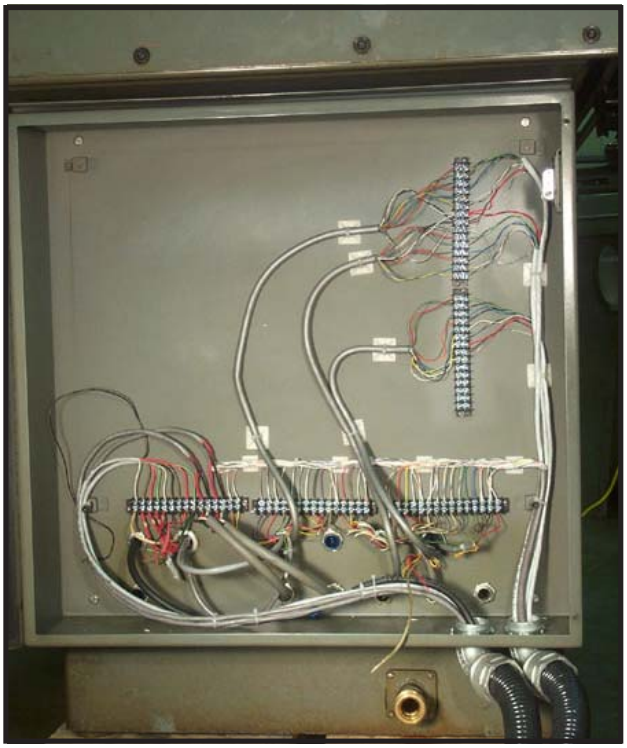

Figure 5.1.2

Set Centroid Magnetics Cabinet on the stand. Run the (2) conduits from the Centroid Magnetics Cabinet to the cabinet on the spindle end of the HNC lathe. Wire Centroid cables to the HNC prewired terminal per schematic provided with the kit (Figure 5.1.2). Install disconnect, spindle inverter, breaking resistor, and contactors in the tail stock cabinet on the HNC as per schematic (Figure 5.1.1). The power cable for the control must be routed from the spindle end cabinet to the tail stock end cabinet. All other connections are in the spindle end cabinet.

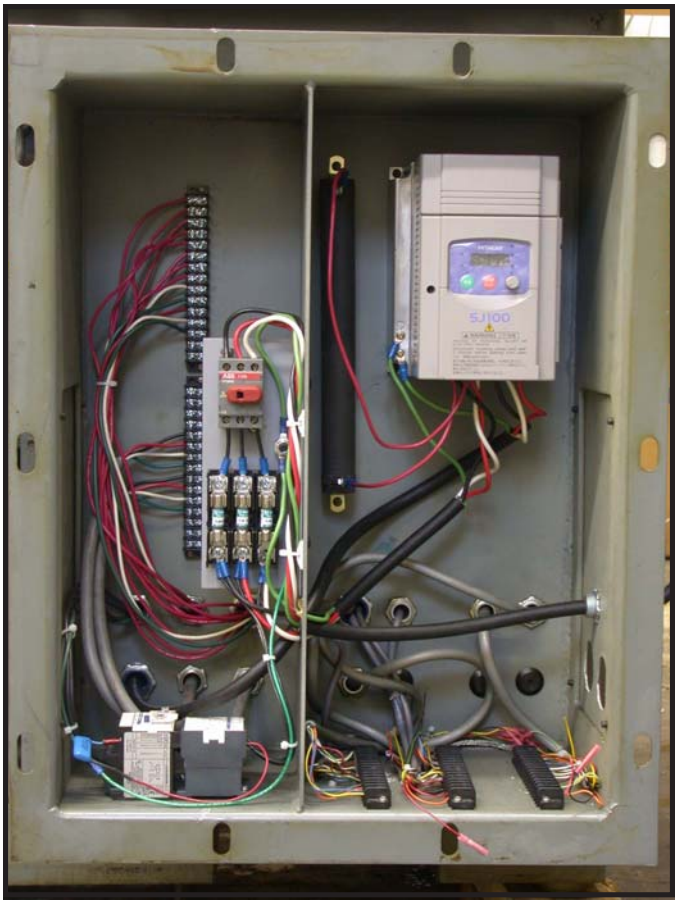

Figure 5.2.1

Set Centroid Magnetic Cabinet on the stand. Run the (2) conduits from the Centroid Magnetics Cabinet to the cabinet on the back of CHNC lathe. Wire Centroid cables to the CHNC prewired terminals per schematic provided with the kit.

Connect the encoder cables and control cable A first, then connect cables B, C and D.

Install the disconnect bracket and connect the power wires.

Figure 5.3.1

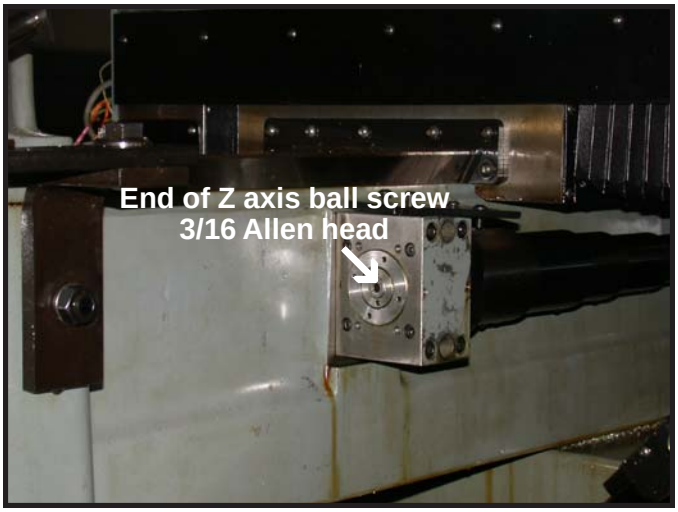

Figure 5.3.2

After double checking power and motor connections to the Spindle Inverter, turn on main disconnect. Check voltages at the main fuses and inverter. At this time program Inverter (see Table 5.3.1 - Hitachi SJ-100 Inverter settings). DO NOT PUT INVERTER IN MANUAL MODE.

To check encoder connections first make sure the E-stop switch is pushed in.Power up control. At main screen hit F1 for setup. Then hit F3 for config.

Hit F4 for PID screen. Locate absolute position. Manually turn the X axis ball screw (Figure 5.3.1). One full turn should give you a readout of 8000 counts (+ or - depending on dirction) at the absolute position for the X axis.

Manually turn the Z axis ball screw (Figure 5.3.2). One full turn should give you a readout of 8000 counts (+ or - depending on direction) at the absolute position for the Z axis.

Repeat for the spindle. Reading will be on the 3rd axis. Exit to the main screen. After making sure that the spindle encoder is working the cover and the collet closer can be reinstalled.

Table 5.3.1 - Hitachi SJ-100 Inverter Settings

Parameter No.	Value	Units	Description
A03	60	Hz	Base frequency setting
A04	Must be set with tach to match max spindle speed (reference 5.8.4 Spindle Calibration section)	Hz	Maximum Frequency setting
B90	100	%	Dynamic braking usage ratio
B91	00 - Decelerate to stop 01- Coast to stop		Stopping method selection
C01	00 - Forward command		Function of terminal 1 setting
C02	01 - Reverse command		Function of terminal 2 setting
C06	18 - Reset command		Function of terminal 6 setting
F02	3 - 5	sec	Acceleration Time
F03	3 - 5 depending upon braking resistor	sec	Deceleration Time
B84 & B85	01 -Data initialization		Used to reset parameters to default
All other parameters	are set to factory	default	

Wiring connections

L1,L2,L3 - 3 phase power in.
L1,N - Single phase power in.
1 - Forward run.
2 - Reverse run
6 - Fault reset.
P24 - Input common
O - Voltage frequency command. (0-10vdc)
L - Common for frequency command.
AL2 - Fault output (normaly open).
AL0 - Fault output common.
U(T1),V(T2),W(T3) - Motor voltage out.
+ , RB - Braking resistor.

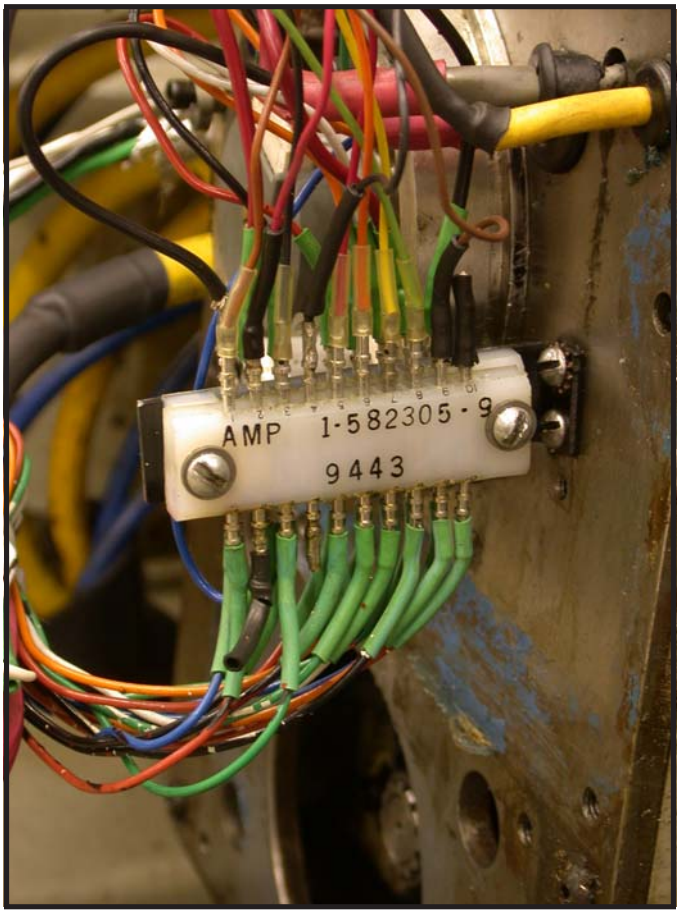

Figure 5.4.1

Figure 5.4.0

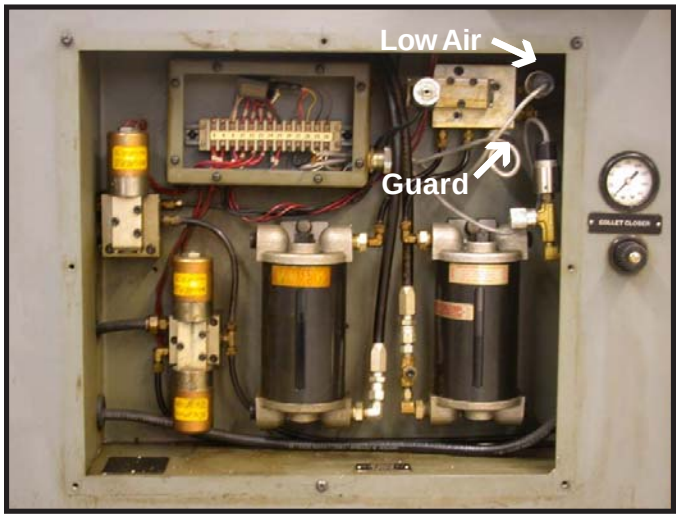

Figure 5.4.2

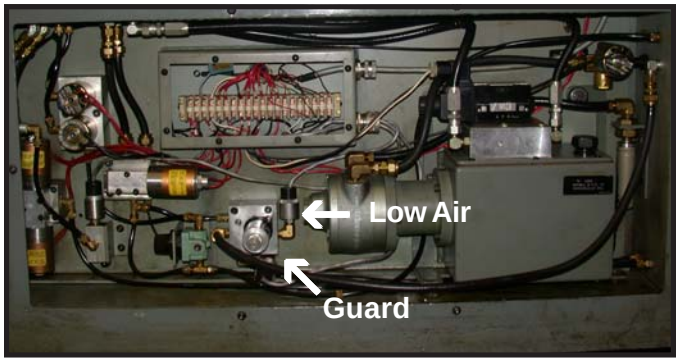

Figure 5.4.3

5.4.0 - On-screen PLC Diagnostic

The state of all PLC inputs and outputs can be viewed by pressing <alt-i> from the main control screen (See Figure 5.4.0). Use this screen to determine the correct operation and cofiguration of the control throughout this chapter.

5.4.1 - Limit Switches

Next check the limit switches. To do this the table must be manually moved to the ends of its travel. There should be a message of Limit tripped and then Limit cleared on the screen as you hit each limit switch. If there is no message, type F1 (Setup), F3 (Config), F2 (Machine).

Check that limits and home are set to 1 for Z-, 2 for Z+, 3 for X- and 4 for X+. This is done because the Hardinge Lathes use a normally open switch so inputs 20, 21, 22, 26 are mirrored to inputs 1 through 4.

If they all work correctly move the table manualy to the center of its travel. If one or more do not work check for broken wires at the White Hardinge terminal block under the axis encoder cover. These wires can be broken off of the pin but still be held in place by the insulating tubing covering it (Figure 5.4.1).

5.4.2 - Air Switches

Apply air pressure (90PSI). The light for input 18 Low Air Pressure should come on when air pressure is applied. The Guard switch also works off of air pressure. There are holes in the back rail that the guard rides on that are blocked when the guard is closed and activates a pressure switch. This switch is connected to input 18 (See Figure 5.4.2 for HNC and Figure 5.4.3 for CHNC). Make sure switch is working correctly. FOR CHECKOUT ONLY, **TEMPORARILY** BLOCK LINE TO BYPASS SWITCH.

This air switch can be replaced with a door interlock switch to eliminate the use of air for the door interlock.

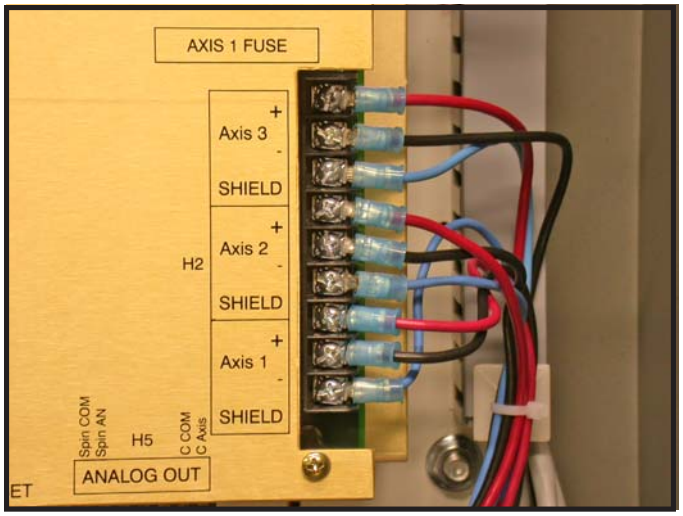

Figure 5.5.1

Release the E-stop. With the control set to slow Jog and the feedrate turned down, try to jog in the Z- direction and then the Z+ direction. If the table does not move smoothly (jumps slightly then gives a full power without motion message) switch the red and black motor cable wires (Figure 5.5.1) for that axis at the servo drive.

Repeat for X axis.

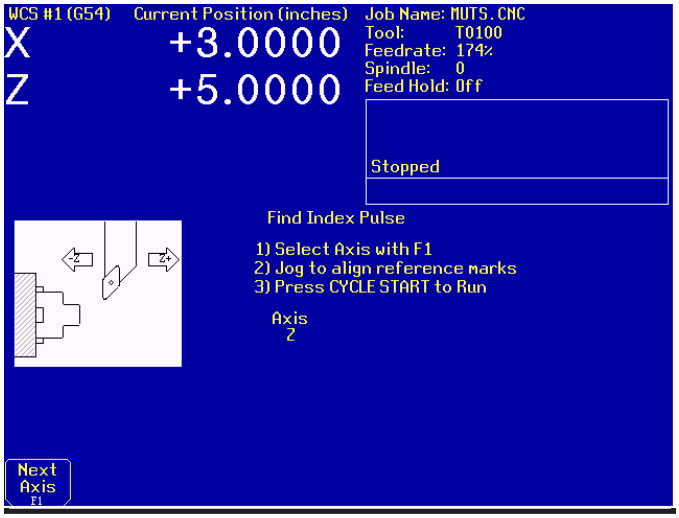

Figure 5.6.1

Manually home machine. Hit F1 (Setup) ->F3 (Control) -> F2 (Machine) -> F3 (Find home). Follow instructions on screen to home the table to the X+ and then the Z+. Escape once and hit F4 (Set home). Follow onscreen instuctions to set home for X and Z axis.

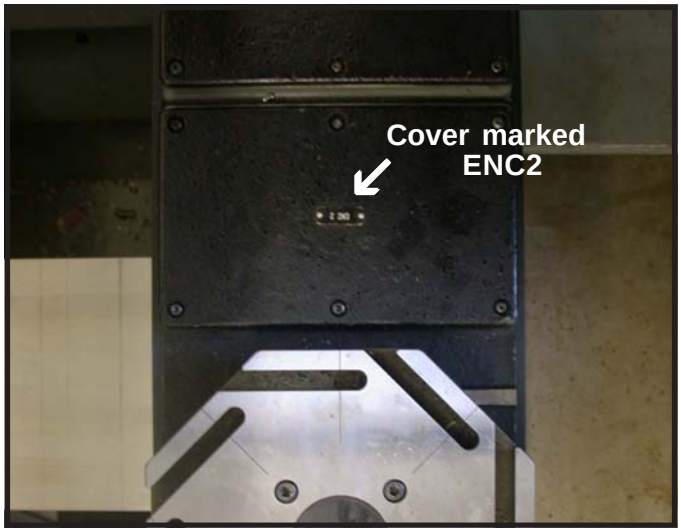

Figure 5.7.1

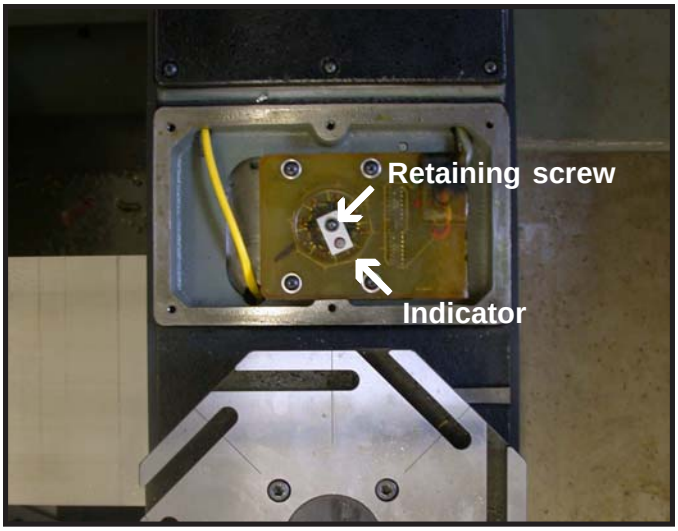

Figure 5.7.2

Push in E-stop button. Remove cover plate from the turret encoder (Figure 5.7.1).

Mark position of indicator as shown in Figure 5.7.2. Loosen the retaining screw holding indicator in place. While watching PLC inputs 7, 8, 32, & 10, rotate indicator counterclockwise. The PLC inputs should display BCD numbers 1 through 8 (Table 5.7.1).

If this is not correct, check for broken wires at the White Hardinge terminal block under the x axis encoder cover. These wires can be broken off the pin but still be held in place by the insulating tubing covering it.

When the PLC is seeing this correctly, note the number that is stamped on the turret facing the spindle. Turn the indicator until the correct BCD number is shown on the display. Move slightly counter-clockwise until all inputs just go out. Tighten retaining screw. If the turret was properly aligned, the indicator should be in the same position that was marked.

To check turret operation, use the turret index button on jog panel to index turret one station at a time through all stations. If the turret does not work correctly check operation of index and stop solenoids.

The first time the turret is moved after the unit is powered up, it may rotate almost 2 revolutions depending on what tool # it is at when it began.

Refer to On-screen PLC (<alt-i>)

Position	Input 7	Input 8	Input 32	Input 10
1	GREEN	RED	RED	RED
2	RED	GREEN	RED	RED
3	GREEN	GREEN	RED	RED
4	RED	RED	GREEN	RED
5	GREEN	RED	GREEN	RED
6	RED	GREEN	GREEN	RED
7	GREEN	GREEN	GREEN	RED
8	RED	RED	RED	GREEN

Table 5.7.1

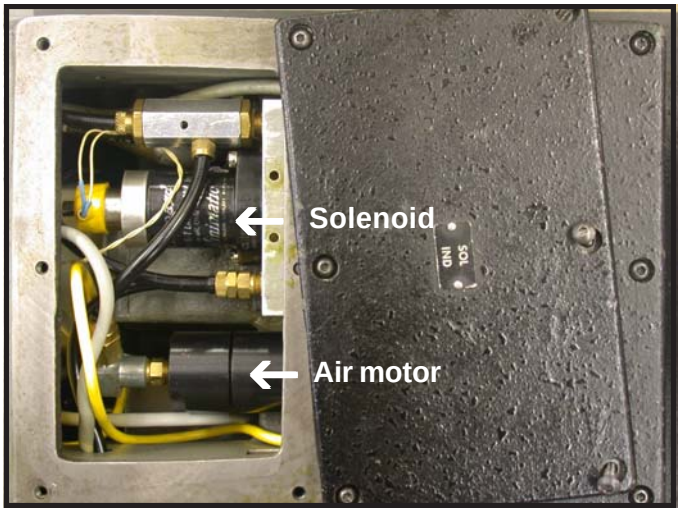

Figure 5.7.4

Figure 5.7.5

Make sure air pressure is at least 90 psi.

Sequence of events for tool change

1. Index solenoid turns on (OUT DRV 1) (Figure 5.7.4).
2. Turret raises and air motor turns on.
3. Turret rotates until PLC sees correct (or next) tool number.
4. Stop solenoid turns on (OUT DRV 5) and stops turret. (Figure 5.7.5)
5. Index soldenoid turns off, turning off air motor and dropping turret.
6. When turret drops, input 19 turns on.
7. This turns off Stop solenoid and completes tool change.

Again, if this is not correct, check for broken wires at the White Hardinge terminal block under the X axis encoder cover. These wires can be broken off the pin, but still be held in place by the insulating tubing covering it.

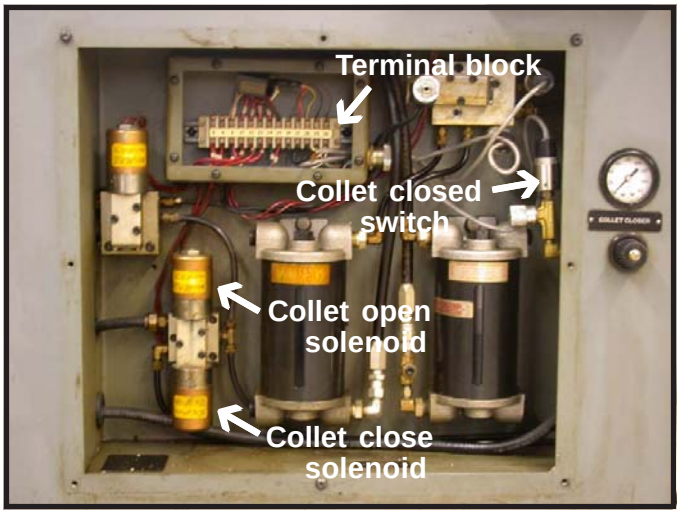

Figure 5.8.1

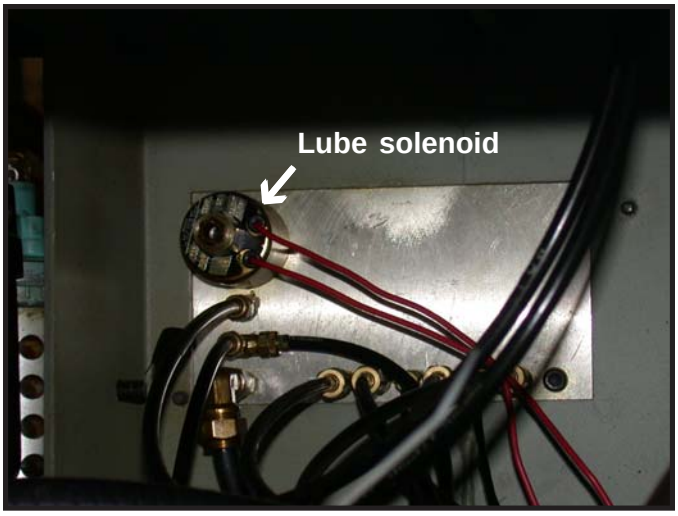

Figure 5.8.3

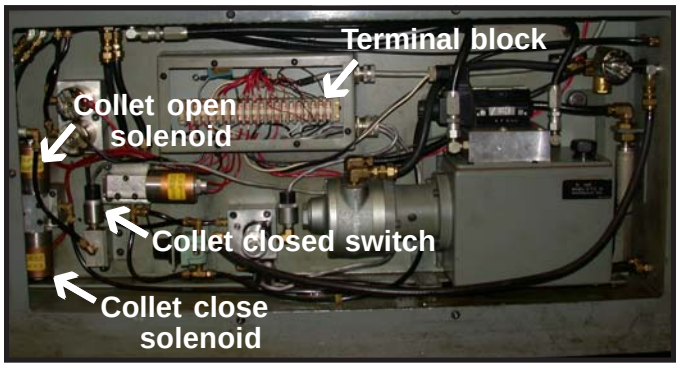

Figure 5.8.2

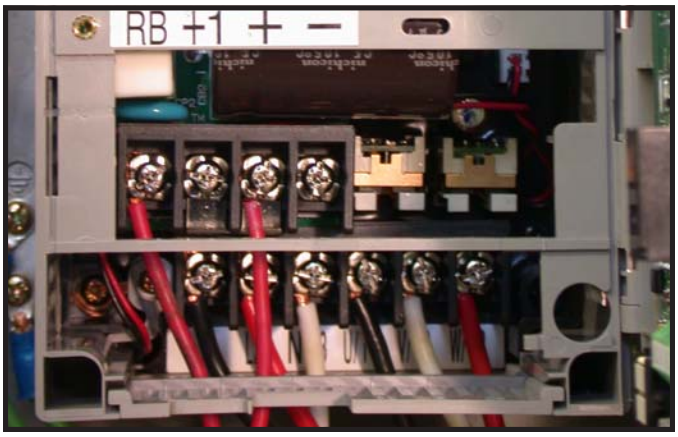

Figure 5.8.4

5.8.1 - Collet Closer Operation

To check collet closer operation, press collet (chuck) closed and collet (chuck) open buttens on jog panel. Collet should open (OUT DRV 11) and close (OUT DRV 10).

Input 24 (collet closed) on the PLC should turn on and off. Close collet.

For HNC collet solenoid layout, see Figure 5.8.1. For CHNC collet solenoid layout, see Figure 5.8.2.

The voltages for these solenoids can be measured on the terminal block between 8 and 14 (collet open) and 8 and 15 (collet close) on the CHNC; or between 8 and 23 (collet open) and 8 and 22 (collet close) on the HNC.

This is momentary and only registers for a second, so a digital meter may not read this. An analog meter or indicator light will work better.

On machines that have been idle for some time the solenoids may need to be disassembled, cleaned, and oiled.

5.8.2 - Lube Pump Operation

To check lube pump operation, from the main screen hit F3 MDI. The lube solenoid (output 2) should come on (See Figure 5.8.3). Check voltage going to the lube solenoid. Voltage can be measured on the terminal block between 8 and 20 on the CHNC; or between 8 and 25 on the HNC.

5.8.3 - Spindle Operation

To check spindle operation, on the jog panel, go to manual spindle and turn spindle speed all the way down. Push spindle start. Spindle should spin clockwise (turning into the tool). If the spindle does not turn, look at the inverter. Is the run light on?

If so check for 0-10 volts DC. If not, check connections for inverter.

If the spindle is spinning backwards, swap two wires on the inverter output (T1 and T3) (See Figure 5.8.4).

5.8.4 - Spindle Calibration

1. Hit F1 (Setup).
2. Hit F3 (Control).
3. Hit F1 (Control).
4. Make sure Max spindle speed is set to 3000 RPM.
5. Escape to main screen.
6. On inverter, set parameter A04 to 120 Hz.
7. Start spindle.
8. Slowly turn spindle speed up while monitoring the spindle speed with a tachometer. Turn speed up to 3000 RPM. Listen for any unusual sounds from the spindle during the operation.
9. Leave spindle running and read the spindle speed in Hertz on the inverter.
10. Turn off spindle.
11. Change parameter A04 in inverter to be 1 Hertz less than the reading from the inverter at 3000 RPM.
12. Change to auto mode on jog pendant.
13. Hit F3 for MDI mode.
14. Type in M3S1000 and push Cycle Start.
15. Turn spindle speed knob on jog panel until spindle speed on screen reads 1000 RPM.
16. Check spindle speed with tachometer.
17. Type S1500.
18. Check spindle speed with tachometer.
19. Type S2000.
20. Check spindle speed with tachometer.
21. Type S2500.
22. Check spindle speed with tachometer.
23. Type S3000.
24. Check spindle speed with tachometer.
25. Type S500.
26. Check spindle speed with tachometer.
27. Type S250.
28. Check spindle speed with tachometer.
29. Type S100.
30. Check spindle speed with tachometer.
31. Type S2000.
32. Actual spindle speed should be within a couple of RPMs of screen reading at low RPM and can be up to 50 RPM off at high speed.
33. If needed, adjust inverter parameter A04 up or down 1 Hertz at a time to achieve this.

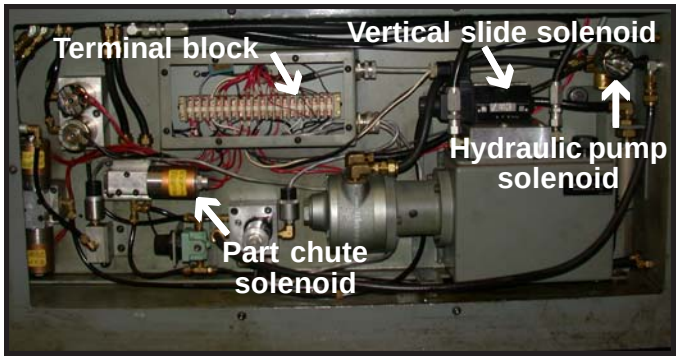

Figure 5.8.5

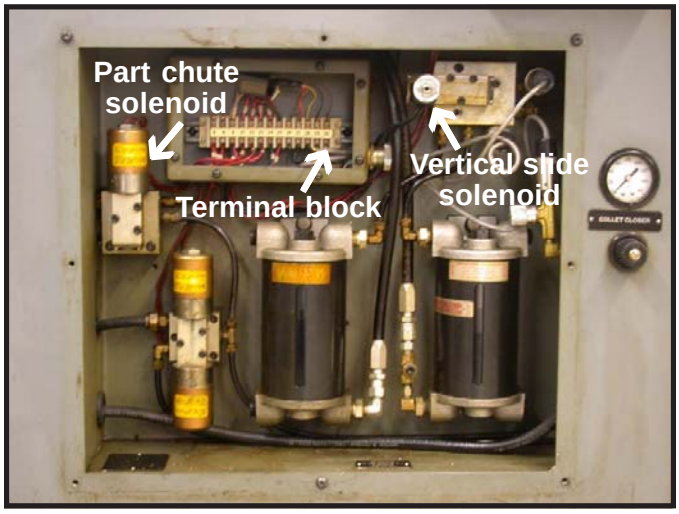

Figure 5.8.6

5.8.5 - Part Chute Operation

To check part chute operation, while in MDI mode, type in M22.

Part chute should extend (OUT DRV 9). Voltage for the solenoid can be measured on the terminal block between 8 and 13 on the CHNC (See Figure 5.8.5); and between 8 and 21 on the HNC (See Figure 5.8.6).

On machines that have been idle for some time the solenoid may need to be disassembled, cleaned, and oiled. M23 should retract the part shute.

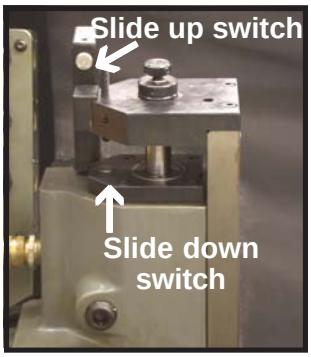

Figure 5.8.7

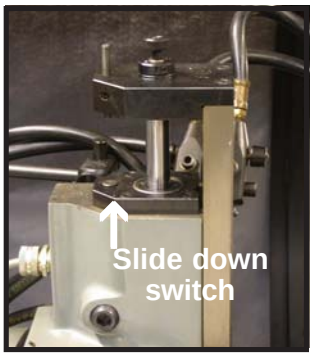

Figure 5.8.8

Figure 5.8.9

Figure 5.8.10

5.8.6 - Vertical Slide Operation

To check vertical slide operation, turn on spindle at low speed. In MDI mode, type in M13. Vertical slide solenoid (OUT DRV 6) and Hydraulic pump solenoid (Output 30, NO) come on.

Slide moves down until slide down (Input 28) is tripped (See Figure 5.8.7 for CHNC or Figure 5.8.8 for HNC) then vertical slide solenoid (OUT DRV 6) turns off. When slide up (Input 27) or dwell time expires, Hydraulic pump solenoid (Output 30, NO) turns off.

Voltage for vertical slide can be measured on terminal block between 8 and 24 on the HNC; and between 8 and 16 on the CHNC.

Hydraulic pump solenoid voltage can be measured between 8 and 18 on the CHNC.

Figure 5.8.11

Figure 5.8.12

5.8.7 - Coolant Pump Operation

To check coolant pump operation, check to ensure that coolant pump hoses are connected and valves are turned off. In manual mode, turn on coolant pump (output 3) (See Figure 5.8.9 for CHNC or Figure 5.8.10 for HNC). Check for correct rotation of pump. If pump does not turn on check that overload on coolant contactor is not tripped. Measure voltage on coolant contactor at 95nc to A1 (24vac) (See Figure 5.8.11 for CHNC or Figure 5.8.12 for HNC).

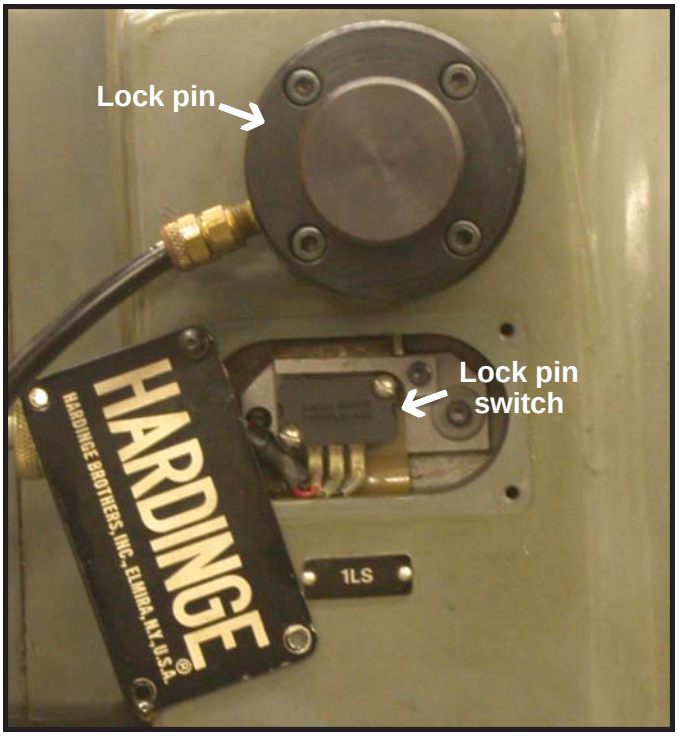

Figure 5.8.13

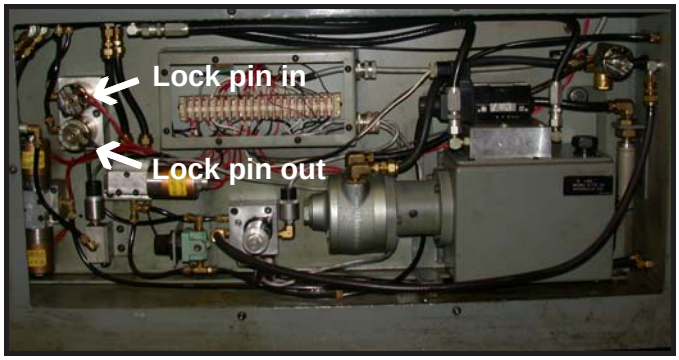

Figure 5.8.14

5.8.7 - Spindle Lock Pin Operation

To check spindle lock pin operation, make sure spindle is in auto mode. In MDI mode, type in M19. Spindle will spin at 100 RPM. When spindle is at speed (input 13), spindle lock pin in turns on (RLYBRD 2, K2 OUT). When spindle locked switch is seen (input 19), spindle (output 14) turns off.

Type in M5, and lock pin will retract (RLYBRD 3, K1 OUT). Lock pin in solenoid voltage can be measured between 8 and 10 on the CHNC. Lock pin out solenoid voltage can be measured between 8 and 11 on the CHNC.

5.8.8 - Coolant contactor

The voltage for the coolant contactor is on control cable C. This is one of the 18/5 cables. The red wire is 24vac1 and the brown wire is 24vac2. This is turned on and off by PLC output 3.

5.8.9 - Turret solenoids

The stop and index solenoids operate on the same +12vdc as the limits and all of the other switches and sensors. They are turned on by PLC OUT DRV 5 (stop) and OUT DRV 1 (index). OUT DRV 5 connects the blue wire in control cable A to 12vdc common and OUT DRV 1 connects the green wire in control cable A to 12vdc common. These wires connect to the original Hardinge cabling.

5.8.10 - Other solenoids

All of the other solenoids operate on 110vac. They all use the same neutral wire. This is the white wire in control cable C. They are all turned on by the PLC connecting them to 110vac hot.

Collet open, OUT DRV 11, control cable B brown wire

Collet close, OUT DRV 10, control cable B red wire

Part chute in, OUT DRV 9, control cable B green wire

Lockpin out, OUT DRV 8, control cable B white wire

Lockpin in, OUT DRV 7, control cable B black wire

Vertical slide down, OUT DRV 6, control cable D white wire

Lube on, OUT 2, control cable D black wire

Hydraulic pump on, OUT 30, NO, control cable D green wire

These wires connect to the original Hardinge cabling.

5.8.11 - Limit/Home switches

The limits are actually Hall effect sensors and turn on when tripped. They are connected to inputs 20, 21, 22, & 26. Because they turn on (close) when tripped, inputs 20, 21, 22, & 26 are mirrored to inputs 1 through 4. This allows the software to see the limits as opening when tripped on inputs 1 through 4. That is why on the setup screen the limits and home switches are listed as 1 through 4. The limits are connected to the PLC by control cable A and are pulled down to 12vdc common when tripped.

Z- limit, Brown wire, input 20

Z+ limit, Red wire, input 21

X- limit, Orange wire, input 22

X+ limit, Yellow wire, input 26

These wires connect to the original Hardinge cabling.

5.8.12 - Other Hardinge sensors

The following are Hall effect sensors that pull down to 12vdc common to the input they are connected to through the control cable A.

Turret down, white wire, input 28

Slide down, white/black/violet wire, input 17

Spindle locked, white/red wire, input 27

Slide up, white/black/blue wire, input 19

These wires connect to the original Hardinge cabling.

The following are air pressure activated switches and pull up +12vdc to the input they are connected to by control cable A.

Guard closed, white/gray wire, input 15

Air pressure OK, violet wire, input 18

Collet closed, black wire, input 24

These wires connect to the original Hardinge cabling.

On a CHNC only, the coolant level switches are magnetic float switches and pull up +12vdc to the input they are connected to through control cable A.

Coolant low, white/black/brown wire, input 30

Coolant high, white/brown/orange wire, input 14

These wires connect to the original Hardinge cabling.

The turret position is sent to the PLC as a BCD number. These pull up +12vdc to the input they are connected to.

1st digit (pos. A), white/black/red wire, input 7

2nd digit (pos. B), white/black/orange wire, input 8

3rd digit (pos. C), white/black/yellow wire, input 32

4th digit (pos. D), white/black/green wire, input 10

These wires connect to the original Hardinge cabling.

Refer to On-screen PLC (<alt-i>)

Position	Input 7	Input 8	Input 32	Input 10
1	GREEN	RED	RED	RED
2	RED	GREEN	RED	RED
3	GREEN	GREEN	RED	RED
4	RED	RED	GREEN	RED
5	GREEN	RED	GREEN	RED
6	RED	GREEN	GREEN	RED
7	GREEN	GREEN	GREEN	RED
8	RED	RED	RED	GREEN

5.8.13 - Inverter Operation

The common for the inverter is P24 (+24vdc). It is connected to PLC output 15 common and output 14 common (control cable A, white/yellow wire).

Output 13 SPINDLE CW is connected to the inverter pin 1 through the E-stop contactor L1 (white wire #30 to contactor then to control cable A, white/violet wire).

Output 13 SPINDLE CCW is connected to the inverter pin 2 through the E-stop contactor L2 (black wire #31 to contactor then to control cable A, white/green wire).

Output 15, white/blue wire, Resets the inverter (pin 6) when a fault is detected. Output 15 only turns on when the control sees an inverter fault signal and the E-stop signal at the same time.

0 to 10vdc from the PLC ANALOG OUT (0-10v) and ANALOG COMMON is connected to the inverter to control the spindle speed.

0-10vdc, white/black/gray wire, inverter pin O

Common, gray wire, inverter pin L

There are 2 outputs on the inverter that are connected to the PLC. They pull the input low when tripped.

Inverter fault is a switch that closes when the inverter faults out.

At Speed is an open collector output that turns on when the programmed spindle speed is reached.

Fault, inverter pin AL2, white/brown/red wire, input 25

At Speed, inverter pin 11, white/brown/yellow wire, input 13

Common, inverter pin AL0 and CM2, white/brown wire, 12vdc common

On a CNC model these wires connect directly to the inverter (except the white/brown wire). On a HNC model there is a secondary cable.

5.8.14 - Control Power

The control power is supplied by a 14/3 SJO cable. It is connected to the Disconnect and Fuses installed in the Hardinge cabinet. Make sure that if the incoming 3-phase has a wild (high) line that the control power cable is **NOT** attached to that line.

5.8.15 - Encoders

The encoders are connected to the original Hardinge cable by butt splicing a pigtail (provided) on to the Hardinge cables. These cables are attached to terminal blocks in the Hardinge cabinet. The encoder cables than go to a DB9 connector for the CPU10 on the back of the PC.

Encoder +5vdc to the DB9 connector pin 9

Encoder 5v common to the DB9 connector pin 2

Encoder channel A to the DB9 connector pin 7

Encoder channel A\ to the DB9 connector pin 4

Encoder channel B to the DB9 connector pin 8

Encoder channel B\ to the DB9 connector pin 5

Encoder channel Z to the DB9 connector pin 6

Encoder channel Z\ to the DB9 connector pin 3

Encoder shield to the DB9 connector body

5.8.16 - Motor Power

If using the original Hardinge axis servo motors the Centroid motor power cables are connected to the original Hardinge cables. If Centroid supplied axis servo motors are used the Centroid motor power cables are connected to the original Hardinge cables and then the other end of the Hardinge cables are butt spliced to the motors.

If the original axis servo motors are reused the connections at the servo drive may need to be reversed. This is indicated by the table moving for a short distance and then giving a position error. The table will also move in the same direction no matter which direction that it is told to move.

If the axis servo motors are replaced only the X axis motor cable connections will have to be reversed because of the encoder being mounted on the ball screw facing the motor. This causes the control to think that the motor is turning backwards from the commanded direction.

5.8.17 - Collet open and close

The Collet open (OUT DRV 11) and Collet close (OUT DRV 10) solenoids are only turned on momentarily. Most digital meters will not be able to measure the voltage to these solenoids as they do not react quickly enough. Use an analog meter or an indicator light to measure the voltage to these solenoids. Listen for the sound of the solenoids firing. If the Lathe has not been used in some time the solenoids may be sticking. This can be determined by hearing the solenoid fire but the collet does not open or close. If this is the case the solenoid valve may need to be disassembled cleaned and oiled. If the control does not see the collet closed signal (INP 24) the spindle will not turn on.

5.8.18 - Part chute

The part chute solenoid valve is turned on (OUT DRV 9, M22) until told to retract (M23). If the Lathe has not been used in some time the solenoids may be sticking. This can be determined by hearing the solenoid fire but the part chute does not extend or retract. If this is the case the solenoid valve may need to be disassembled cleaned and oiled.

5.8.19 - Spindle Lockpin operation

The spindle must be in auto mode. On receiving M19 the spindle turns on CW (output 13) at 100rpm. When the PLC sees the at speed signal (input 13) from the inverter the lockpin in solenoid turns on (OUT DRV 7). When the PLC sees the spindle locked signal (input 19) the spindle turns off. Lockpin retracts (OUT DRV 8) when it is given a M5.

5.8.20 - Vertical Slide (cut off) operation

The spindle must be turning. When receiving M13 the vertical slide solenoid (OUT DRV 6) and the hydraulic pump solenoid (OUT 30, NO) turn on. The slide will come down until the slide down sensor (input 28) is tripped. Vertical slide solenoid (OUT DRV 6) turns off. When the slide up sensor (input 27) or the dwell time expires, the hydraulic pump solenoid (OUT 30, NO) turns off.

On units without slide up sensor, input 27 must be jumpered to 12vac common.

5.8.21 - Lube operation

The lube solenoid (output 2) turns on whenever the control is in “program running” mode (MDI mode or running a program).

Lube pump is always on in “program running” mode. Flow is adjusted by turning the flow adjustment knobs on the lube pump.

Parts List

6.1 Supplied Parts

Supplied Parts (All retrofits)

1 - M39hp cabinet prewired

1 - Cabinet stand with hardware

1 - Keyboard and monitor tray with hardware

1 - Jog pendant bracket with mounting hardware

3 - Encoders, 2000 line for 1/4 inch shaft

3 - Pigtails with attached butt splices

3 - 6-32x1/4" panhead Phillips screws with lock washers

1 - Spindle encoder shaft

1 - Hitachi SJ00 5 HP inverter with mounting hardware (4 - 8-32x3/8" with internal lockwashers)

1 - Braking resistor with mounting hardware (2 - 8-32x1/4" with internal lockwashers)

1 - Lincoln 5 HP inverter rated spindle motor with mounting hardware, prewired for CHNC

1 - Coolant contactor 24vac coil with mounting hardware (2 - 8-32x3/8" with internal lockwashers) and snubber

1 - Thermal overload protector

2 - SR-50-500 strain relief (1 for spindle motor, 1 for power in)

5 - 15 position terminal blocks with mounting hardware (10 6-32x1/2" php and internal tooth lockwashers)

10 feet of 12/4 SJOW cable (power in)

3 - 30 amp time delay fuses

1 - 3 fuse, fuse block mounted on old style M-400 disconnect bracket with hardware

If new servo motors are needed

2 - 17 in/lb servo motors

2 - 24 tooth pulleys (for 2 to 1 ratio)

1 - X axis motor mounting plate with mounting hardware

1 - Z axis motor mounting plate with mounting hardware

1 - X axis belt

1 - SR-50-375 strain relief (HNC only)

1 - 1/2 NPT plug (HNC only)

4 - Butt splices 12-10 AWG (yellow)

HNC with Vari-drive spindle

10 feet of 12/4 SJOW cable

10 feet of 14/3 SJOW cable

10 feet of 12 conductor 22 AWG cable

17 - Blue ring terminals #10

5 - Blue butt splices

Paper template for marking spindle motor mounting holes

Spindle belt

Bored-out pulley from vari-drive

2 - SR-50-375 strain relief

1 - SR-50-500 strain relief

1 - 1/8 NPT plug for Vari-drive lube line

1 - Rotary disconnect and long shaft with mounting hardware

1 - Disconnect handle

CHNC with DC spindle motor

Spindle encoder mounting plate

Spindle motor mounting alignment plate

2 - 1/4-20x3/8" with locknuts

1 - Rotary disconnect with short shaft

12 - Blue ring terminals #10

4 - Blue ring terminals 1/4 inch

1 - Blue butt splice

2 - Red butt splices

4 - 1/2-13x1-3/4" bolts

10" channel gasket

1 - old style M400 disconnect bracket

CHNC4

Same as CHNC, but with larger spindle encoder shaft

Parts that are good to have in case they are needed

Spare fuses

Extra butt splices of all sizes

Extra ring terminals of all sizes

Extra spade terminals of all sizes

Extra hardware to replace missing hardware on the Hardinge

10-32 and 1/4-20 socket head cap screws are the most common

Flat and lock washers #10 & 1/4 inch

Extra belts for Hardinge

Tools that are needed

1. 1 1/4" conduit punch.
2. A .035 Allen wrench for removal of existing feedback couplers.
3. A 1.5mm Allen wrench for installing the new encoders
4. Standard Allen wrench set from 0.050 to 3/8".
5. A center punch.
6. A fine tip permanent marker (Sharpie ultra fine point).
7. Combination wrenches from 1/4" to 7/8".
8. Number 35, 29, 19, and 11/32" drill bits (More than one in case they break).
9. 6-32, 8-32, and 10-32 taps (More than one in case they break).
10. A tap handle for small taps.
11. Tap Magic or equivalent.
12. A 17/32 drill bit for the CHNC or a 5/16 drill bit and 3/8-16 tap with handle for the HNC
13. For the CHNC a notch must be made for spindle motor clearance. A Sawzall, hand grinder or some other tool to cut out the notch is needed.

Tools that are needed (continued)

14. A step drill from 1/4" to 7/8".
15. A very good pair of crimpers.
16. #2 Phillips head screwdriver (A second #2 with a long shaft makes it easier to connect the wires to the terminal strips).
17. Assorted straight screwdrivers.
18. A pair of small needle nose pliers.
19. Wire cutters.
20. Wire strippers.
21. A sharp utility knife.
22. A crescent wrench or channel lock pliers that open up to at least 1 1/2".
23. A good drill (cordless drill is not recommended but will work).
24. A good multi meter.
25. A small soldering iron and solder (for repairing pins at the Hardinge terminal blocks).
26. A work light.
27. Tie wraps.
28. A spray bottle of 409 cleaner.
29. A Scotch Bright pad.
30. A marker to mark the cables with.
31. WD-40 or equivalenet.
32. Rags.
33. A dial indicator to check that the turns per inch are set.
34. A tachometer to measure spindle speed.

213T MOUNTING PATTERN.DWG
07/26/02

BOLT PATTERN FOR A 213T FRAME MOTOR ON A HNC HARDINGE LATHE