
Section 11: Probes & Scales

Probes

MP-11 Probe The MP-11 Probe operates by transmitting signals between the probe and the machine control via the probe cable and the interface cable. The power 12VDC is supplied from the 1060 Mother board. On machines with standard sheetmetal, the interface cable connector is mounted on the top right panel, under the wire cover. On machines with the slant sheetmetal, the connector is mounted in the right wire gutter with the logic wires. After installation, use the following steps to test the MP-11 probe:

- 1) Orient spindle, using the M19 command and insert the MP-11 probe into spindle. (The probe LED has to be facing the front door).
- 2) Plug one end of the probe cable into the probe and the other end into the interface connector on the top right panel.
- 3) At the "ENTER NEXT COMMAND" prompt type UT and press <ENTER>.
 - a. Select #4(test MP Probe) from the menu.
 - b. Press the Start key while depressing the probe sensor.
 - c. Release the probe sensor and the start key.
 - d. Press the start key again.
 - e. Wait for the CNC to display "PASSED" or "FAILURE."

Maintenance:

- 1) When the probe is not in use, store the probe cable in the box supplied with the probe and keep the interface connector covered by the cap attached to the connector.
- 2) Keep all components clean and free from grease and oil.
- 3) Periodically check cables for signs of damage, corrosion, or loose connections.
- 4) Treat the probe as a precision tool.

MP-12 Probe This probe is used for position location of a part or home position, for accuracy when machining multiple parts. The probe system operates by transmitting signals between the probe and the machine control using the Optical Module Probe (OMP) MP-12, the Optical Module Machine (OMM), and the MI-12 Interface Unit.

The power, 24VDC, is supplied by the power supply board mounted on the right side of the CNC cabinet. The OMM is mounted on the front, top, left panel of the VMC facing the spindle. The Interface Unit is mounted on the top of the CNC cabinet. The Interface Unit is factory set in Auto Start Mode. The flashing yellow LED in the OMM indicates this mode. The red LED in the OMM will be lit when the power is on and the green LED will be lit when the signal is received from the probe. To test the probe, use the same program as for the MP-11 on page 2. Make sure that when installing the probe into the spindle that the probe window is facing the OMM.

Maintenance:

The maintenance for the MP-12 probe is the same as the maintenance for the MP-11.

TS-27 The TS-27 probe is used for setting tool length offsets. The probe can be mounted on either side of the table, though it is factory installed on the left side of the table to leave room for any rotary table that may be installed. The cable is mounted on the top right side of the sheetmetal and routed through the back of the machine over to the CNC cabinet.

The TS-27 probe uses the same test procedure as the MP-11 and the MP-12 probes. The same maintenance procedure should also be used.

Scales**Installing Scales**

- 1) Remove the front cover plate from the table and position a .001" Indicator on the face of the table.

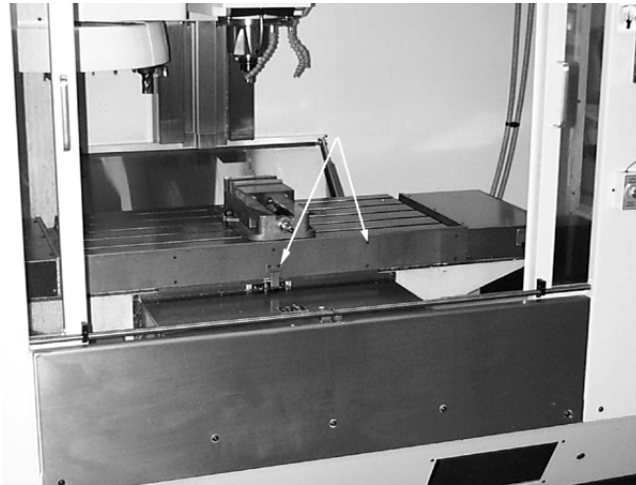


Figure 11-1 Remove Front Cover Plate and Position Indicator

- 2) Jog the table to the maximum negative X axis travel.



Figure 11-2 Jog Table to Maximum Negative X Axis Travel

- 3) Remove the telescoping way cover by removing three button head socap screws and two 1/4-20 cap screws.

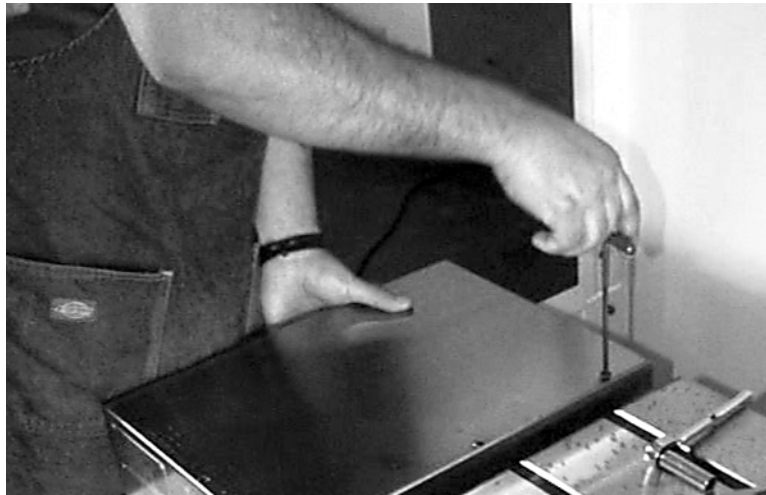


Figure 11-3 Remove Telescoping Way Cover

- 4) Jog the table to the X axis home position.



Figure 11-4 Jog Table to X Axis Home Position

- 5) Measure and mark the center of the table.

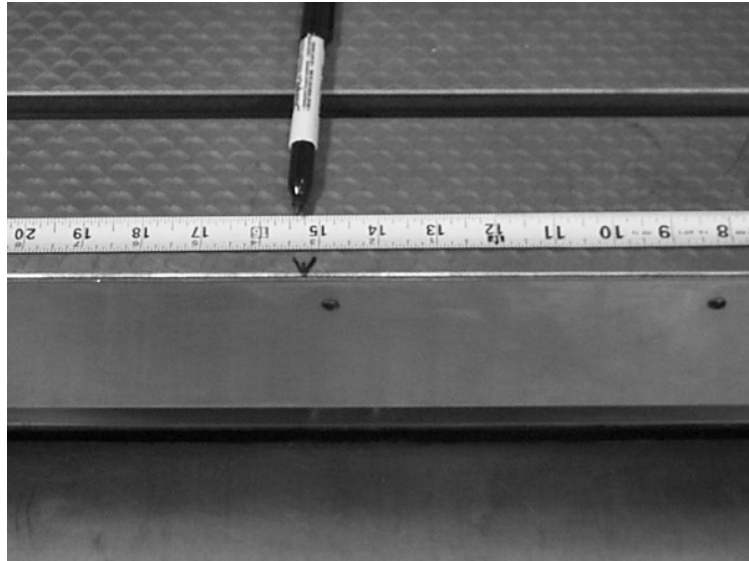


Figure 11-5 Measure and Mark Table Center

- 6) Install the scale template with clamps. Center the template on the table marks that were made in step 5. Verify that the alignment pins are tight against the bottom of the table.

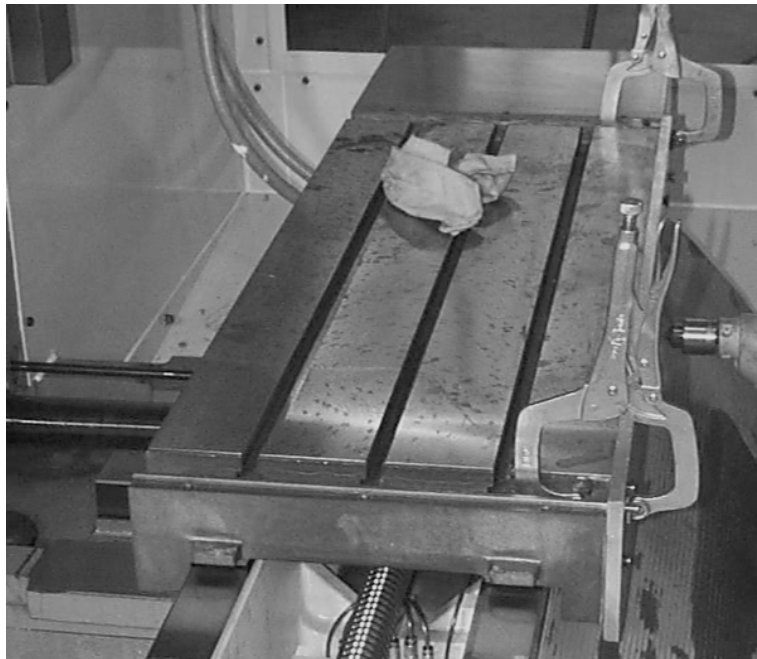


Figure 11-6 Install Scale Template with Clamps

- 7) Drill $21/64$ " starting holes. [For the 6030 and 8030 drill $3/16$ " holes, and $1/4$ " dowel pin holes (6 total). Skip step 8.]



Figure 11-7 Drill Starting Holes

- 8) Remove the Template.



Figure 11-8 Remove Template

- 9) Drill the holes with 21/64" drill. Drill to a depth of 1 inch. Counter sink the holes after drilling.



Figure 11-9 Counter Sink Holes

(For 6030 and 8030 machines drill with a #3 drill for attachment bars and a 1/4" drill for dowel pins.)

- 10) Apply tapping lubricant to the holes and tap them with a 10-32" tap.

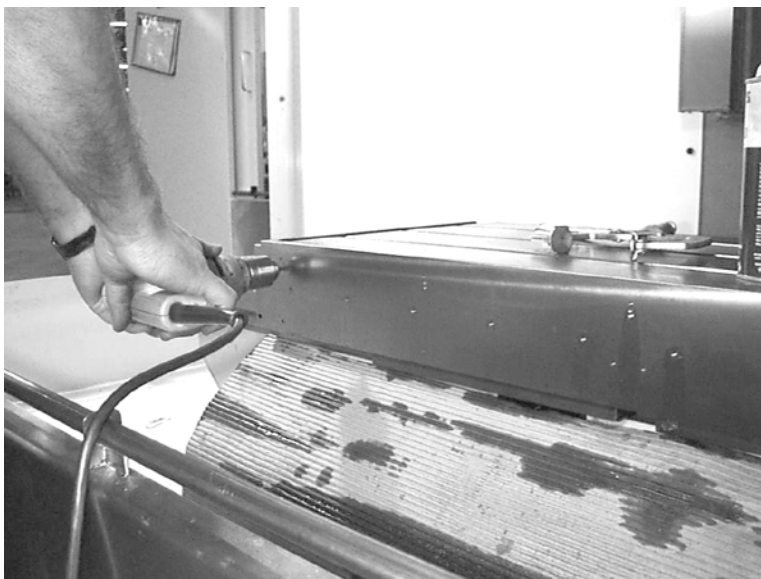


Figure 11-10 Tap Holes

(For 6030 and 8030 machines, tap with a 1/4-20 tap.)

11) Clean debris from inside the holes with a air.



Figure 11-11 Clean Debris from Holes

12) Clean all surfaces to remove lubricant and debris.



Figure 11-12 Clean Surfaces

(For 6030 and 8030 machines only: Insert 1/4" dowel pins into the mounting plates.)



Figure 11-13 Insert Dowel Pins into Mounting Plates of 6030 & 8030

13) Attach mounting plates to the table with 1/4-20 x 1/2" socap screws (HDW-0295). Adjust the way covers so that the plate is flush with table.

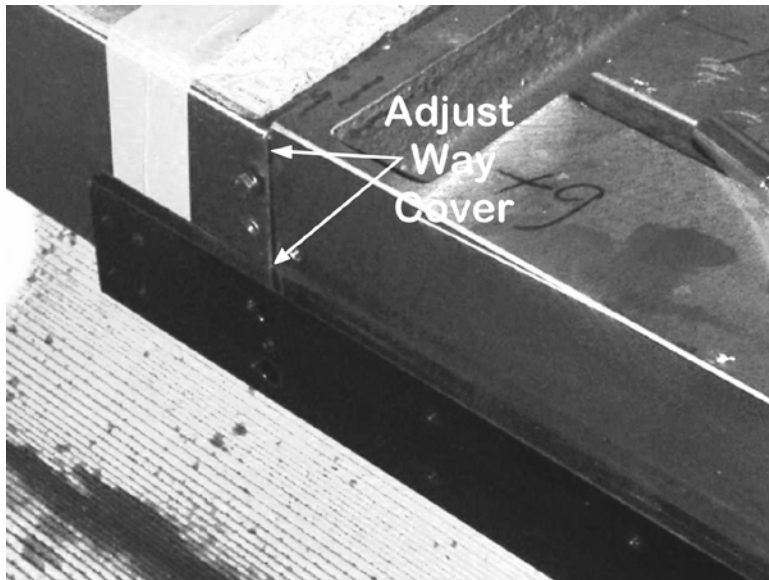


Figure 11-14 Adjust Way Cover

- 14) Remove the cap plate from the center line of table by removing two socap screws with a 3/16" Allen wrench.

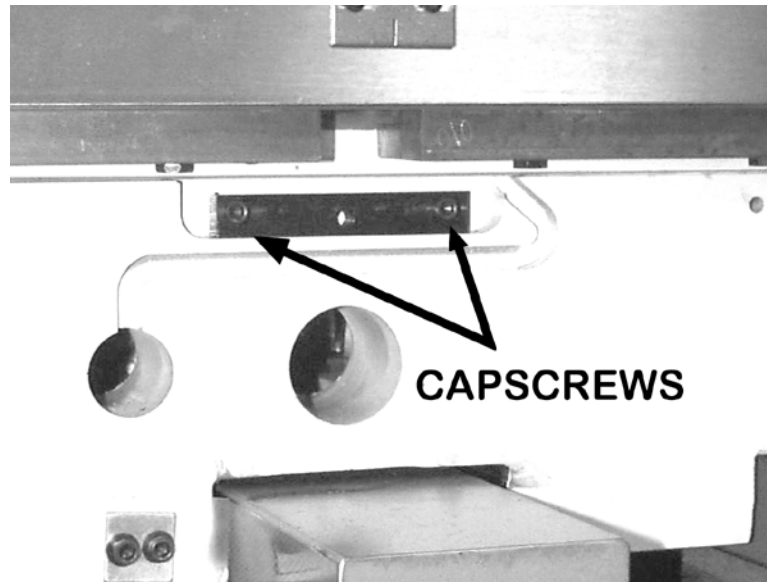


Figure 11-15 Capscrews

- 15) Scrape paint from all areas that the scale will cover. Stone the surface lightly and clean them with a solvent.

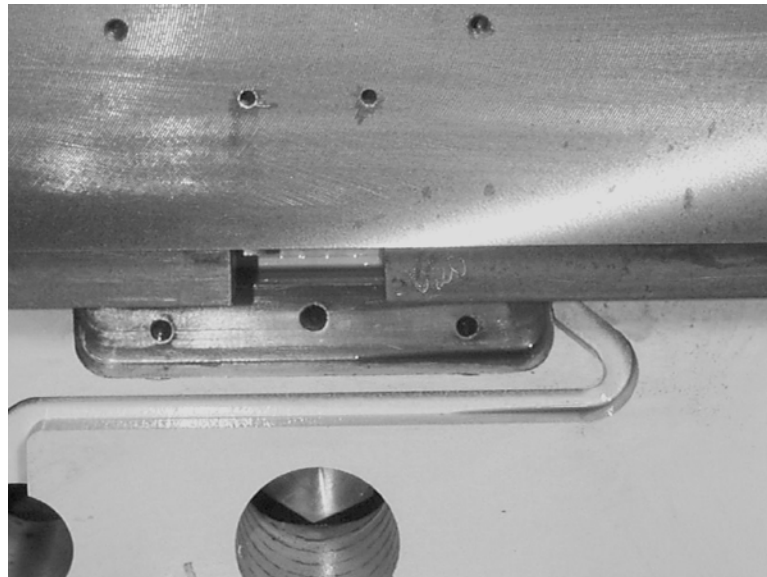


Figure 11-16 Scrape Paint from Areas Scales Will Cover

- 16) Install the X axis scale reader mounting plate with socap screws and a 3/16" Allen wrench. Using an indicator, level the plate to within .0003".



Figure 11-17 Install X Axis Scale Reader Mounting Screws

- 17) Remove the scale from the box. Remove the retainer clip and loosen the screws holding the packing clips.

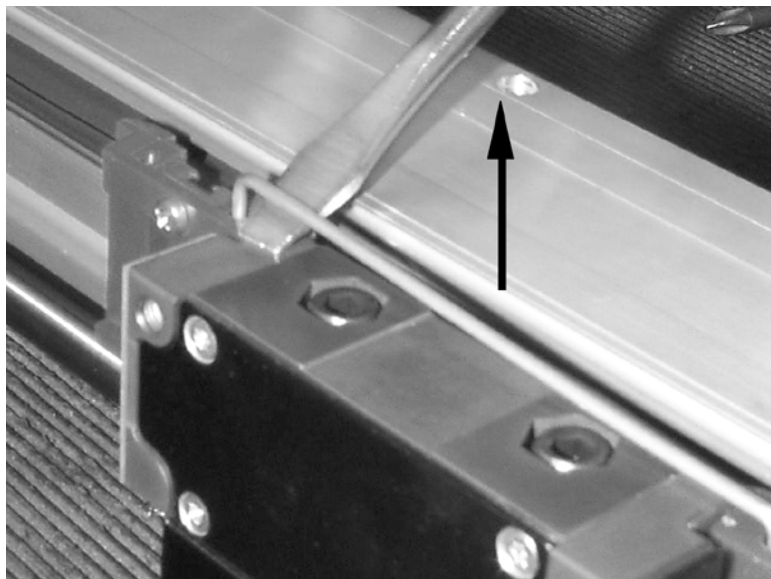


Figure 11-18 Remove Scale from the Box

18) Remove the protective cover, located over the pin connector.



Figure 11-19 Remove Protective Cover from Pin Connector

19) Remove the packing clips from the scale assembly.

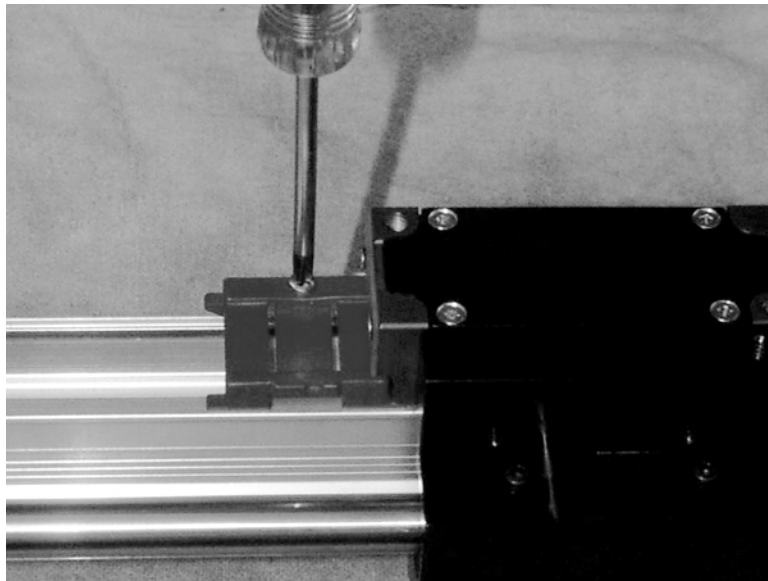


Figure 11-20 Remove Packing Clips from Scale Assembly

- 20) Attach the scale assembly to the table with 10-32 x 3/4" button head socap screws (HDW-797) and washers (HDW-0450) using a 1/8" Allen wrench. *Do Not Tighten Securely At This Time.*



Figure 11-21 Attach Scale Assembly to Table

- 21) Attach the scale reader to the mounting plate with two #8 socket head cap screws.

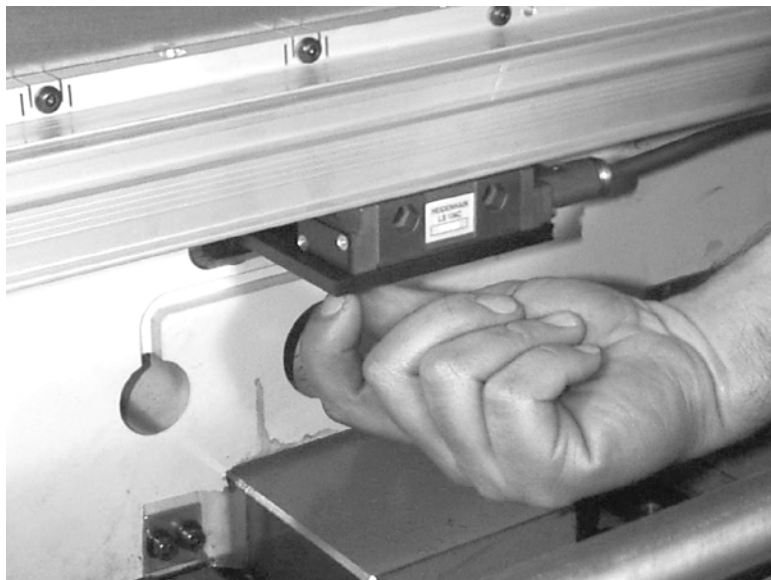


Figure 11-22 Attach Scale Reader to Mounting Plate

- 22) Place a .060" shim between the scale and the reader. Adjust the scale so that a .010" shim cannot be inserted between the scale and the shim on the reader. Continue adjusting along the length of the scale.

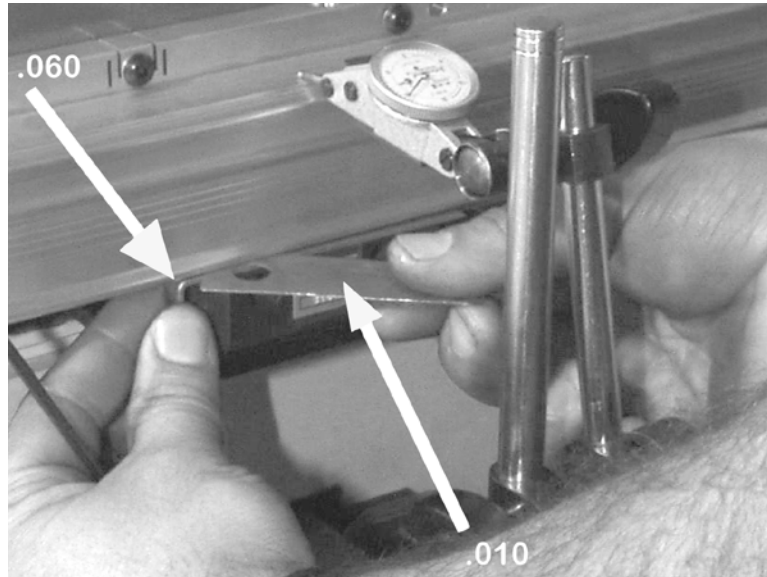


Figure 11-23 Place Shim Between Scale and Reader

- 23) Mount the scale to the table, using a dial indicator with a magnetic base, to the center of the way. Position the indicator on the widest rib on the top side of the scale. Align the scale within .001", end to end.



Figure 11-24 Mount Scale to Table

- 24) Place a straight edge against the front of the aluminum extrusion. Adjust the reader so that it is flush with the scale. Tighten the mounting screws.



Figure 11-25 Adjust Reader So it is Flush with Scale

- 25) Attach the cable to the scale reader with a #8 metric allen wrench. The alignment pin ensures that the cable is installed correctly.

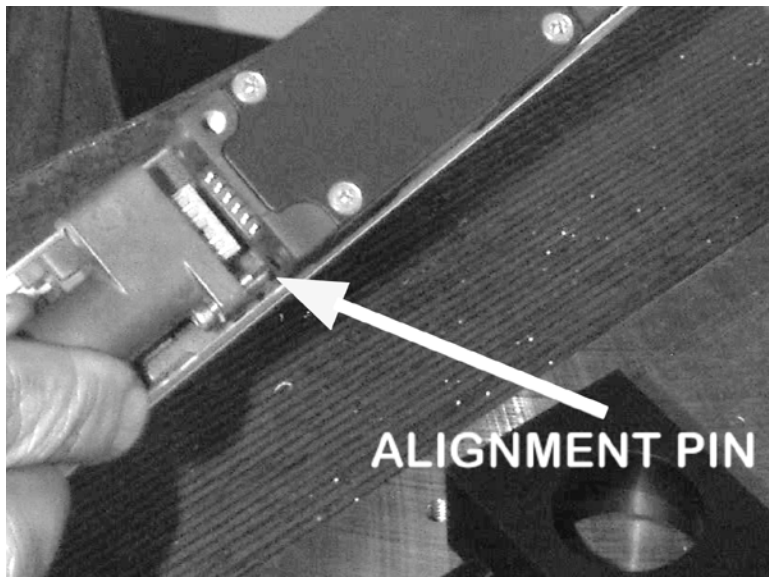


Figure 11-26 Alignment Pin

26) Route the cable through the access hole on the saddle.

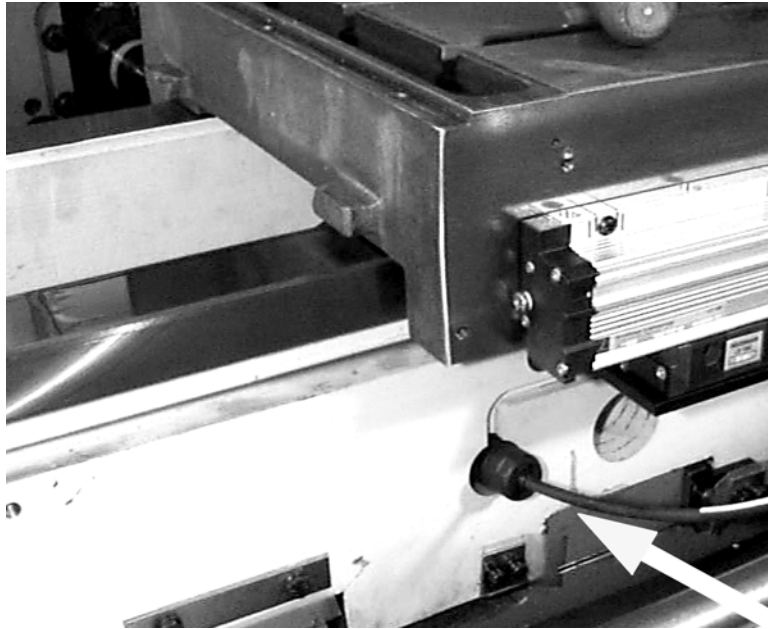


Figure 11-27 Route Cable Through Access Hole on Saddle

27) Pull the excess cable through the saddle and tie it to the lubrication line bundle.

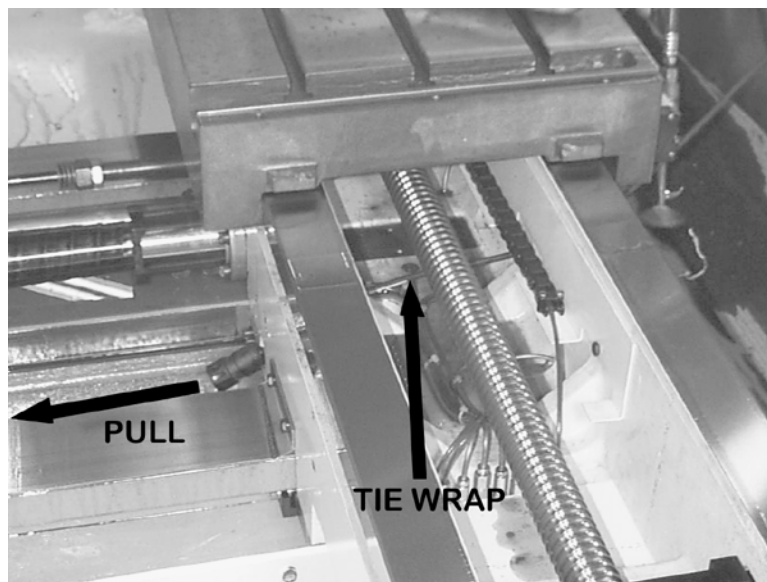


Figure 11-28 Pull Excess Cable Through Saddle and Tie to Lubrication Line Bundle

28) Reinstall telescoping way cover.

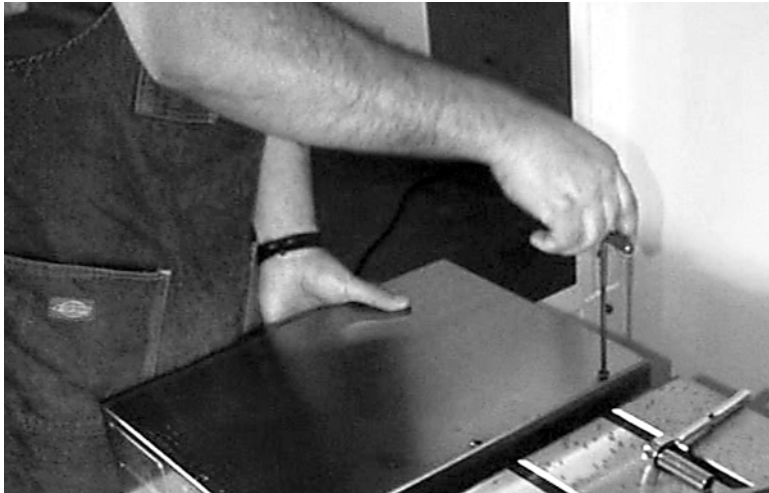


Figure 11-29 Reinstall Telescoping Way Cover

29) Attach the axis position indicator to the scale cover with two 10-32 nylok nuts (HDW-0634). Attach the scale cover to the side of the table with five 10-32 button head socap screws (HDW-0348).



Figure 11-30 Attach Axis Position Indicator to Scale Cover

- 30) Press the X-axis shield tube cap onto the end of the tube, fasten with 1/4-20 x 1/2" hex cap screw (HDW-0319) and hex nut KEPS 1/4-20 (HDW-0337).

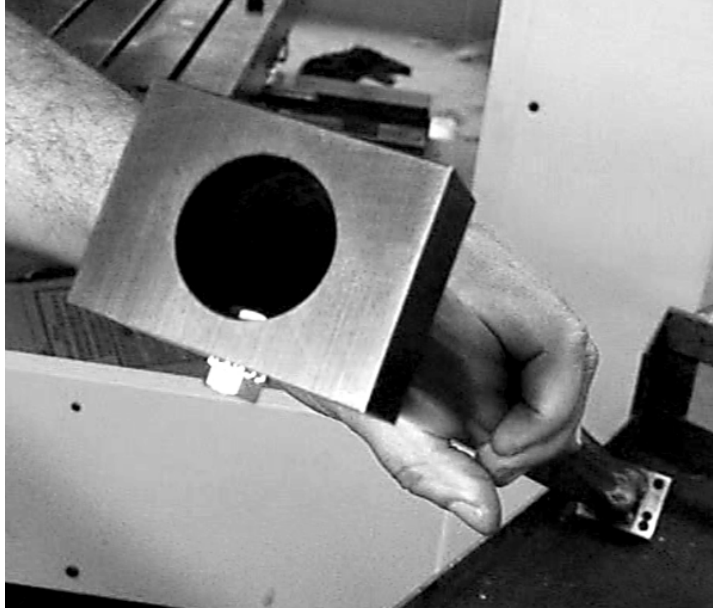


Figure 11-31 Press X Axis Shield Tube Cap onto End of Tube

- 31) Pull the X axis cable through the shield tube, while inserting the tube through the machined opening through the column.

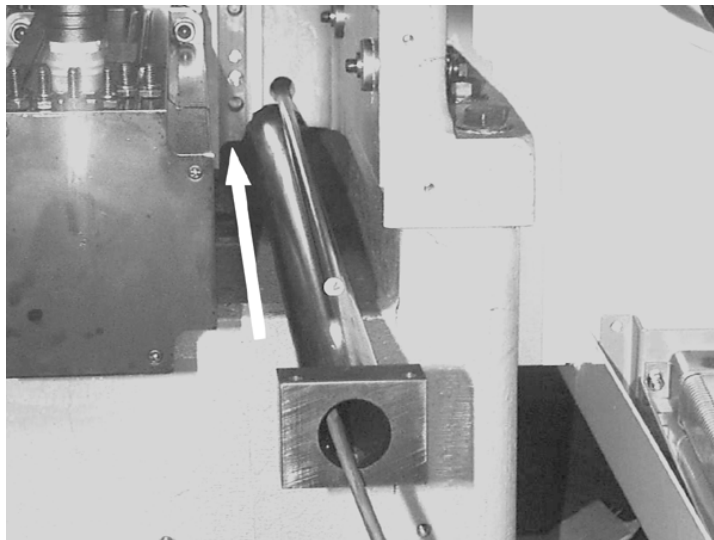


Figure 11-32 Insert Tube Through Column

32) Attach the X axis shield tube to the saddle with three 5/16-18 x 1 1/4" socap screws. (HDW-0792)

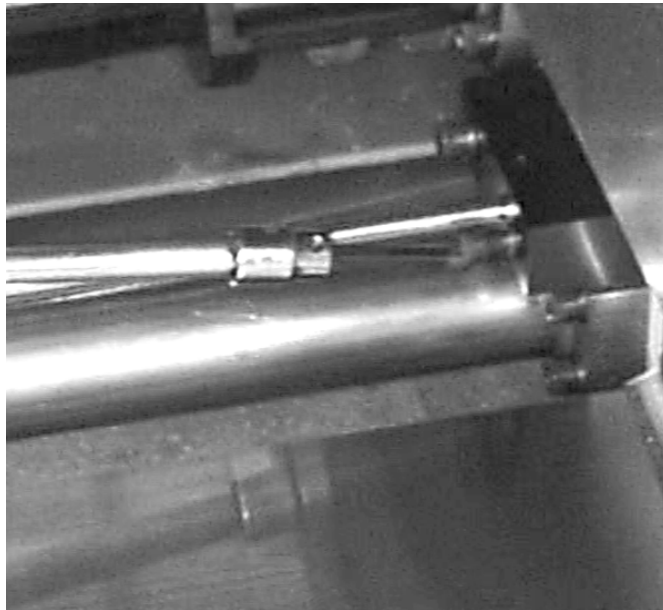


Figure 11-33 Attach X Axis Shield Tube to Saddle

33) Clean the Y axis mounting plate.

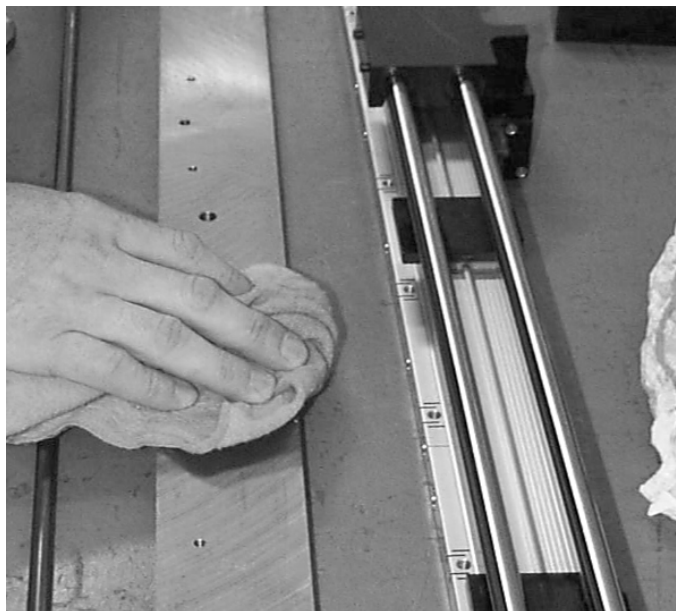


Figure 11-34 Clean Y Axis Mounting Plate

- 34) Remove the scale from the packaging. Remove the wire retainer and loosen the screws holding the plastic retainer plates.

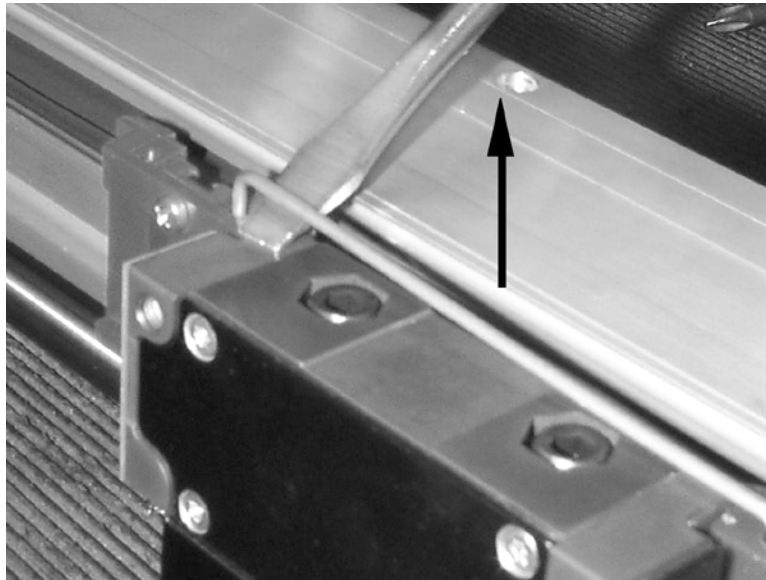


Figure 11-35 Remove Wire Retainer and Loosen Screws Holding Retainer Plate

- 35) Remove the pin connector protective cover.

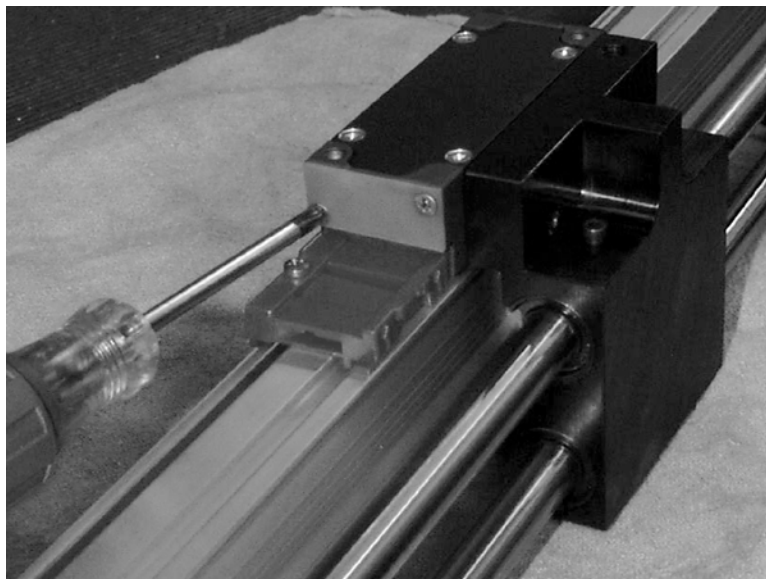


Figure 11-36 Remove Pin Connector Protective Cover

36) Attach the cable to the scale reader with a #2.5 metric allen wrench. The alignment pin ensures that the cable is installed correctly.

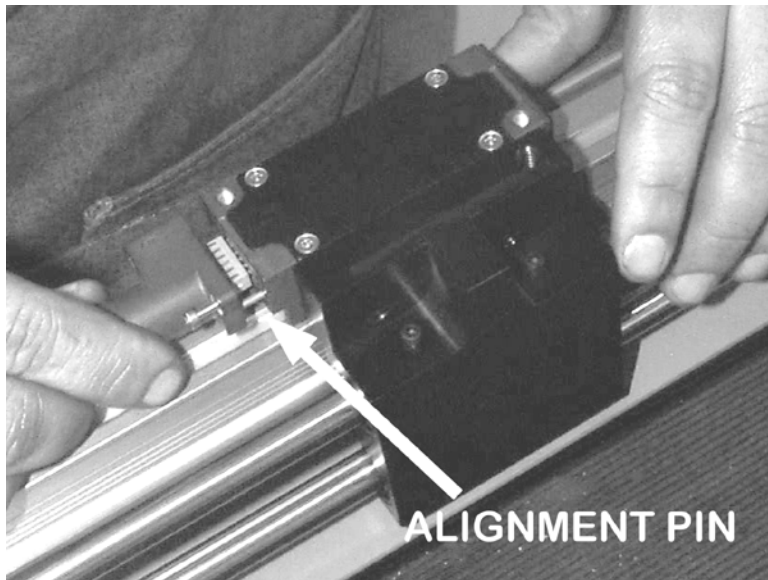


Figure 11-37 Attach Cable to Scale Reader

37) Remove the packing clips from the scale assembly.



Figure 11-38 Remove Packing Clips from Scale Assembly

- 38) Temporarily attach the throw rod to the scale reader. Visually align the rod with the scale and tighten the bracket. Remove the throw rod.

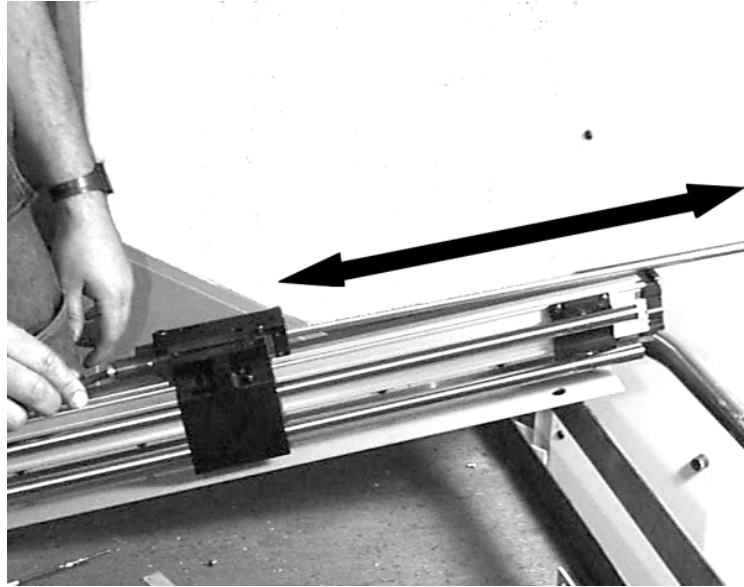


Figure 11-39 Attach Throw Rod to Scale Reader

- 39) Attach the scale assembly to the mounting plate with eight 10-32 x 3/4" button head socap screws (HDW-0797) and washers (HDW-0450). While pushing the scale upward against the mounting bolts, use a 1/8" Allen wrench to tighten the screws.

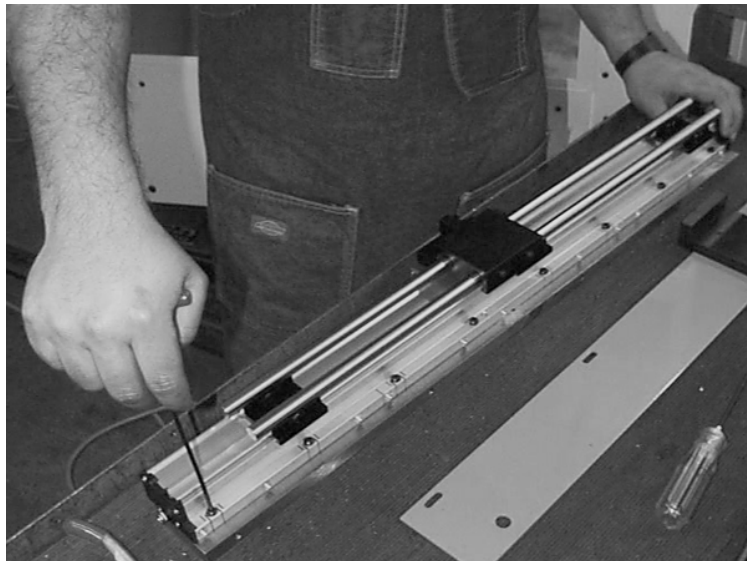


Figure 11-40 Attach Scale Assembly to Mounting Plate

- 40) Attach the throw rod mounting bracket to the scale reader with two #8 button head socap screws.



Figure 11-41 Attach Throw Rod Mounting Bracket to Scale Reader

- 41) Attach the cover plate to the scale using four 1/4-20 x 1/2" hex cap screws (HDW-0319) and lock washers (HDW-0279) with a 7/16" socket wrench.

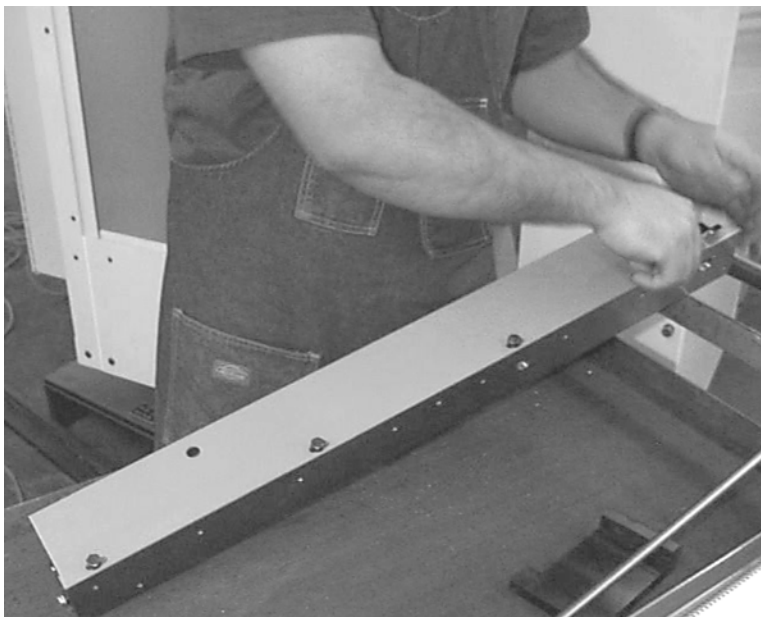


Figure 11-42 Attach Cover Plate to Scale

- 42) Insert two 1/4-20 x 1/2" set screws into the throw rod's saddle mounting bracket.



Figure 11-43 Insert Screw into Throw Rod's Saddle Mounting Bracket

- 43) Insert one 3/8-16 x 2 1/2" hex cap screw (HDW-0570) with one lock washer (HDW-0280) and two 5/16-18 x 3/4" hex cap screws (HDW-0575) with lock washers (HDW-0281) into the Y axis scale mounts.



Figure 11-44 Insert Screws and Washers into Y Axis Scale Mounts

- 44) Insert the mounts into the machined openings at the bottom of the column.
Secure to the column with the 5/16-18 cap screws.

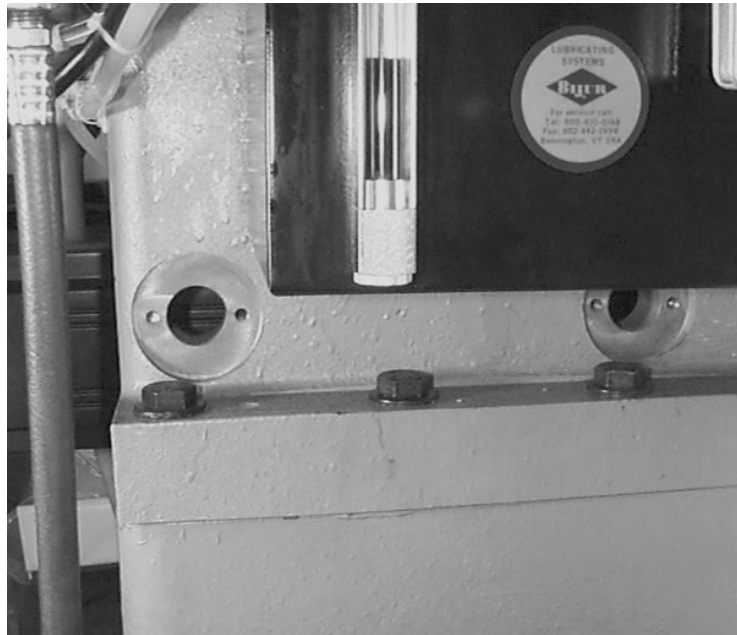


Figure 11-45 Insert Mounts into Openings at Bottom of Column

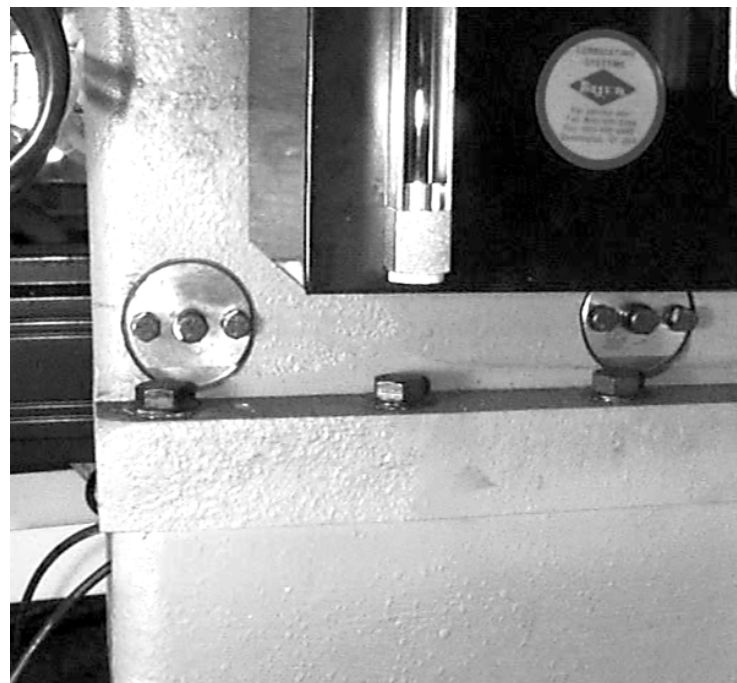


Figure 11-46 Secure Mounts to Column

- 45) Insert the Y axis throw rod, flat end first, through the machined hole above the X axis tube.

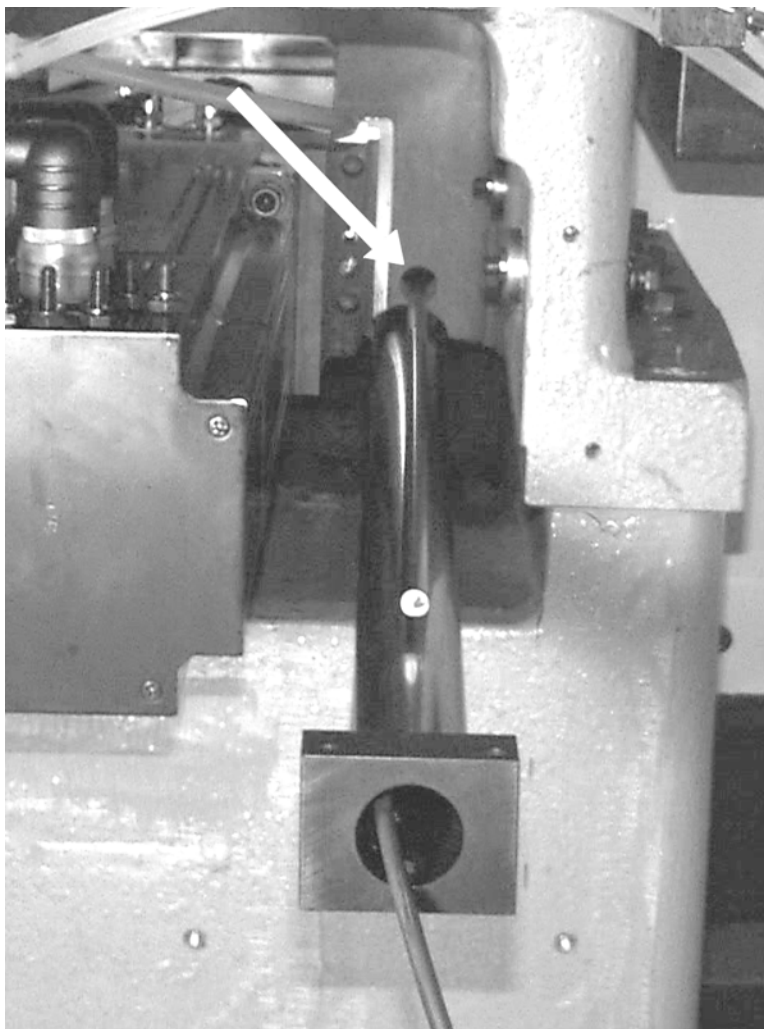


Figure 11-47 Insert Y Axis Throw Rod Through Hole Above X Axis Tube

- 46) Attach the Y axis throw rod bracket to the saddle with two 5/16-18 x 2" socap screws (HDW-0484). Insert the throw rod into the bracket and secure the rod with the two 1/4-20 set screws.

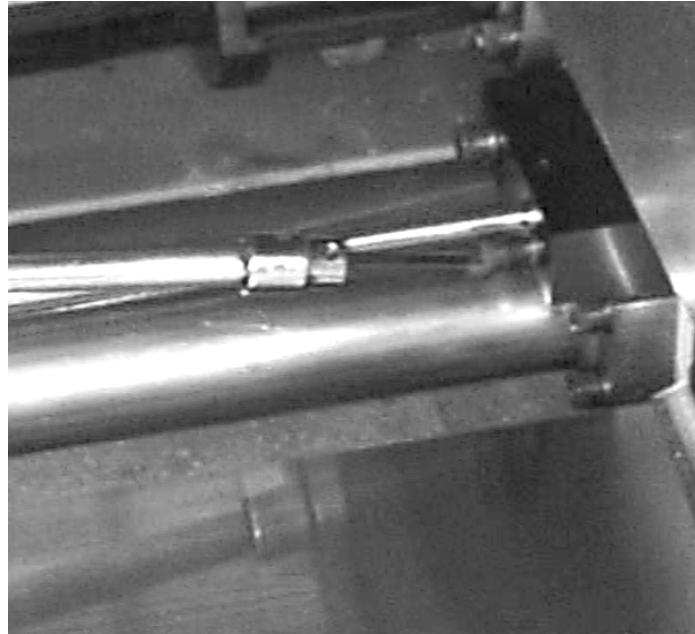


Figure 11-48 Attach Y Axis Throw Rod Bracket to Saddle

- 47) Attach the Y axis scale to the column with the 3/8-16 x 2 1/2" cap screws on the mounting pads.

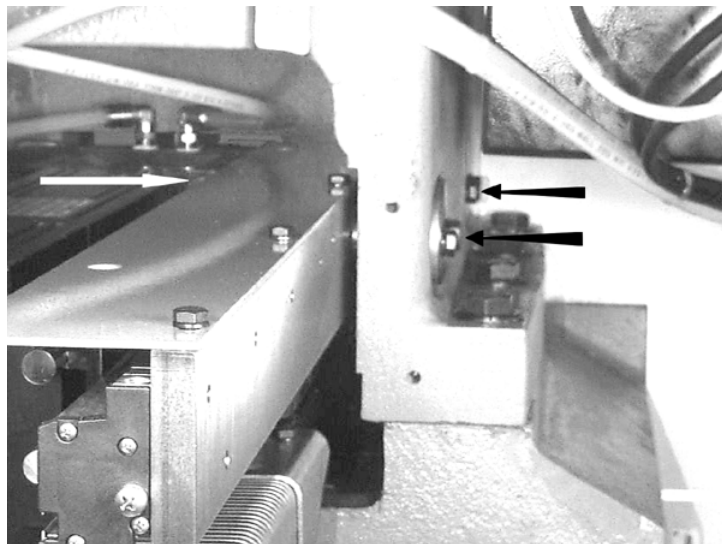


Figure 11-49 Attach Y Axis Scale to Column

- 48) Insert the throw rod into its bracket on the scale reader and tighten the two 8-32 x 3/4" socap screws (HDW-0505) using a 9/64" allen wrench. Align the throw rod at the side and top within .005". Adjustments are made at the block attaching the rod to the saddle.

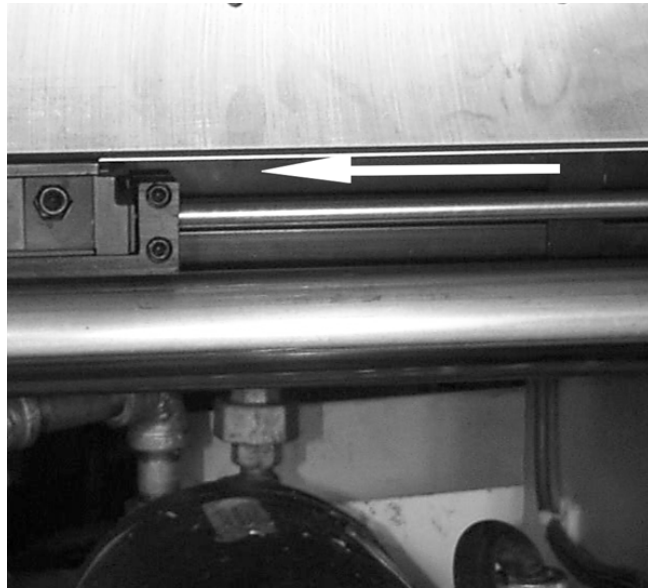


Figure 11-50 Insert Throw Rod into Bracket on Scale Reader

- 49) Attach the flex shield to the mounting bracket with two 1/4-20 nuts (HDW-0336) and lock washers (HDW-0279).

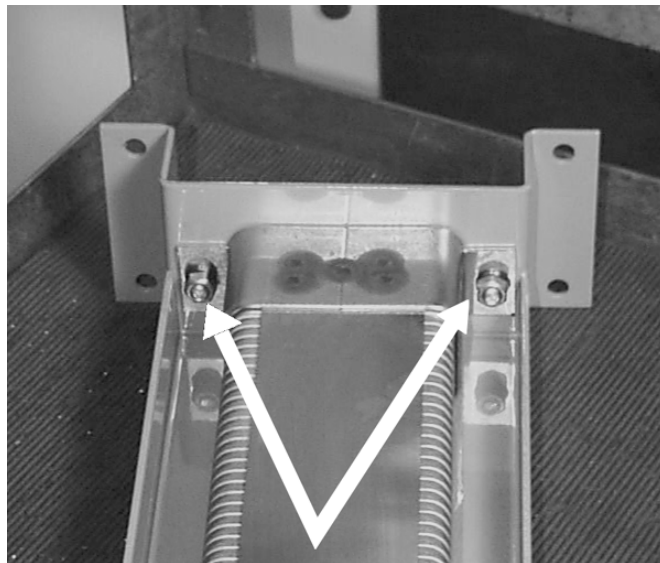


Figure 11-51 Attach Flex Shield to Mounting Bracket

50) Attach the flex shield assembly to the base with four 1/4-20 x 5/8" hex cap screws (HDW-0581) and lock washers (HDW-0279). Drill and tap four 1/4-20 holes with template.

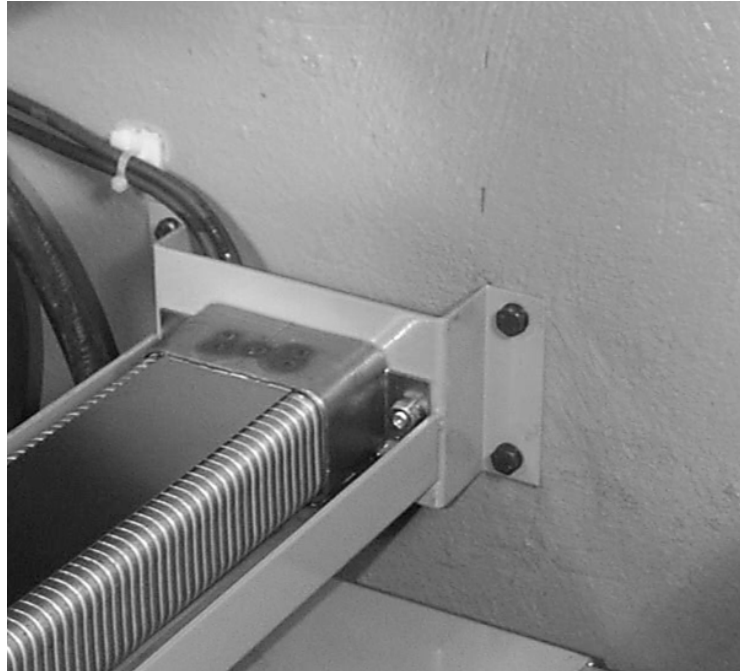


Figure 11-52 Attach Flex Shield Assembly to Base

51) Feed the X and Y axis cables through the flex shield.

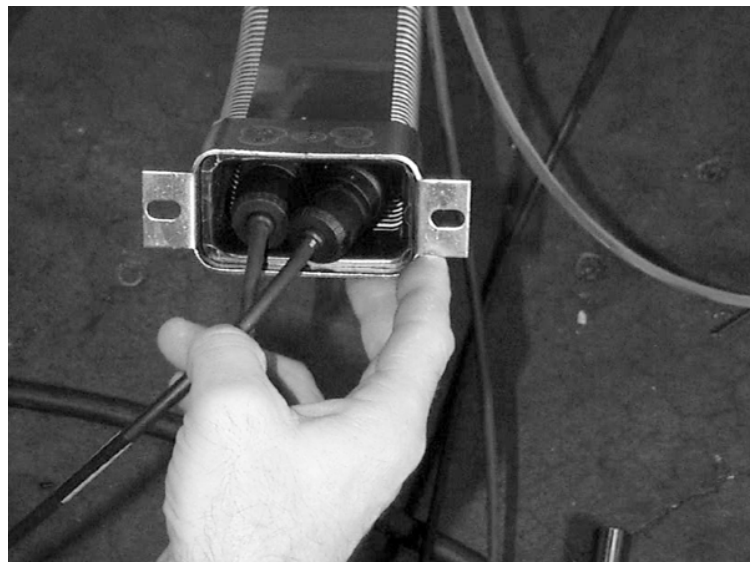


Figure 11-53 Feed X and Y Axis Cables Through Flex Shield

52) Attach the end of the flex shield to the bracket on the X axis tube with two 1/4-20 x 1/2" hex cap screws (HDW-0319) and lock washers (HDW-0279).

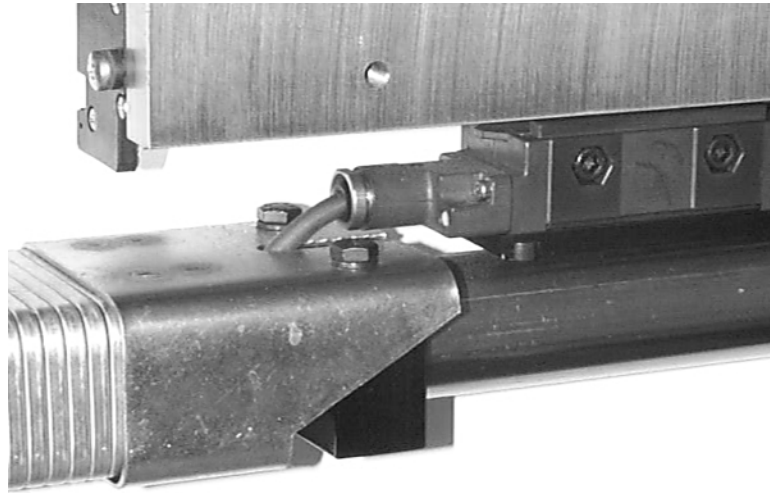


Figure 11-54 Attach End of Flex Shield to Bracket on X Axis Tube (Side View)

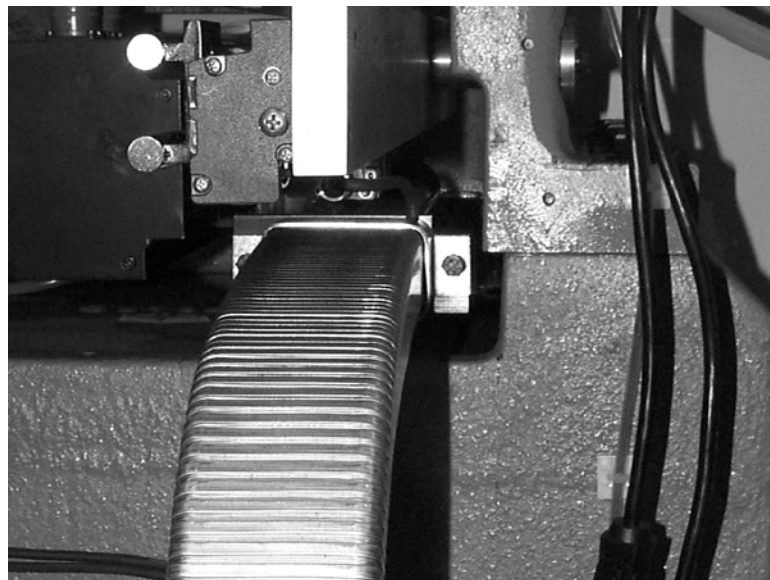


Figure 11-55 Attach End of Flex Shield to Bracket on X Axis Tube (Front View)

- 53) Check the clearance between the scale reader and X axis shield tube.
Adjust the clearance by applying downward pressure on the tube.

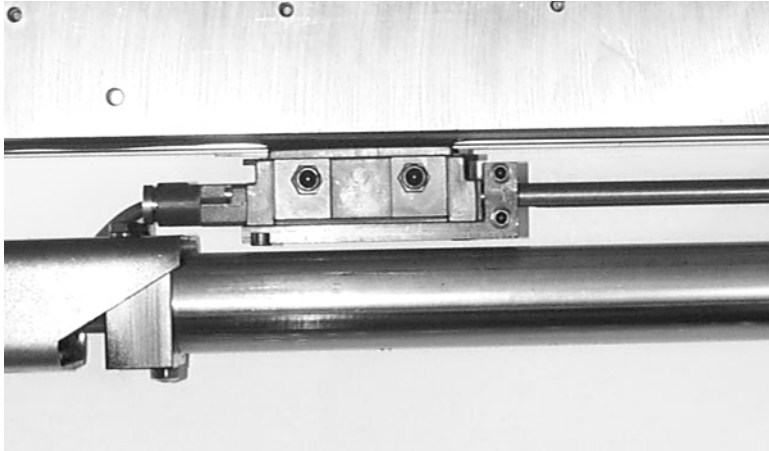


Figure 11-56 Check Clearance Between Scale Reader and X Axis Shield Tube

- 54) Route the cables to the back of the Control cabinet.



Figure 11-57 Route Cables to Back of Control Cabinet

(For 6030/8030 Machines: Attach a support bracket between the Y scale and the CNC junction box.)



Figure 11-58 Attach Support Bracket Between Y Scale and CNC Junction Box (6030/8030)

- 55) Scrape the paint from the mounting bracket pad on the side of the column. Stone lightly and thoroughly clean.

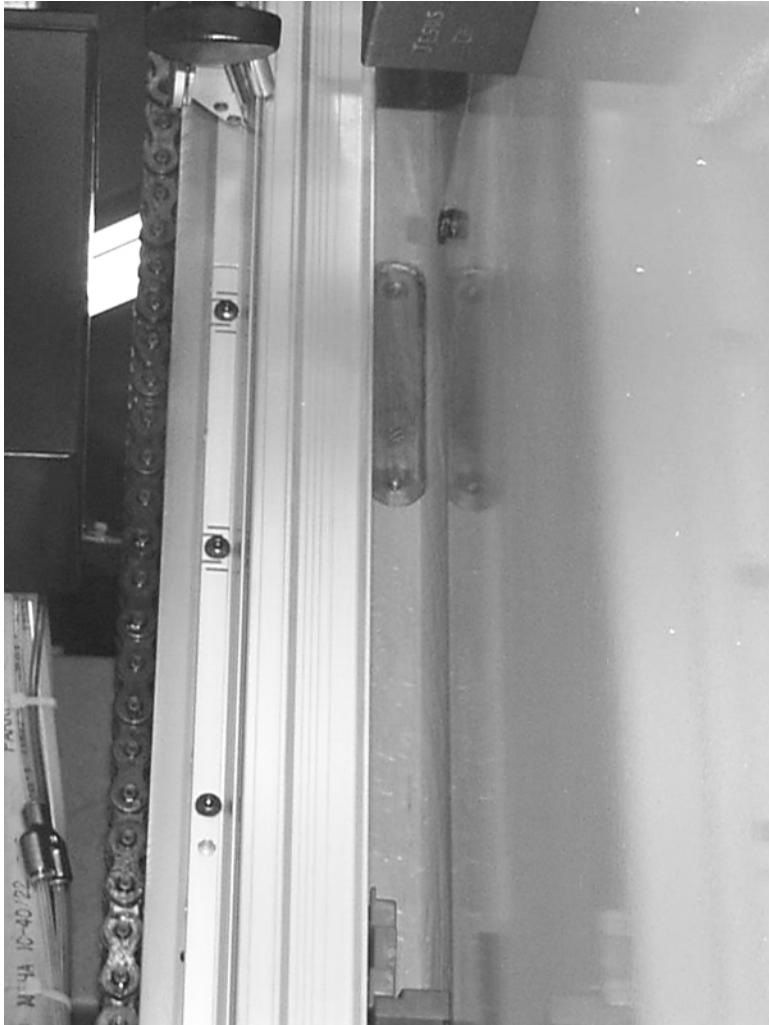


Figure 11-59 Scrape Paint from Mounting Bracket, Stone Lightly, Clean Thoroughly

- 56) Attach the Z axis mounting plate to the side of the head assembly with three 5/16-18 x 2" socap screws (HDW-0484) with a 1/4" Allen wrench.



Figure 11-60 Attach Z Axis Mounting Plate to Side of Head Assembly

57) Mount a dial indicator to the column. Place the tip of the indicator on the mounting plate.



Figure 11-61 Mount Dial Indicator to Column

- 58) Zero the dial indicator and jog the Z axis through the full range of travel. Adjust the mounting plate until less than .005" deflection is achieved. The gib/straps may require loosening to complete the adjustments.

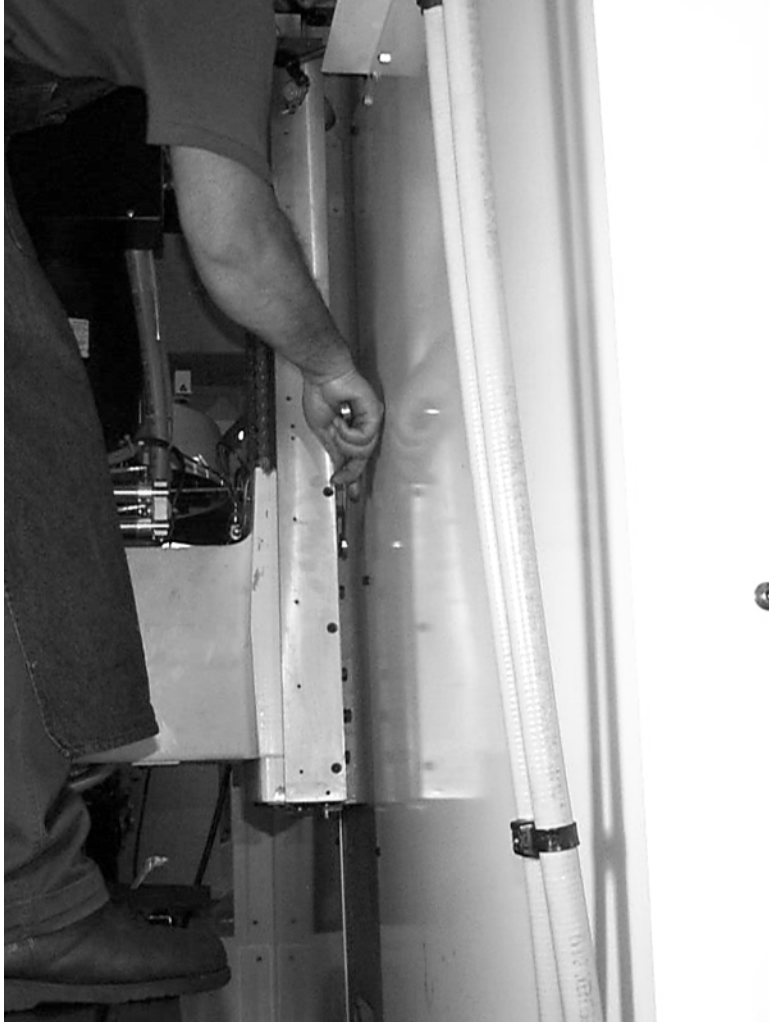


Figure 11-62 Adjust Mounting Plate

59) Thoroughly clean the Z axis mounting plate.



Figure 11-63 Thoroughly Clean Z Axis Mounting Plate

60) Remove the scale from the packaging. Remove the wire retainer clip. Loosen the screws holding the packing clips.

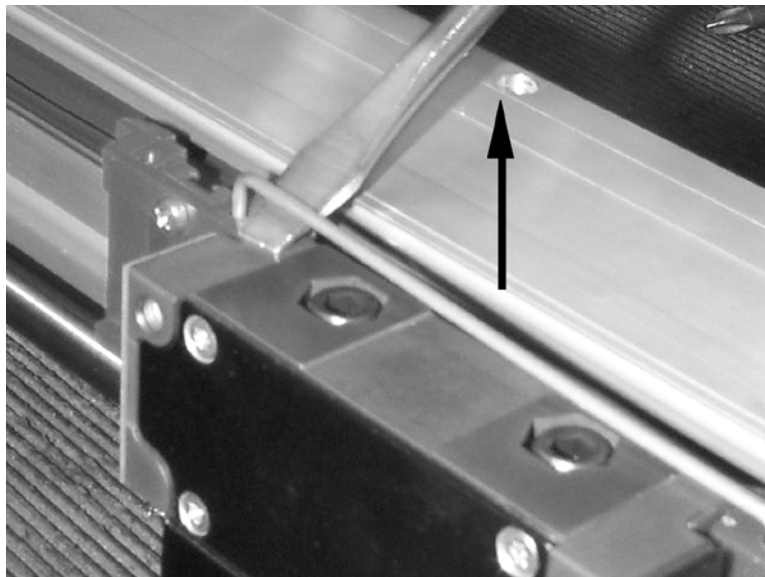


Figure 11-64 Remove Wire Retainer Clip

61) Remove the pin connector cover plate.

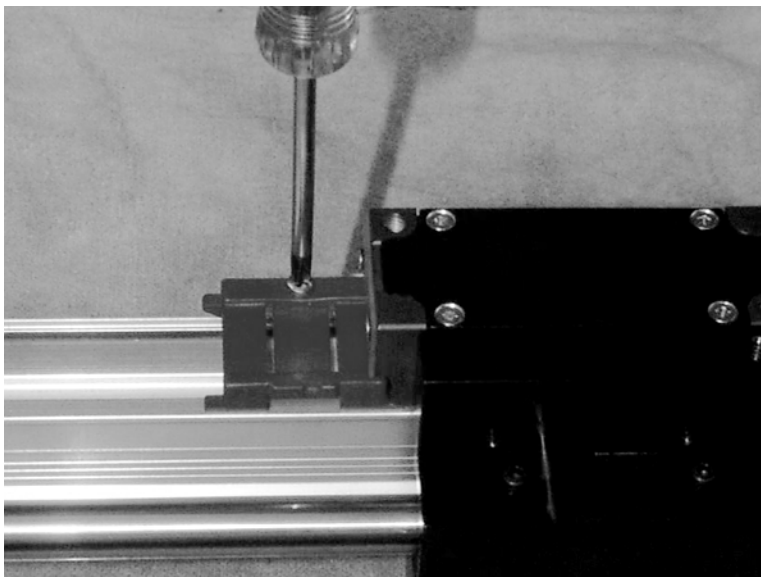


Figure 11-65 Remove Pin Connector Cover Plate

62) Attach the cable to the scale reader with a #2.5 metric allen wrench. The alignment pin ensures that the cable is installed correctly.

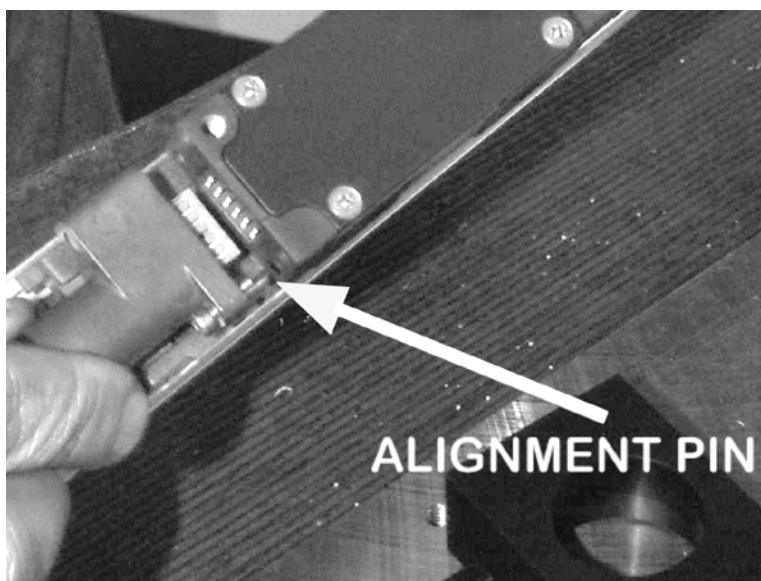


Figure 11-66 Attach Cable to Scale Reader

63) Remove the packing clips from the scale assembly.

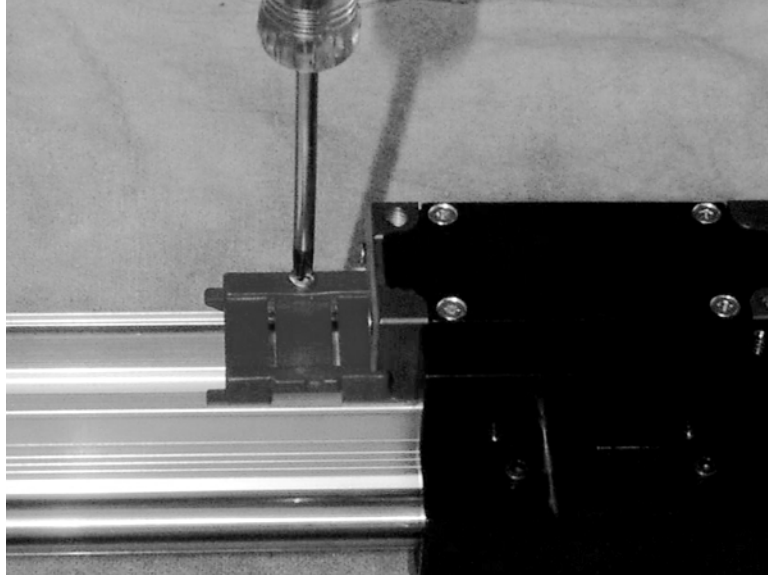


Figure 11-67 Remove Packing Clips from Scale Assembly

64) Attach the scale to the mounting plate with 1/4-20 x 1/2" button head socap screws (HDW-0346).



Figure 11-68 Attach Scale to Mounting Plate

- 65) Set the dial indicator tip on the widest ridge on the scale. Zero the Z axis and mark the center of the scale. Adjust the scale so that it has less than .003" runout.



Figure 11-69 Set Dial Indicator Tip on Scale's Widest Ridge; Adjust Scale

66) Attach the Z axis mounting bracket to the column with two 1/4-20 x 1 1/4" socap screws (HDW-0296), using a 3/16" Allen wrench.



Figure 11-70 Attach Z Axis Mounting Bracket to Column

67) Attach the scale reader to the mounting bracket with two 1/4-20 x 1 1/2" socap screws. The reader should be evenly aligned with the Aluminum

housing. Adjust the length of the bracket by shaving material from the base if required.



Figure 11-71 Attach Scale Reader to Mounting Bracket

68) Place the .060" shim between the scale reader and scale. Adjust the scale at the center so that the shim slides out with light friction. If the shim

cannot be slid into this area, ream the bracket mounting holes to provide the required clearance.



Figure 11-72 Adjust Scale at Center

69) Attach the scale cover to the scale with three 1/4-20 x 3/8" button head socap screws (HDW-0347).



Figure 11-73 Attach Scale Cover to Scale

1580 Board Setup

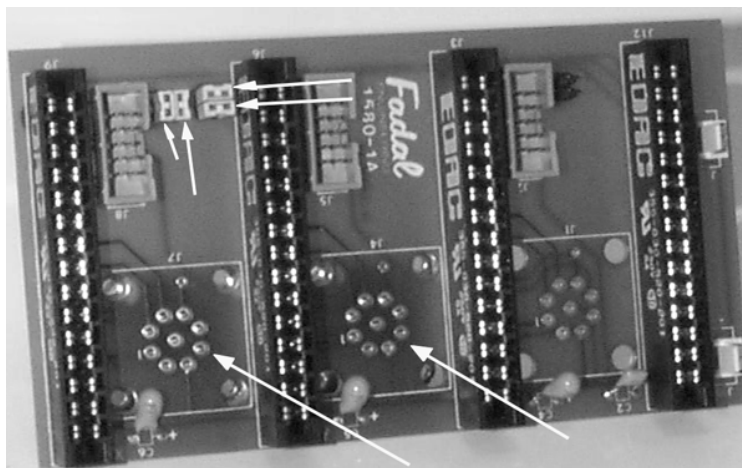


Figure 11-74 X, Y Axis Scales

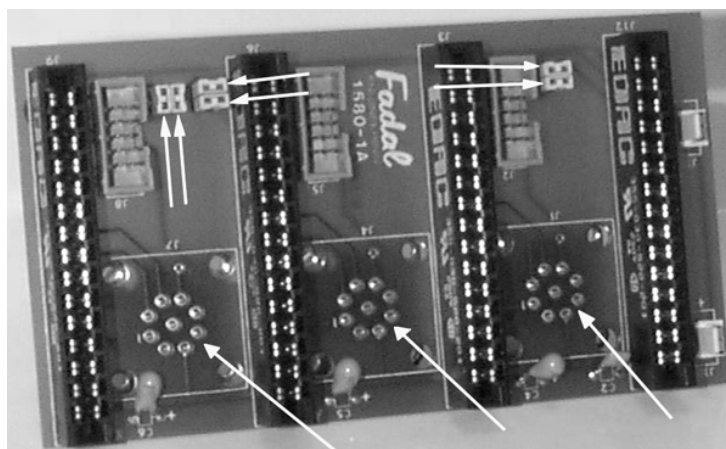


Figure 11-75 X, Y and Z Scales

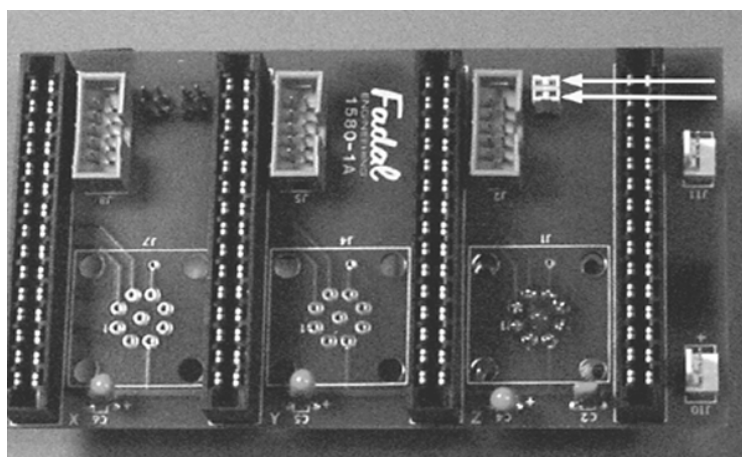


Figure 11-76

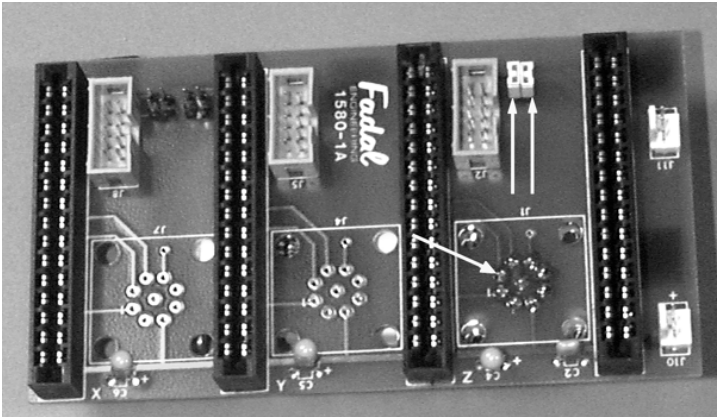


Figure 11-77

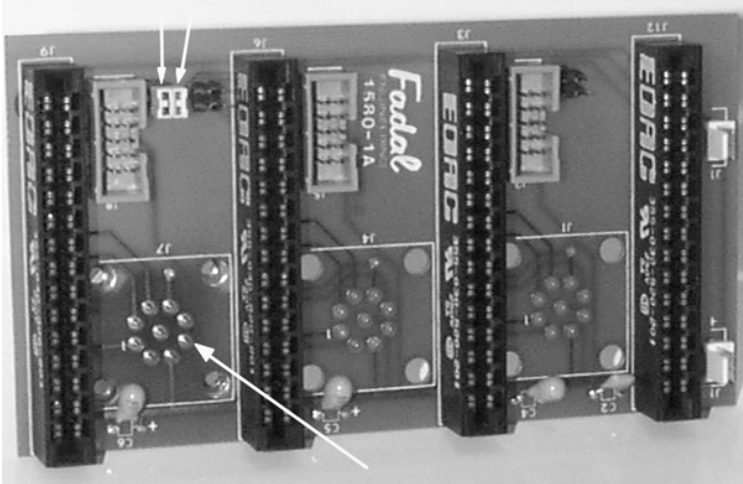


Figure 11-78

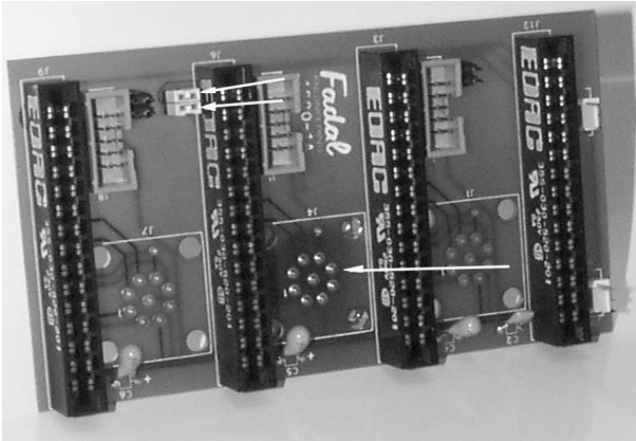


Figure 11-79

Scale Box Installation / Side Mount

- 1) Knockout the existing scale box access plate.

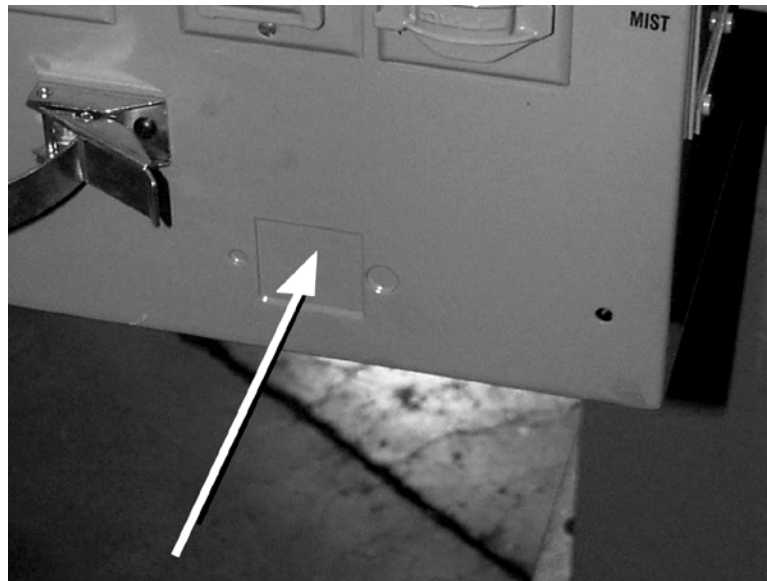


Figure 11-80 Knockout Existing Scale Box Access Plate

- 2) Run the ribbon cable through the opening and attach the scale junction box to the side of the control cabinet with two button head socap screws and locking nuts.

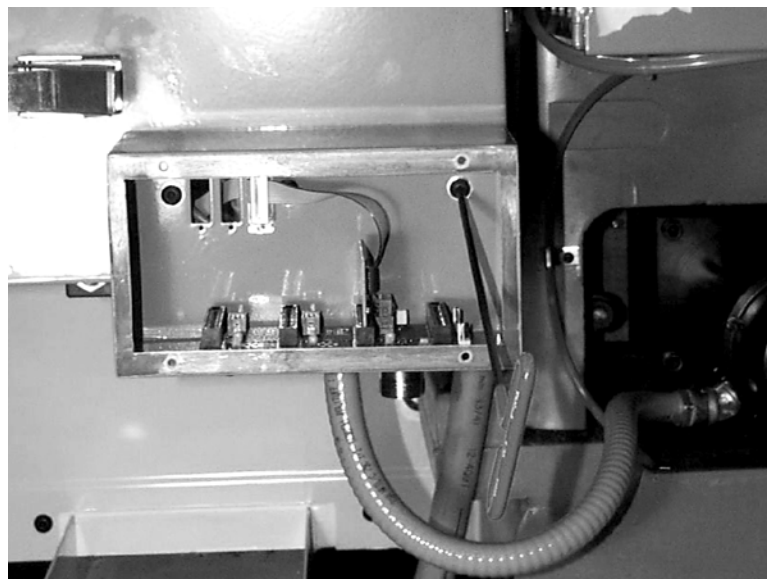


Figure 11-81 Attach Scale Junction Box to Side of Control Cabinet

- 3) Install WIR-0506 to the terminal strip on the 1220 power supply board (#3 wire to com side, #9 wire to +5VDC side).

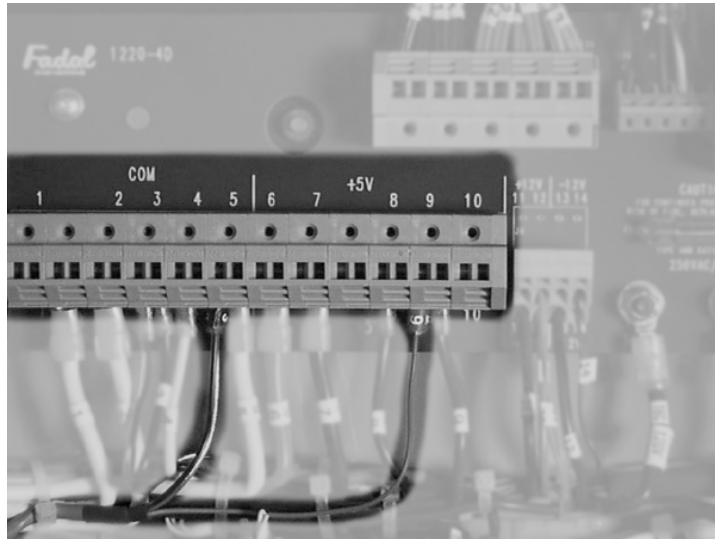


Figure 11-82 Install WIR-0506 to Terminal Strip on 1220 Power Supply Board

- 4) Route WIR-0506 from the 1220 board to the scale box. Secure it to the existing wire bundles. Insert the end of the wire through access hole to the junction box.

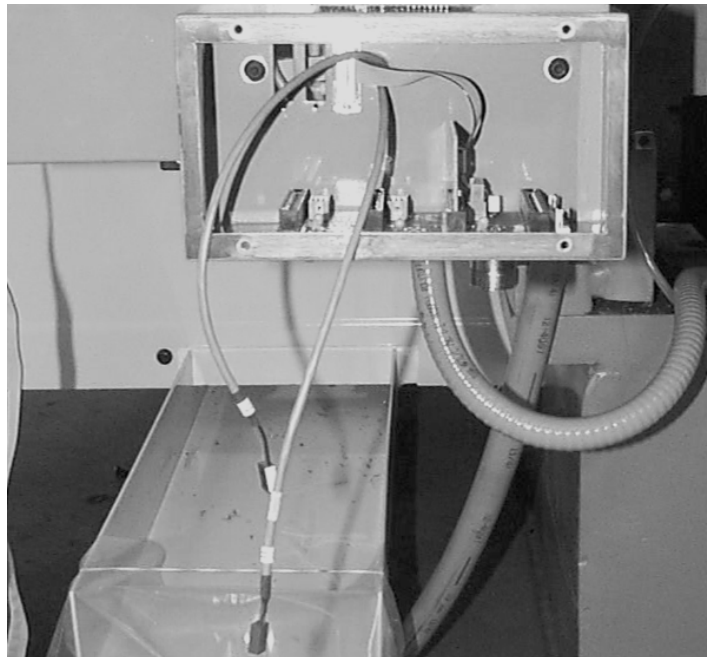


Figure 11-83 Route WIR-0506 from 1220 Board to Scale Box

- 5) Insert WIR-0134 through the access hole. Unplug the J13 connector from the 1060 board and install the red wire to J13 #11 and the black wire to J13 #10. The lower row of J13 contains the following wires: center #11 right side #10. Secure the cable to the existing J13 wires. Plug the J13 connector into the 1060 board.

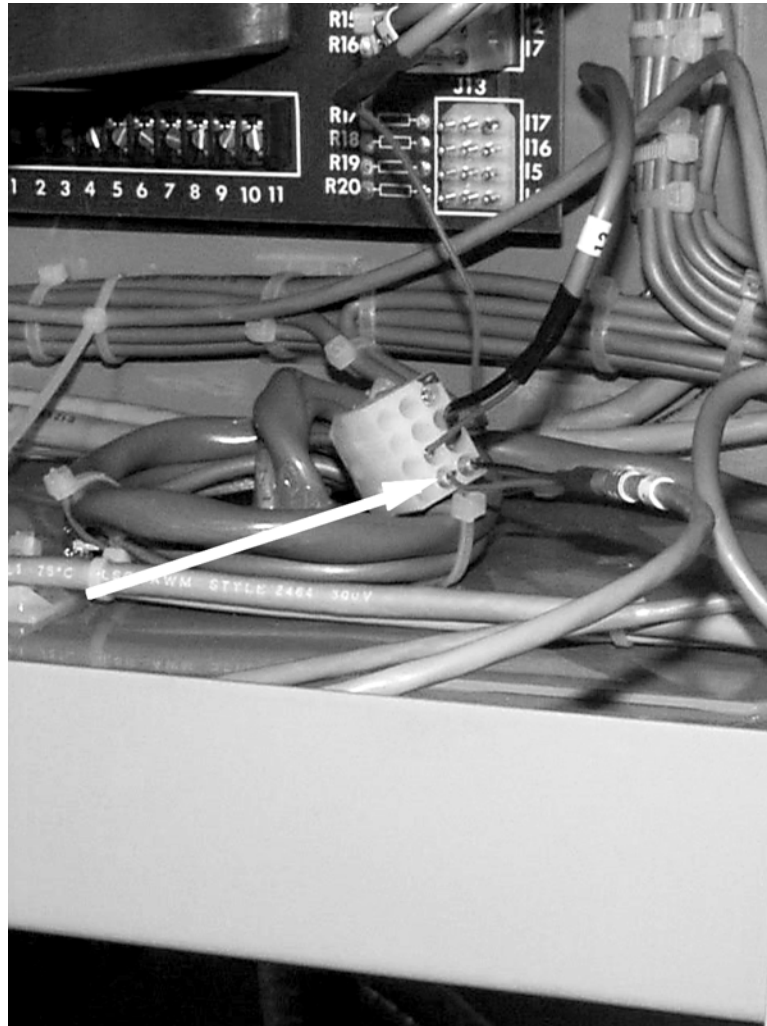


Figure 11-84 Unplug J13 Connector from 1060 Board

- 6) Plug WIR-0506 into the J10 connector on the 1580-1A board and WIR-0134 into connector J1.

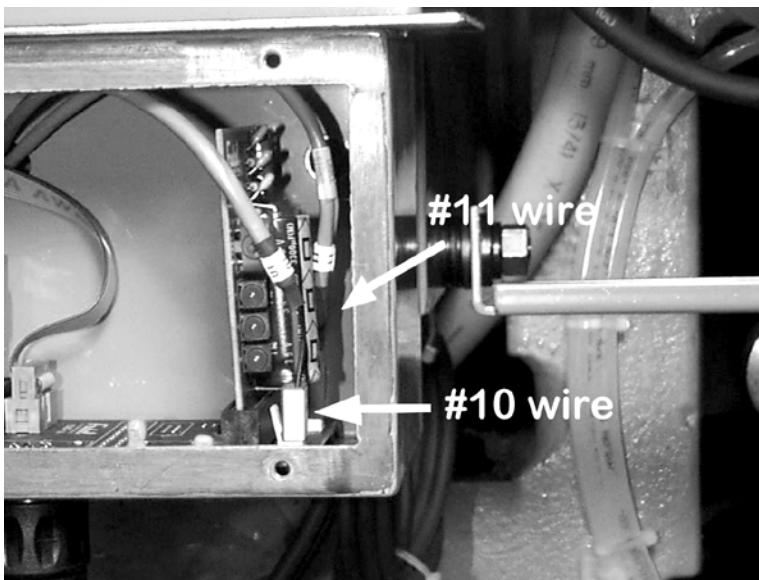


Figure 11-85 Plug WIR-0506 into J-10 Connector; Plug WIR-0134 into J1 Connector

- 7) Plug the ribbon cable from the scale box into J6 of the appropriate axis controller card. Secure the cable to the bottom of the cabinet with self adhesive cable wire ties.

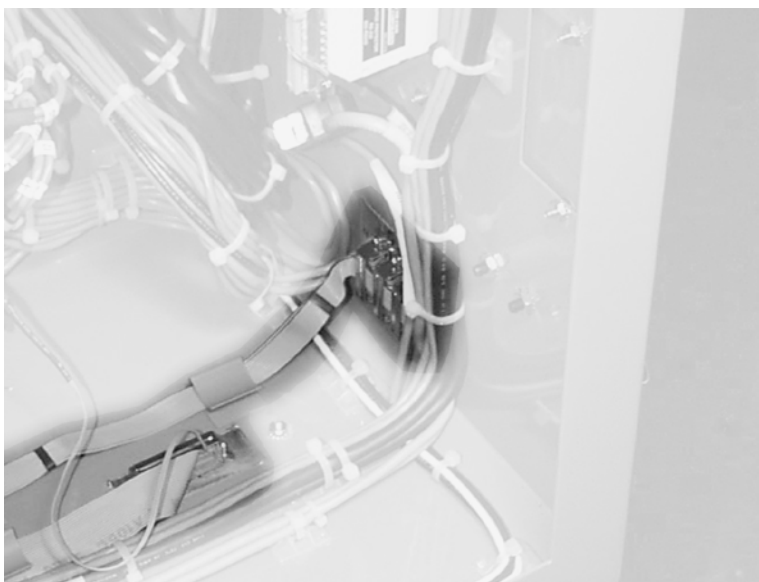


Figure 11-86 Plug Ribbon Cable into J6 of Appropriate Axis Controller Card



Figure 11-87 Secure Cable to Bottom of Cabinet

Note: Power off the machine and Lockout/Tagout the disconnect box, before attempting any work in the junction cabinet.

- 8) Insert interpolation boards into slots on the 1580-1A card. Plug the cables, from the scales, in to the bottom of the box. Insert the Scale Fault Detection board (1580-1-1B) into the slot next to the J13 and J11 plugs. All components on the boards must face the right side of the box, for proper installation.

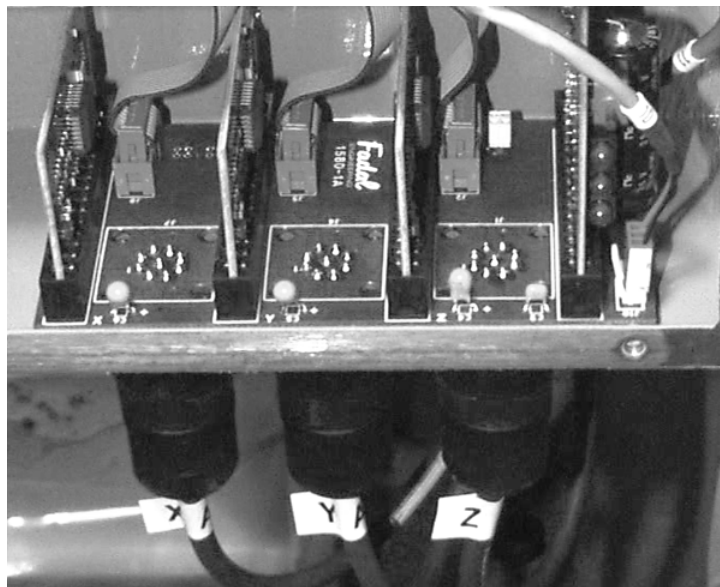


Figure 11-88 Insert Interpolation Boards into Slots on 1580-1A Card

**Scale Box
Installation / Top
Mount**

- 1) Place a piece of paper in the top inside of the CNC cabinet to prevent debris from falling into electronic panels while drilling holes in cabinet.



Figure 11-89 Place Paper in CNC Cabinet

**WARNING**

Wear safety glasses when using hand or power tools.

- 2) Using the scale box as a template, mark the positions to be drilled out. Mount the box towards the left and rear, on top of the CNC cabinet.



Figure 11-90 Mark Positions to be Drilled Out



Figure 11-91 Mount Box on Top of CNC Cabinet

3) Center punch the hole locations for drilling.



Figure 11-92 Center Punch Hole Locations for Drilling

- 4) Drill a starting hole at each marked location.



Figure 11-93 Drill Starting Holes

- 5) With a step drill, open the mounting holes up to 5/16". Open the wire hole to 1/2". Open the B axis ribbon scale cable opening to 7/16".



Figure 11-94 Open Holes with Step Drill

- 6) Use a metal punch with an RS-232 die to create the opening for the fourth axis scale ribbon cable.



Figure 11-95 Create Opening for Fourth Axis Ribbon Cable

- 7) Attach the fourth axis scale box to the cabinet with two 1/4-20 x 1/2" button head socap screws and 1/4-20 KEPS nuts.

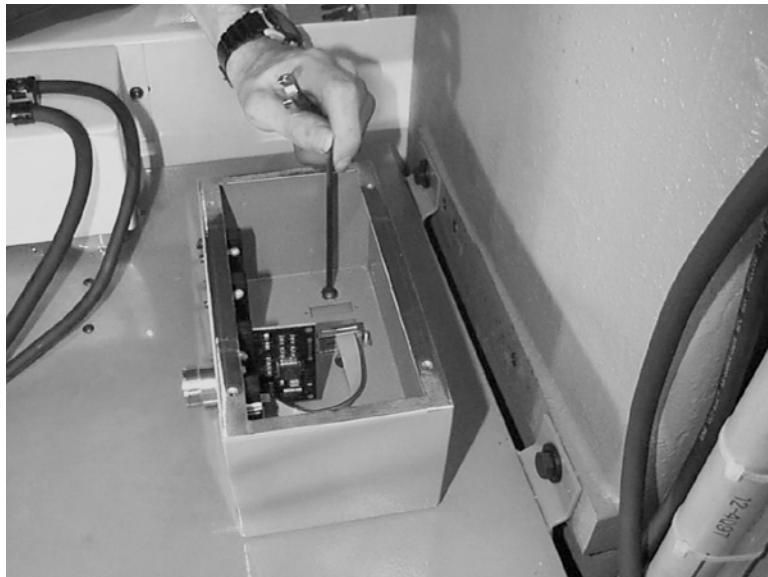


Figure 11-96 Attach Fourth Axis Scale Box to Cabinet

- 8) Plug the signal cable into J11 and the power cable into the J10 connection on the 1580-1a board. Install a grommet and pull the cables down through the access hole.

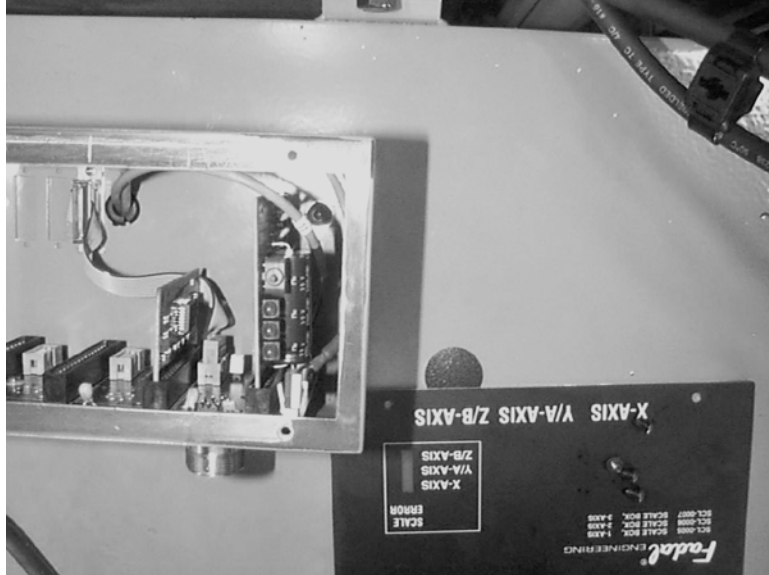


Figure 11-97 Plug Signal Cable into J11 and Power Cable into J10 Connection

- 9) Install the power supply cable into the 1220 power supply board (#3 wire to com side, #9 wire to +5VDC side).

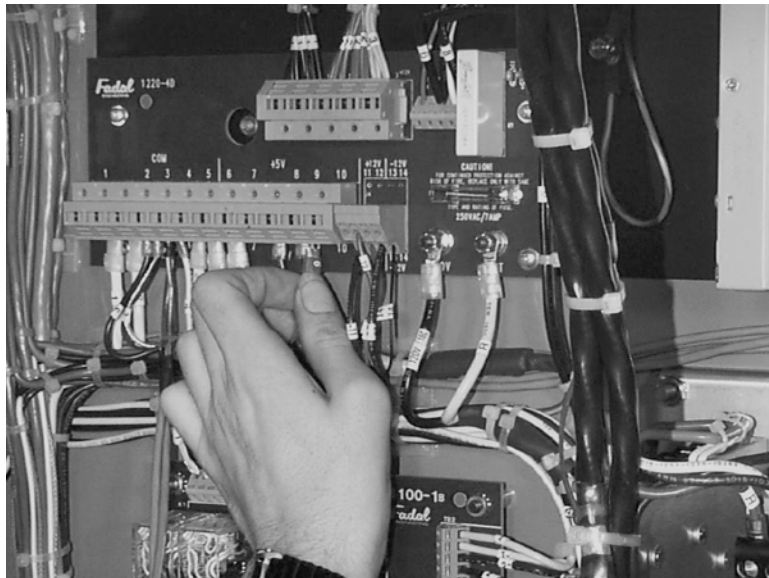


Figure 11-98 Install Power Supply Cable into 1220 Power Supply Board

- 10) Run the scale box signal cable down the wire bundle and along the bottom of the cabinet to connector J13 at the 1060 board. Unplug J13 from the

1060 board and install the red wire to J13 #11 and the black wire to J13 #10 (Lower row of J13: center #11, right side #10). Secure the cable to existing J13 wires. Plug J13 into the 1060 board.

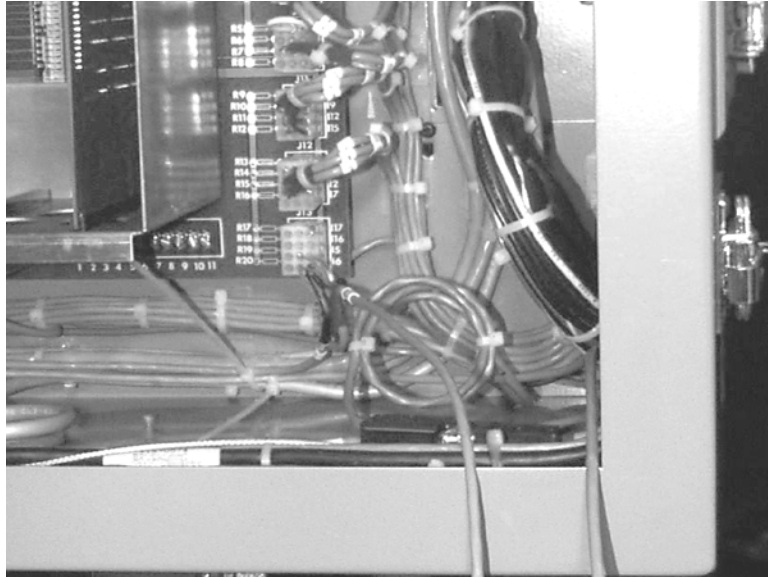


Figure 11-99 Plug J13 into 1060 Board

11) Adjust all wires and secure them to the existing wire bundle.

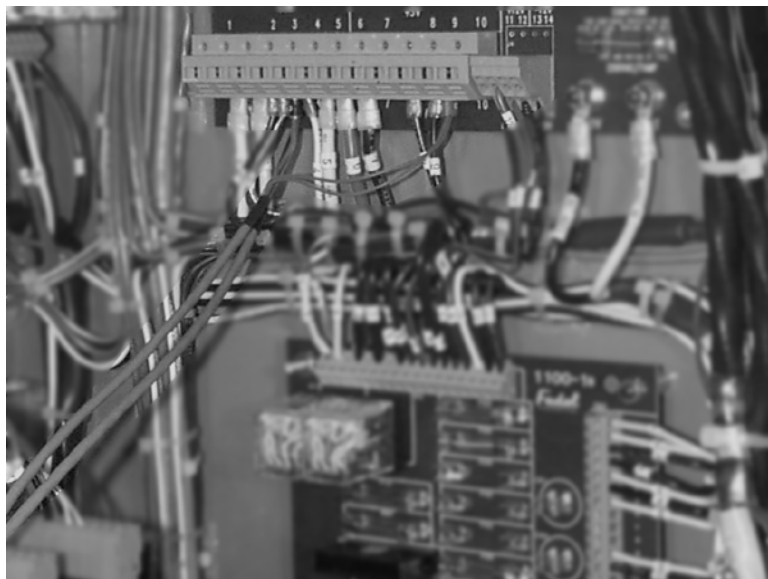


Figure 11-100 Adjust and Secure Wires to Existing Bundle

12) Plug the 15 pin connector on WIR-0133 to the scale box connector and tighten the screws. Route the 10 pin connector end to the appropriate axis

controller card and plug it into J6. Secure the wiring to existing wire bundles.



Figure 11-101 Plug 15 Pin Connector into Scale Box Connector

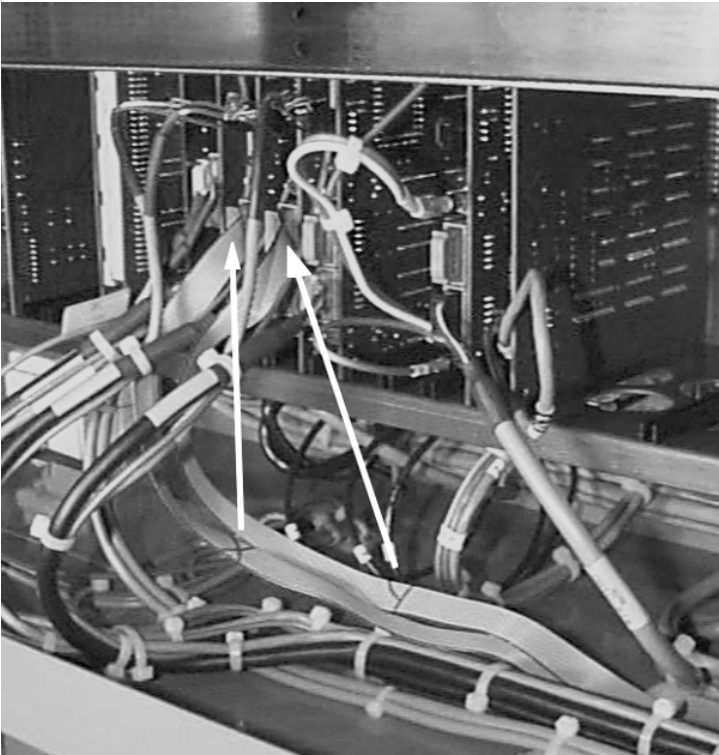


Figure 11-102 Secure Wiring to Existing Bundles

Heidenhain Tester

- 1) Remove the pin connector from the junction box and plug it into the scale test box. Plug the power supply into a 110 VAC outlet.



Figure 11-103 Plug Pin Connector Into Scale Test Box

- 2) Program the axis to be tested to travel back and forth along its length, reading the upper portion of the tester window.
- 3) The outer brackets are the measurement of the amplitude of the signal. During the overall travel of the scale, the indicator of the outer brackets should be between 7 and 16. 10 to 14 is an optimal reading and 11 is the best. If the tester turns off, it is out of range.

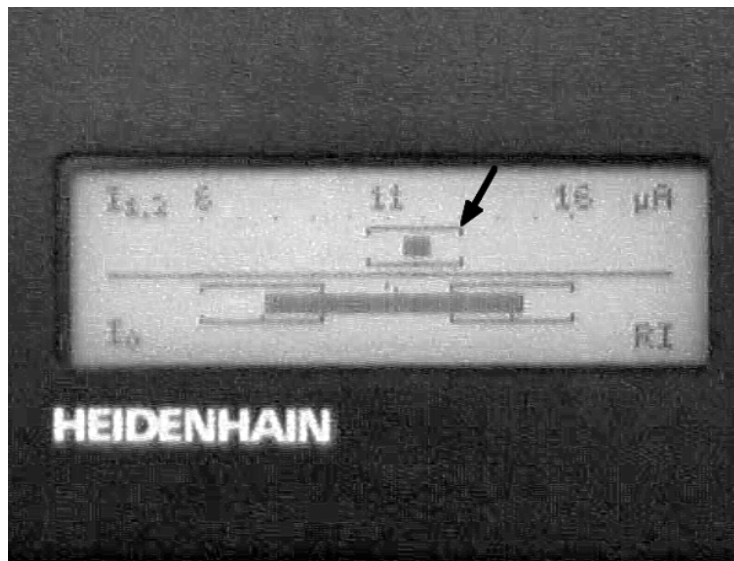


Figure 11-104 Indicator of Outer Brackets Should Read Between 7 and 16

- 4) The solid bar is the amplitude ratio and phase angle (TV1 And TV2). The solid bar must be inside the brackets during overall travel of the scale. A narrow bar is better than a wide bar.

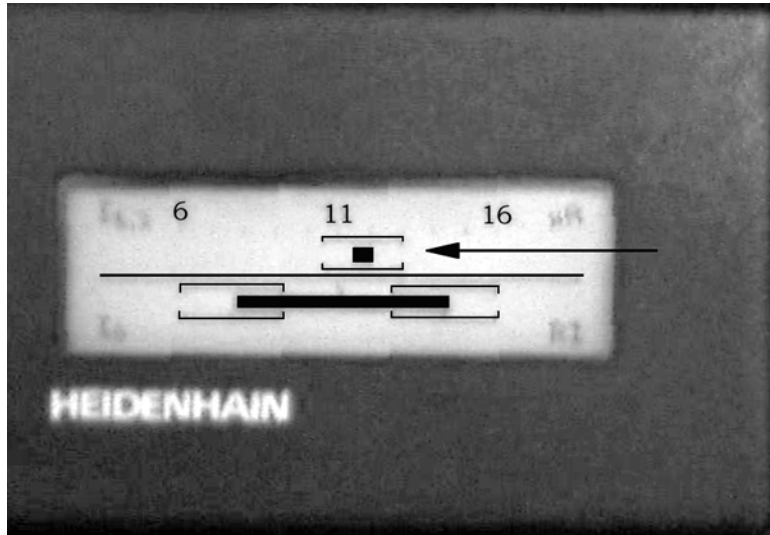


Figure 11-105 Solid Bar Must be Inside Brackets During Overall Travel of Scale

- 5) The brackets measure the width of the reference mark. The solid bar must be within the brackets. The tester turns off if it is out of range.

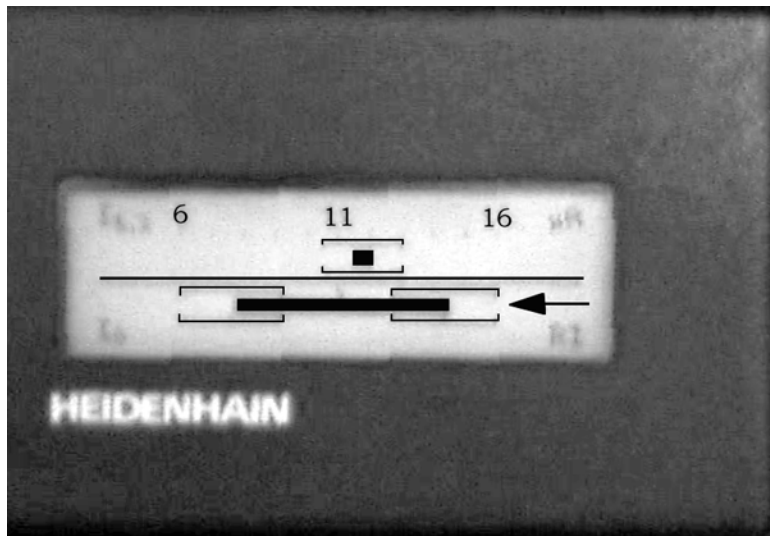


Figure 11-106 Solid Bar Must be Within Brackets

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