TRAK® TRL 1840CSS

Safety, Installation, Maintenance, Service & Parts List Manual

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IMPORTANT!

- This manual, as well as the TRAK TRL 1840 CSS Programming, Operating and Care Manual, should be studied and understood by each operator before they install, use, or maintain this machine tool.
- It is solely the responsibility of the purchaser to properly train and educate each machine operator.
- The employer has total responsibility to provide point of operation safeguarding in accordance with ANSI B11.6-1984.

TRAK MACHINE TOOLS

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1.0 Safety Specifications

The safe operation of the TRAK TRL 1840 CSS depends on its proper use and the precautions taken by each operator.

- Read and study the TRAK TRL 1840 CSS & ProtoTRAK LX3 Programming, Operating, and Care Manual. Be certain that every operator understands the operation and safety requirements of this machine ***before*** its use.
- Always wear safety glasses and safety shoes.
- Always stop the spindle and check to ensure the CNC control is in the stop mode before changing or adjusting the tool or workpiece.
- Never wear gloves, rings, watches, long sleeves, neckties, jewelry, or other loose items when operating, or around the machine.
- Use adequate point of operation safeguarding. It is the responsibility of the employer to provide and ensure point of operation safeguarding per ANSI B11.6-1984.

1.1 Safety Publications

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

Safety Requirements for the Construction, Care and Use of Lathes (ANSI B11.6-1984). Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

Concepts and Techniques of Machine Safeguarding (OSHA Publication Number 3067). Available from the Publication Office - O.S.H.A., U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, DC 20210.

All other regulations are specific to the State in which the machine is installed.

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

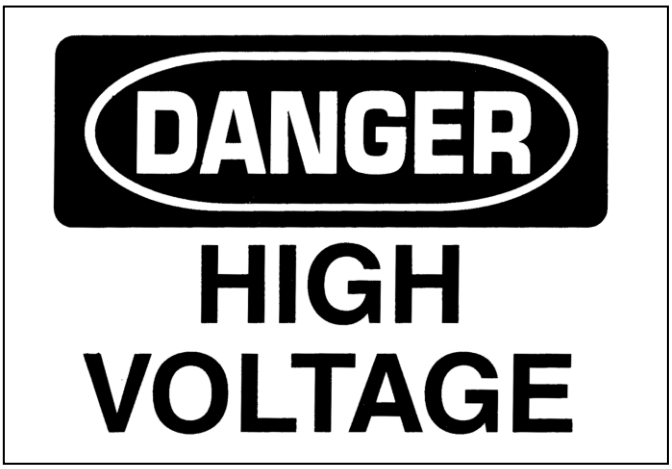
DANGER - Immediate hazards which **will** result in severe personal injury or death. Danger labels on the machine are red in color.

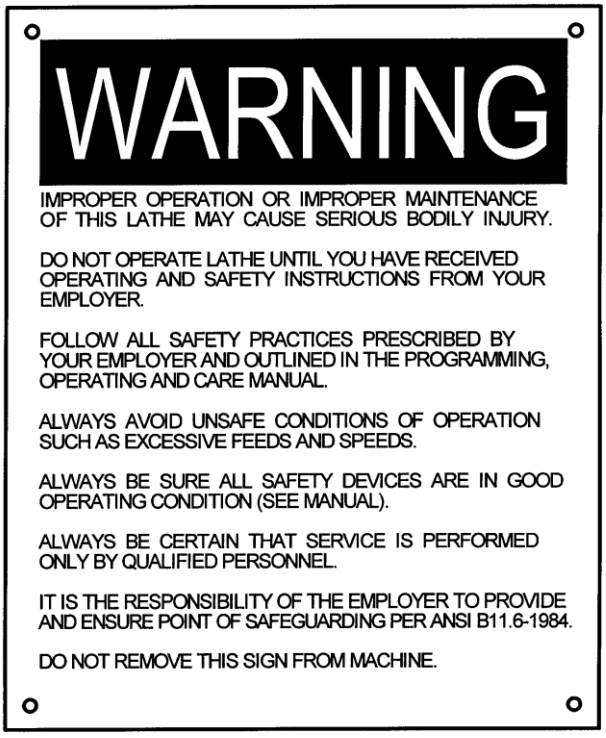
WARNING - Hazards or unsafe practices which *could* result in severe personal injury and/or damage to the equipment. Warning labels on the machine are gold in color.

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

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

115 Volts
230 Volts





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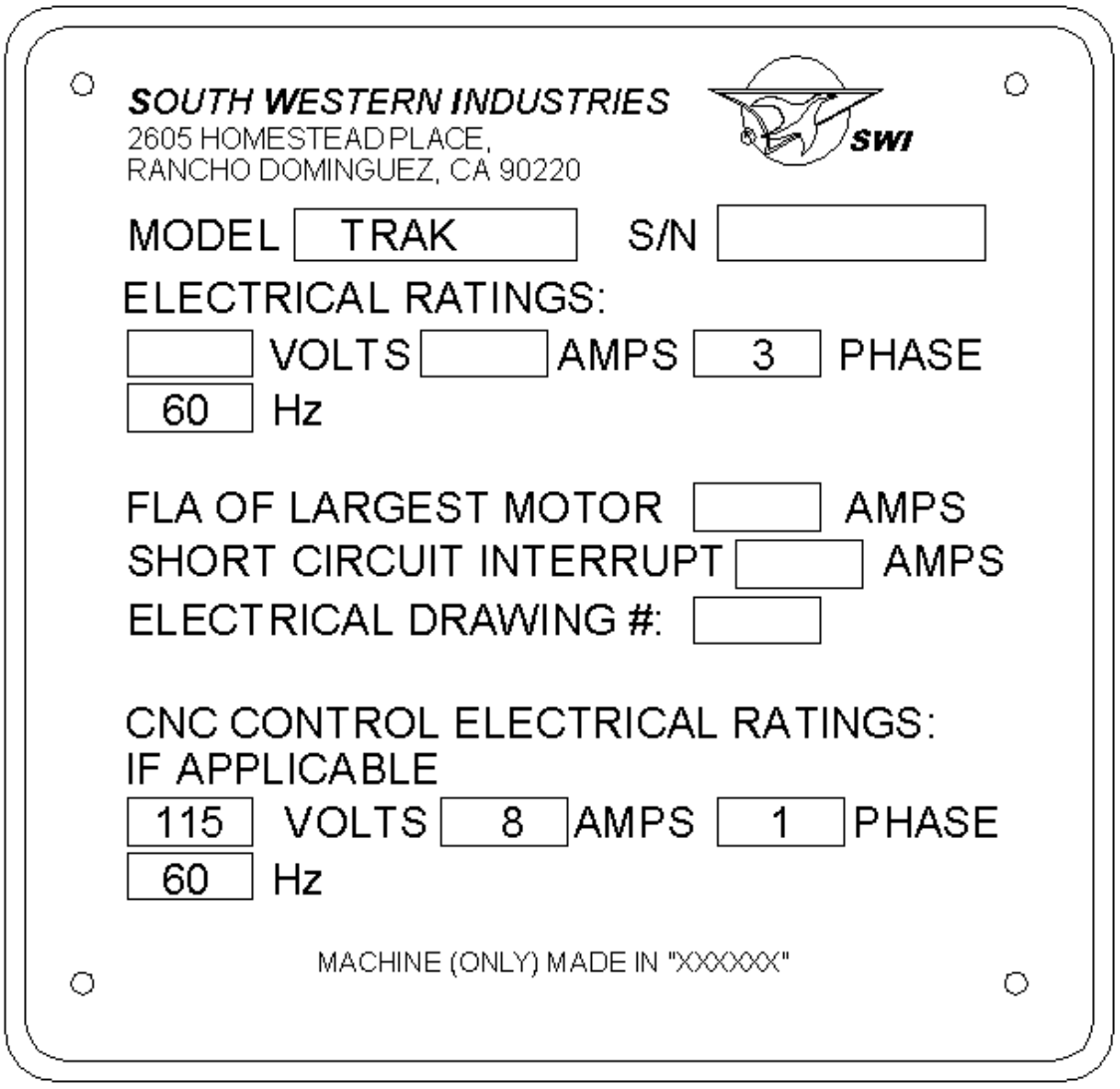
Safety & Information Labels Used on the TRAK TRL 1840 CSS Lathe

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



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Safety & Information Labels Used on the TRAK TRL 1840 CSS Lathe

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

1.3 Safety Precautions

1. Do not operate this machine before the TRAK TRL 1840 CSS & ProtoTRAK LX3 Programming, Operating and Care Manual have been studied and understood.

2. Do not run this machine without knowing the function of every control key, button, knob, or handle. Ask your supervisor or a qualified instructor for help when needed.

3. Protect your eyes. Wear approved safety glasses (with side shields) at all times.

4. Don't get caught in moving parts. Before operating this machine remove all jewelry, including watches and rings, neckties, and any loose-fitting clothing.

5. Keep your hair away from moving parts. Wear adequate safety head gear.

6. Protect your feet. Wear safety shoes with oil-resistant, anti-skid soles, and steel toes.

7. Take off gloves before you start the machine. Gloves are easily caught in moving parts.

8. Remove all tools (wrenches, chuck keys, etc.) from the machine before you start. Loose items can become dangerous flying projectiles.

9. Never operate any machine tool after consuming alcoholic beverages, or taking strong medications, or while using non-prescription drugs.

10. Protect your hands. Stop the machine spindle and ensure that the CNC control is in the STOP mode:

    - Before changing tools
    - Before changing parts
    - Before you clear away the chips, oil or coolant. Always use a chip scraper or brush
    - Before you make an adjustment to the part, chuck, coolant nozzle or take measurements
    - Before you open safeguards (protective shields, etc.). Never reach for the part, tool, or fixture around a safeguard.

11. Protect your eyes and the machine as well. Don't use a compressed air hose to remove the chips or clean the machine (oil, coolant, etc.).

12. Stop and disconnect the power to the machine before you change belts, pulley, gears, etc.

13. Keep work area well lighted. Ask for additional light if needed.

14. Do not lean on the machine while it is running.

15. Prevent slippage. Keep the work area dry and clean. Remove the chips, oil, coolant and obstacles of any kind around the machine.

16. Avoid getting pinched in places where the spindle, carriage, cross-slide or door create "pinch points" while in motion.

17. Securely clamp and properly locate the workpiece in the chuck or in the fixture. Use proper tool holding equipment.

18. Use correct cutting parameters (speed, feed, and depth of cut) in order to prevent tool breakage.

19. Use proper cutting tools for the job.

20. Prevent damage to the workpiece or the cutting tool. Never start the machine (including the rotation of the spindle) if the tool is in contact with the part.

21. Don't use dull or damaged cutting tools. They break easily and may become airborne. Inspect the sharpness of the edges, and the integrity of cutting tools and their holders.

22. Large overhangs on cutting tools when not required result in accidents and damaged parts.

23. Prevent fires. When machining certain materials (magnesium, etc.) the chips and dust are highly flammable. Obtain special instruction from your supervisor before machining these materials.

24. Prevent fires. Keep flammable materials and fluids away from the machine and hot, flying chips.

25. Never change gears when the spindle is rotating.

26. Do not rotate the spindle by hand unless the Red Emergency Stop button is pressed.

2.0 Machine Set-Up

This section provides the information necessary to install the TRAK TRL 1840 CSS. Check your delivery slip against the accessories that were ordered with the machine. If there is a shortage or error, report it immediately to Southwestern Industries, Inc., giving the serial number of the machine which is stamped on the recessed face on the top of the bed at the tailstock end.

2.1 Pre-Check Requirements

Before the TRAK TRL 1840 CSS can be checked by a qualified Field Service Technician, the following is required:

- The machine must be in position and placed on its rest pads.
- The machine must be leveled (see Section 2.6, of this manual).
- The machine must be wired (see Section 2.8, of this manual).
- A workholding device and appropriate tooling for holding and turning the O.D. of the test part is required (see Section 3.3 for a description and drawing).

The process for final check-out is described in Section 3.0 "Installation Check-Out."

2.2 TRL Site Preparation

Electrical

230 VAC, 60 Hz, 50 AMP, 3 Phase
A separate 230 VAC circuit with a 50 AMP breaker originating at the main power panel for shop electrical service and dedicated to the sole use of the TRL is required to maintain proper operation of the ProtoTRAK LX3.

Machine tool must be earth grounded.

NOTE: 440V shops must use a step down transformer to 230V. The transformer must be rated at least 15 KVA.

Air

No air is required.

Space & Weight

Floor area: 113" x 53"
Height: 67"
Net Weight: 4500 lbs.
Shipping Weight: 5170 lbs.
The floor area encompasses the space required for the sliding door to move fully to the right of the machine. A 36" clearance from the rear of the machine to the wall will be required in case it is necessary to facilitate computer repairs in the electrical enclosure. The sliding door travels an extra 12" past the tailstock end of the lathe. This has been included in the 113".

A solid and level foundation to maintain approximately 4500 lbs. plus the weight of the workpiece is required. Six leveling screws and pads are provided with the TRAK TRL 1840 CSS for leveling.

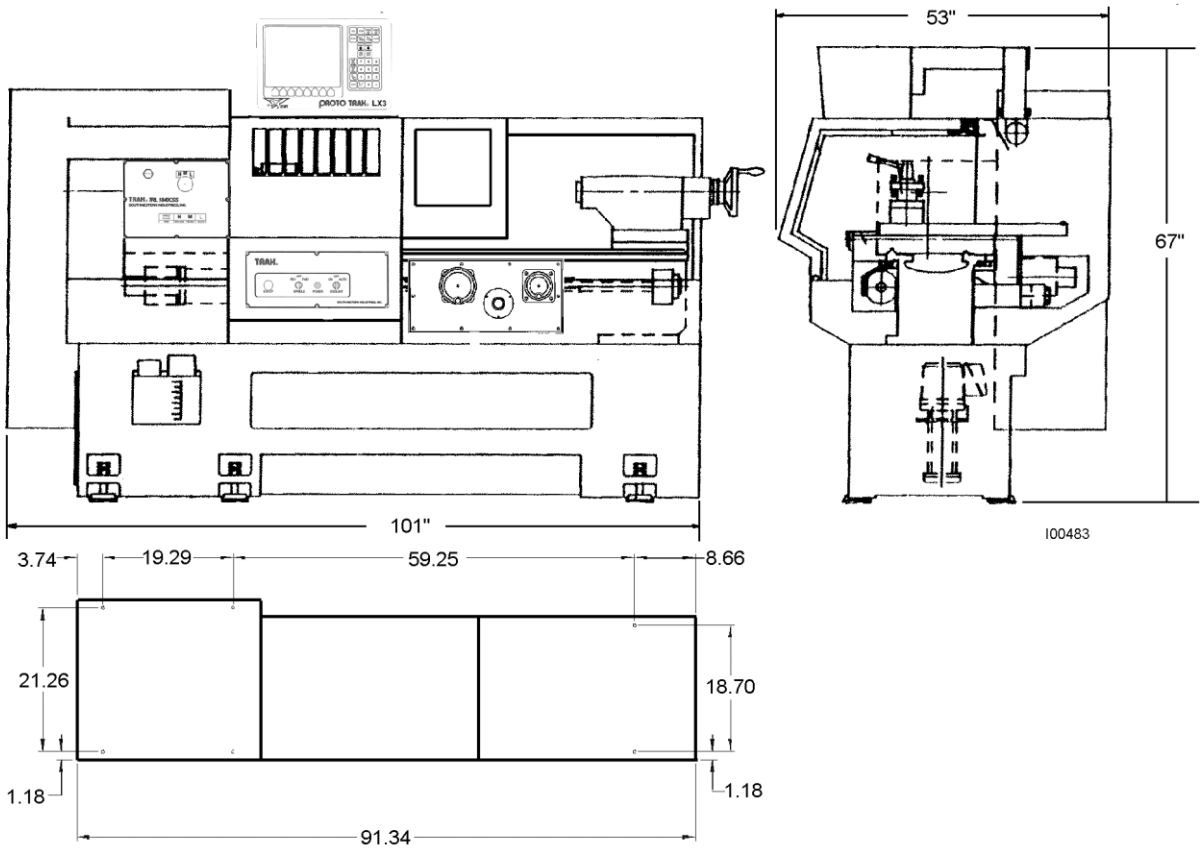


Figure 1 - Space Requirements

2.3 Lathe Specifications

TRL 1840 CSS

Capacity	Inch	MM
Height of Centers	9.0	230
Distance between centers	40.2	1000
Swing over bed	18.5	470
Swing over saddle wings	17.0	430
Swing over cross-slide	9.0	230
Cross-slide travel	13.0	330
Tool section max	1 x 1	25 x 25
Coolant	13 gal.	50 L

Bed		
Width	14.5	370
Height	13.4	340

Headstock		
Spindle nose	CAMLOCK D1-6	
Spindle through hole	2.36	60
Spindle taper	MT-6	
Taper reduction sleeve	MT-4	
Spindle dia. at front bearing	3.35	85
Number of spindle speeds	infinitely variable	
Spindle speed range	Low 50 - 270	
	Medium 150 - 850	
	High 450 - 2500	
ID Thread on end of Spindle	M62 X 2 MM Pitch	

Tailstock		
Quill travel	6.3	160
Quill diameter	2.95	75
Quill taper hole	MT-5	

Motors	
Main motor	10.0 HP
Amps, full load	36
Phase/Hz	3/60
Coolant pump motor	0.25 HP

2.4 Lifting the Lathe

To lift the machine, remove the chip pan. Place the forks of the forklift 32" apart as shown in the figure below. Be certain to lift the lathe toward the headstock.

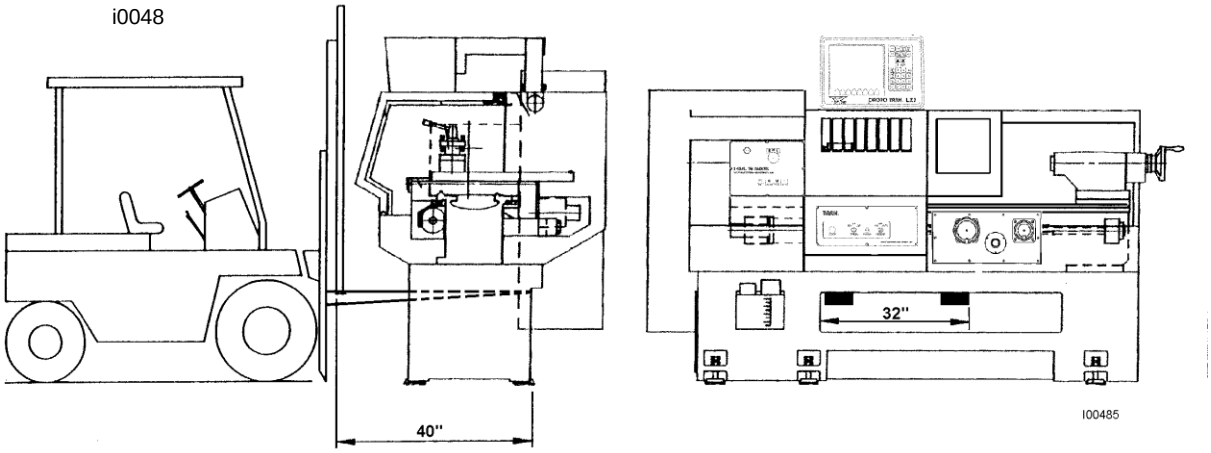


Figure 2 - Lifting the Lathe

Do not attempt to lift this machine with a forklift having less than 3 ton capacity. The shipping weight of the machine including electronics is 5170 lbs.

Do not remove the skid from the machine until it is brought to its final position, especially if the machine is to be moved on rollers.

Once the skid has been removed, place the machine in position on top of the six (6) rest pads.

For proper operation, the machine should be set on a substantial floor capable of supporting the weight safely. For the location of the bolt holes, size and recommended mounting (see Figure 1).

2.5 Cleaning

All unpainted parts of the machine have been coated with an anti-rust compound. This should be thoroughly removed after the machine is installed, and before moving the carriage, compound rest or tailstock on their respective slides. To remove the anti-rust compound use a wiper dipped in kerosene.
All unpainted surfaces should immediately be coated with a film of light machine oil to prevent rust.

2.6 Leveling

The precision and durability of the lathe depends on it being leveled properly. Final inspection can be done only when the machine has been correctly leveled.

After the machine is in position on top of the six (6) rest pads, it must be leveled by the use of the six (6) leveling bolts. It is important that the lathe be level in order to produce accurate work. It may be necessary to lag bolt the machine in order to eliminate a small amount of twist.

NOTE: The use of a precision level having a minimum accuracy of .0005" over 10.0" will be required.

Move the saddle and tailstock to the center of the bed. To take a reading off the level longitudinally, place the level at each of the four (4) corners of the bedways (Figure 3, Positions B & C). To take a reading off the level transversely, place it on top of .7500" parallels at each end of the bedways (Figure 3, Positions A & D).

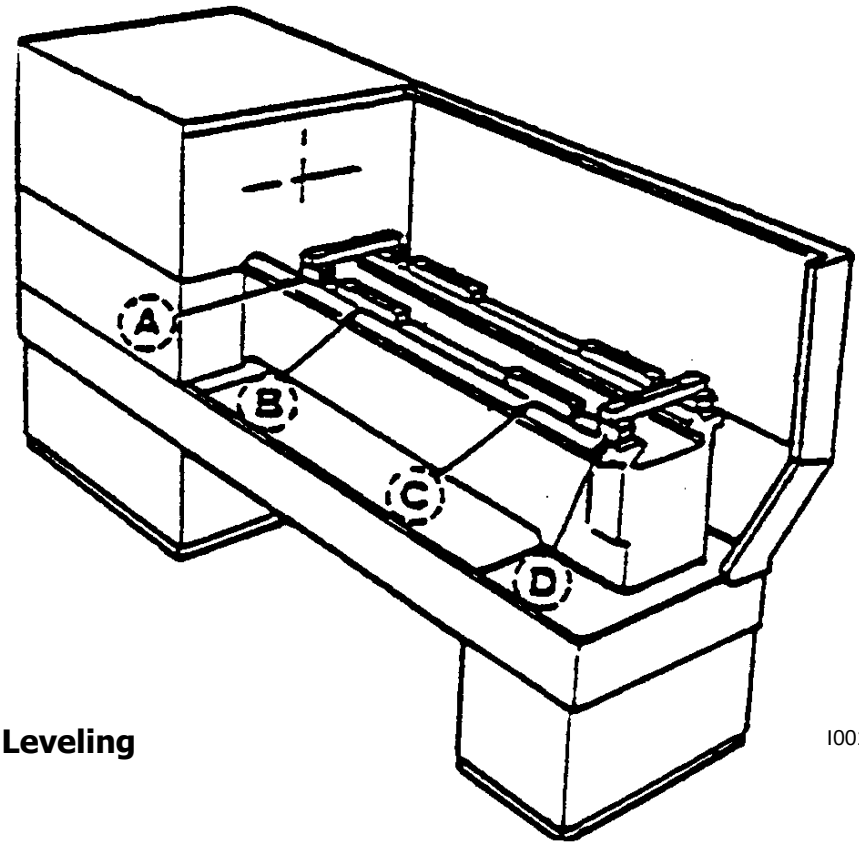


Figure 3 - Leveling I00193

Using the four (4) interior leveling screws (see Figure 1) on the lathe base, level the bedways longitudinally within .0008" over the total length and transversely within .0005" inches. After leveling with the four (4) interior leveling screws, bring the two (2) exterior leveling screws (see Figure 1) into contact with the leveling pads using care not to disturb the level.

For a newly installed machine, check the level once every week. Once the foundation is rigid enough, then check it once per month.

2.7 Lubrication

See Section 6.2.7 for lubrication instructions.

Before turning on the spindle check to make sure the headstock oil reservoir is full. A site glass is located under the spindle cover. The reservoir holds approximately 3 1/2 gallons. If low, fill the site level with Mobil DTE 24 or equivalent oil through the plug located on the headstock cover.

To set up the machine, make sure all Cosmoline is removed from way surfaces. Manually override the automatic oiler and pump oil to lubricate all sliding surfaces. Hold the feed override button for 10 to 15 seconds. The spindle must be on to override the lube pump.

2.8 Electrical Wiring

The TRAK TRL 1840 CSS operates from 230 volt, 3-phase electricity.

DANGER!
THE 230-VOLT LINE MUST ORIGINATE FROM A DEDICATED AND INDEPENDENT FUSED BOX WITH A MANUAL SHUT-OFF LEVER. IT IS THE RESPONSIBILITY OF THE PURCHASER TO SUPPLY A WIRED BOX THAT MEETS ALL LOCAL CODES AND REGULATIONS.

The 230 volt, 3 phase electricity should be wired to the TRAK TRL 1840 CSS as shown on the wiring diagrams which follow, and only by a qualified electrician.

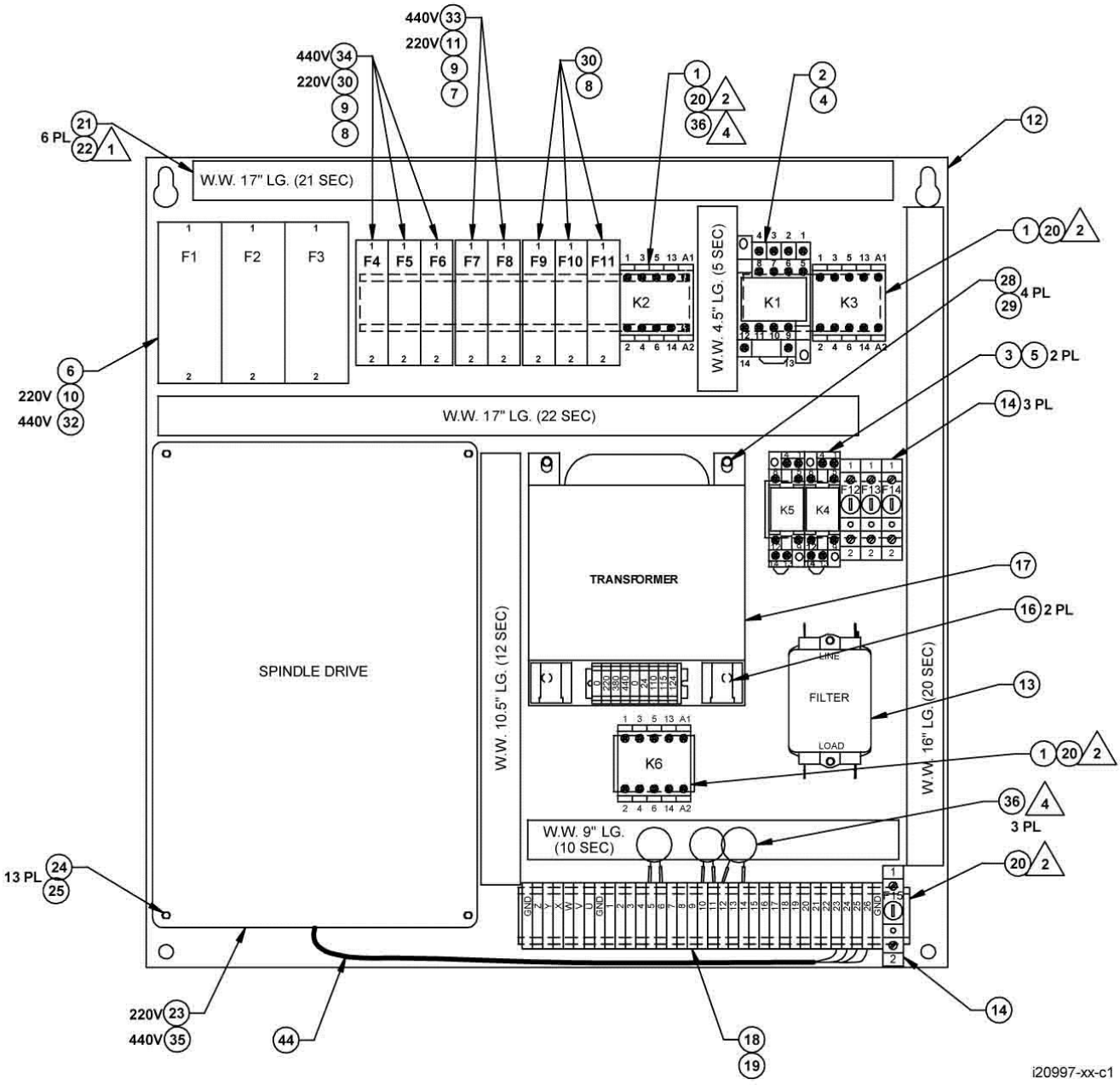


Figure 4 - TRAK TRL 1840 - CSS Electrical Layout

1	1	SWI	21218	CABLE, CONTROL PANEL TO AC DRIVE	44
1	1	LITTLE FUSE	21824-2	2 AMP FUSE - F14	43
2	2	WEY YII		40· - 750W BRAKING RESISTORS	42
2	2	LITTLE FUSE	313004	4 AMP FUSE - F12 & F15	41
1	1	SIEMENS	8WA8861-1AB	TERMINAL BLOCK LABELS; LETTERING	40
1	1	SIEMENS	8WA8861-OAC	TERMINAL BLOCK LABELS; 1-40	39
1	1	WAGO	260-361	END PLATE	38
1	1	WAGO	260-333	TERMINALS	37
3	3	HARRIS	V150LA20B	MOV	36
1	0	SWI	21398-440	SPINDLE AC DRIVE - 400V CLASS	35
3	0	LITTLE FUSE	FLQ1	1 AMP TIME DELAY - F4, F5, F6	34
2	0	LITTLE FUSE	FLQ3	3 AMP TIME DELAY - F7, F8	33
3	0	GOULD	AJT20	20 AMP CLASS J FUSE - F1, F2, F3	32
1	0	GOULD	60308J	3 POLE FUSE HOLDER	31
0	6	LITTLE FUSE	FLQ2	2 AMP TIME DELAY FUSE - F4, F5, F6, F9, F10 & F11	30
4	4	SWI	M6	WASHER, SPLIT LOCK	29
4	4	SWI	M6 x 1.0 x 9mm LG.	SCREW, SOCKET HD CAP	28
1	1	FUJI/WEY YII	EA53B-50A	3 POLE 50A BREAKER	27
1	1	FUJI/WEY YII	BZ-N2OB	HANDLE / DOOR MECHANISM	26
16	16	SWI	M5	WASHER, SPLIT LOCK	25
16	16	SWI	M5 x .8 x 9mm LG.	SCREW, ZINC PLATED, PAN HEAD	24
0	1	SWI	21398-220	SPINDLE AC DRIVE - 200V CLASS	23
AR	AR	PANDUIT	C.75L G6	WIRE WAY COVER - 4.5", 7", 9", 11", 14" & 17" LENGTHS	22
AR	AR	PANDUIT	E .75 x 2L G6	WIRE WAY - 4.5", 9", 11", 16" & 17" LENGTHS	21
AR	AR	SIEMENS	5ST1146	DIN RAIL - 35mm. 2", 3.5", 3.5", 8" & 9.5" LENGTHS	20
3	3	SIEMENS	8WA1011-1PG00	TERMINAL BLOCK / GROUND	19
32	32	SIEMENS	8WA1011-1DG11	TERMINAL BLOCK	18
1	1	JEC	21258	TRANSFORMER (34101) 220/380/440 - 109/115/124/24	17
2	2	PANDUIT	ARC 68-A-C	CABLE CLAMPS	16
1	1	LITTLE FUSE	326 008	8 AMP FUSE - F13	15
5	4	PHOENIX CONTACT	30 05 50 7	FUSE TERMINAL BLOCK	14
1	1	CORCOM	10VS1	LINE FILTER	13
1	1	WEY YII	21026	PANEL 12 GA. (.10") THK SHEET METAL, 19.65x19.25	12
0	2	LITTLE FUSE	FLQ6	6 AMP TIME DELAY FUSE - F7, F8	11
0	3	GOULD	AJT40	40 AMP CLASS J. FUSE - F1, F2, F3	10
4	4	GOULD	DRM	DIN RAIL ADAPTER	9
2	2	GOULD	30323	3-POLE FUSE HOLDER	8
1	1	GOULD	30322	2-POLE FUSE HOLDER	7
0	1	GOULD	60608J	3-POLE FUSE HOLDER	6
2	2	OMRON	PYFO8A-E	RELAY SOCKET	5
1	1	OMRON	PTF14A-E	RELAY SOCKET	4
2	2	OMRON	MY2-AC 110/120	DPDT RELAY - K4, K5	3
1	1	OMRON	LY4-AC120	4 PDT RELAY - K1	2
3	3	ALLEN BRADLEY	100-MO5ND3	4 N.O. CONTACTOR RELAY - K2, K3, K6	1
-440	**-220**	**VENDOR**	**PART NUMBER**	**DESCRIPTION**	**NO**

Parts List – TRAK TRL 1840 – CSS Electrical Layout (Figure 4)

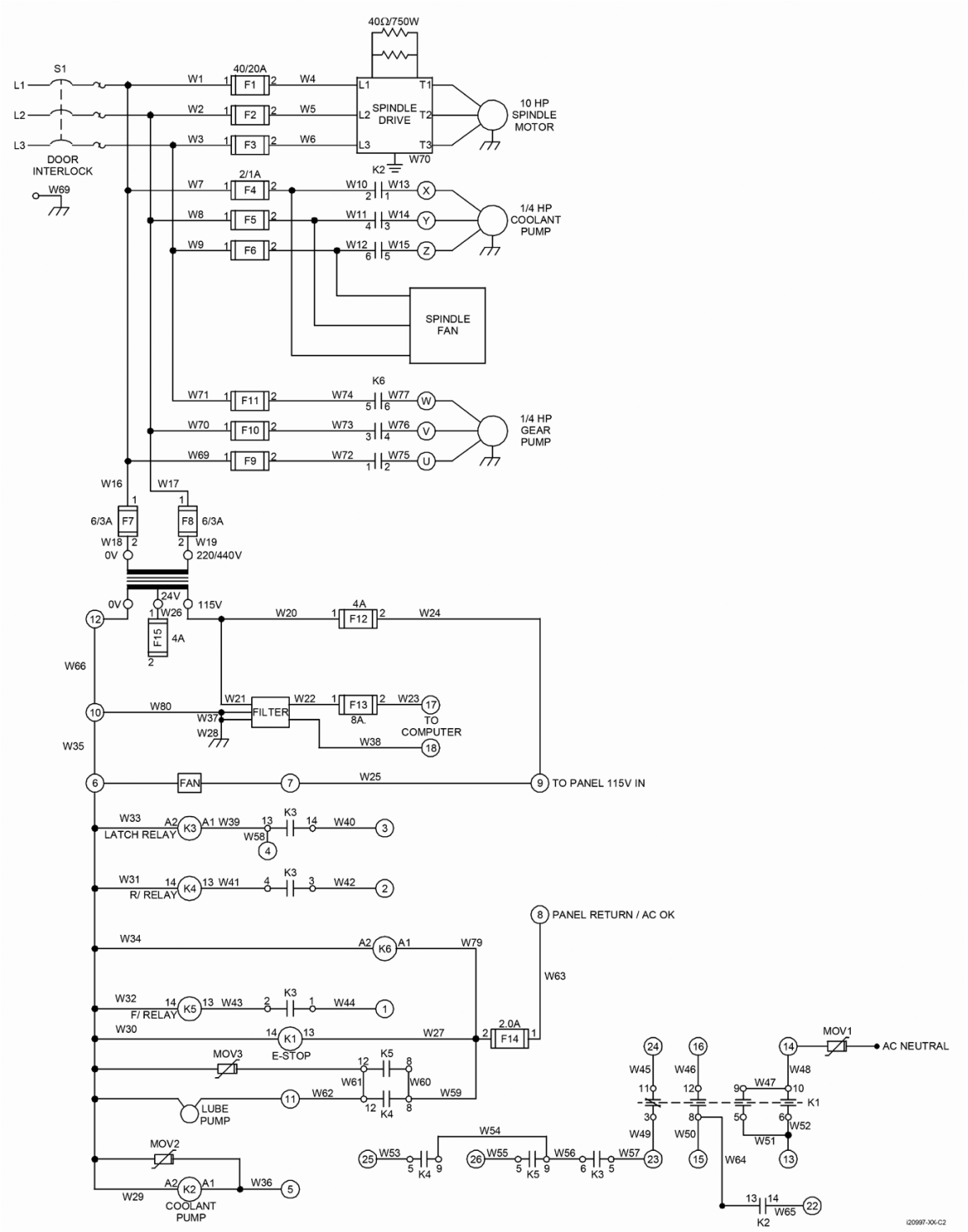
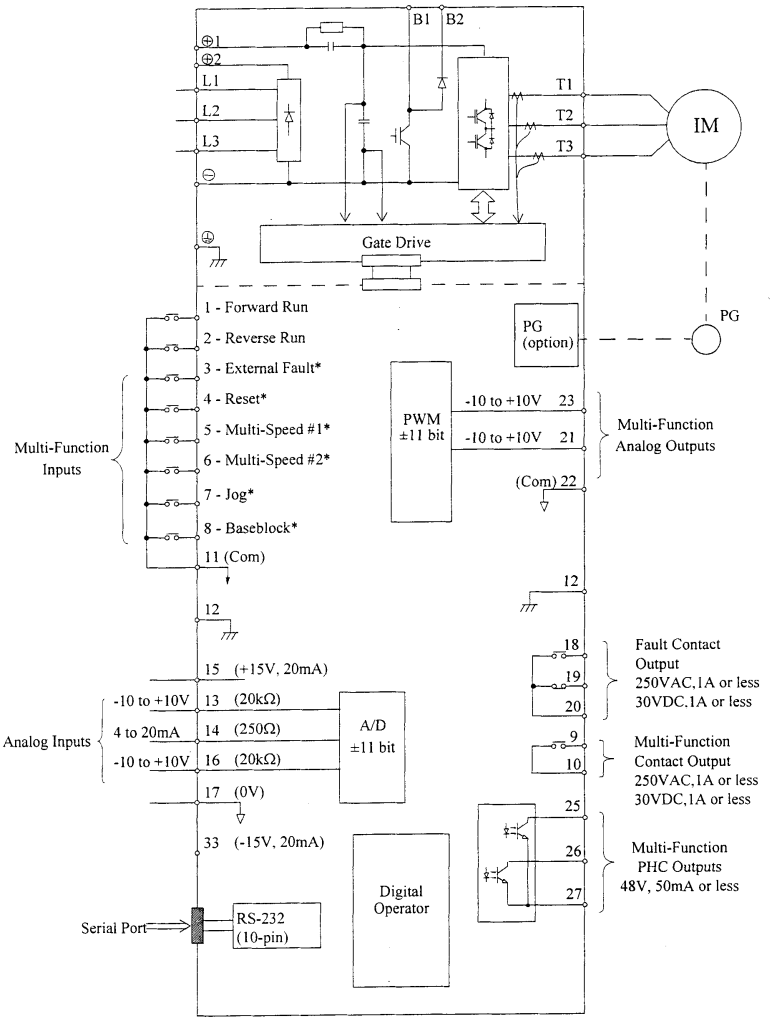


Figure 5 - TRAK TRL 1840 - CSS Wiring Schematic

TRAK TRL 1840 - CSS
Wiring Charts

REFERENCE FOR MACHINE ASSY	
F13	24V AC / 4 A. FUSE
GND	AC DRIVE/PENDANT
26	AC DRIVE- FORWARD RUN (BLK)
25	AC DRIVE- REVERSE RUN (RED)
24	AC DRIVE- EXT. FAULT (GRN)
23	AC DRIVE- COMMON (WHT)
22	COOLANT "ON" - AUX LED
21	NO CONNECTION
20	NC
19	AUX - COOLANT PUMP (GREY)
18	PENDANT 115VAC - NEUTRAL
17	PENDANT 115VAC - LINE
16	E-STOP LOGIC - 5V (BLK)
15	E-STOP LOGIC - GROUND (WHT)
14	E-STOP - COMPUTER AC (BLK)
13	E-STOP - COMPUTER AC (WHT)
12	AC NEUTRAL, LUBE
11	LUBE PUMP 115VAC
10	NEUTRAL - LAMP
9	SW_BOX - 115V IN (BLK)
8	SW_BOX - AC OK (BRN)
7	FAN, LAMP -115VAC
6	SW_BOX - NEUTRAL, FAN (ORG)
5	SW_BOX - COOLANT PUMP (VIO)
4	F/R SWITCH - HOLD RELAY (WHT)
3	F/R SWITCH - LATCH (YEL)
2	F/R SWITCH - FORWARD (RED)
1	F/R SWITCH - REVERSE (BLU)
GND	LUBE PUMP
U	220/440V TO GEAR PUMP (BLUE)
V	220/440V TO GEAR PUMP (BLK)
W	220/440V TO GEAR PUMP (BRN)
X	220/440V TO COOLANT PUMP
Y	220/440V TO COOLANT PUMP
Z	220/440V TO COOLANT PUMP
GND	COOLANT PUMP (GREEN)
TERMINAL	DESCRIPTION
TERMINAL BLOCK - WIRING	



Spindle AC Drive Connections

TRAK TRL 1840 - CSS Wiring Charts

AUX PCB - WIRING			
AUX PCB	DESCRIPTION	14-PIN CPC	TERMINAL BLOCK
T7	AC NEUTRAL	1 - WHITE	10
T14	LATCH ENABLE	2 - RED	3
T16	AC IN	3 - YELLOW	9
T10	AC OK	4 - BLACK	8
T3	PUMP ENABLE	5 - VIOLET	19
T4	E-STOP LOGIC	6 - ORANGE	16
T17	LOGIC GND	7 - GREEN	15
T2	PENDANT AC	8 - BROWN	17
T17A	LOGIC GND	11- GREEN	-
T23	INTERLOCK	10- GREY	-
T6	COOLANT LED	12 - BLUE	22
-	-	4-PIN CPC	DRIVE TERMINAL
T1	SPINDLE LED	1- BLACK	10 - AC DRIVE
T16	AC IN	2- WHITE	9 - AC DRIVE
T5	FAULT LED	3- RED	18 - AC DRIVE
T17A	LOGIC GND	4- GREEN	20 - AC DRIVE

TRAK TRL 1840 - CSS Wiring Charts

WIRE #	GA./COLOR	LENGTH	LOCATION TO LOCATION	CONNECTORS
W1	10/BLACK	28	L1 OF S1 to 1 OF F1	RG-SW
W2	10/BLACK	28	L2 OF S1 to 1 OF F2	RG-SW
W3	10/BLACK	28	L3 OF S1 to 1 OF F3	RG-SW
W4	10/BLACK	31	2 OF F1 to L1 OF AC DRIVE	SW-SW
W5	10/BLACK	31	2 OF F2 to L2 OF AC DRIVE	SW-SW
W6	10/BLACK	31	2 OF F3 to L3 OF AC DRIVE	SW-SW
W7	10/BLACK	7.5	1 OF F1 to 1 OF F4	SW-SW
W8	10/BLACK	7.5	1 OF F2 to 1 OF F5	SW-SW
W9	10/BLACK	7.5	1 OF F3 to 1 OF F6	SW-SW
W10	16/BLACK	10	2 OF F4 to 2 OF K2	SW-SW
W11	16/BLACK	10	2 OF F5 to 4 OF K2	SW-SW
W12	16/BLACK	10	2 OF F6 to 6 OF K2	SW-SW
W13	16/BLACK	28	1 OF K2 to TB - X	SW-FR
W14	16/BLACK	28	3 OF K2 to TB - Y	SW-FR
W15	16/BLACK	28	5 OF K2 to TB - Z	SW-FR
W16	10/BLACK	6	1 OF F4 to 1 OF F7	SW-SW
W17	10/BLACK	6	1 OF F5 to 1 OF F8	SW-SW
W18	16/BLACK	14	2 OF F7 to XFORMER- 0 V	SW-FR
W19	16/BLACK	14	2 OF F8 to XFORMER- 220/440V	SW-FR
W20	18/RED	18	XFORMER-115V to 1 OF F12	FR-SW
W21	18/RED	11.5	1 OF F12 to L-LINE OF FILTER	SW-FO
W22	18/RED	18	L-LOAD OF FILTER to 1 OF F13	FO-SW

TRAK TRL 1840 - CSS Wiring Charts

W23	18/RED	14	2 OF F13 to TB- 17	SW-FR
W24	18/RED	16	TB- 9 to 2 OF F12	FR-SW
W25	18/RED	4	TB-7 to TB-9	FR-FR
W26	18/BLACK	29	XFORMER-24V to 1 OF F15	FR-SW
W27	18 RED	11.5	2 OF F14 to 13 OF K1	SW-SW
W28	14/GREEN	12	GND OF FILTER to TB-GND	FO-FR
W29	18/WHITE	17	TB - 0 V to A2 OF K2	SW-SW
W30	18/WHITE	6	A2 OF K2 to 14 OF K1	SW-SW
W31	18/WHITE	13	14 OF K1 to 14 OF K4	SW-SW
W32	18/WHITE	4	14 OF K4 to 14 OF K5	SW-SW
W33	18/WHITE	14	14 OF K5 to A2 OF K3	SW-SW
W34	18/WHITE	21	A2 0F K3 to A2 of K6	FR-SW
W35	18/WHITE	4	TB- 6 to TB- 10	FR-FR
W36	18/RED	28	TB- 5 to A1 OF K2	FR-SW
W37	14/GREEN	3	N of FILTER to GND FILTER	FO/FO
W38	18/WHITE	6	N-LOAD OF FILTER to TB- 18	FO-FR
W39	18/RED	4	A1 OF K3 to 13 OF K3	SW-SW
W40	18/RED	22	TB- 3 to 14 OF K3	FR-SW
W41	18/RED	11.5	13 OF K4 to 4 OF K3	SW-SW
W42	18/RED	28	3 OF K3 to TB- 2	SW-FR
W43	18/RED	11.5	13 OF K5 to 2 OF K3	SW-SW
W44	18/RED	29	1 OF K3 to TB- 1	SW-FR
W45	18/BLUE	19	TB- 24 to 11 OF K1	FR-SW
W46	18/BLUE	21	TB- 16 to 12 OF K1	FR-SW
W47	18/RED	3	9 OF K1 to 10 OF K1	SW-SW
W48	18/RED	21	TB- 14 to 10 OF K1	FR-SW
W49	18/BLUE	6	3 OF K1 to 5 OF K3	SW-SW
W50	18/BLUE	27	8 OF K1 to TB- 15	SW-FR
W51	18/RED	3	5 OF K1 to 6 OF K1	SW-SW
W52	18/RED	27	6 OF K1 to TB- 13	SW-FR
W53	18/BLUE	17	TB- 25 to 5 OF K4	FR-SW
W54	18/BLUE	3	9 OF K4 to 9 OF K5	SW-SW
W55	18/BLUE	17	TB- 26 to 5 OF K5	FR-SW
W56	18/BLUE	13	9 OF K5 to 6 OF K3	SW-SW
W57	18/BLUE	23.5	5 OF K3 to TB- 23	SW-FR
W58	18/RED	27	TB- 4 to 13 OF K3	FR-SW
W59	18/RED	4.5	13 OF K1 to 8 OF K5	SW-SW
W60	18/RED	4.5	8 OF K5 to 8 OF K4	SW-SW
W61	18/RED	3	12 OF K5 to 12 OF K4	SW-SW
W62	18/RED	16	12 OF K4 to TB- 11	SW-FR
W63	18/RED	21	TB- 8 to 1 OF F14	FR-SW
W64	18/BLUE	7	8 OF K1 to 13 OF K2	SW-SW
W65	18/BLUE	23.5	14 OF K2 to TB-22	SW-FR
W66	18/WHITE	6	TB-10 to TB-12	FR-FR
W67	14/GREEN	43	GS-1 to TB-GND	RG-FR
W68	14/GREEN	16	GND-AC DRIVE to TB-GND	RG-FR
W69	10/BLACK	6	1F7 to 1F9	SW - SW
W70	10/BLACK	6	1F8 to 1F10	SW - SW
W71	10/BLACK	9	1F6 to 1F11	SW - SW

TRAK TRL 1840 - CSS Wiring Charts

W72	16/BLACK	15	2F9 to 1 of K6	SW - SW
W73	16/BLACK	15	2F10 to 3 of K6	SW - SW
W74	16/BLACK	15	2F11 to 5 of K6	SW - SW
W75	16/BLACK	5	2 of K6 to TB-U	SW-FR
W76	16/BLACK	5	4 of K6 to TB-V	SW-FR
W77	16/BLACK	5	6 of K6 to TB-W	SW-FR
W78	16/WHITE	16	A2 of K6 to N of LINE FILTER	SW-FO
W79	16/RED	10	A1 of K6 to 2 of F14	SW-SW
W80	18/WHITE	17	N-LINE OF FILTER TO TB6	FO.FR

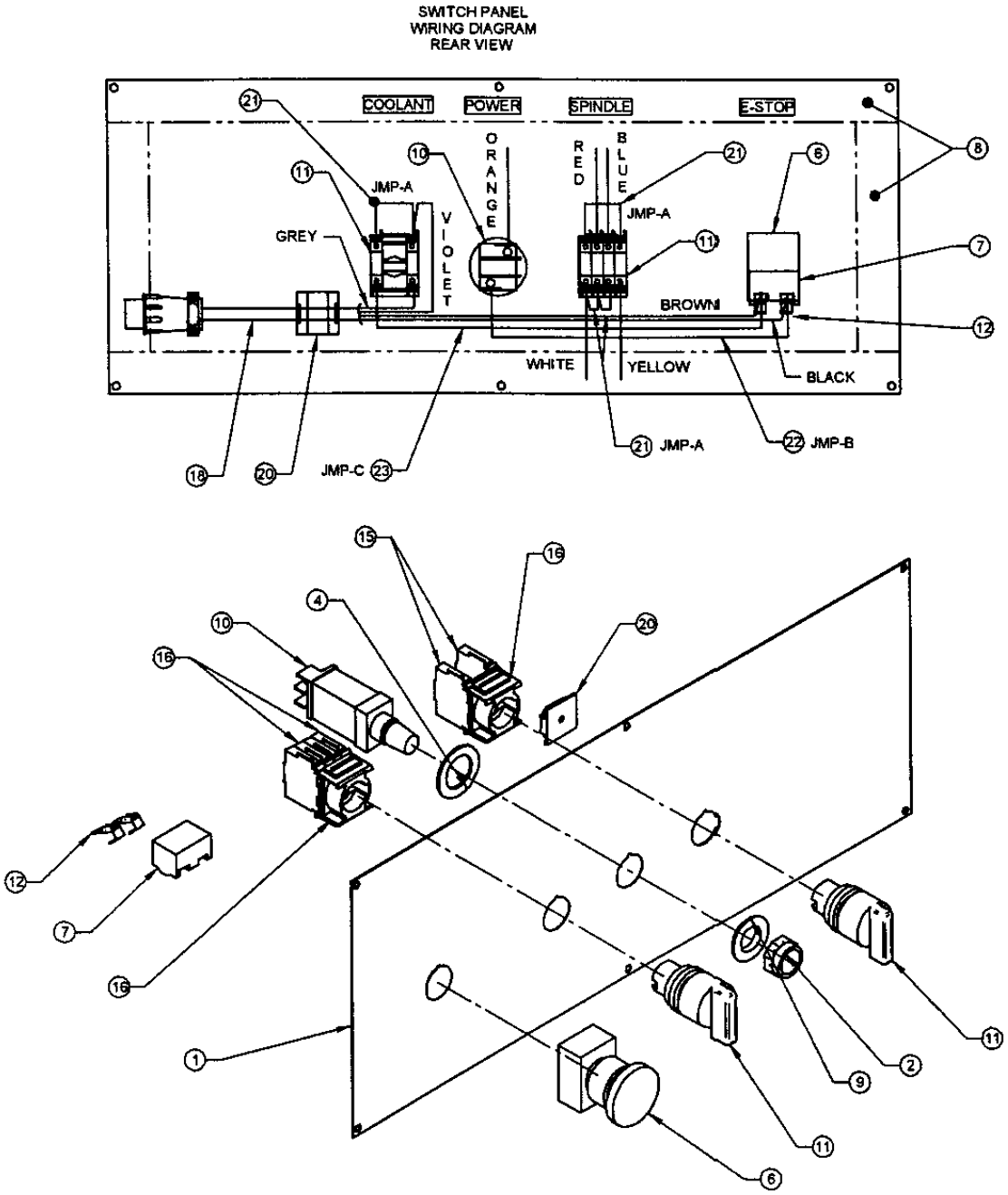
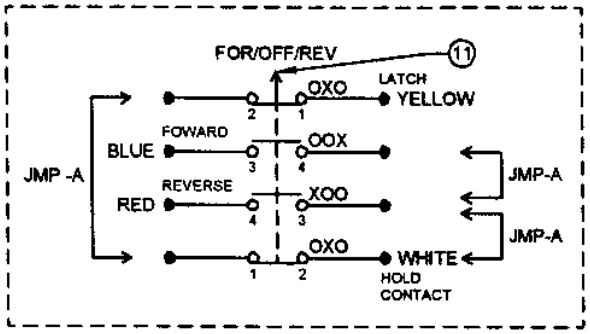
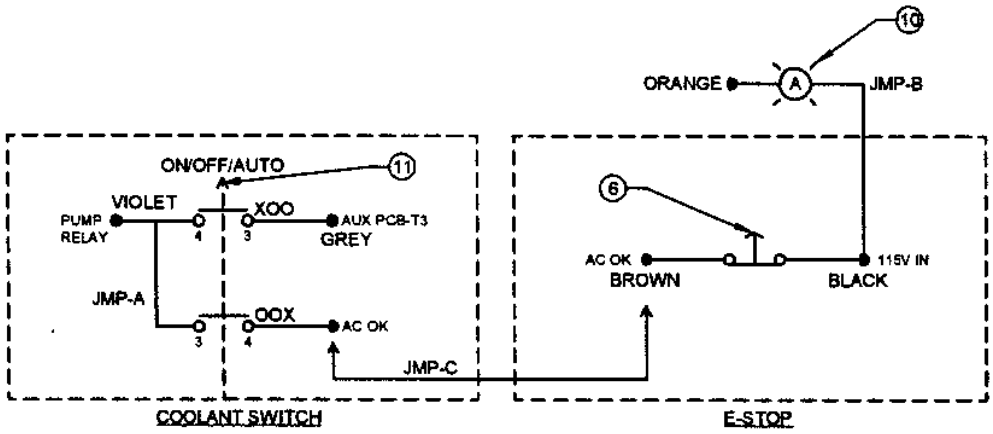


Figure 6 - TRAK TRL 1840 CSS - Switch Panel Electrics



FORWARD/REVERSE SWITCH

SWITCH PANEL WIRING CHART			
PANEL TB'S	AMP CPC #	COLOR	DESCRIPTION
1	1	BLUE	FORWARD
2	2	RED	REVERSE
3	3	YEL	LATCH
4	4	WHT	HOLD CONTACT
5	5	VIO	PUMP RELAY
6	6	ORG	NEUTRAL
W	7	GREY	AUTO - COOLANT
8	8	BRN	115V RETURN
9	9	BLK	115V IN
		BLK	JUMPER - A (4)
		BLK	JUMPER - B
		BLK	JUMPER - C



COOLANT SWITCH

E-STOP

				25
				24
1	SWI	21225	WIRE ASSY - INTERNAL SWITCH PANEL	23
1	SWI	21224	WIRE ASSY - INTERNAL SWITCH PANEL	22
4	SWI	21223	JUMPER-INTERNAL SWITCH PANEL	21
1	CAL SWITCH	ARC-68-A-C	CABLE CLINCHER	20
				19
1	SWI	21118	CABLE-INTERNAL	18
6		M4x9mm	SCREW,PAN HD, STL. BLACK OXIDE	17
2	ALLEN-BRADLEY	800E-4LX11	CONTACT CARTRIDGE, N.O. & N.C. WITH LATCH	16
2	ALLEN-BRADLEY	800E-4X10	CONTACT CARTRIDGE, N.O.	15
				14
				13
2	VOLTREX	MMF-X0-2525	Y TERMINAL	12
2	ALLEN-BRADLEY	800EP-HM32	SWITCH SELECTOR	11
1	ALLEN-BRADLEY	800T-PS16A	LAMP,PILOT,AMBER	10
1	SWI	17084	BUSHING LAMP	9
1	T & W CONV.	1/32 x 1/2 WIDE	TAPE,FOAM, ADHESIVE,CHARCOAL COLOR,4.5 FT	8
1	ALCO ELECTRONICS	F40	CONTACT BLOCK-QUICK CONNECT	7
1	ALCO ELECTRONICS	RM065	E-STOP-PUSHBUTTON W METAL BUSHINGS	6
				5
1	McMASTER	3088A471	SHIM, 7/8 x 1 3/8 x .062	4
				3
1	SWI	17085	NUT, LAMP	2
1	SWI	21123	PANEL	1
QTY	VENDOR	PART NUMBER	DESCRIPTION	NO.

TRAK TRL 1840 CSS - Switch Panel Wiring Chart

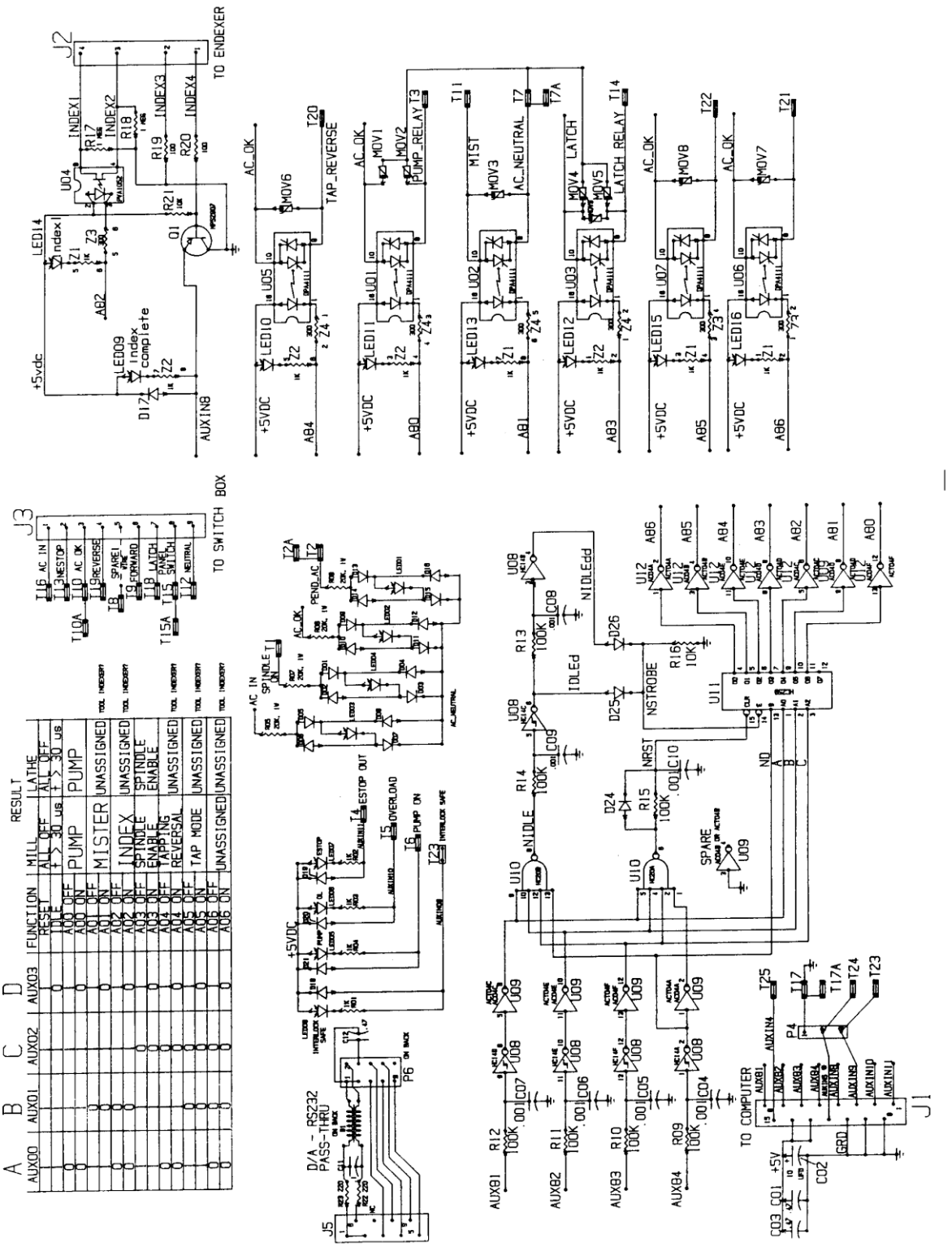


Figure 7 - TRAK TRL 1840 CSS - Auxiliary Box Electrics

2.9 Tooling Note

A chuck and appropriate tooling (see Sections 3.3 and 3.4 for a description of the required tooling) will need to be available for the Field Service Technician to perform an accuracy test on the TRL.

2.10 Installation Instructions & Checklist

Installer: Complete and check off each item in order. Do not continue until the current operation is completed and its box checked off.

☐	1.	Shut off power to the machine.
☐	2.	Visually inspect the 200V wiring going into the electrical panel. Visually verify that the wiring is correct per our wiring diagram, Fig. 5 on Page 15.
☐	3.	Clean the machine if needed. Remove any remaining grease and Cosmoline.®
☐	4.	Mount the pendant on top of the sliding door and make the cable connections. Make sure the pendant swivels and slides easily.
☐	5.	Remove the protective plastic covers from the headstock and window on the sliding door.
☐	6.	Slide the door back and forth to make sure it slides smoothly.
☐	7.	Switch on power to the machine and the pendant. Make sure the 230V line is plugged in.
☐	8.	Jog the Z-axis and center the carriage. Slide the tailstock to the center of the Z-axis until it is up against the carriage.
☐	9.	Check the level of the machine and correct if needed. Level the machine within .0008" longitudinally over the total length, and traversely within .0005."
☐	10.	Visually inspect and verify that the oil level is correct in the headstock prior to turning on the machine tool. Add oil if necessary. The oil level can be check by the site glass located under the spindle cover. Make a notation on the installation summary sheet if the oil level is incorrect.
☐	11.	Manually override the automatic oiler and pump oil to lubricate all sliding surfaces. Hold in the feed override button for 10 to 15 seconds. The spindle must be on to override the lube pump.
☐	12.	Jog the cross slide and carriage back and forth until the ways are well lubricated. Oil should be visible on all of the way surfaces. Wipe oil onto the tailstock ways by hand or with a brush.
☐	13.	Check the tailstock and the tailstock barrel locks by locking and unlocking. Run the tailstock barrel in and out to ensure proper function. *NOTE: The tailstock barrel may feel stiff when first operating. After proper lubrication and removal of remaining Cosmoline®, it will loosen up.*

☐	14.	Check to make sure the following machine control functions are working properly: headstock oil pump, spindle fwd/rev, coolant on/off, jogstick, X and Z handwheels. *Note: Make sure the headstock pump and coolant pumps are rotating in the correct direction. If not, switch 2 legs of the incoming power lines. This will not affect the spindle motor. If the spindle motor is turning backwards, reverse 2 legs of the 3-phase power coming out of the drive to the motor.*
☐	15.	Check to make sure the E-Stop button is functioning correctly.
☐	16.	Run the spindle at 500 RPM for 15 to 20 minutes in order to warm the headstock.
☐	17.	Run the spindle through its speeds using all 3 gear ranges.
☐	18.	Center the axis and run Service Code 12. This is very important. Code 12 values should be around 16 for the X-axis, and around 8 for the Z-axis. This code must be run anytime that a mechanical adjustment is done to the machine.
☐	19.	Calibrate the X and Z-axis and check for repeatability. If repeatability is a problem run Service Code 127 to calculate the backlash in each axis. Service code 128 enters the backlash compensation value.
☐	20.	Run Service Code 100. Feedrate should be around 130 for the X-axis, and 200 for the Z-axis, and be fairly consistent in the positive and negative directions.
☐	21.	Cut the test piece to check for taper. Measure the test bar and make any machine adjustments if required. If unacceptable taper is found, re-check the level before attempting to adjust the headstock.
☐	22.	Wipe down the machine prior to leaving.

CAUTION!
IF THE TRAK TRL 1840 CSS HAS A CHUCK MOUNTED TO THE SPINDLE, MAKE SURE THE CAM LOCKS ARE TIGHT, AND THE CHUCK JAWS ARE ENGAGED ONTO THEMSELVES OR A PIECE OF MATERIAL BEFORE RUNNING THE MACHINE.
IF THE CHUCK WAS NOT PURCHASED FROM SWI, CHECK TO MAKE SURE THE CHUCK IS RATED FOR THE MAXIMUM RPM'S OF THE MACHINE. IF IT IS NOT, DO NOT RUN THE MACHINE ABOVE THE CHUCK'S MAXIMUM RATED RPM.
IF THE CHUCK'S RPM RATE IS UNKNOWN, DO NOT RUN THE CHUCK OVER 1000 RPM.
THE CHUCKS PURCHASED FROM SWI ARE RATED FOR THE MACHINE'S MAXIMUM RPM.

3.0 Installation Checkout

This procedure will be performed by an SWI Field Service Technician or the Service Representative of an Authorized TRAK Distributor. Before checkout procedures may be performed, it is necessary for the machine to have been installed and tooling provided. See Section 2 for machine set-up.

3.1 Visual Inspection

- Check if the display pendant has been installed (see Figures 8 and 9 for reference to display and computer module interconnections).
- Check if the lathe is leveled (see Section 2.6).
- Check if loose parts, keys or jaws will be thrown from the chuck if it is turned on.

DANGER!
BEFORE OPERATING THE LATHE, VERIFY THAT THE MAXIMUM SAFE OPERATING SPEED FOR THE CHUCK IS RATED BY THE MANUFACTURER AT A MINIMUM OF 2500 RPM.

- Check if the oil reservoir in the headstock is filled and pumping oil to the headstock site glass. Check that the lube pump is filled and pumps oil to the ways.
- Check if 230-volt power is connected by switching on the master 230 volt switch on the back of the lathe and then switching on the TRL spindle (generally, forward = the chuck rotating counterclockwise when facing it).
- Switch on the LX3 pendant display, enter Set Up Mode, and enter Service Code 133 (see TRL operation manual for detailed instructions). Rotate the chuck manually and check if the Z-axis reads. If it reads, this will indicate that the spindle encoder is functioning.

3.2 Inspection of DRO Operation

Turn on the ProtoTRAK LX3 display and enter the DRO Mode (for detailed instructions, see the TRAK TRL operation manual).

- Check if X and Z handwheels move each axis in both directions in DRO mode.
- Check if the jogstick moves each axis in both directions in DRO mode.
- Check if the emergency stop button stops the spindle and disables the X and Z handwheels.

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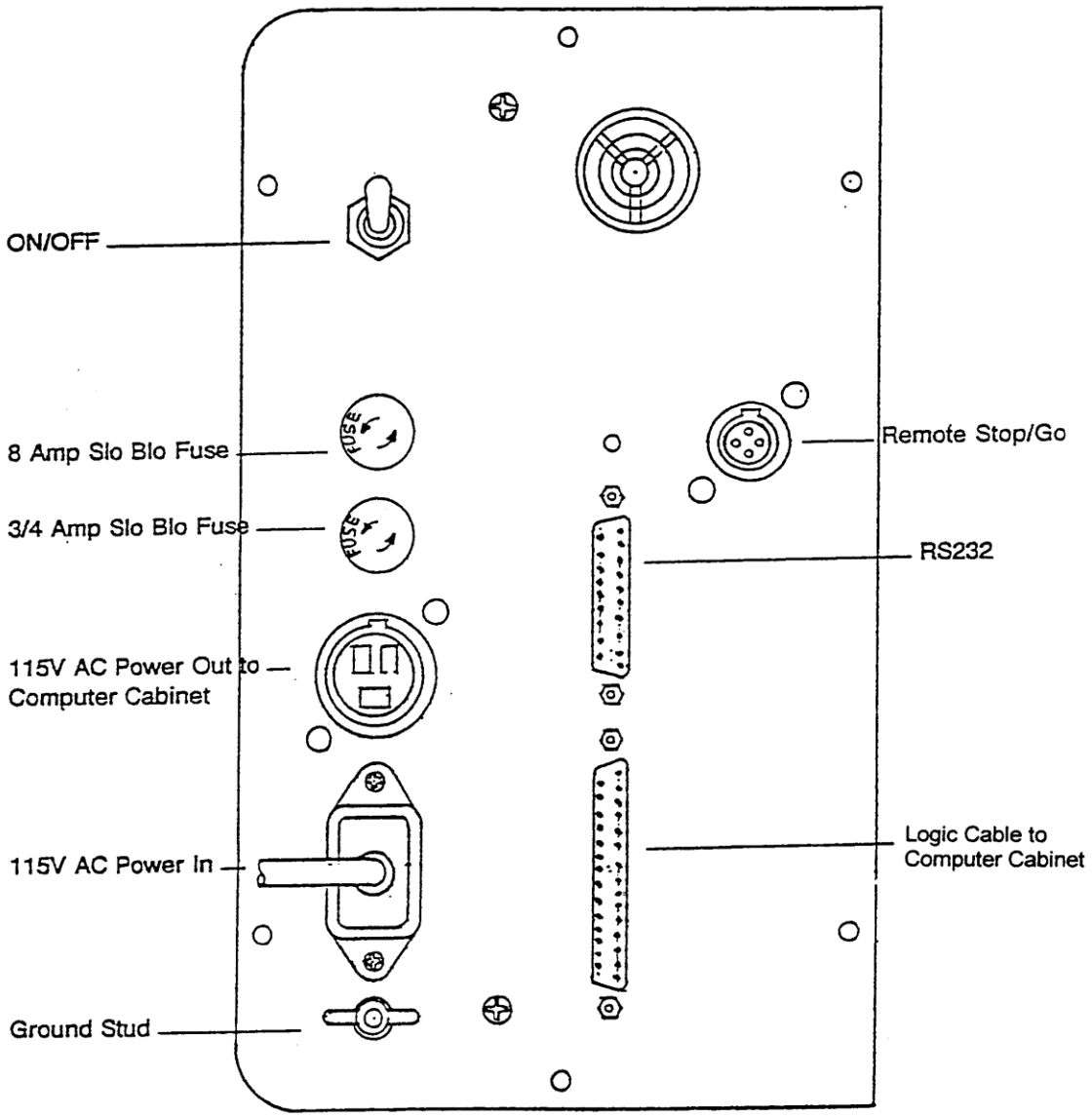

Figure 8 - LX3 - Back Pendant Display

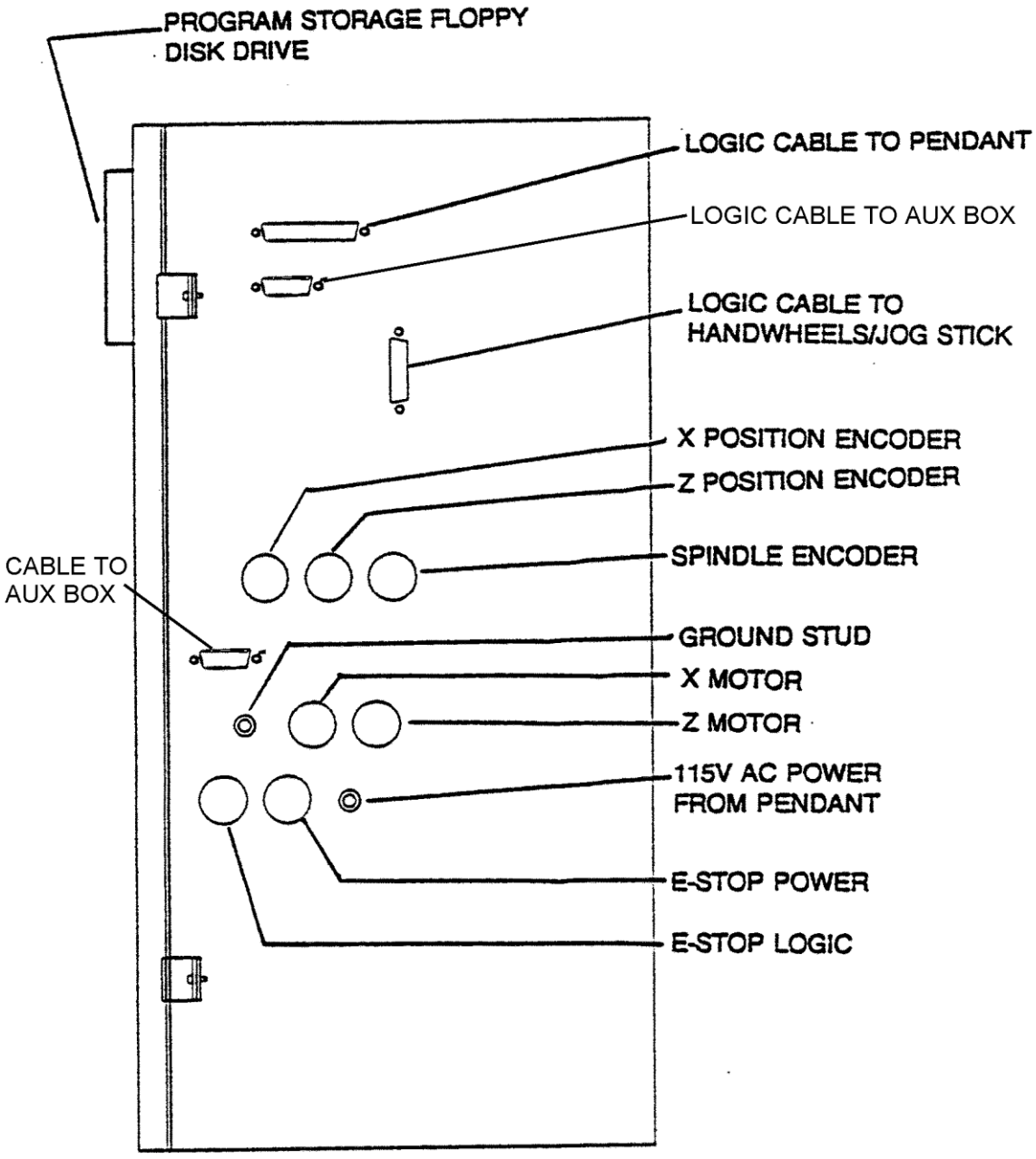

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Figure 9 - LX3 Computer Cabinet

3.3 Cutting the Test Part (See Figure 10)

TOOLS REQUIRED:
Tool Post
Tool Block
Tool Holder, right-hand face and turn type

In order to accurately machine the test part, the gears and bearings in the headstock must be properly warmed and preloaded. This is accomplished by running the spindle for 15 to 25 minutes prior to cutting the test bar.

Load an approximately 2" dia. aluminum bar into the spindle chuck (refer to Figure 10). Load a standard right hand face and turning tool into a tool block. Align and lock the tool block onto the tool post. Set the depth of cut to a maximum of .002.

Set the spindle to an acceptable speed for turning the test piece. A speed range from 650 to 950 RPM is recommended.

3.4 Measurement of the Test Part

TOOLS REQUIRED:
O.D. Micrometers with .0001" graduations

Using a calibrated O.D. micrometer with .0001" graduations, measure and record the generated dimension at a 6.00 spacing. The acceptable measurement of parallelism of spindle axis to carriage movement (taper of test piece) is .0008" in 6". If the taper measured is not acceptable, re-machine the test part and/or check and adjust the level of the machine, or adjust the headstock per Section 6.2.4.

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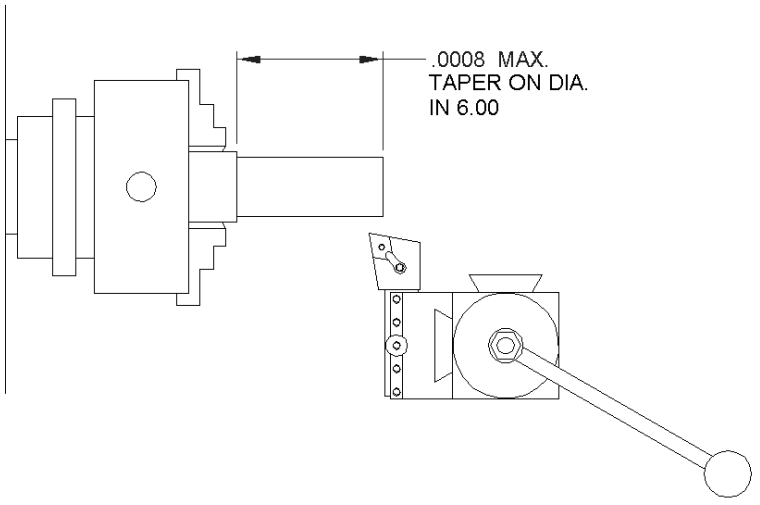


Figure 10

4.0 Troubleshooting by Symptom

4.1 Problems Relating to Machining Results

4.1.1 Poor Finish/Chatter

Poor finish can be caused by a number of variables including: speeds, feeds, tooling, machine setup and chatter.

Possible Cause	Check This
Machine set-up problem	Machine's feet are not equally supporting weight. See *Leveling,* Section 2.6
Tooling problem	Improper tooling, Work piece not properly supported speeds too fast, Feeds too slow. See *Machine Tool & Setup*, Section 5.1
X gib too tight or loose	See *Gib Adjustment,* Section 6.2.2
Loose bearing problem	Looseness in the spindle bearings. Adjust spindle preload. Ball screw misalignment, See *Mechanical Drive Train (X,Z),* Section 5.2. See *Spindle Bearing Preload,* Section 6.2.5

4.1.2 Turning Diameters Out of Round

Parts are not round within .0004" TIR. This is best measured by using a .0001" micrometer.

NOTE: The typical geared head engine lathe is not capable of more precise Diameters. Careful adjustments to this turning machine will insure to maintain this accuracy. Better accuracy should not be expected from a lathe of this class.

Do the following service code and procedures:

- Code 12 Determines the feed forward constant for the axis motors.

Possible Cause	Check This
Tooling problem	Improper tooling, workpiece not properly supported. See *Machine Tool & Setup*, Section 5.1
Loose bearing problem	Looseness in the spindle bearings. See *Mechanical Drive Train (X, Z)*, Section 5.2. Spindle bearing not preloaded correctly. Reseat bearing and preload. See *Adjust Spindle Bearing Preload,* Section 6.2.5

4.1.3 Cutting Taper

Parts are considered to be cutting on a taper if there is a difference in diameter more than .0008" over 6 inches. This is best measured by using a .0001" micrometer.

Do the following service code and procedures:

- Code 12 Determines the feed forward constant for the axis motors.

Possible Cause	Check This
Machine set-up problem	Machine not leveled properly See Leveling - Section 2.6
Tooling problem	Improper tooling; Work piece not properly supported. Use steady rest or follow rest, reduce overhang from chuck headstock or tailstock.
Looseness in the gib or misalignment of ball screw	Gib adjustment. See Gib Adjustment - Section 6.2.2 See Z Ball screw Alignment - Section 6.2.3
Loose bearing problem	Looseness in the spindle bearings. See Mechanical Drive Train (X,Z) - 5.2 See Spindle Bearing Preload - Section 6.2.5
Headstock and/or tailstock not aligned	See Adjust Headstock for Taper - Section 6.2.4 To adjust tailstock from side to side, adjust grub screw. See Section 6.2.6

4.1.4 Parts have incorrect dimensions

Parts are being machined with dimensions that are different than those programmed. Typical accuracy expectations should be:

- Parts should be round within .0004" TIR.
- The acceptable measurement of parallelism of spindle axis to carriage movement is .0008" over 6 inches.

Do the following service codes and procedures:

- Code 12 Determines the feed forward constant for the axis motors.
- Code 123 Encoder calibration mode
- Code 127 Backlash compensation

4.1.4.1 Every Part Has the Same Error

Possible Cause	Check This
Programming Error	Programmed dimensions not correct. Check absolute and incremental values.
Machine & Setup Related	See Machine Tool & Setup - 5.1
Incorrect backlash compensation Machine not calibrated correctly	See Calibration - 6.2.1

NOTE: Calibration is usually only done when the computer module, ball screw or EPROM's are replaced.

4.1.4.2 Errors are Random or Accumulate in Size over the Part Run

Possible Cause	Check This
Machining Setup	See Machine Tool & Setup - 5.1

Looseness in the Drive Train, ball nut loose in yoke, split nut loose, yoke loose	See Mechanical Drive Train (X,Z) - 5.2
Incorrect backlash compensation	See Calibration 6.2.2

4.1.5 Threading Problems

Threads can be cut with and an unlimited number of pitches and up to 10 leads.

To reduce the relief area when threading up to a shoulder the spindle speed should be reduced as much as possible. The slower the speed of the spindle, the closer the cutting tool can come to the end of the programmed thread before it pulls out and retracts. If a nut must be turned all the way up to a shoulder, machine a relief area behind the last thread.

NOTE: No machine can thread up to a shoulder and instantaneously pull out.

Do the following service codes and procedures:

- Code 12 Determines the feed forward constant for the axis motors.
- Code 133 Spindle encoder test

4.1.5.1 Cross Threading

Threaded parts are cross-threaded after completion of the threading event.

Possible Cause	Check This
Looseness in the Gib	Gib adjustment See Gib Adjustment - Section 6.2.2
Looseness in the drive train	The drive train Diagnostics See Mechanical Drive Train (X,Z) - Section 5.2
Failure of the spindle encoder Run service code 133 to check if the encoder counts.	Replace spindle encoder See Spindle Encoder replacement - Section 6.1.7

4.1.5.2 Not Threading

The machine will not cut a thread at all.

Possible Cause	Check This
Spindle speed too fast	Slow down spindle speed.
Failure of the spindle encoder Run service code 133 to check if the encoder counts.	Replace spindle encoder See Spindle Encoder replacement - Section 6.1.7
Broken or slipping encoder coupling	Check and replace as necessary

4.2 Problems Relating to the Motion of the Machine

4.2.1 Run-Away Axis

The axis makes an unwanted move at rapid speed in one direction.

Do the following service codes and procedures:

- Code 131 Manual DRO, Disables Electronic Handwheels
- Code 132 Electronic Handwheel Test

Possible Cause	Check This
Encoder connections	Check where the encoder plugs into the cabinet and all other junctions.
Faulty handwheels, jogstick or apron cables	Replace as necessary. See *Handwheel and Jogstick Replacement,* Sections 6.1.3, 6.1.4, 6.1.5 Run Service Code 132. Turn handwheels to and check if they count correctly.
Bad motor or motor encoder	Run Service Code 131. Turn ball screw manually. If axis doesn't count smoothly on the DRO, replace motor.

4.2.2 Slow Down Axis

Axis moving slower than programmed speed.

Do the following service codes and procedures:

- Code 12 Determines the feed forward constant for the axis motors.
- Code 100 Used if machine is not calibrated correctly, axis configured wrong, voltage low, DRO not counting. Displays maximum feedrate of axis.

Possible Cause	Check This
Faulty servo driver	See *Servo Driver,* Section 5.5
Gibs too tight, lack of lubrication	See *Gib Adjustment,* Section 6.2.2
Tightness in the mechanical drive train	See *Mechanical Drive Train (X,Z),* Section 5.2

4.2.3 Axis Will Not Move

Axis will not move in either direction.

Do the following service codes and procedures:

- Code 131 Manual ball screw encoder test. Check to see if the DRO counts smoothly.

- Code 132 Electronic handwheel test. Turn the faulty axis handwheel and see if the DRO counts smoothly

4.2.3.1 Axis Will Not Move - Faulting

Possible Cause	Check This
Tightness in the drive train, ball screw misalignment, lack of lubrication	See *Mechanical Drive Train (X,Z),* Section 5.2 Make sure machine is level.
Bad motor encoder or motor	Run Service Code 131. See *Motor Diagnostics,* Section 5.5
Broken drive belt	Replace
Faulty servo driver	See *Servo Driver Diagnostics,* Section 5.6
Bad computer module	See *Computer Module,* Section 5.4

4.2.3.2 Axis Will Not Move - No Faulting

Possible Cause	Check This
Bad jogstick, handwheels or connections Run Service Code 132	Swap the handwheels to see if the problem moves. Replace handwheel and jogstick. See-Sections 6.1.3, 6.1.4, 6.1.5

4.2.4 Axis Motion is Not Smooth

Axis motion is not smooth while running a program or cutting manually. The X and Z ball screw feels tight as you manually turn the ball screw in both directions.
Do the following service codes and procedures:

- Code 12 Determines the feed forward constant for the axis motors.
- Code 131 Manual ball screw encoder test. Check to see if the DRO counts smoothly.

Possible Cause	Check This
Machine out of level, gib too tight, lack of lubrication	See *Machine Tool & Setup* , Section 5.1
Ball screw misalignment, tightness in the drive train	See *Mechanical Drive Train (X,Z),* Section 5.2 See *Ball Screw Alignment Procedure,* Section 6.2.3
Faulty servo driver	See *Servo Driver Diagnostics,* Section 5.6
Bad motor encoder or motor	Run Service Code 131. See *Motor Diagnostics* , Section 5.5

4.2.5 Vibration

Vibration of the machine tool while at rest or in motion. Severe vibration problems can lead to poor finishes and part inaccuracies.

4.2.5.1 Vibration at Rest

While axis is holding the handwheel is vibrating back & forth a couple of thousandths. This may be a sign there is a problem with the axis servo driver.

4.2.5.2 Vibration in Motion

Possible Cause	Check This
Loose leveling screws	Set all screws so that they bear evenly on leveling plates. See leveling procedures.
Tooling problem	Improper tooling, work piece not properly supported. See *Machine Tool & Setup,* Section 5.1
Torn, loose drive belts	Replace or adjust belts.
Work or chuck out of balance or operating at high spindle speeds.	Balance chuck or reduce spindle speed.
Ball screw misalignment, motor loose on bracket, tight drive train	See *Mechanical Drive Train (X,Z)*, Section 5.2

4.2.6 Grumbling (searching) Axis

The axis makes a grumbling noise as it moves in both directions. Motor overshoots the programmed location. (Searching)

Do the following service codes and procedures:

- Code 131 Axis encoder test

Possible Cause	Check This
Motor belts loose or slipping	Tighten motor belts
Bad motor encoder or motor - encoder wheel	Run Service Code 131. Turn ball screw manually. If axis doesn't count smoothly on the DRO then replace encoder. See *Motor Diagnostics,* Section 5.5
Encoder connections	Check where the encoder plugs into the cabinet and all other junctions.
Ball screw misalignment	See *Z Ball Screw Alignment,* Section 6.2.3

4.3 Problems Relating to the Operation of the Control

4.3.1 Display Blanks

The display is completely blank.

Possible Cause	Check This
Screen saver has been activated	Press any key to turn back on
The brightness control knob has been turned down	Re-adjust the brightness control knob on the back of the pendant display.
The system has shut down	Turn the power switch off, check the

	computer module and pendant fuses. See *Electrical*, Section 5.7. See computer module diagnostics
Failure of the pendant display	Replace pendant

4.3.2 Bad Picture on the Display

The display has strange characters, horizontal bars or other unfamiliar images, or the display continually rolls.

NOTE: if the display is dim, try the brightness adjustment on the back of the pendant.

NOTE: it is normal for the CRT to "burn-in" where there is an image on all the time, for example, the XZ position readout. For this reason the system software has a screen saver routine that will cause the display to blank after 20 minutes of non-use. Nevertheless, some burn-in of image will occur. This is normal and does not constitute a problem in itself. If the display is unreadable, replace pendant.

Possible Cause	Check This
Poor connection of system electronics	Check to see if all cables are connected and seated properly.
Pendant failure	Try logic cable test. If this fails replace the pendant. See Section 5.3

4.3.3 Keyboard Lockup

The screen display is normal but the system will not respond to key presses.

Possible Cause	Check This
Voltage drop/spike has occurred	Shut down control and wait 10 seconds before rebooting system.
Remote Stop-Go (RSG) switch has a short (if connected)	Remove the RSG; turn the system off and on again and try again; if the problem goes away and then re-appears when the RSG is plugged in again, replace the RSG
Poor connections	Re-seat cable connectors by pulling out and pushing back in.
Electromagnetic interference has entered through the RS232 cable (if connected); especially if intermittent	Especially suspected if the RS232 cable is run near any electrical conduit. If the problem is chronic, remove the cable for a while to see if there is a difference.
Pendant failure	Try Logic Cable Test, Section 5.3 Replace pendant if test fails.
Computer module has failed	See *Computer Module, S*ection 5.4.

4.3.4 Problems Reading the Floppy; Programs Not Saved Properly

The system will not properly access part programs that are saved on the floppy.

NOTE: See the controls CAD/CAM or the Off-line Manual for troubleshooting communication with off-line computer systems.

Possible Cause	Check This
Floppy disk failure	The floppy itself may be bad, see if it can be read by a PC
Floppy disk full	Put the floppy disk in a PC to see how many bytes remain. *Note: the maximum number of programs on a disk is 192, no matter how many bytes are free.*
Disk drive failure	See *Computer Module,* Section 5.4

4.3.5 System Will Not Turn On

Nothing happens when the switch is turned on.

Possible Cause	Check This
Fuse bad	The fuses on the back of the pendant. See *Electrical,* Section 5.7
Incoming AC line voltage is too high, too low or not present	The 110 power. See *Electrical,* Section 5.7.
Pendant failure	Try logic cable test, Section 5.3
Computer module has failed	See *Computer Module Diagnostics*, Section 5.4

4.3.6 System Reboots by Itself

During operation, the screen suddenly blanks and then shows that the system has begun the boot-up sequence.

Possible Cause	Check This
Incoming AC line voltage	The power. See *Electrical,* Section 5.6
Poor connections within the system	Re-seat all connections
Computer module failure	See *Computer Module,* Section 5.7

4.3.7 System Shuts Off

During operation, the system shuts off and will not turn back on.

Possible Cause	Check This
Fuse bad	The fuses on the back of the pendant and in the computer module. See *Electrical* , Section 5.7
Incoming AC line voltage is too high or too low	The power. See *Electrical,* Section 5.7.
Poor connections	Re-seat all connections
Computer module or pendant has failed	See *Computer Module Diagnostics*, Section 5.4 Try logic cable test, See Section 5.3

4.3.8 System Turns On But Will Not Initiate Control Software

After turning on the power, there is some activity on the screen but the system does not initiate.

Possible Cause	Check This
Bad system disk (*NOTE: The system disk is in the lower floppy disk drive.)*	Reboot the system by turning off and on. Replace the disk if it will not boot up normally.
Disk drive failure	See *Computer Module Diagnostics*, Section 5.4

4.3.9 Will Not Hold Calibration

Calibration usually is only done when the Computer module, ball screws or EPROM's are replaced.

The control will not hold calibration. Run Code 125 and write down the values. Recalibrate system and see if values change. Turn system off and on and see if values are held.

Do the following service codes and procedures:

- Code 12 Sets a feed forward power constant to drive X-axis motor.
- Code 123 Calibration Mode
- Code 125 Displays calibration factors.

Use a dial indicator and check to see if the DRO is counting correctly over a known length. Move from position 1 to 2 on each axis and check values.

Possible Cause	Check This
Not taking calibration factors	Replace computer module See Computer module - Section 5.4

If calibration factors are holding, but the measurements are not repeating or are not accurate.

See Section 4.4.1, *Measurements Are Not Repeating or Are Not Accurate*.

4.3.10 E-Stop Error

Any time there is a break in 220V power the E-Stop error will show on the pendant.

Possible Cause	Check This
The E-Stop is pressed	Pull E-Stop switch out
Faulty E-Stop switch	Thoroughly clean and inspect the male and female connectors of the emergency stop. Replace switch assembly if this does not work.
Electrical hardware failure	When the E-Stop is pressed, LED #7 in the auxiliary function box will shut off. If it does not there is an electrical hardware problem.

4.4 Problems with the Measurements

4.4.1 Measurements Do Not Repeat or Are Not Accurate

Part dimensions are not accurate or the machine tool will not repeat.

Do the following service codes and procedures:

- Code 12 Determines the feed forward constant for the axis motors.
- Code 100 Axis open loop test. Used if machine is not calibrated correctly, axis configured wrong, voltage low, DRO not counting. Displays maximum motor feedrates.
- Code 127 Backlash compensation
- Code 131 Manual ball screw encoder test. Check to see if the DRO counts smoothly.

Possible Cause	Check This
Gib too tight, lack of lubrication	See *Machine Tool & Setup,* Section 5.1 See *Gib Adjustment,* Section 6.2.2.
Backlash in axis. Ball screw misalignment, tightness in the drive train, split nut loose	See *Mechanical Drive Train (X,Z),* Section 5.2. See *Z Ball Screw Alignment Procedure,* Section 6.2.3. Run Service Code 127 to calculate backlash compensation. Enter value with code 128.
Bad motor encoder or motor	Run Service Code 131. *See Motor Diagnostics,* Section 5.5
Computer module failure.	See *Computer Module Diagnostics,* Section 5.4

4.4.2 The DRO Is Not Counting

The DRO for one axis is not counting when an axis is moved.

Do the following service code:

- Code 131 Manual ball screw encoder test. Checks to see if DRO counts smoothly.
- Code 132 Electronic handwheel test. Turn the faulty axis handwheel & see if the DRO counts smoothly.

Possible Cause	Check This
motor encoder not counting	Switch encoder cables and see if problem carries over to new axis. If it does then replace encoder.
Faulty handwheels	Check connections and replace as necessary
Computer module failure	See *Computer Module Diagnostics* - Section 5.4

4.4.3 X, Z Counting in Wrong Direction

The DRO is counting in the wrong direction.

Do the following service code and procedures:

- **Code 97 Axis configuration**

This procedure sets the Plus and Minus motion for the Motor encoders. It is often necessary to perform this procedure after a new installation or after installing a new Computer module.

Steps:

1. Go into Service Codes and input Service Code 97.

2. Very carefully, turn the handwheel in the positive direction. Positive motion is:
   - X - (Turn handwheel counterclockwise)
   - Z - (Turn handwheel clockwise.)

   If you do not move correctly from the beginning, repeat the procedure from Step 2.

3. Very carefully, turn the ball screw manually in the positive direction. Positive motion is:
   - X - cross slide moves toward you. (Turn ball screw clockwise, opposite of handwheel.)
   - Z - the Z-axis moves away from the headstock. (Turn ball screw clockwise.)

   If you do not move correctly from the beginning, repeat the procedure from Step 2.

4. Press INC SET to complete the procedure.

4.5 Problems Relating to the Machine Tool

4.5.1 Excess Gearbox Noise

Gearbox noise is louder than normal. Run the lathe at the gear where the noise is most noticeable. Remove the gearbox lid and try to isolate where the noise is coming from.

Possible Cause	Check This
Headstock oil pump failure	make sure oil is flowing in the site glass.
Shift level out of position. Gears are not mating properly.	Move the shift lever in and out. Turn off spindle and put back in gear. Adjust the gear cluster in question to make sure it is mating properly.
Lack of lubrication to gear train	Check level of oil in gearbox
Spindle bearing not being lubricated properly, worn bearing	Check to make sure oil is finding its way to the bearings.
Spindle preload loose	Tighten spindle preload on bearing. The spindle preload should be approximately 10 in/lbs.

4.5.2 Headstock is Leaking Oil

A Form-A-Gasket sealant should be use to seal any leaking areas. Make sure the sealant fills the leaking area thoroughly. Sealant must cure for 14 hours for best results.

4.5.2.1 Leaking Oil from Rear of Gearbox

Possible Cause	Check This
Leaking from behind belt drive pulley	Replace shaft seal - o-rings or gaskets.
Oil leaking from behind the spindle encoder.	Remove spindle encoder and check seal.
Oil leaking from the rear bearing assembly.	Make sure the rear backing plate is mounted correctly. There should be a tapped hole located at the 12 o'clock position. If the tapped hole is located at the 6 o'clock position the seal will leak.

4.5.2.2 Leaking Oil From Front of Gearbox

Possible Cause	Check This
Oil leaking from seal between lid and gearbox	Remove gearbox lid and reseal. Thoroughly clean lid before resealing. Make sure the front backing plate matches up with the seal behind the cover.

4.5.3 Tailstock Barrel is Stiff

The tailstock barrel is stiff or not smooth moving through its travel. The tailstock barrel subassembly jams inside the tailstock

Possible Cause	Check This
Misalignment of tailstock housing	Realign bearing housing and tailstock screw. Loosen screw support and realign.
Too much Cosmoline® or grease.	Disassemble and remove excess grease.
Vernier Dial is binding or rubbing on screw support.	Remove dial and machine off a couple of thousandths or shim.

5.0 Diagnostics
5.1 The Machine Tool and Set-Up

5.1.1 Leveling

Leveling is one of the most important aspects of setting up the machine properly. Improper leveling can lead to a variety of machining problems.

The machine should be level to within .0008" longitudinally and .0005" transversely. See *Leveling Procedures*, Section 2.6.

5.1.2 A Special Word about the X and Z Gib

The X gib is vital to the performance of your lathe.

Gibs should be:

- flat
- free of twist
- free of burrs
- free of blockages in the oil passages and channels

Defective or scarred gibs must be replaced. Shimming of gibs will not yield acceptable results.

It is good machining practice to avoid the use of shop air to clean the chips off a machine. This risks blowing chips into the sliding way surfaces and compromising the performance of the machine.

The Z gib is used to keep the carriage firmly planted down to the ways. There are two Z gibs, one located on each way.

See *Gib Adjustments,* Section 6.2.2.

5.1.3 Lubrication

Lubrication is one of the single most important maintenance issues that plays a key role in assuring the performance and durability of the lathe. It is a good idea to manually supply oil to the machine at start-up by pushing the feed button on the auto lube pump. The spindle must be on to manually feed the lube pump.

Make sure the oil pump for the headstock is working properly at the start of each day. Check periodically the site glass for the headstock oil. The site glass is located under the spindle cover.

Lack of lubrication can lead to a variety of problems with your machine motion due to increased friction in the sliding ways. This increased friction may lead to part inaccuracies and decreased life expectancies of your ball screws. All lubrication lines should be free to ensure proper lubrication is provided to the ball screws as well as the sliding surfaces. Lack of lubrication in the headstock can lead to increased wear of the gear train as well as premature wearing or failure of the spindle bearings.

See Section 6.2.6 for lubrication maintenance.

5.1.4 Machining Set-up

The machining set-up itself is always something that can greatly influence the performance of the lathe. The following are some things to keep in mind.

Problems With	Can Contribute To:
Feed and Speeds (spindle rpm) See below	Poor finish Excessive speeds and feeds can break cutting tools or wear out too fast.
Tooling Using the wrong cutter for an application	Poor finish Parts incorrect
Cutting too deep	Part dimensions incorrect Driving and cutting forces cause deflections, since no material is totally rigid
No coolant	Poor finish, decrease the life of the cutter

The following is a list of common machining problems and some possible solutions.

Problem	Check or Try This
Poor surface finish	Dull tool Reduce feedrate Increase spindle speed Use a higher rake angle tool Make sure tool is not dull or chipped Use proper grade of cutting tool Use coolant Check to see if tools are on the centerline
Long workpieces out of round	Use a follow or steady rest

Problem (continued)	Check or Try This (continued)
Excessive chatter	Tool bit improperly ground or not on center Avoid extreme negative rake inserts Tool overhang too great, tool deflection Improper feeds and speeds X gib loose. See *Gib Adjustment,* Section 6.2.2. Work improperly supported Machine tool out of level - See *Leveling Procedures, Section 2.6.*

5.1.4.1 Spindle Speeds

Spindle speeds are influenced by a number of variables:

- Material
- Rigidity of the Machine Setup
- Coolant
- Insert, geometry and material of insert
- Depth of cut

5.1.4.2 Feedrates

Factors that affect feedrates:

- Depth of cut
- Design or type of insert
- Sharpness of the insert
- Workpiece material
- Type of finish or accuracy required

5.2 The Mechanical Drive Train (X, Z)

Indications:

- Troubleshooting instructions indicate that the drive train is potentially the problem and other, more easily checked, variables have been exhausted.
- Roughness, looseness, tightness or jamming movement in the carriage or cross slide.
- Carriage walk-up due to Z ball screw misalignment.

1. Check for machine considerations, especially X gib adjustments and leveling. See *Gib Adjustments,* Section 6.2.2.

2. Do the following special service codes:

    - **Code 12** - this is a procedure that helps the control adjust to the friction characteristics unique to the machine. Write down the resulting values from the display. If your problem is control related, check to see if this procedure has resolved the problem.

3. The torque required to manual turn the Z and X-axis respectively is 15 and 13 in/lbs. These values should be consistent in both directions and along all areas of the axis travel. Values that differ from that of above may correspond to misaligned ball screws.

The following steps take you in logical sequence through the assemblies. If the step doesn't isolate or resolve the problem, it will be necessary to disassemble the indicated item and move to the next step.

See Figures 9 and 10 in Section 7.0

1. Ensure that the screws that hold the bearing housing in place are not loose.

2. Ensure that the Clamp Nut is secured. The following applies to the clamp nut: When loosening, make sure to back out the 10-32 screw from the clamp nut.

3. When tightening, snug the 10-32 screw to keep the clamp nut from spreading, tighten it again after the clamp nut is tight.

4. Take out the angular contact bearings in the X & Z-axis and inspect them. They should roll smoothly and be lightly greased. If not, replace them. The Z-axis has 2 bearing housings.

NOTE: *The bearing housing and spacer rings are matched sets - keep them together.*

5. With the motor and drives removed, inspect the ball screw, ball nut and yoke for the potential problems shown in the chart below.

CAUTION!
UNLIKE A LEADSCREW, DO NOT UNSCREW THE BALL SCREW FROM ITS NUT. THIS WILL DESTROY THE BALL SCREW!

Potential Problem:	Check By:
Bad ball screw	• Visual inspection of the ball nut - if the nylon seal is broken or deformed, if contamination has visibly entered the ball nut or if balls are out of the ball nut, replace the ball screw. • Cranking the ball screw through a significant part of its travel. If it jams, feel loose or has rough spots, replace the ball screw. • Dial indicator on a vertical flat of the ball screw indicates backlash between the ball screw and ball nut.
Ball nut not tightened to the yoke	• Inspection for space between the head of the bolt and the ball nut i.e. the retaining bolt has bottomed out in its thread and is not securing the ball nut to the yoke properly.
Yoke loose in the carriage	• Inspection for any motion of the yoke or looseness in the Yoke mounting screws. See Figure 10 in Section 7.0.
Oil lines sheared	• Visual inspection.
Oil line blockage	• Pump the oil and ensure that it flows evenly to the ways, ball screws and cross-slide.
Z Ball screws not aligned properly	• Manually turn the ball screw through the length of its travel. Pay particular attention to the movement near the headstock, the middle and the tailstock.

NOTE: Ball screws are inspected throughout their entire travel for backlash and consistent torque. A ball screw should be good for millions of inches of travel if installed properly. Do not be too quick to replace a ball screw if there is insufficient indication that it is bad; this will just be a costly delay to resolving the real problem.

See *Z Ball Screw Removal,* Section 6.1.2
X Ball Screw Removal, Section 6.1.14
Aligning Z Ball Screw, Section 6.2.3

5.3 Logic Cable Test

Indications:
- Problem symptoms in the Pendant Display such as blank screen or no response to key presses.

Objective:
- To determine whether the Pendant Display or computer module has failed.

Steps:
1. With the system power on, locate and disconnect the logic cable on the back of the Pendant Display. This is the largest cable on the back of the Pendant Display; it is held down with two screws.
2. Look at the CRT on the display. There should be nine yellow bars across the display. If the display is blank, replace the display. (If the fuses have not been checked, do so before replacing the display.)
3. If there are yellow bars, press every key on the keypad including the arrow keys under the CRT. Each of the keys should cause a "beep" feedback. If any keys fail to give a feedback, replace the display.
4. If the display shows the 9 bars and all the keys beep, the display is okay and does not need to be replaced.

5.4 Computer Module

Indications:

- Problems that are manifested in the Display Pendant (e.g. Blank Screen), but the Display Pendant passes the logic cable test.
- There are problems with axis motion and this test is performed because it is an easy procedure.

Objective:

- To determine if the computer module has failed.

NOTE: *SWI's exchange program provides for an exchange of the entire computer module once a problem has been isolated to this subassembly. This makes it unnecessary to identify the exact nature of the failure within the computer.*

1. Open the computer cabinet. Be sure to clean the area around the cabinet first so that the chips are not allowed to enter the computer module.
2. Check the floppy disk drive lights. There are two drives.

Drive	How to Check	When to Check
Bottom - System disk	Turn the system off and then back on. Observe the floppy drive light as the system boots up. It should come on and stay on until the "Select Mode" or Main Menu screen appears.	Problems with the system booting up
Top - Part Programs Disk	While in the Program In/Out mode, give the system a Store or Retrieve command and observe the light. It should come on after the system command is given.	Problems loading in the part programs.

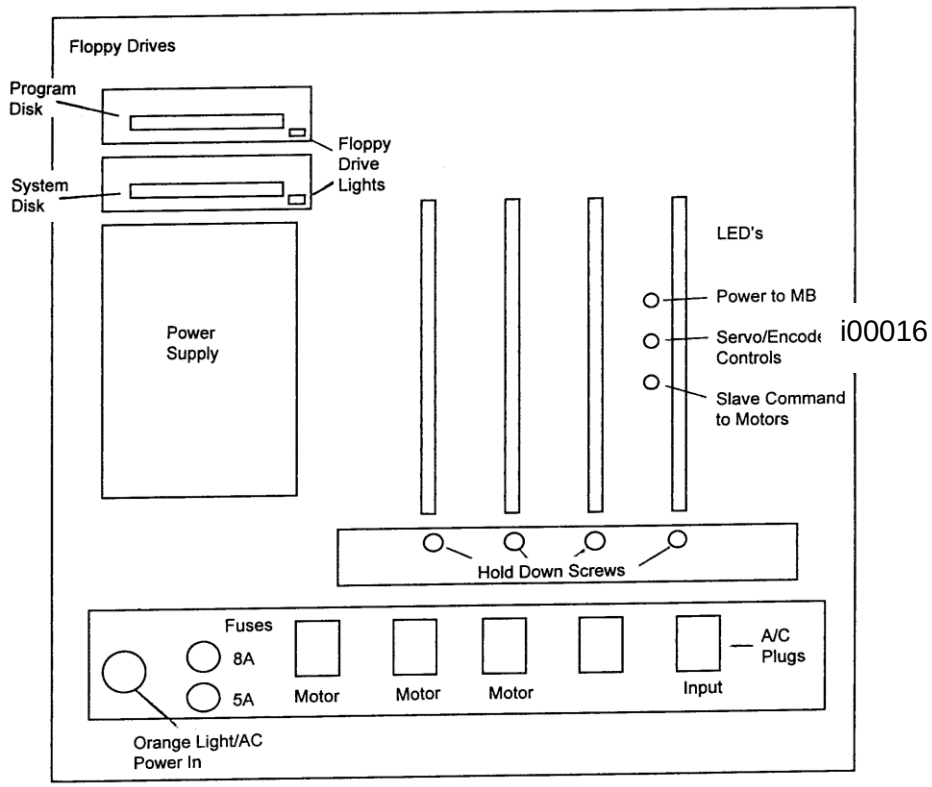
3. Check the fuses. See *Electrical,* Section 5.7.

4. With the system power on, check the large orange light at the bottom left of the cabinet. This indicates whether the motor/servo drive assembly is receiving AC power.
5. Check the LED's that are mounted to a PC board on the right side of the cabinet. These LED's may be viewed through a slot through the black sheet metal cover. You may also remove the sheet metal cover. Use the following guidelines for diagnoses with the LED's.

CAUTION!
THE COMPUTER CABINET CONTAINS VOLTAGES
THAT ARE VERY DANGEROUS.

Position	Purpose	Comment
Top	Indicates power to the motherboard	Should be on whenever the system is on. If not, replace the computer module.
Middle	Indicates if the system is receiving counts from the motor or independent position encoder.	View the light while moving an axis of the machine using a handwheel. The LED should flicker as the axis moves.
Lower	Indicates if the slave board is sending a command to the motors.	View the light while attempting to jog the system. The light should flicker.

Failure of these lights to come on during the operations shown above indicates that the computer module should be replaced.



5.5 Motor

Indications:

- The axis does not move and the Computer Module diagnosis indicates that commands are being sent properly from the computer to the motor driver board
- The Servo Driver test indicates the Servo Driver is working.
  See Servo Driver.

Motor Types:

- The X and Z motors are different on the lathe

Objective:

- To verify that a particular motor is bad.
- To verify that the motor encoder is bad. See service code 131.

Steps:

1. Check to see that the motor is plugged in to the proper outlet and that there is no visible damage to the cable or connectors.

2. Swap the X and Z motor cables. If the problem follows to the axis that was working then replace the motor. If the problem stays on the same axis then it is either the computer or servo driver.

   NOTE: When you swap the motor cables on their new axes, be sure that the belt tension is such that there is little or no motion possible in the middle of the belt. Do not overtighten!

   See:
   X Motor Replacement, Section 6.1.6
   Z Motor Replacement, Section 6.1.1

5.6 Servo Driver

NOTE: The servo driver is mounted in the computer cabinet on the lathes.

Indications:

- The axis does not move and the Computer module diagnosis indicates that the computer module is not the problem.

- If you switch the motor cables and the test indicates that the motor is good.

Servo Types:

- X and Z servos are different on the lathe

Objective:

- Isolate the problem to the particular Servo Driver

Steps:
1. Turn off and unplug the system.

WARNING!
DO NOT WORK WITH THE SERVO DRIVER UNLESS THE POWER IS DISCONNECTED FROM THE MACHINE. THERE IS POSSIBILITY OF DEATH BY ELECTROCUTION!

2. Physically swap the servo module from the axis that is not working to the one that is.

WARNING!
ONLY MOVE THE AXIS A SHORT DISTANCE TO CHECK IF SERVO IS FUNCTIONAL. EXCESSIVE MOVEMENT MAY DAMAGE SERVO DRIVER.

NOTE: To avoid pulling the wires out of the connector, use the loop to pull the connector from the Servo Driver.

If the problem moves to the other axis and clears up from the original axis, replace the Servo Driver.

5.7 Electrical

5.7.1 Checking A/C Voltage

This procedure tests for the 115V power for the control. The 115V comes off of a transformer in the electrics box.

Use a Voltmeter, reading A/C volts.

Acceptable range is 104V to 126V.

NOTE: Systems running consistently close to the high or low values may have problems when normal voltage fluctuations push the voltage out of the acceptable range. The secondary voltage can be adjusted if your line voltage is less than 220V by switching the taps on the transformer from the 115V tap to the 124V tap.

Test the following in the order presented:

Problems Here:	May Indicate:
1. The wall outlet.	• Fuse blown in the shop electrical panel. • Incoming service from local utility is bad. Call the electric company.
2. The A/C out connector on the Pendant display.	• 8 Amp fuse in pendant display blown. • Pendant display failed.

5.7.2 Checking Fuses

There are 16 fuses to check on the lathe, 14 in the electrics box and two in the pendant.

To check fuses:

1. Use a Volt/Ohmmeter. Select "OHM".
2. Remove the fuse completely from the pendant display or computer module.

3. Place a lead of the meter on each end of the fuse.

   - A good fuse reads 0 (zero) or close to it.
   - A bad fuse reads Open or Infinity.

See Figure 5 in Section 2

5.8 Auxiliary Connector Box

Indications:

- AC drive problems, chronic or intermittent.
- Auto coolant problems
- Tool indexer problems

Explanation:
It is often the case that what appears to be the failure of an electrical component is actually attributable to a poor connection.

It is not likely that there has been a failure in the External connector box. This procedure guides you through an inspection of the connections into and out of the connector box.

1. Turn off and *unplug* the system from the wall.

CAUTION!
DO NOT PLUG AND UNPLUG CONNECTORS WITH THE SYSTEM POWER ON.
THIS MAY CAUSE DAMAGE TO THE CONNECTOR BOARD.

2. Visually inspect the connections for excessive debris, moisture, or obvious damage.

3. Carefully clean any chips away from the connectors.

4. One-by-one, take out each connector and then plug them back in. Do the same at the pendant display. If the connection is sloppy, squeeze the connectors together to make a better connection.

The External connector box must be protected from excessive debris or moisture.

The main function of the auxiliary box is to:

1. Filter output from computer module to AC drive.

2. Troubleshoot system through the use of LCD's.

3. Control spindle on/off.

4. Control auto coolant feature

5. Control tool indexer interface.

See Figure 13 in Section 7.0 for an explanation of the connections.

5.9 Service Codes

All Service Codes are accessed in the SET-UP Mode by pressing the soft key for "SERV CODES". See the system operations manual for more details on running the control.

5.9.1 CODE 12: Feed Forward Constant

The Code 12 procedure helps the control "learn" the friction characteristics of the machine by sending a graduated series of motor signals and observing the results. The process takes about 1 minute to run.

It is both a diagnostic routine that displays values and a routine that sets the parameters of the control for the particular machine.

Code 12 is used for diagnosing and resolving:

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

NOTE: Code 12 routine will set the parameters for the particular machine and its particular situation. If the machine changes its friction characteristics, the Feed Forward Constant should change too or the system will not servo properly.

Use Code 13 to re-set the Feed Forward Constant to the factory default.

Steps:

1. Position the carriage in the center of travel.

NOTE: You will lose your DRO position reference.

2. Go into the Service Codes and input the Code 12.

3. The system will run the routine automatically and then display values on the position readout.

- **Explanation:**
  Values around 16 are considered normal for the X-axis and 8 for the Z axis. Higher values indicate excessive friction in the system.

5.9.2 CODE 13: Sets Factory Values for Feed Forward

If CODE 12 produces improper values, perform CODE 13 to set best compromise values.

- Press **MODE**, **SET UP**, **SERV CODES**, **13**, **INC SET**.

5.9.3 CODE 22: Activate Simulation Mode

Simulation Mode allows the control to run a program without actually moving the table. It is helpful in diagnosing computer/display problems (Section 5.3). See CODE 89 to deactivate Simulation Mode.

- Press **MODE**, **SET UP**, **SERV CODES**, **22**, **INC SET**.

5.9.4 CODE 33: Software ID

Code 33 is the software identification procedure. The two types of software in the control include:

- **Floppy** - the version of the system you have installed
- **Slave** - the version of EPROM software which is responsible for control to servo interface.

Steps:

1. Go into the Service Codes and input the Code 33.
2. If you are working with the SWI Customer Service Group, write down the values.

NOTE: Remember that there are two floppy disk drives. The bottom disk drive is for the system disk.

5.9.5 CODE 54: Program Continuous Run

This code runs a program continuously without stopping. It is helpful in running a long period to identify an intermittent problem.

Steps:

1. Prepare a program as you normally would.
2. Press **MODE**, **SET UP**, **SERV CODES**, **54**, **INC SET**. The program run will start automatically.
3. Press **STOP** to stop, and **GO** to continue as you would like.

5.9.6 CODE 66: Default Metric

This code causes the control to turn on in the metric mode.

- Press **MODE**, **SET UP**, **SERV CODES**, **66**, **INC SET**.

5.9.7 CODE 67: Default English

This code causes the control to turn on in the English mode.

- Press **MODE**, **SET UP**, **SERV CODES**, **67**, **INC SET**.

5.9.8 CODE 79: Beeper On

This turns on the beeper to the control keys.

- Press **MODE**, **SET UP, SERV CODES**, **79**, **INC SET**.

5.9.9 CODE 80: Beeper Off

This turns off the beeper to the control keys.

- Press **MODE**, **SET UP, SERV CODES**, **80 INC SET**.

5.9.10 CODE 89: Cancel Simulation Mode Code 22

- Press **MODE**, **SET UP, SERV CODES**, **89 INC SET**

5.9.11 CODE 97: System Axis Configuration

This procedure sets the Plus and Minus motion for the Motor encoders. It is often necessary to perform this procedure after a new installation or after installing a new Computer module.

Steps:

Go into Service Codes and input Code 97.

1. Very carefully, turn the handwheel in the positive direction. Positive motion is:
   - X - (Turn handwheel counterclockwise)
   - Z - (Turn handwheel clockwise.)

   If you do not move correctly from the beginning, repeat the procedure from Step 2.

2. Very carefully, turn the ball screw manually in the positive direction. Positive motion is:
   - X - cross slide moves toward you. (Turn ball screw clockwise, opposite of handwheel.)
   - Z - the Z-axis moves away from the headstock. (Turn ball screw clockwise.)

   If you do not move correctly from the beginning, repeat the procedure from Step 2.

3. Press INC SET to complete the procedure.

5.9.12 CODE 99: Set System Defaults

This procedure sets most control parameters to the factory settings.

Steps:

1. If desired, save the program in current memory. The current memory will be erased by this procedure.

2. Go to Service Codes and input code 99.

5.9.13 CODE 100: Axis Open Loop Test

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

IMPORTANT -- SAFETY NOTICE
DURING THIS PROCEDURE THE DESIGNATED AXIS WILL BE GIVEN A COMMAND TO MOVE AT MAXIMUM SPEED FOR 1 SECOND IN THE DIRECTION YOU CHOOSE. AVOID CRASHES BY MAKING SURE THE CARRIAGE IS IN THE CENTER OF TRAVEL AWAY FROM THE HEADSTOCK AND TAILSTOCK. MAKE SURE THAT NO ONE IS STANDING IN THE WAY OF THE CARRIAGE!

NOTE: You will lose the DRO reference position.

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

Steps:

1. Center the carriage.

2. On the Pendant display, go into the Service Codes and input Code 100.

3. The conversation line will say: "SELECT AXIS". Input the axis X or Z.

4. The conversation line will say: "WHICH DIRECTION? PLUS".

   - If you want to run in the plus direction, press INC SET.
   - If you want to run in the minus direction, press +/-, then INC SET

5. In the conversation line will say, "PRESS GO". Press **GO** after you are sure that the machine will not crash in the direction and axis that you have specified.

6. Afterward the screen will display values next to the DRO position axes.

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

Your input		
X -	X	motor encoder reading
	Z	nothing (should be 0)
	Feedrate	the maximum feedrate attained

Your input		
Z +	X	nothing (should be 0)
	Z	motor encoder reading
	Feedrate	the maximum feedrate attained

Your input		
Z -	X	nothing (should be 0)
	Z	motor encoder reading
	Feedrate	the maximum feedrate attained

Interpretation of the resulting values displayed:

The motor encoder reading is not applicable to the lathe.

The feedrate should be around 130 IPM for the X-axis and about 200 IPM for the Z-axis and be fairly consistent in the plus and minus direction for each axis. This is the maximum feedrate possible for the axis.

- If the feedrate is very different on the same axis for + and -, the motor or servo driver are suspected. On the X-axis the gib may be floating and then jamming. If the feedrate is considerable low on the Z-axis, the ball screw may be mis-aligned, the drive train is tight or the Z-axis gibs may be too tight.

- If the feedrate is considerably less than the above feedrates, incoming AC voltage should be checked. See *Electrica*l, Section 5.6.

5.9.14 CODE 123: Calibration

This routine sets the calibration factor for each axis. Calibration should be performed after replacing the computer module or working on the drive trains.

See Section 6.2.2.

5.9.15 CODE 125: Display EEPROM Values

This is a diagnostic routine in which the values resulting from the calibration procedure are displayed.

Steps:

1. Go into Service Codes and input 125.

2. Read the resulting values. There are 2 pages of information that are displayed when the corresponding softkey is pushed: A, Band C:

   - A Calibration Factor

     X Calibration Factor = 8
     Y Calibration Factor = 16

   - B Encoder Configuration & Backlash

     X encoder configuration =
     Y encoder configuration =

   - C Checksum

     X axis checksum =
     Y axis checksum =

The calibration factors (Section A) should be 8 for the X-axis and 16 for the Z-axis, plus or minus a few %. Sections B & C are not applicable.

5.9.16 CODE 126: Set EEPROM Default Parameters

- Press **MODE**, **SET UP, SERV CODES**, **126**, **INC SET**.

5.9.17 CODE 127: Auto Set Backlash Constants

Every mechanical system has at least a little backlash or lost motion. It is produced by the small amount of play in the drive train under load. The backlash constant is factory set, but may need to be adjusted periodically.

1. Set a .0001 inch dial indicator in the spindle and touch off on a block or the vise along the direction (X or Z) you wish to check, or set the backlash constant.

2. Turn on the control and at the Main Menu, precisely follow the procedure below:

Conversation Line Says	You Do
a. -----	a. Press MODE
b. Select Mode	b. Press SET UP
c. Select	c. Press SERV CODE
d. Code	d. Press 1 2 7, INC SET
e. Select Axis	e. Press X or Z
f. Backlash Value = __ __ __ __	f. What is shown is the current value. Follow the instruction on the screen and press the appropriate soft keys. Wait a few seconds between each INCR VALUE or DECR VALUE press.

3. The X backlash identified and stored in Step 2 should be around 0.001, and the Z backlash should be .0010 to .0020. If it is appreciably larger, inspect the drive train for loose bolts, brackets, bearings, etc.

5.9.18 CODE 128: Input Backlash Constant

The value found in Service Code 127 is to be entered here.

5.9.19 CODE 131: Manual DRO, Disable Electronic Handwheels

1. Press the "MODE" key to get back to the "MODE" screen.

2. Press the "SET UP" soft key.

3. Press the "SERV CODE" soft key.

4. Input 131 on the keyboard, then press the "INC SET" key.

5. Manually turn each axis with the manual hand wheel. The numbers on the digital read out screen should count up and down smoothly and not stop counting while the axis is being turned.

5.9.20 CODE 132: Electronic Handwheel Test

1. Press the "MODE" key to get back to the "MODE" screen.

2. Press the "SET UP" soft key.

3. Press the "SERV CODE" soft key.

4. Input 132 on the keyboard, then press the "INC SET" key.

5. Turn the X-axis electronic hand wheel. The display should show movement as the hand wheel is being turned. There should be no skipping and it should count smoothly while the hand wheel is being tuned.

6. Turn the Z-axis electronic hand wheel. The display should show movement as the hand wheel is being turned. There should be no skipping and it should count smoothly while the hand wheel is being turned.

5.9.21 CODE 133: Spindle Encoder Test

1. Press the "MODE" key to get back to the "MODE" screen.

2. Press the "SET UP" soft key.

3. Press the "SERV CODE" soft key.

4. Input 133 on the keyboard, then press the "INC SET" key.

5. Ensure the threading handle on the gear box is engaged.

6. Manually turn the spindle. Turn the spindle both clockwise and counter clockwise. The X-axis digital read out should count up to 36.0 and then reset to 0 after one completed revolution of the spindle. The counting should not skip as long as the spindle is turned.

5.9.22 CODE 139: Clear Tool Table

If you wish to erase the entire tool table including offsets, radii and modifiers, use the following procedure:

a) Press the SERV CODES soft key.

b) Press 139 SET when the conversation line prompts "CODE". The tool table will automatically be completed erased and lost.

6.0 Procedures
6.1 Replacements

6.1.1 Z-Axis Motor

1. Unplug or remove all power from the lathe.

2. Access to the Z axis motor is gained by removing the sheet metal panel below the head stock gearbox nameplate.

3. Loosen 4 motor bolts.

4. It will be necessary to remove the 2 cables with the motor.

5. Z and X motors are not interchangeable.

See Figure 9 in Section 7.0.

6.1.2 Z-Axis Ball screw Removal

1. Unplug or remove all power from the lathe.

2. The Z-axis ball screw is attached to the lathe in three places:

   a. The left end where the Z-axis motor, the pulley, the clamp and the pair of angular contact bearings are mounted (see *Ball Screw Encoder Removal*).

   b. Behind the apron assembly where the ball nut is attached to the yoke and the oil line is located.

   c. The right end where the floating bearing is located.

3. Access to the left end is gained by removing the sheet metal panel below the headstock gearbox nameplate.

4. Access to the ball nut and the yoke is gained by removing the apron assembly.

5. For easy assess to the ball screw, remove the ball screw cover.

See Figure 9 in Section 7.0.

6.1.3 Z-Axis Electronic Handwheel Removal

1. Unplug or remove all power from the lathe.

2. Remove the handwheel from the apron. It is not necessary to remove the apron.

3. The electronic handwheel assembly is only available as a complete unit. Do not disassemble.

See Figure 11 in Section 7.0.

6.1.4 X-Axis Electronic Handwheel Removal

1. Unplug or remove all power from the lathe.
2. Remove the handwheel from the apron. It is not necessary to remove the apron.
3. The electronic handwheel assembly is only available as a complete unit. Do not disassemble.

6.1.5 Jogstick Removal

1. Unplug or remove all power from the lathe.
2. Remove the jog stick from the apron. It is not necessary to remove the apron.
3. The jogstick assembly is only available as a complete unit. Do not disassemble.

6.1.6 X-Axis Motor Removal

1. Unplug or remove all power from the lathe.
2. Remove the access door in the chip pan and remove the X-axis motor cover.
3. Loosen 4 motor bolts.
4. It will be necessary to remove the 2 cables with the motor. The cable extends through the cable carrier to the computer cabinet.
5. X and Z motors are not interchangeable.

See Figure 10 in Section 7.0.

6.1.7 Spindle Encoder Removal

1. Unplug or remove all power from the lathe.
2. Remove the spindle cover to gain access to the encoder.
3. Loosen setscrews on flexible coupling and the bolts that hold the encoder on.
4. Slide the encoder off.
5. The spindle encoder assembly is only available as a complete unit. Do not disassemble.

6.1.8 Spindle/Coolant/E-Stop Switch

1. Unplug or remove all power from the lathe.
2. Remove the screws that hold on the door switch panel.
3. Remove the switch and replace.

See Figure 12 in Section 7.0

6.1.9 X-Axis and Z-Axis Servo Driver Removal

1. Unplug or remove all power from the lathe.
2. The X and Z-axis servo driver are located in the computer cabinet.
3. The X and Z-axis servo drivers are mounted to each side of the computer cabinet with 4 screws.
4. The X and Z-axis servo drivers are not interchangeable.

6.1.10 Computer Module Removal

1. Unplug or remove all power from the lathe.
2. The computer module is located in the computer cabinet.
3. Unplug the 4 A/C plugs from the sockets at the bottom of the computer module.
4. Disconnect two ribbon cable connectors from the connector printed circuit board to the right of the computer module.
5. Disconnect the green grounding wire.
6. Remove the 2 silver, Philips head screws.
7. Grip the computer module by the finger hold and slide the entire computer module out of the computer cabinet.

6.1.11 Spindle Drive Belt Tightening/Replacement

The spindle drive motor is located inside the base pedestal, underneath the headstock gearbox. Access is gained by opening the upper cover on the headstock and removing the lower access panel on the pedestal.

When removing the belt, loosen the top nut and raise motor with the bottom nut until the belt is loose.

To tighten the spindle belt, loosen the bottom nut "A" under the motor bracket and use the top nut "B" to tighten the belt. See the figure below. Make sure the tension on the belt is such that there is no slippage when the lathe is started at its maximum speed. The belt tension can be checked by pulling on one of the belts in the center of its travel with a scale until you reach 15 lbs. on the scale. At this point the deflection of the belt relative to the other belt should be no more than 1/2". If the deflection is more than 1/2" tighten the belt.

Belt tension should be checked frequently during the first days of operation, and periodically thereafter. Keep the pulleys and belt clean and free of any foreign material to ensure long life and maximum traction.

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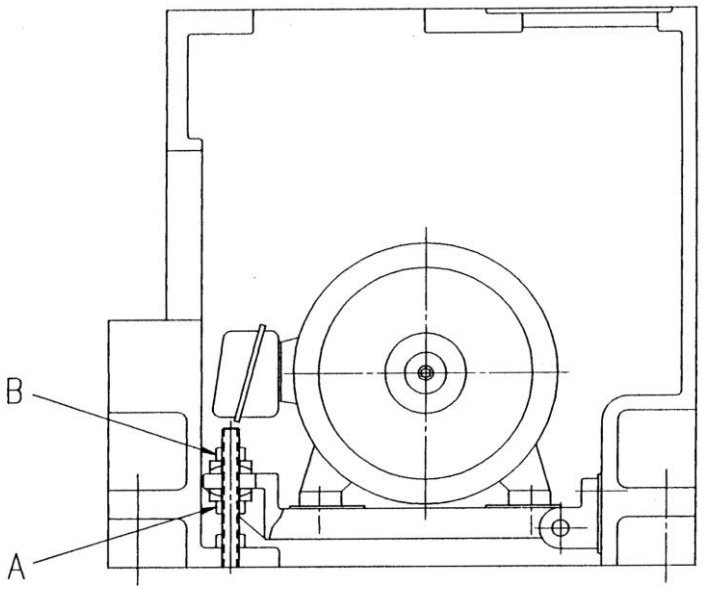


6.1.12 Spindle Motor Removal

1. Unplug or remove all power from the lathe.

2. Mark and remove motor electrical leads.

3. Because of the weight and size of the spindle motor, and the restricted working space, extreme caution should be used in sliding the motor from its mounting plate.

4. Loosen the belt tension. See section above.

5. The motor is secured with four screws to a flange plate. See the figure above.

6.1.13 Injection Brake Removal

1. Unplug or remove all power from the lathe.

2. The injection brake resistors are located in the electrical cabinet.

3. Remove the protective cage and replace resistors.

4. Be careful when rewiring resistors.

6.1.14 X-Axis Ball Screw Removal

1. Unplug or remove all power from the lathe.

2. Access to the X-axis ball screw is gained by removing the back chip guard and removing the X-axis motor cover.

3. Remove the motor and ball screw encoder.

4. Remove all items on the right end of the ball screw. See the drawing below.

5. The X ball screw is removed through the exposed hole when the cross slide is removed.

See Figure 10 in Section 7.0.

6.1.15 Installing Angular Contact Bearings

1. On the inner race of the angular contact bearings, the thin walls face each other.

2. 50 ft/lb. torque is needed to tighten the clamp nut.

See the figure above.

6.2 Maintenance

6.2.1 Calibration

NOTE: Calibration usually is only done after replacing a computer module or adjusting the drive train.

1. Recheck machine level and adjust as necessary.

2. Press the "SERV CODE" soft key.

3. Input 123 on the keyboard, then press the "INC SET" key.

4. Input the "X" key to tell the control the x-axis is being calibrated.

5. Place the .0001 indicator in the spindle and set up the metric standard on the cross slide. Make sure the standard is parallel to the cross slide by using a combination square. Ensure that the

standard is set up so that the readings will be taken with the cross slide extended towards the operator and moving in towards the motor end of the x-axis.

6. When the indicator is zeroed at the beginning of the standard press the "INC SET" key.

7. Move the cross slide towards the motor side of the x-axis until the indicator zeros on the end of the standard. Input 300. on the keyboard.

8. If the calibration was successful the screen will return to the set up screen.

9. Press the "SERV CODE" soft key.

10. Input 123 on the keyboard, then press the "INC SET" key.

11. Press the "Z" key to tell the control that the z-axis is being calibrated.

12. Set up the metric standard on the Z-axis ways.

13. Set up the magnetic base and .0001 indicator on the cross slide.

14. When the indicator is zeroed at the beginning of the standard press the "INC SET" key.

15. Move the saddle towards the chuck until the indicator zeros on the end of the standard, then press the "INC SET" key.

16. Input 150. on the keyboard.

17. If the calibration is successful the screen will change to the set up screen.

6.2.2 Gib Adjustment

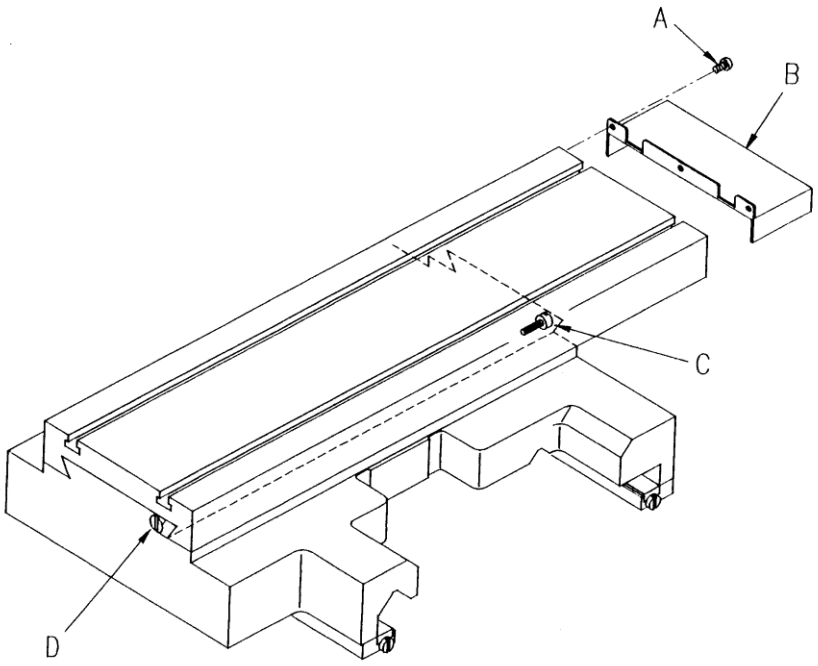
The objective of adjusting the gibs is to eliminate as much play in the cross slide and saddle as possible without having the tightness of the gib interfere with its free movement, and cause a decrease in the accuracy and/or performance of the machine due to excessive friction.

6.2.2.1 Cross Slide Gib Adjustment

1. Remove the yoke bolts from the top of the cross slide and slide it back and forth and feel for any looseness in the system. If it is loose tighten up the adjusting screws.

   NOTE: This should be where the gibs are worn the worst.

2. Turn the X-axis ball screw with a torque wrench and measure the torque. The torque should be less than 13 in/lb. and consistent over the travel of the X-axis. If the measurement is higher than this then loosen the gib. Make sure the cross slide is aligned properly. One easy way to check for this is to remove the yoke bolts and see if the yoke springs back into position. Misalignment is also evident if the torque is higher when the yoke is up against the rear bearing housing.

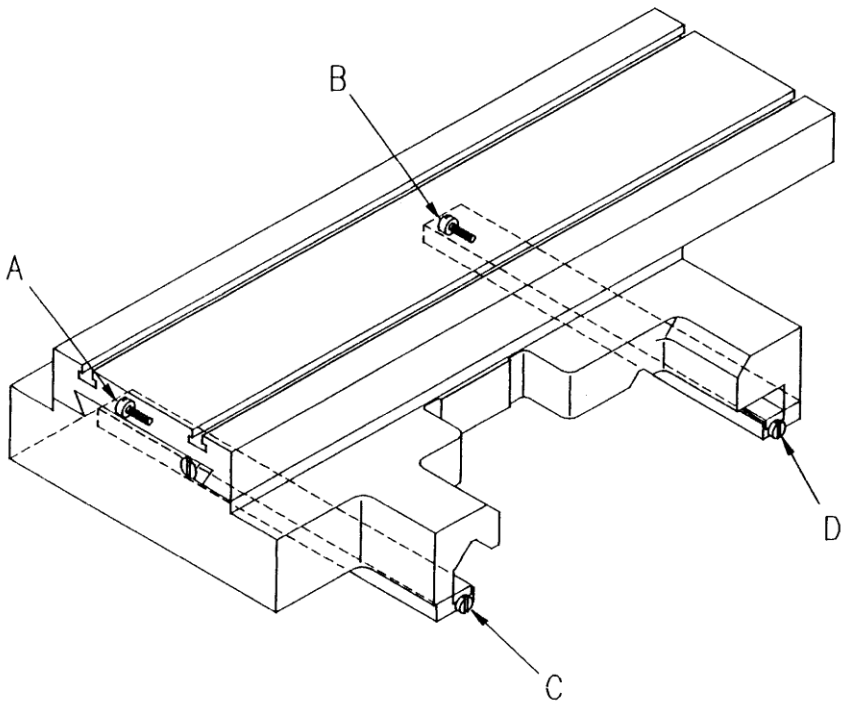


6.2.2.2 Z-Axis Gib Adjustment

1. Mount a dial indicator on the Z axis ways and locate on top of the carriage.

2. Lift the carriage up to measure the amount of play. The dial indicator should not move more than 0.001". If it moves more tighten the gibs. Make sure not to over tighten the gibs.

3. This procedure with the dial indicator will need to be done in the front and rear of the saddle.



6.2.3 Align Z-Axis Ball Screw Assembly

See Figure 9 in Section 7.0.

1. Recheck machine level. Adjust as necessary.
2. Move carriage to middle of travel.
3. Loosen headstock bearing housing and mounting bracket and loosen tailstock bearing housing.
4. Snug but do not tighten the yoke mounting bolts.
5. Move the ball screw manually and move the carriage to the tail stock end.
6. Tighten the yoke, this will align it vertically.
7. Tighten the tailstock bearing housing.
8. Loosen the apron plate and retighten to realign ball horizontally.
9. Using a 3/8" socket extension, move the carriage to the headstock.
10. Tighten the Z-axis housing.

11. Tighten the bearing housing.

12. Turn the ball screw manually with the 3/8" socket extension and move the carriage to the middle of the travel.

13. Loosen the yoke mounting bolts to readjust the apron plate after the bearings have been tightened.

14. Retighten the yoke.

15. Move the ball screw manually and move the carriage through the entire length of the Z-axis. Pay special attention to the areas near the headstock, tailstock, and in the middle of the travel. If there is any binding or rough spots, the alignment procedure must be repeated. The axis should feel equally free throughout the entire range.

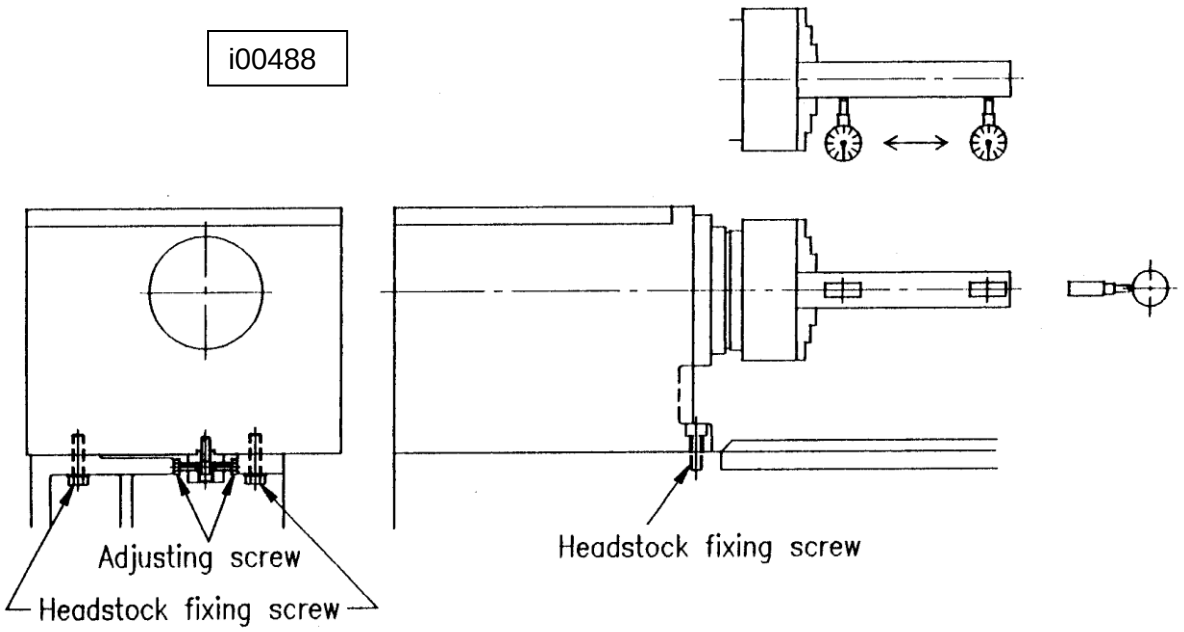
16. Using a torque wrench, measure the torque to move the z-axis at each end, and in the middle of the axis travel. The torque reading should be a maximum of 10-15 in-lb.

6.2.4 Headstock Taper Adjustment

The headstock may be adjusted to remove turning taper if the taper is caused by a lack of parallelism of the headstock to the bed ways. Ensure that the level of the bed is correct prior to any headstock adjustments.

To adjust the headstock alignment, loosen the four socket head cap screws that attach the headstock housing to the bed. Using the adjusting screw located at the rear of the headstock, (see figure on following page) adjust the headstock position in the direction necessary to remove the taper. Note that the headstock will pivot about a pin located between the two front attaching screws. Tighten the attaching screws and test for taper.

To access the front two cap screws the front cover guard will have to be removed.



6.2.5 Spindle Bearing Preload

1. Run the lathe for 10 minutes to insure the bearings are lubricated and slightly warmed. Run the lathe at 500 RPM.
2. Stop lathe and set the gearbox in neutral between medium and high gears. Using the torque wrench, measure the spindle rolling torque. The acceptable range of rolling torque is around 10 in-lb. Note that the torque required to start ("breaking away torque") the spindles rotation will be higher.
3. If torque is out of tolerance. Remove the head stock access panel and loosen the three setscrews on the spindle-adjusting nut (Item 14, Figure 4).
4. Torque too low: Lock the spindle in low gear. With a spanner wrench tighten the adjusting nut. Return the speed selection lever to the neutral position. Measure the rolling torque and repeat until 10 in -lb. of rolling torque is achieved. Tighten the three setscrews to retain the adjustment.
5. Torque too high: Lock the spindle in gear. With a spanner wrench loosen the adjusting nut two full turns. Place an aluminum block over the end of the spindle and with a hammer drive the spindle forward until it is loose. (Near zero rolling torque) With a spanner wrench tighten the adjusting nut. Return the speed selection lever to the neutral position. Measure the rolling torque and repeat until 10 in -lb. of rolling torque is achieved. Tighten the three setscrews to retain the adjustment.

6.2.6 Aligning Tailstock to Spindle

If there is taper appearing on the workpiece while machining by using the tailstock, the tailstock will need to be realigned to the spindle. Follow the steps below.

1. Insert a gage bar between the spindle and tailstock, attach a base of a dial indicator to the saddle, apply the needle of the indicator to the surface of the bar, then move the saddle through the longitudinal travel. Take the measurement of its maximum difference from end to end for later adjustment.

2. Release the 4 bolts labeled "A" in the drawing.

3. Release the screw labeled "B".

4. Adjust screw "C" until the tailstock is aligned with the spindle.

5. Tighten up the locking nuts "A".

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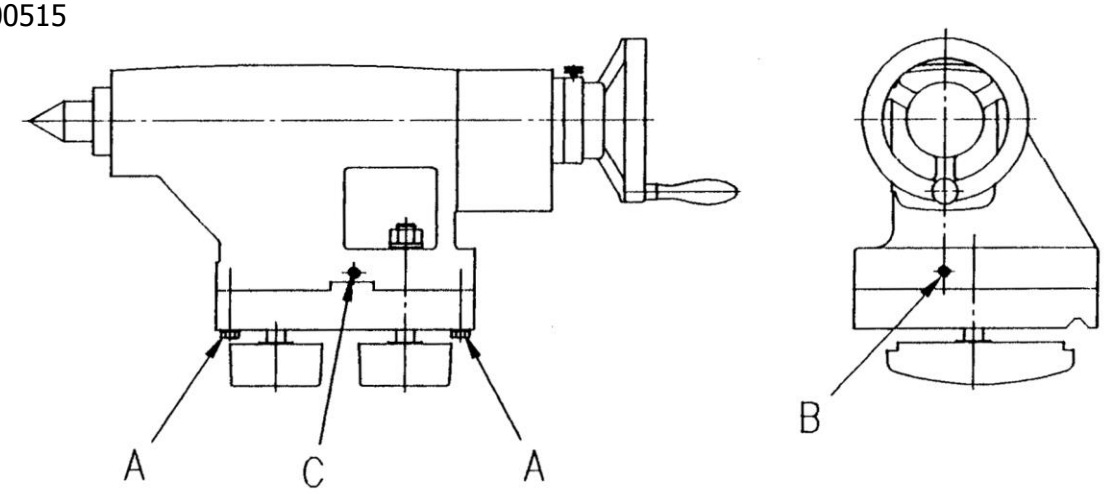


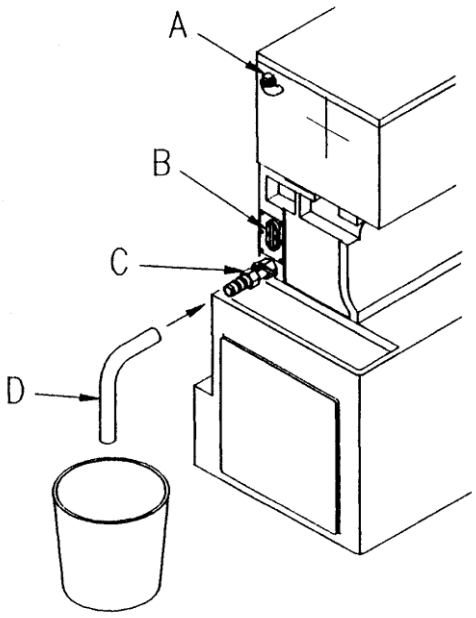
6.2.7 Lubrication

6.2.7.1 Headstock

An oil pump provides lubrication for an even distribution of oil to all the gears and bearings in the headstock. One of the oil lines pumps oil to a site glass located on the headstock. Periodically check to see that oil is flowing. Pressing the E-Stop will shut down this pump. It is recommended the E-stop be pressed at the end of each working day.

The plug to drain the headstock is located under the spindle cover towards the bottom of the casting. See the figure below. Oil can be added to the reservoir by a plug in the top of the headstock cover or by removing the cover and pouring it into the headstock. There is a level site glass located under the spindle cover. The headstock reservoir holds approximately 3 1/2 gallons. Fill the headstock with Mobil DTE 24 oil or an equivalent grade.

The headstock gearbox oil must be drained and flushed after the first 150 hours of operation. A small percentage of kerosene may be added to the gearbox to flush out dirt and sediment. Operate the machine for several minutes without load so that the flushing oil can circulate through the reservoir and remove the dirt. The flushing oil must then be drained and new oil added. Do not flush with solvents that will soften the paint. Thereafter, the oil should be flushed and drained every 1500-2000 hours of operation.



6.2.7.2 Automatic Lubrication Pump – (p/n 21157)

The auto lube system provides centralized automatic lubrication for the cross slide, saddle and ball screws. The lube pumps 2-liter reservoir is serviced with S.A.E. 30 weight oil. The pump is factory set to pump every 60 minutes for 15 seconds. The 60 minutes is based on actual spindle time. There is an internal memory on the pump so the pump will not reset every time the spindle is turned off.

Note: An alarm on the pump will sound if the pump is empty.

The pump output can be regulated electronically to control the pause time between pumping cycles, and the duration of the pumping cycle. The following describes the buttons used program the lube pump. In order to modify any of the settings the spindle must be on.

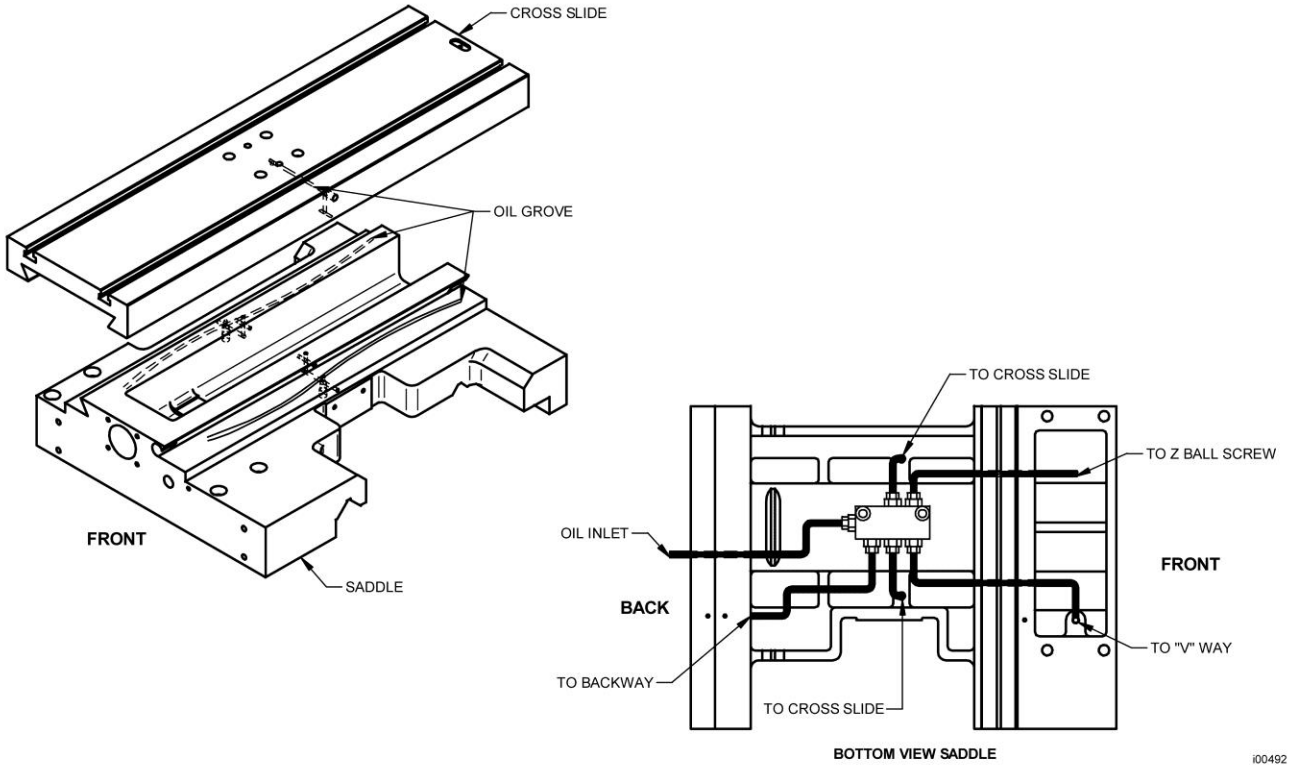
INT (Interval) - this button programs the interval between pumping cycles. Each press of the button increases the interval by one minute.

DIS (Discharge) - this button programs the amount of time the pump will discharge each pumping cycle. Each press of the button increases the discharge time by one minute.

FEED - this button is used to manually feed the ways, ball screws and yokes.

RST - this button tells the pump to discharge for the time programmed.

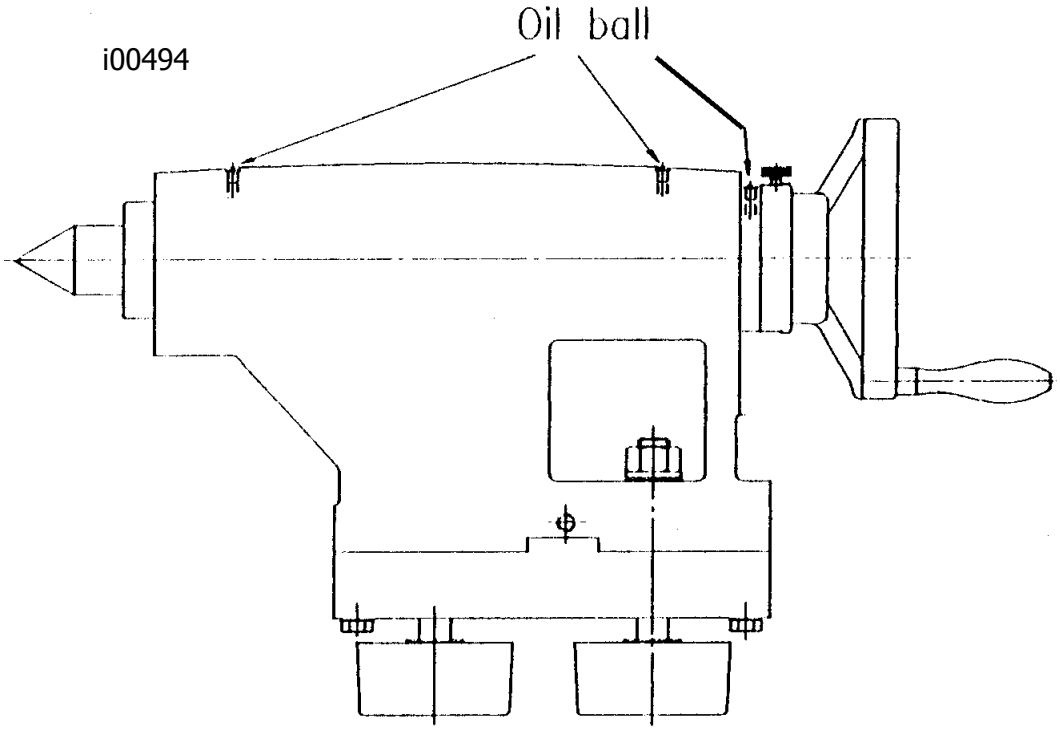
See the figure below for a diagram of the lubrication lines.



Lubrication System

6.2.7.3 Tailstock

Three oilers located on top of the spindle housing lubricate the spindle and screw. The bedways on which the tailstock slides should be cleaned and oiled frequently.



6.2.7.4 Miscellaneous Information

For all oilers on the machine, use medium S.A.E. NO. 30 machine oil. Before filling reservoirs or oil cups, always wipe off with a clean rag any accumulation of old oil, grease or dirt that might get into a part being lubricated.

6.2.7.5 Caution

Do not mix detergent type automotive oil, or multi-purpose oils with the regular grade of S.A.E. No. 30 lubricating oil.

7.0 Drawings

7.1 Bed and Chip Pan

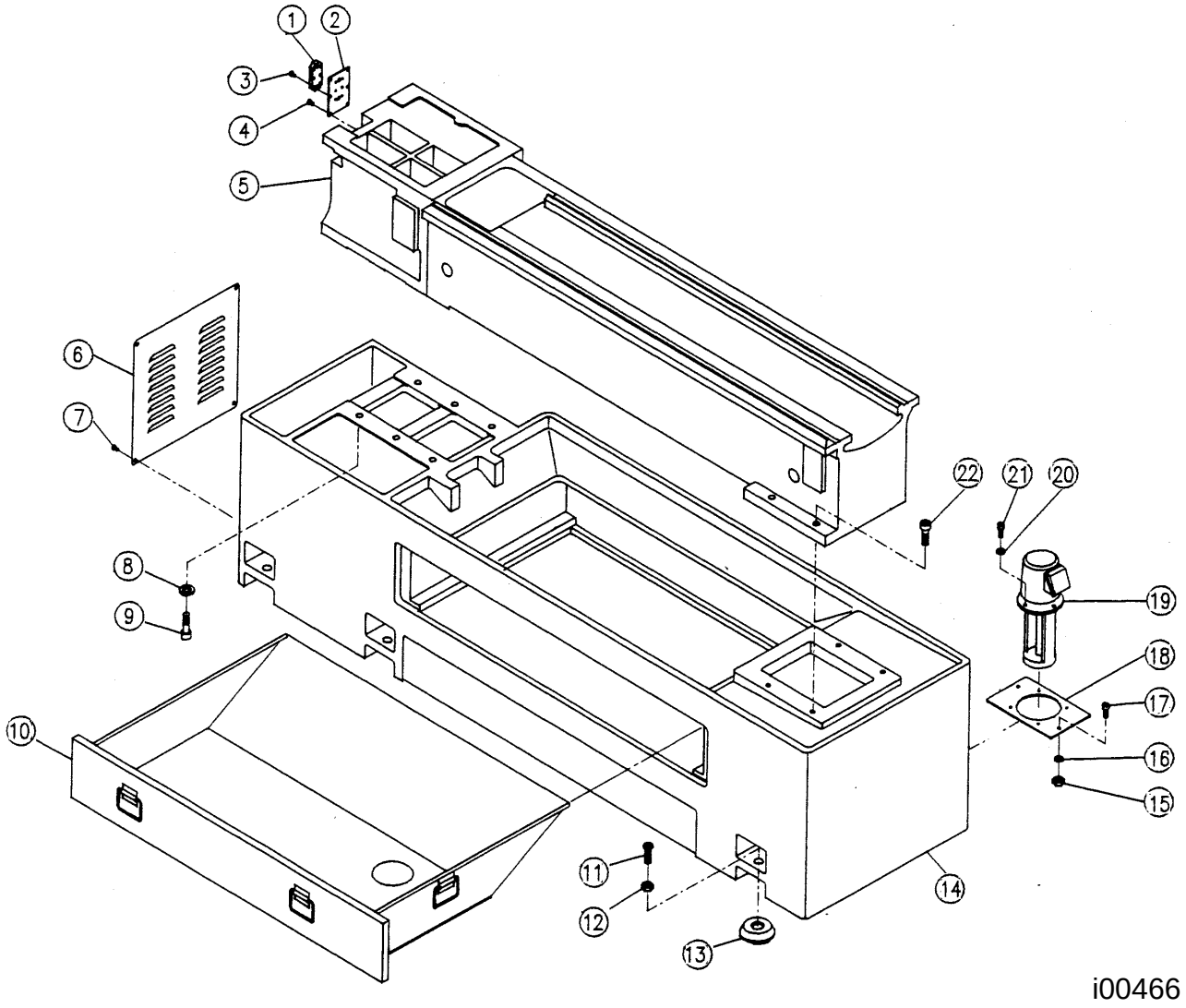


Figure 1 - Bed and Chip Pan

Parts List - Bed and Chip Pan (Figure 1)

NO.	P/N	DESCRIPTION	QTY
1	21239-01	COVER	1
2	21239-02	OIL SIGHT GLASS	1
3	21239-03	ROUND SCREW M5X10L	6
4	21239-04	SOCKET HEAD CAP SCREW M5X10L	6
5	20980	BED	REF
6	21239-06	END COVER	1
7	21239-07	ROUND SCREW M6X8L	4
8	21239-08	SPRING WASHER M16	6
9	21239-09	SOCKET HEAD CAP SCREW M16 X60L	6
10	21239-10	CHIP TRAY	1
11	21239-11	ADJUSTING SCREW	6
12	21239-12	LOCKING NUT	6
13	21239-13	INSTALLATION BLOCK	6
14	21239-14	STAND	1
15	21239-15	HEXAGON NUT M8	2
16	21239-16	SPRING WASHER M8	2
17	21239-17	SOCKET HEAD CAP SCREW M8 X30L	2
18	21239-18	PUMP BRACKET	1
19	21239-19	COOLANT PUMP 1/8HP	1
20	21239-20	SPRING WASHER M6	
21	21239-21	SOCKET HEAD CAP SCREW M6X16L	4
22	21239-22	SOCKET HEAD CAP SCREW M16 X50L	4
23	21239-23	LUBE PUMP-HEADSTOCK	1
24	21239-24	BELT-SPINDLE MOTOR	1
25	21239-25	SPINDLE MOTOR	1
26	21239-26	INVERTER-YASKAWA G5	1
27	21239-27	BRAKE RESISTOR	1
28	21239-28	MAIN ELECTRIC SWITCH	1
29	21239-29	CABLE CARRIER-METAL	1
30	21239-30	MOVING DOOR-GLASS	1
31	21239-31	MOTOR PULLEY-SPINDLE	1
32	21239-32	LUBE PUMP-WAY	1
34	G250	O RING	
35	77A-0616-01	LEAK PLATE	
36	G210	O RING	
37	A-W510DB	WORKLIGHT	

7.2 Control Box Assembly

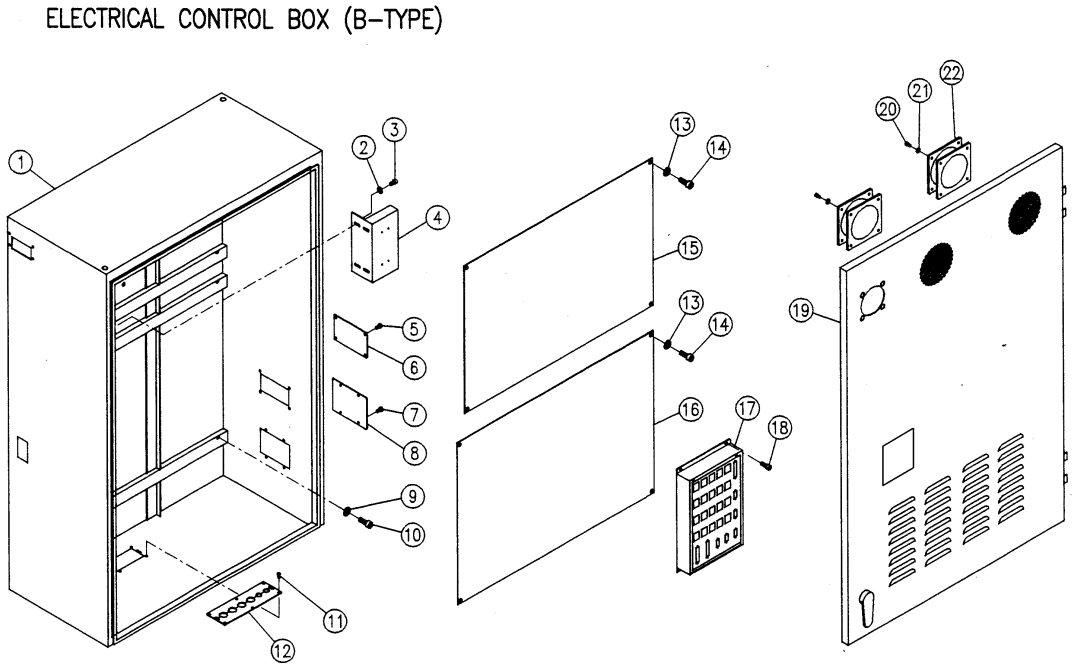


Figure 2 - Control Box Assembly

Parts List - Control Box Assembly (Figure 2)

NO.	P/N	DESCRIPTION	QTY
1	21045-1	ELECTRICAL CONTROL BOX 77B-0606-02	1
2	21238-02	FLAT WASHER M6	4
3	21238-03	SOCKET HEAD CAP SCREW M6X16L	4
4	21238-04	SWITCH SEAT	1
5	21238-05	ROUND SCREW M4X 6L	4
6	21238-06	COVER PLATE	1
7	21238-07	ROUND SCREW M4X 6L	4
8	21238-08	COVER PLATE	1
9	21238-09	FLAT WASHER M8	4
10	21238-10	SOCKET HEAD CAP SCREW M8X 40L	4
11	21238-11	ROUND SCREW M4X 6L	10
12	21238-12	SETTING PLATE	2
13	21238-13	FLAT WASHER M8	8
14	21238-14	SOCKET HEAD CAP SCREW M8X10L	8
15	21238-15	BASE PLATE	1
16	21238-16	BASE PLATE	1
17	21238-17	RELAY CONTACTOR SET SEAT	1
18	21238-18	SOCKET HEAD CAP SCREW M6X10L	4
19	21045-2	ELEC. CONTROL BOX DOOR 77B-0617-00	1
20	21238-20	SOCKET HEAD CAP SCREW M4X 6L	8
21	21238-21	SPRING WASHER M4	8
22	21238-22	FAN 5"	2

7.3 Splash Guard and Cover

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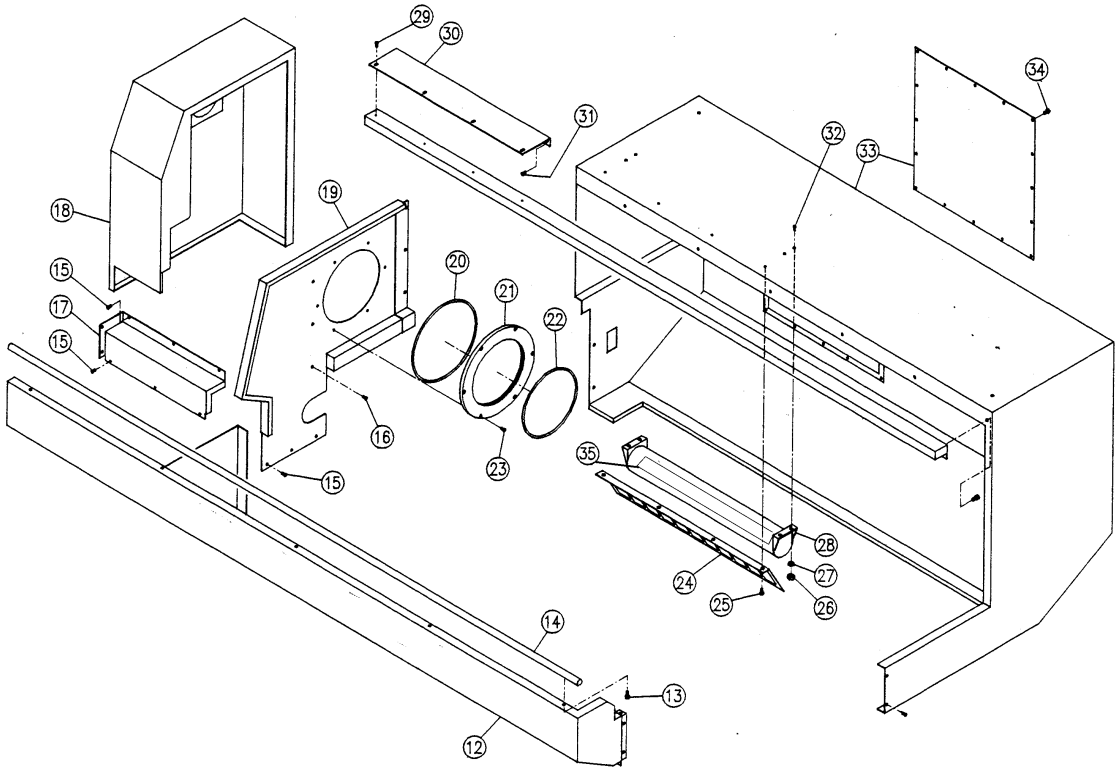


Figure 3 - Splash Guard and Cover

Parts List - Splash Guard and Cover (Figure 3)

NO.	P/N	DESCRIPTION	QTY
12	21241-12	PROTECT COVER (FRONT)	1
13	21241-13	SOCKET HEAD CAP SCREW M6X10L	5
14	21241-14	SLIDE WAY	1
15	21241-15	ROUND SCREW M5X6L	20
16	21241-16	ROUND SCREW M6X10L	5
17	21241-17	Z-AXIS MOTOR PLATE	1
18	21241-18	END COVER	1
19	21241-19	PROTECTOR PLATE	1
20	21241-20	O-RING G250	1
21	21241-21	ANTI-LEAKING PLATE	1
22	21241-22	O-RING G210	1
23	21241-23	SOCKET HEAD CAP SCREW M5X10L	6
24	21241-24	PLATE	1
25	21241-25	ROUND SCREW M5X6L	4
26	21241-26	HEXAGON NUT M6	4
27	21241-27	FLAT WASHER M6	4
28	21241-28	LAMP TUBE	1
29	21241-29	ROUND SCREW M5X6L	4
30	21241-30	SUPPORTING PLATE	1
31	21241-31	ROUND SCREW M5X6L	4
32	21241-32	ROUND SCREW M6X16L	4
33	21241-33	REAR PROTECTOR COVER	1
34	21241-34	ROUND SCREW M5X6L	16

7.4 Headstock Assembly

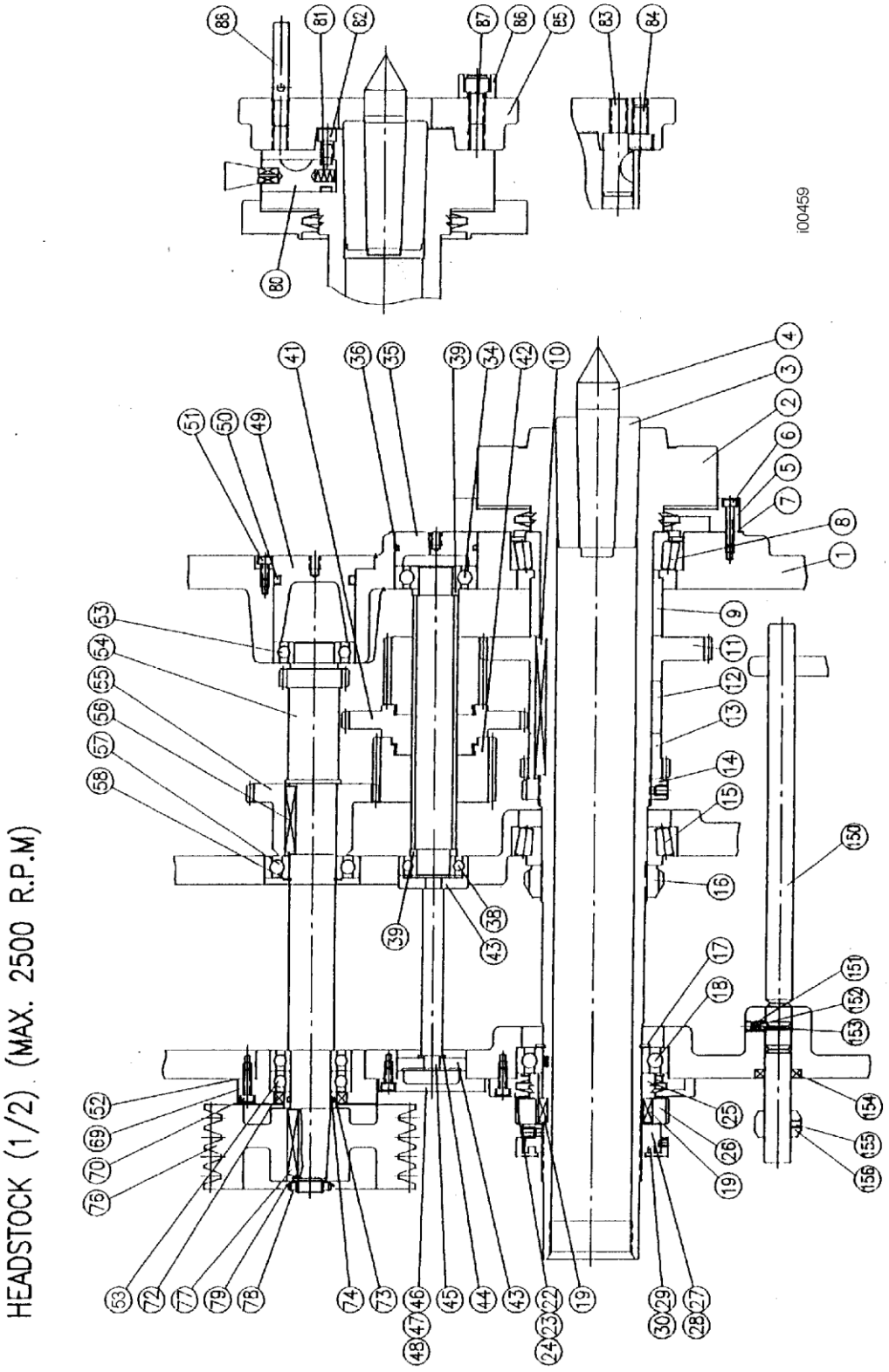


Figure 4 - Headstock Assembly

7.4.1 Headstock Assembly

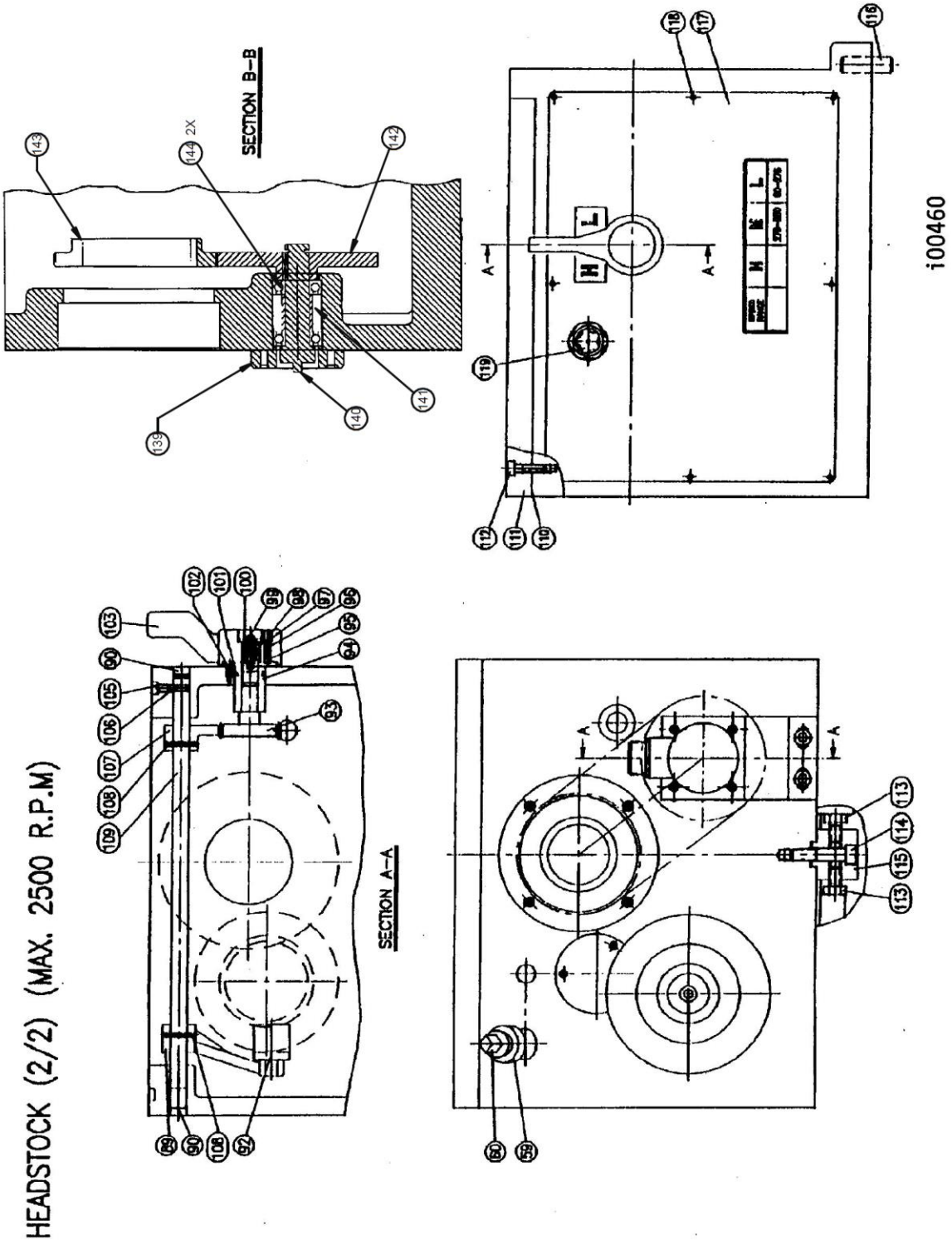


Figure 5 - Headstock Assembly

Parts List - Headstock Assembly (Figures 4 & 5)

NO.	P/N	DESCRIPTION	QTY
1	21234-001	HEADSTOCK CASTING	1
2	21234-002	SPINDLE D1-6	1
3	21234-003	CENTER SLEEVE	1
4	21234-004	CENTER	1
5	21234-005	BEARING COVER (FRONT) D1-6	1
6	21234-006	SOCKET HEAD CAP SCREW M6X30L	6
7	21234-007	PACKING	1
8	21234-008	TAPER ROLLER BEARING #32017XC/P5	1
9	21234-009	SPACER	1
10	21234-010	DOUBLE ROUND HEAD KEY 10X8X105L	1
11	21234-011	LOW SPEED GEAR	1
12	21234-012	SPACER	1
13	21234-013	HIGH SPEED GEAR	1
14	21234-014	LOCKING NUT	1
15	21234-015	TAPER ROLLER BEARING #32016XC/P5	1
16	21234-016	LOCKING NUT	1
17	21234-017	RETAINING RING #STW75	1
18	21234-018	TAPER ROLLER BEARING #6015	1
19	21234-019	DOUBLE ROUND HEAD KEY 8X7X18L	2
22	21234-022	PACKING	1
23	21234-023	BEARING COVER (REAR)	1
24	21234-024	SOCKET HEAD CAP SCREW M6X16L	4
25	21234-025	SPACER	4
26	21234-026	SYNCHRONOUS BELT	1
27	21234-027	DYNAMIC BALANCING COLLAR	1
28	21234-028	SOCKET HEAD SET SCREW M8X8L	2
29	21234-029	DYNAMIC BALANCING BLOCK	3
30	21234-030	SOCKET HEAD SET SCREW M6X8L	6
34	21234-034	DEEP GROOVE BALL BEAR #6305	1
35	21234-035	BEARING PLUG	1
36	21234-036	O-RING G55	1
37	21234-037	SHAFT	1
38	21234-038	DEEP GROOVE BALL BEAR #6205	1
39	21234-039	SPACER	2
41	24919	CLUSTER GEAR & SHAFT ASSEMBLY	1

Parts List - Headstock Assembly (Figures 4 & 5)

42	21234-042	GEAR	1
43	21234-043	SPACER	2
44	21234-044	WASHER	1
45	21234-045	ROD	1
46	21234-046	PACKING	1
47	21234-047	BEARING PLUG	1
48	21234-048	SOCKET HEAD CAP SCREW M6X12L	3
49	21234-049	BEARING COVER	1
50	21234-050	O-RING P52	1
51	21234-051	SOCKET HEAD CAP SCREW M6X12L	3
52	21234-052	PACKING	1
53	21234-053	DEEP GROOVE BALL BEAR #6206	1
54	21234-054	INPUT SHAFT	1
55	21234-055	GEAR	1
56	21234-056	DOUBLE ROUND HEAD KEY 8X8X50L	1
57	21234-057	DEEP GROOVE BALL BEAR #6207	1
58	21234-058	RETAINING RING	1
59	21234-059	ELBOW	1
60	21234-060	DRAIN PLUG	1
69	21234-069	COVER	1
70	21234-070	SOCKET HEAD CAP SCREW M6X20L	3
71	21234-071	DEEP GROOVE BALL BEAR #6206	2
72	21234-072	OIL SEAL TC38X55X8	1
73	21234-073	SPACER	1
76	21234-076	PULLEY	1
77	21234-077	DOUBLE ROUND HEAD KEY 10X8X50L	1
78	21234-078	LOCKING NUT AN04	1
79	21234-079	LOCK WASHER WAN04	1
80	21234-080	CAM	6
81	21234-081	DETENT SPRING	6
82	21234-082	DETENT SCREW	6
83	21234-083	CAM STUD	6
84	21234-084	SOCKET HEAD CAP SCREW 3/8-16UNCX16L	6
85	21234-085	DRIVING PLATE	1
86	21234-086	DRIVING COLLAR	1

Parts List - Headstock Assembly (Figures 4 & 5)

87	21234-087	SOCKET HEAD CAP SCREW M12X25L	1
88	21234-088	DRIVING PIN	2
89	21234-089	SHIFTING ARM	1
90	21234-090	PLUG	2
92	21234-092	SHIFTING FORK	1
93	21234-093	CHANGE SPEED SHAFT	1
94	21234-094	SLEEVE	1
95	21234-095	STEEL BALL Ø1/4	1
96	21234-096	COMPRESSION SPRING Ø6XØ0.8X30L	1
97	21234-097	SOCKET HEAD SET SCREW M8X8L	1
98	21234-098	DOUBLE ROUND HEAD KEY 5X15L	1
99	21234-099	SCREW	1
100	21234-100	WASHER	2
101	21234-101	O-RING P24	1
102	21234-102	SOCKET HEAD SET SCREW M5X12L	2
103	21234-103	KNOB	1
105	21234-105	SOCKET HEAD SET SCREW M8X8L	2
106	21234-106	STEEL BALL	1
107	21234-107	QUADRANT GEAR	1
108	21234-108	SPRING PIN Ø5X30L	2
109	21234-109	CHANGE SPEED ROD	1
110	21234-110	PACKING	1
111	21234-111	HEADSTOCK COVER	1
112	21234-112	SOCKET HEAD CAP SCREW M8X30L	6
113	21234-113	SOCKET HEAD CAP SCREW M12X25L	1
114	21234-114	SOCKET HEAD CAP SCREW M12X55L	1
115	21234-115	ADJUSTING BLOCK	1
116	21234-116	POSITIONING PIN	1
117	21234-117	HEADSTOCK NAME PLATE	1
118	21234-118	REVIT Ø2X5L	8
119	21234-119	OIL SIGHT GLASS	1
121	21234-121	COLLAR	1
122	21234-122	DOUBLE ROUND HEAD KEY 5X5X20L	1
123	21234-123	DEEP GROOVE BALL BEAR #6006ZZ	2
124	21234-124	INTERNAL RING	1

Parts List - Headstock Assembly (Figures 4 & 5)

125	21234-125	SYNCHRONOUS BELT 270L050	1
126	21234-126	SYNCHRONOUS PULLEY	1
127	21234-127	DOUBLE ROUND HEAD KEY 5X5X20L	1
128	21234-128	WASHER Ø8.5XØ30X3T	1
129	21234-129	SPRING WASHER M8	1
130	21234-130	SOCKET HEAD CAP SCREW M8 X25L	1
131	21234-131	SHAFT	1
132	21234-132	EXTERNAL RING	1
133	21234-133	BRACKET	1
134	21234-134	SOCKET HEAD CAP SCREW M10 X30L	2
135	21234-135	FLAT WASHER M10	2
136	21234-136	SPEED CODER	1
137	21234-137	SOCKET HEAD CAP SCREW M5X25L	4
138	21234-138	SPRING WASHER M5	4
150	21234-150	POSITION CHECK ROD	1
151	21234-151	SOCKET HEAD SET SCREW M8 X8L	1
152	21234-152	COMPRESSION SPRING	1
153	21234-153	STEEL BALL Ø1/4	1
154	21234-154	OIL SEAL TC20X35X7	1
155	21234-155	SET SCREW M6X8L	1
156	21234-156	TOUCH BLOCK	1
157	21037	HEADSTOCK ASSY MODIFICATIONS	1

7.5 Tailstock Assembly

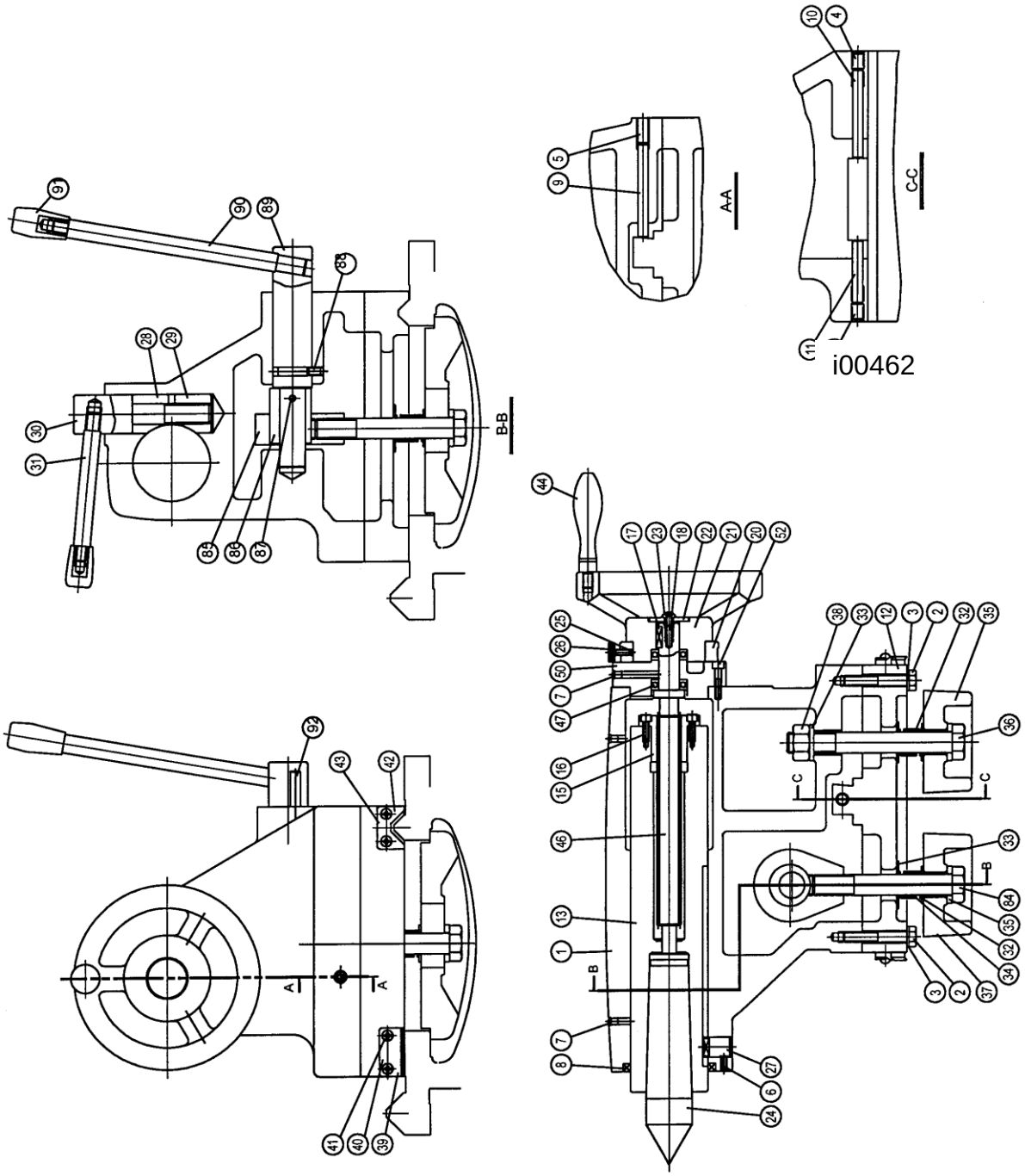


Figure 6 - Tailstock Assembly

Parts List - Tailstock Assembly (Figure 6)

NO.	P/N	DESCRIPTION	QTY
1	21236-01	TAILSTOCK BODY	1
2	21236-02	SOCKET HEAD CAP SCREW M10X60L	2
3	21236-03	FLAT WAHER M10	2
4	21236-04	SOCKET HEAD SET SCREW M12X16L	2
5	21236-05	SOCKET HEAD SET SCREW M12X25L	1
6	21236-06	SOCKET HEAD SET SCREW M6X10L	1
7	21236-07	BALL CUP 1/4"	2
8	21236-08	OIL SEAL TC75X90X8	1
9	21236-09	STRAIGHT PIN 10X85L	1
10	21236-10	STRAIGHT PIN 10X60L	1
11	21236-11	STRAIGHT PIN 10X90L	1
12	21236-12	TAILSTOCK BASE	1
13	21236-13	SLEEVE	1
15	21236-15	FEED SCREW NUT IMPERIAL	1
16	21236-16	SOCKET HEAD CAP SCREW M6X12L	4
17	21236-17	DOUBLE ROUND HEAD KEY 6X6X20L	1
18	21236-18	SOCKET HEAD SET SCREW M5X20L	1
20	21236-20	DIAL- INCH	1
21	21236-21	HANDWHEEL	1
22	21236-22	WASHER	1
23	21236-23	SCREW	1
24	21236-24	CENTER	1
25	21236-25	BRASS PAD	1
26	21236-26	ROUND SCREW	1
27	21236-27	PIN	1
28	21236-28	LOCKING BLOCK	1
29	21236-29	CLAMPING BLOCK	1
30	21236-30	LOCKING ROD	1
31	21236-31	SHIFTING ROD	1
32	21236-32	FLAT WASHER	2
33	21236-33	FLAT WASHER	2
34	21236-34	COMPRESSION SPRING	2
35	21236-35	FLAT WASHER	3
36	21236-36	HEXAGON SCREW M20X160L	1
37	21236-37	CLAMPING BLOCK	2
38	21236-38	HEXAGON NUT M20XP2.0	1

Parts List - Tailstock Assembly (Figure 6)

39	21236-39	BEDWAY WIPER	2
40	21236-40	BEDWAY WIPER PLATE	2
41	21236-41	CROSS RECESS HEAD SCREW M6X16L	8
42	21236-42	BEDWAY WIPER	2
43	21236-43	BEDWAY WIPER PLATE	2
44	21236-44	KNOB	1
46	21236-46	FEED SCREW IMPERIAL	1
47	21236-47	THRUST BEARING # 51104	2
50	21236-50	BRACKET	1
52	21236-52	SOCKET HEAD CAP SCREW M6X16L	4
84	21236-84	HEXAGON SCREW M20X125L	1
85	21236-85	ADJUSTING BLOCK	1
86	21236-86	ECCENTRIC COLLAR	1
87	21236-87	SPRING PIN 6X40L	1
88	21236-88	SOCKET HEAD SET SCREW M8X 12L	1
89	21236-89	SHAFT	1
90	21236-90	LEVER	1
91	21236-91	KNOB	1
92	21236-92	STUD	1
93	21247	NUT AND FEED SCREW ASSY	1

7.6 Drive Assembly

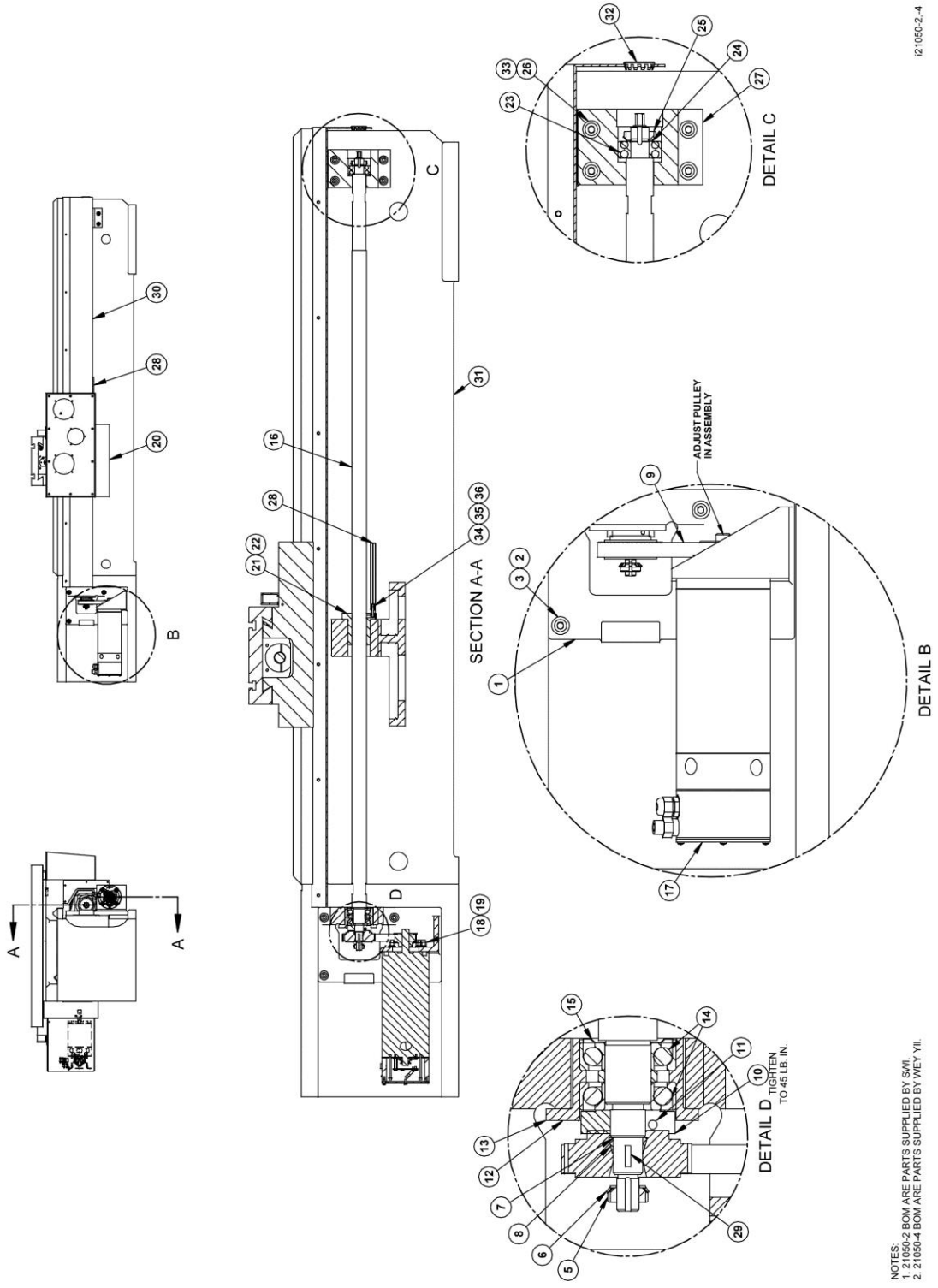


Figure 9 - Drive Assembly

Parts List - Drive Assembly Z-Axis (Figure 9)

NO.	P/N	DESCRIPTION	QTY
1	20961	HOUSING Z-AXIS	1
2	M12-1.75X 35 25B	SCREW-SHCS-STL-BO	4
3	M12 73B	WASHER-SPLIT LOCK-STL-BO	1
4	20011	ENCODER ASSY-Z AXIS	REF
5	NO1	NUT-LOCK	REF
6	WO1	WASHER-LOCK	REF
7	16983-1	PULLEY	REF
8	16350	FERRULE	REF
9	400-5M-15	TIMING BELT	REF
10	16452	NUT-CLAMP	REF
11	10-32 X 3/4 25B	SCREW-SHCS-STL-BO	REF
12	M8-1.25 X 30 25B	SCREW-SHCS-STL-BO	REF
13	16295-1	HOUSING-BEARING	REF
14	20374	BEARING-ANGULAR CONTACT 7205	REF
15	7205 AVH	RING-NILOS	REF
16	21025	BALLSCREW ASSY-Z AXIS	REF
17	16775-1	MOTOR-Z AXIS	REF
18	15759	WASHER-FLAT	REF
19	1/4-20 X 1 1/4 25B	SCREW-SHCS-STL-BO	REF
20	20995	YOKE-Z AXIS	1
21	M8-1.25 X 30 25B	SCREW-SHCS-STL-BO	REF
22	M8 73B	WASHER-SPLIT LOCK-STL-BO	REF
23	2204E-2RS1-TN9	BEARING-SELF ALIGNING	REF
24	W04	WASHER-LOCK	REF
25	N04	NUT LOCK	REF
26	M12-1.75X45 25B	SCREW-SHCS-STL-BO	4
27	20962	HOUSING-TAILSTOCK BEARING	1
28	20086-3	STOP	REF
29	98481A090	KEY-WOODRUFF #3 (1/8 X 1/2)	REF
30	20999	COVER-TRL 1840 Z AXIS	1
31	20980	BED-MODIFIED	1
32	21155	PLUG-BALLSCREW COVER	REF
33	M12 73B	WASHER-LOCK SPLIT-STL-BO	4
34	185210	CONTROL UNIT CSA5	REF
35	186251	COMPRESSION NUT	REF
36	106254	COMPRESSION SLEEVE	REF
37	21050-4A	CHIP WIPER-LEFT 77A-0317-00	1
38	21050-4B	CHIP WIPER-RIGHT 77A-0316-00	1

7.7 Drive Assembly X-Axis

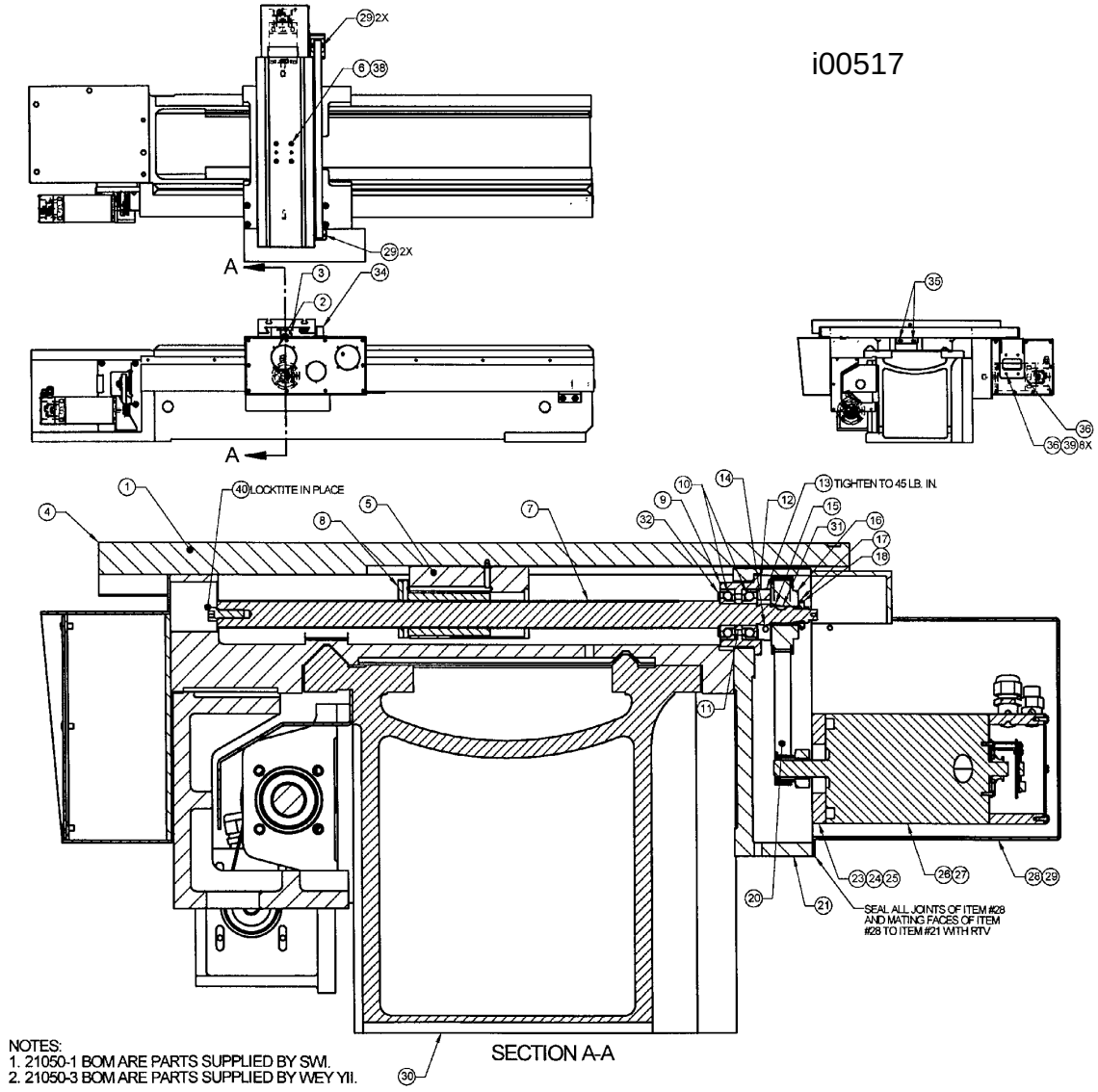


Figure 10 - Drive Assembly X-Axis

Parts List - Drive Assembly X-Axis (Figure 10)

NO.	P/N	DESCRIPTION	QTY
1	20982	SADDLE-TRL 1840 CSS	1
2	20996	COVER PLATE-TRL 1840 X AXIS	1
3	M6-1.0X12 25B	SCREW-BHCS-STL-BO	6
4	20981	CROSS SLIDE-TRL 1840 CSS X AXIS	1
5	20960	YOKE-TRL 1840 X AXIS	1
6	M8-1.25X30 25B	SCREW-SHCS-STL-BO	1
7	20984	BALLSCREW-X AXIS TRL 1840CSS	REF
8	5/16-18X1.0 25B	SCREW-SHCS-STL-BO	REF
9	16300-1	BEARING HSG	REF
10	20373	BEARING-7204	REF
11	15885	BEARING RING	REF
12	M6-1.0X25 25B	SCREW-SHCS-STL-BO	REF
13	16314	CLAMP NUT	REF
14	10-32X3/4 25B	SCREW-SHCS-STL-BO	REF
15	16350	FERRULE	REF
16	16983-1	PULLEY	REF
17	W02	WASHER-LOCK	REF
18	16918	NUT-LOCK	REF
19	20986	ENCODER ASSY-X AXIS TRL 1840	REF
20	425-5M-15	TIMINING BELT	REF
21	20953	BRACKET-MOTOR MOUNTING	1
22	M10-1.5X80 25B	SCREW-SHCS-STL-BO	4
23	20958	PLATE-MOTOR SLIDE	1
24	M8 73B	WASHER-LOCK SPLIT-STL-BO	REF
25	M8-1.25X30 25B	SCREW-SHCS-STL-BO	REF
26	16385	MOTOR-X AXIS	REF
27	1/4-20X1.25 25B	SCREW-SHCS-STL-BO	REF
28	20957	COVER-X AXIS MOTOR	1
29	M5-0.8X10 27B	SCREW-BHCS-STL-BO	1
30	20980	BED-TRL 1840 CSS	1
31	98481A090	WOODKEY #3	REF
32	7204JVH	NILOS RING-JVH 7204	REF
33	1/4 73B	WASHER-SPLIT LOCK-STL-BO	REF
34	20988	CABLE WAY	1
35	M6-1.0X14 25B	SCREW-SHCS-STL-BO	6
36	20987	CONNECTOR-CABLE WAY	1
37	M6-1.0X20 25B	SCREW-SHCS-STL-BO	3
38	93501A030	WASHER-SEREATED BELLEVILLE 5/16	REF

Parts List - Drive Assembly X-Axis (Figure 10)

39	M6 71B	WASHER-SAE FLAT-STL-BO	REF
40	M8-1.25X20 25B	SCREW-SHCS-STL-BO	REF
41	21050-3A	CHIP WIPER-SADDLE LF & RH 50-0360-00	1
42	21050-3B	CHIP WIPER-SADDLE FLAT 50-0364-00	1
43	21050-3C	VALVE 50-06166-00	1
44	21050-3D	COOLANT HOSE 50-06167-00	1
45	21050-3E	NOZZLE 50-06168-00	1
46	21050-3F	GIB-Z AXIS 77A-0216-00	1
47	21050-3G	GIB-X AXIS 77A-0217-00	1
48	21050-3H	CHIP WIPER 77A-0244-00	1
49	21050-3J	CHIP WIPER 77A-0245-00	1

7.8 Apron Assembly

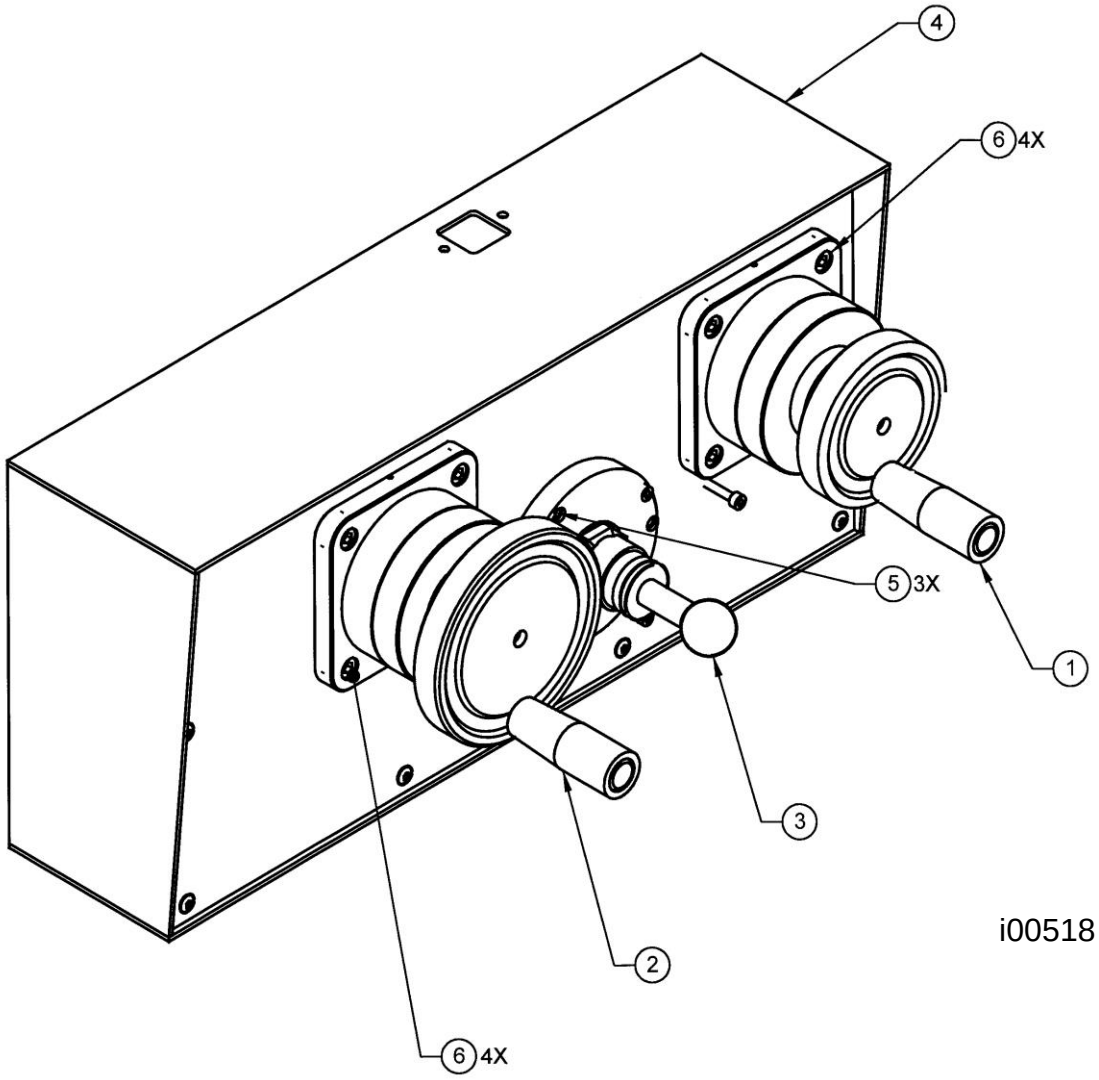


Figure 11 & Parts List Shown - Apron Assembly 21051.xls

NO.	P/N	DESCRIPTION	QTY
1	20082-2	HAND WHEEL ELECTRONIC -X AXIS	1
2	20082-3	HAND WHEEL ELECTRONIC -Z AXIS	1
3	20295	JOGSTICK CONTROL	1
4	21046	PANEL HOUSING ASSY	REF
5	M4-.7X18 25B	SCREW - SHCS - STL - BO	3
6	M6-1.0X12 25B	SCREW - SHCS - STL - BO	8

7.9 Spindle/Coolant/E-Stop Switch Box

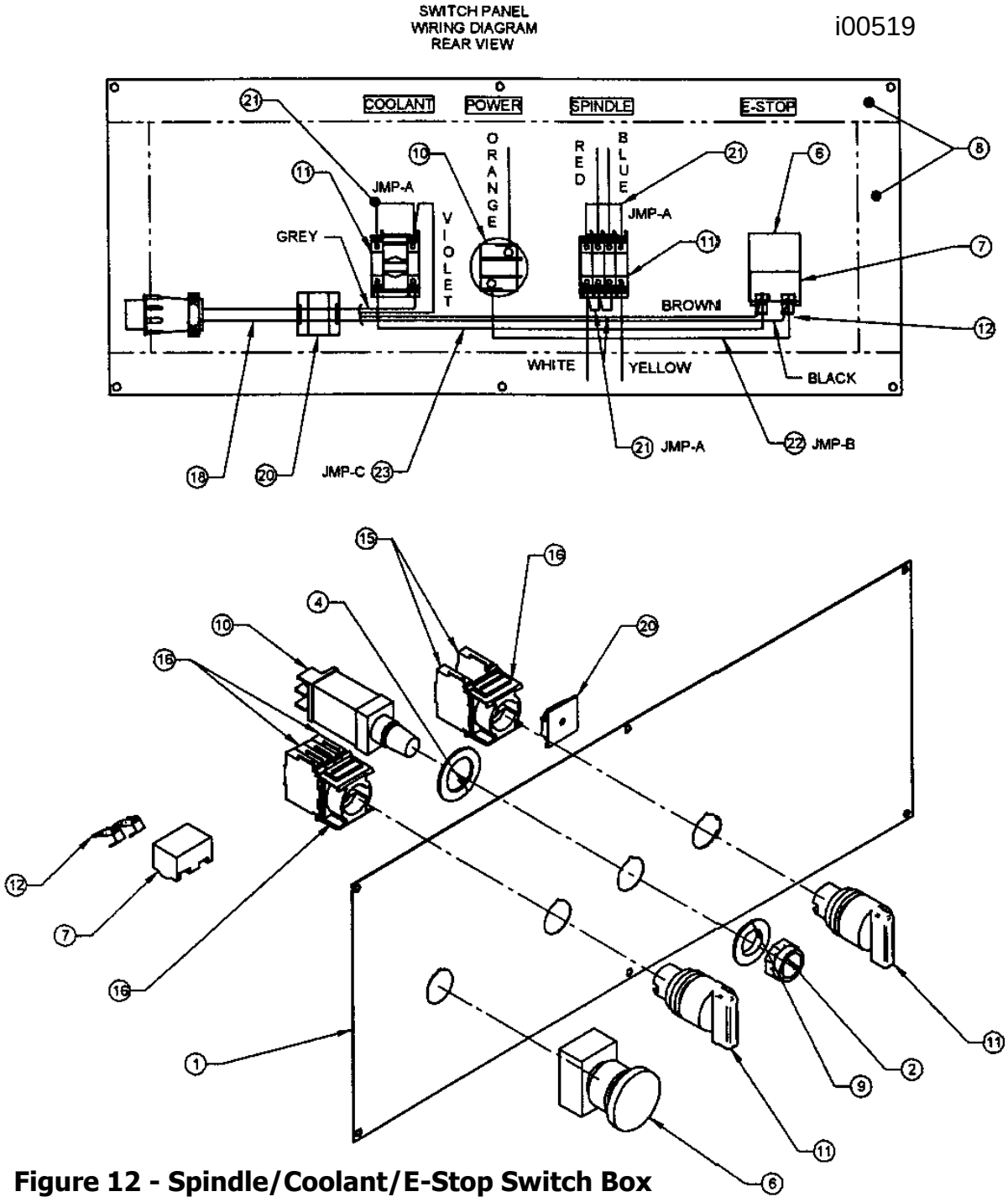
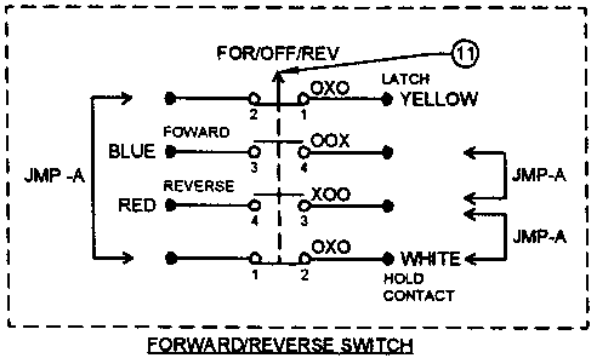
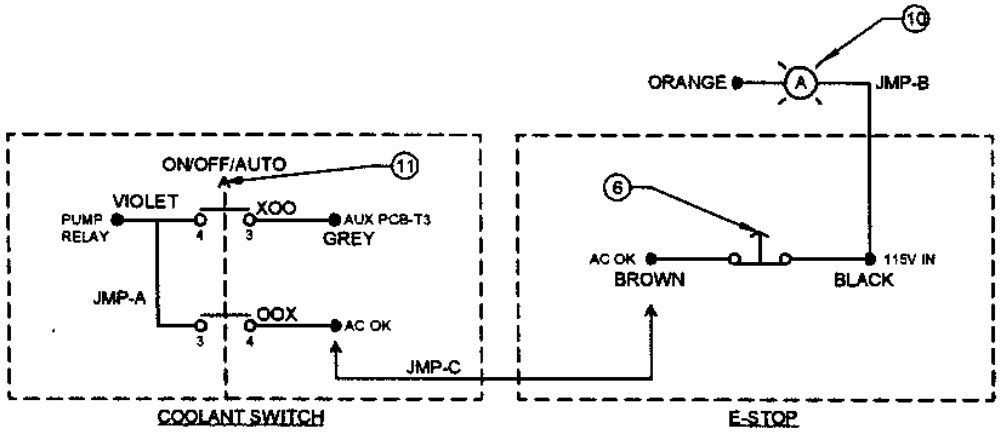


Figure 12 - Spindle/Coolant/E-Stop Switch Box



FORWARD/REVERSE SWITCH

SWITCH PANEL WIRING CHART			
PANEL TB'S	AMP CPC #	COLOR	DESCRIPTION
1	1	BLUE	FORWARD
2	2	RED	REVERSE
3	3	YEL	LATCH
4	4	WHT	HOLD CONTACT
5	5	VIO	PUMP RELAY
6	6	ORG	NEUTRAL
W	7	GREY	AUTO - COOLANT
8	8	BRN	115V RETURN
9	9	BLK	115V IN
		BLK	JUMPER - A (4)
		BLK	JUMPER - B
		BLK	JUMPER - C



COOLANT SWITCH

E-STOP

Parts List & Wiring Chart - Spindle/Coolant/E-Stop Switch Box (Figure 12)

				25
				24
1	SWI	21225	WIRE ASSY - INTERNAL SWITCH PANEL	23
1	SWI	21224	WIRE ASSY - INTERNAL SWITCH PANEL	22
4	SWI	21223	JUMPER-INTERNAL SWITCH PANEL	21
1	CAL SWITCH	ARC-68-A-C	CABLE CLINCHER	20
				19
1	SWI	21118	CABLE-INTERNAL	18
6		M4x9mm	SCREW,PAN HD, STL. BLACK OXIDE	17
2	ALLEN-BRADLEY	800E-4LX11	CONTACT CARTRIDGE, N.O. & N.C. WITH LATCH	16
2	ALLEN-BRADLEY	800E-4X10	CONTACT CARTRIDGE, N.O.	15
				14
				13
2	VOLTREX	MMF-X0-2525	Y TERMINAL	12
2	ALLEN-BRADLEY	800EP-HM32	SWITCH SELECTOR	11
1	ALLEN-BRADLEY	800T-PS16A	LAMP,PILOT,AMBER	10
1	SWI	17084	BUSHING LAMP	9
1	T & W CONV.	1/32 x 1/2 WIDE	TAPE,FOAM, ADHESIVE,CHARCOAL COLOR,4.5 FT	8
1	ALCO ELECTRONICS	F40	CONTACT BLOCK-QUICK CONNECT	7
1	ALCO ELECTRONICS	RM065	E-STOP-PUSHBUTTON W METAL BUSHINGS	6
				5
1	McMASTER	3088A471	SHIM, 7/8 x 1 3/8 x .062	4
				3
1	SWI	17085	NUT, LAMP	2
1	SWI	21123	PANEL	1
QTY	VENDOR	PART NUMBER	DESCRIPTION	NO.

7.10 Auxiliary Function Box

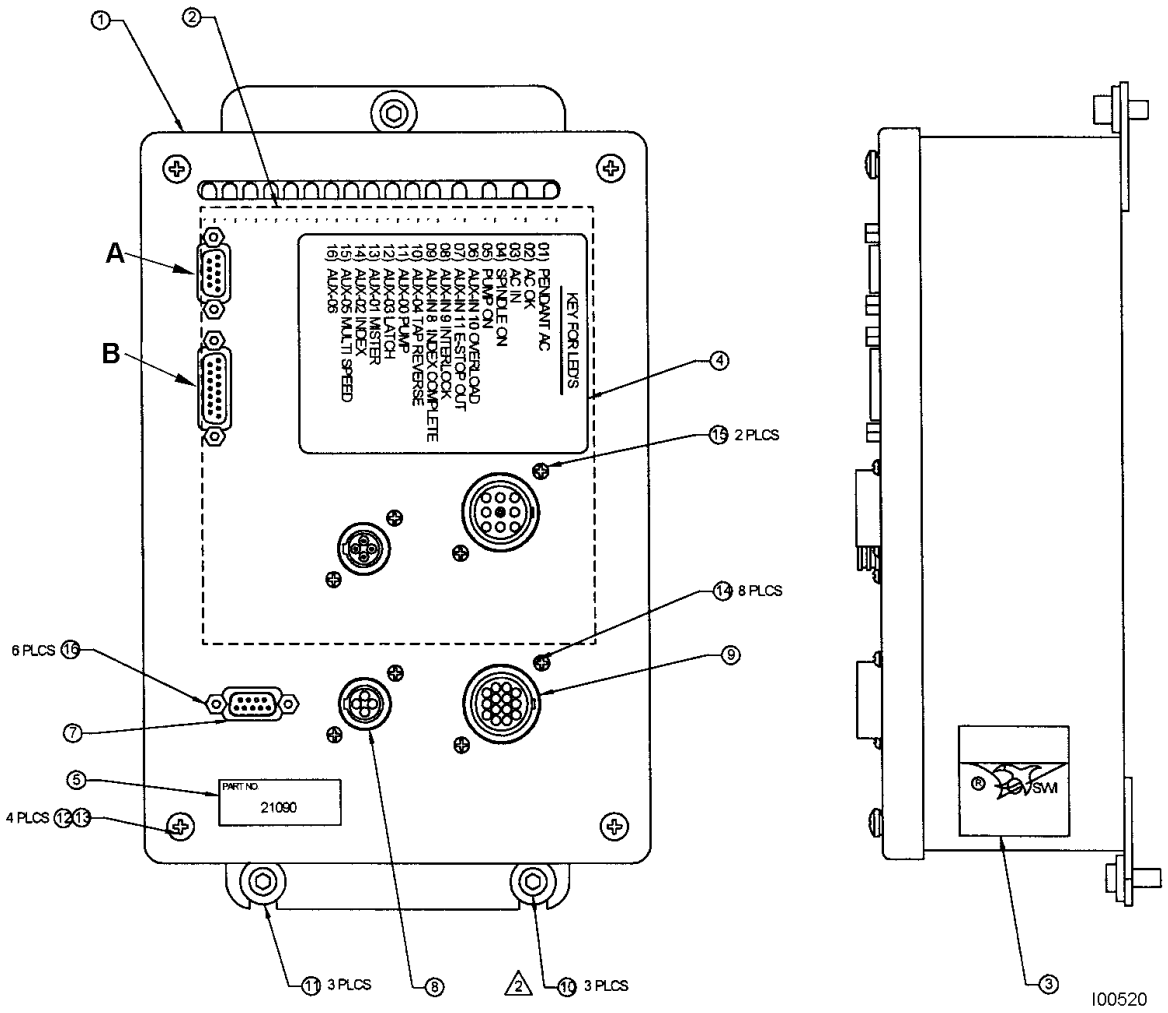
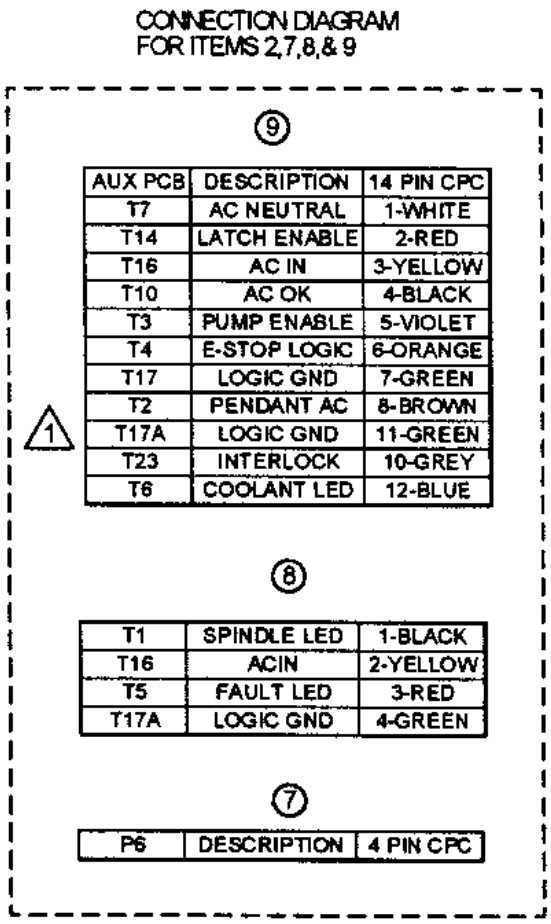


Figure 13 - Auxiliary Function Box

Item A	Unfiltered RPM command from computer module.
Item B	Auxiliary functions in, signals to LED's.
Item 7	Sends filtered RPM command to AC drive.
Item 8	Signal from auxiliary box to AC drive. Activates LED if drive faults.
Item 9	Used to bring AC in, power LED's, E-Stop interlock, Auto Coolant feature, spindle on/off.



Parts List & Wiring Chart - Auxiliary Function Box (Figure 13)

QTY	VENDOR	PART NUMBER	DESCRIPTION	NO.
6		DA 001A	4-40 JACK SCREW	16
2		# 4-40 2 NC KEP NUT	NUT- EXT TOOTH LOCKWASHER	15
8		# 4-40X0.38 20B	SCREW-PHL PAN EXT SEMS STL B/OX	14
4		# 10 73B	WASHER-LOCK-STL-BO	13
4		#10-32X0.50 10B	SCREW-PH-PHIL-STL-BO	12
3		15759	WASHER-THICK	11
3		1/4-20X0.50 25B	SCREW-SHCS-STL-BO	10
1	SWI	21132	14 PIN CPC INTERNAL CABLE	9
1	SWI	21131	AUX BOX INTERNAL CABLE	8
1	SWI	21212	CABLE ASSY SERIAL	7
2	NEWARK	MMF-XO-2525	TERMINAL	6
1	SWI	21360	LABEL- PART NO.	5
1	SWI	21361	LABEL- KEY FOR LED'S	4
1	NELSON NAMEPLATE	14786	LABEL- SWI LOGO	3
1	SWI	20990-1	PCB- ASSY AUX # 2	2
1	SWI	21078	ENCLOSURE- WEYH	1

I00532

7.10 Pendant Bracket

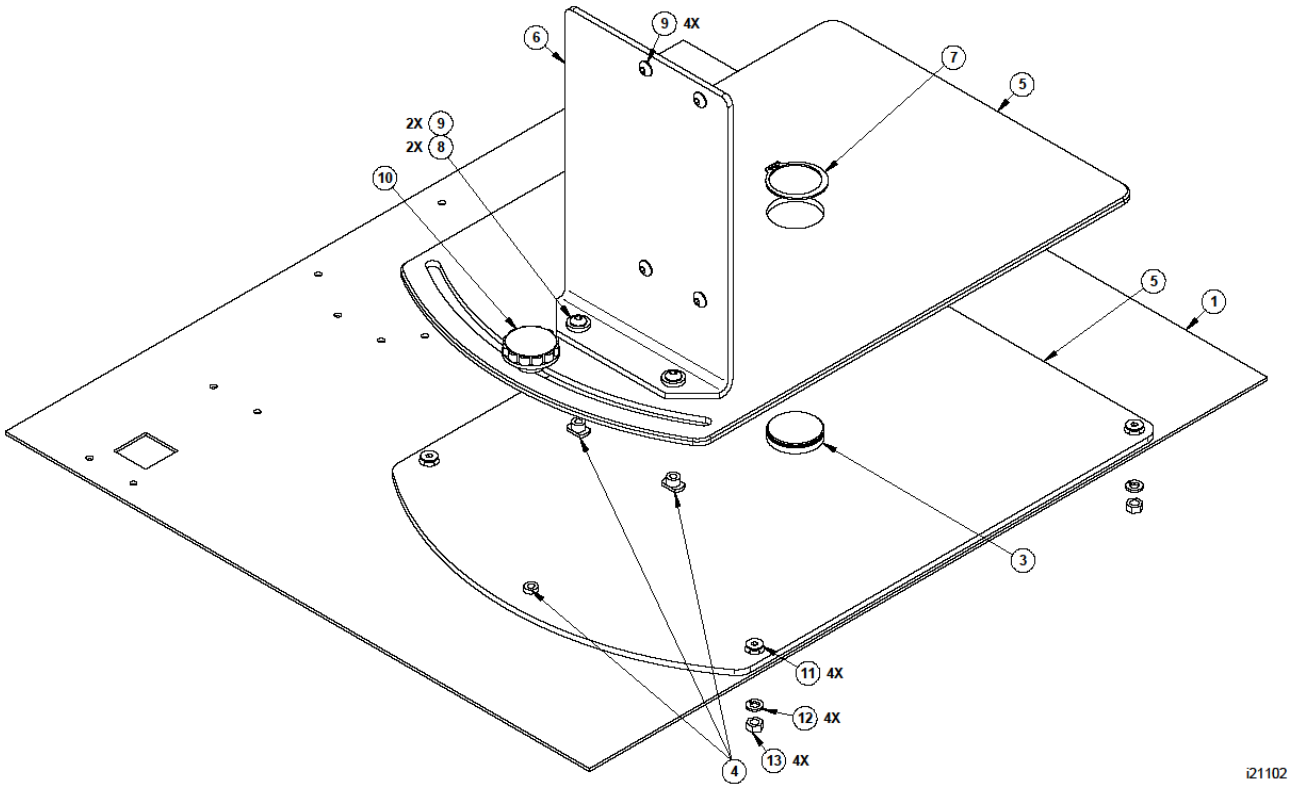


Figure 14 & Parts List Shown - Pendant Bracket Kit

Item	P/N	Title	Qty
1	20998	DOOR TOP-DRILLING PATTERN	0
2	21061	SWIVEL PLATE BASE-WEY YII	1
3	21063	PIVIOT PIN WAY YII	1
4	21062	T-NUT WEY YII	3
5	21060	SWIVEL PLATE-WEY YII	1
6	20959	BRACKET-PENDANT	1
7	21104-150	SNAP RING-TYPE SH 1.5 DIA	1
8	15759	WASHER-1/4 HARD BLK OX 1/8 THK	2
9	1/4-20X1/2 25B	SCREW-SHCS-STL-BO	6
10	21103	KNOB - MODIFIED	1
11	M6-1.0X16 26B	SCREW-FHCS-STL-BO	4
12	M6 73P	WASHER-SPLIT LOCK-STL-PLAIN	4
13	M6-1.0 50P	NUT-HEX-STL-PLAIN	4
		i21102	

Parts List - Miscellaneous

No	P/N	Description
1	21375-1	Cable Assy - Computer to Aux Box
2	20080	Cable Assy - Apron
3	20147	Cable Assy - Logic E-stop
4	20148	Cable Assy - AC E-stop
5	21226	Cable Assy - Aux DB9 to AC Drive
6	17023	Cable Assy - Aux DB15
7	21030	Cable Assy - DB37 Cabinet to Pendant
8	21115	Cable Assy - Pendant Power
9	21133	Cable Assy - Computer Power Extension
10	21221	Cable Assy - Ext. Aux to Panel
11	21130	Cable Assy - Ext. Aux to Ac Drive
12	21116	Cable Assy - Fan Power
13	21124	Rubber Pad - Headstock
14	20994-1	Rubber Stop - Right
15	20994-2	Rubber Stop - Left
16	16455	Disk Door - Floppy
17	SP101A-1123HBT	Cooling Fan
18	SC120-W2	Fan Guards
19	16873	Encoder Assy - Spindle
20	21209	Pendant
21	16425-2	Computer Module
22	20074-1	Computer Cabinet
23	21125	Chuck/Cam Lock Key
24	21241-36	Door Handle
25	21241-35	Work Light Bulb
26	21050-3E	Coolant Nozzle
27	21050-3D	Coolant Hose
28	21050-3C	Coolant Valve

8.0 Maintenance Timetable

What	When	How
Headstock Lubrication	Every 1500-2000 hours	See Section 6.2.6.
Carriage, Cross-Slide and Ball Screws	Daily	At the beginning of each day, press the RST button located on the lubrication auto lube pump control panel at the rear of the machine. This button will discharge oil for as many seconds as the pump is programmed
Tailstock	Weekly	Through its oilers with a high grade S.A.E. 30 oil.
Belt - Spindle Drive	Yearly	Check belts for cracks or peeling. See Section 5.13 for replacement.
Belt - X Drive	Yearly	Check for peeling or damaged teeth. See Figure 10, Drawing 17077 to replace.
Belt - Z Drive	Yearly	Check for peeling or damaged teeth. See Figure 9, Drawing 17076 to replace.
Coolant	Daily	Refill coolant reservoir as necessary.
Adjusting Gibs	Periodically	Wear in the cross-slide ways may be adjusted by turning the socket head screws located at the ends of the cross-slide.

Addendum

TRAK TRL 1840 CSS
Safety, Installation, Maintenance, Service & Parts List Manual, P/N 21251

Dorian Indexer Option

Field Installation Instructions

1. Turn power on to the machine.

2. Verify air has been hooked up to the machine. The air regulator is mounted to the bottom left of the electrical cabinet.

3. Make sure the on/off switch on the white box on top of the chip guard is turned on. When it is on a green light will be illuminated.

4. Go to SETUP mode under TOOL GROUPS to verify the indexer softkey is activated. If it is not, enter Service Code 145. Then press the INDEXER key to activate the indexer.

5. Go to DRO mode and press **TOOL #** and enter a number from 1 to 8. The indexer should move to this tool number. The tool number on the indexer is found right above the tool slot. If the tool # in the control and on the indexer is in the wrong position, enter Service Code 147 to re-initialize the indexer.

6. To verify the indexer is working properly run program 88888888.LX2 on the part program disk. To run the program, enter a home position in Setup Mode. Make sure you set the X and Z absolute zero position 12 to 18 inches from the chuck. Set the home position to X = 0 and Z = 3. Run the program and make sure the indexer moves to the correct tool stations. Event 1 will correspond to Tool 1, Event 2 to Tool 2 and so on up to 8 events and eight different tool stations. Verify that the indexer positions to each tool station. If there is a problem refer to the troubleshooting section.

Removing the Indexer from the Lathe

1. Turn the main power off to the machine.

2. Unhook the air line from the air regulator.

3. Disconnect 2 air lines and 2 electrical lines. The 2 air lines need to be disconnected at the white box that is mounted on the top of the chip enclosure. The fittings are the quick-disconnect type where you push in on the connector and pull the air lines loose. One electrical cable needs to be removed from the white electrical box and one cable from the black electrical box. All four connections to the indexer are inside a flexible black conduit. See Figure 1 at the end of this section for layout of cable connections.

4. Unhook the black cable from the brackets that run on top of the chip enclosure.

5. Remove the 2 clamps that hold the cabling in place. One clamp is mounted to the carriage and the other one is mounted to the bed. Loosen 2 screws on each to remove the clamps from these areas.

6. Remove the indexer from the cross slide. It is fastened down with 6 socket head cap screws to the riser block. Remove the riser block from the cross slide. You may want to remove the indexer and riser block assembled together but it may be difficult to slide the whole thing out of the T-slots. Be careful, the indexer weighs approximately 80 lbs.

7. To re-install the indexer, follow these steps in reverse order. Make sure you install the riser block at least 2 ¼" from the front of the cross slide**, not the front bracket**. Failure to do this will cause the indexer to hit the sliding door when the cross slide is all the way toward the operator.

Troubleshooting the Indexer

The following fault messages will appear on the screen when there is a problem with the indexer. There are also LED's in the black box on top of the chip guard that may be helpful when troubleshooting the indexer. Please refer to that section below.

- **Fault 85 – Impossible Tool Position**
  This message will appear if the indexer goes to a tool number that you did not select. For example, the operator chose Tool 2 and the indexer went to Tool Station 6. To fix this problem, re-initialize the system by choosing Service Code 147. If this does not solve the problem, refer to the LED troubleshooting section.

- **Fault 86 – Indexer Power Problem**
  This message will appear if the power is interrupted to the indexer. It could indicate that no power or low power is getting to the indexer. The black box on top of the chip enclosure receives 115V power from the main electrical cabinet and sends it to the white box. From there it is reduced to 24V by a power supply in the black box and reduced to12V in the white box by a transformer. If there is a power problem you will need to back track to find out where the power is being interrupted. If voltage drops outside of the 20–28 volts range in the black box this message could also appear. To make sure power is getting to the white box verify that the green light on the side of the box is illuminated. If it is not, check the fuse next to the light.

- **Fault 87 – Indexer Air Pressure Problem**
  This message will appear if the air pressure sensor senses low air or no air pressure. The recommended air pressure for the indexer is 80 psi. The air pressure should be at least 70 psi and no more than 150 psi for the indexer to work correctly. **Do not exceed 150 psi. This will void the warranty on the indexer.** Check to make sure the air regulator is set to at least 80 psi.

- **Fault 88 – Indexer Not Initialized**
  This message will appear if the indexer does not know its present position. An example of this would be if the turret stops in the middle of a tool change. An interruption of power or air may cause this fault. Pressing the E-stop button can also cause this problem if the tool is not in a known position. Initialize with Service Code 147.

- **Fault 89 – Indexer Time Out**
  This message appears if the indexer does not get to position after a few seconds. This may be caused by an internal problem inside the indexer such as a broken gear or jammed component. Very low air pressure may also cause this fault. It should take no longer than 2 or 3 seconds for the indexer.

Troubleshooting from LED's in Black Box

Inside the black box, which is mounted on top of the chip enclosure, there is an LED that signifies indexer position. It reads numbers from 1 to 8. There are also directional LED's to signify how far and in what direction the indexer is told to rotate by the control. Remove the lid from the box in order to see the LED's. The number in the black box should correspond to the tool number of the indexer. If these numbers are different, re-initialize the indexer with Service Code 147. The directional LED's will be helpful in verifying that the command from the control is getting to the black box and to the indexer. If the command is getting to the black box but not the indexer, there is a problem with the indexer. For example, if you command the indexer to move from Tool 1 to Tool 3 the LED for -90° should light up for a second. When facing the indexer, the rotation of the turret in a CW direction signifies a negative move and a CCW move signifies a positive move. Since the indexer takes the shortest path between tool changes, it can only move 45, 90, 135 in the positive direction, and 45, 90, 135 in the negative direction.

Indexer Encoder Re-alignment

This procedure is necessary only if the indexer does not return to a true home position after initializing with Service Code 147. If the encoder is misaligned the turret will consistently be off by some angle. In order to perform the operation it may be necessary to use two people. One will adjust the encoder while the other watches the number inside the black box on top of the chip enclosure. If the encoder is misaligned, there will be no number on the screen in the black box.

1. Remove the 4 screws that hold the back cover onto the indexer. The encoder is mounted to the far right of the indexer if you are at the front of the machine and facing it. Please refer to the Dorian manual that is included with the machine for an illustration.

2. Remove the cover from the encoder.

3. If initialization does not work, attempt to index the indexer until it sits in a true position. Do this by pressing the E-stop button when it is in a true position, meaning the tool station is parallel to the cross slide. It will be obvious when the indexer is back to a true position. The indexer moves in approximately 15° increments.

4. Using an allen wrench, loosen the set screw holding the encoder onto the shaft.

5. Rotate the encoder with the allen wrench until a number appears in the black box. Carefully tighten down the setscrew making sure not to move the encoder. If the encoder moves, the number in the box will disappear and it will be necessary to re-align the encoder.

6. Reassemble the unit.

Indexer Maintenance

Dorian recommends that the indexer be lubricated twice a year after the first year. The worm and worm gear should be lubricated with quality lithium based grease every 6 months after the first year.

Remove the side cover, top cover and stepper motor and grease the gears. When re-mounting make sure the
O-ring and side seal are intact so that no coolant can enter the turret. Refer to the Dorian manual that is supplied with each machine for more information and drawings.

Warranty Issues

Dorian warrants the Dorian Indexer for 1 year. If it is determined that there is a problem with the indexer it will need to be sent back to Dorian for repair. Please refer to the Dorian manual that was shipped with the indexer. Control problems are warranted by Southwestern Industries, Inc. for 1 year.

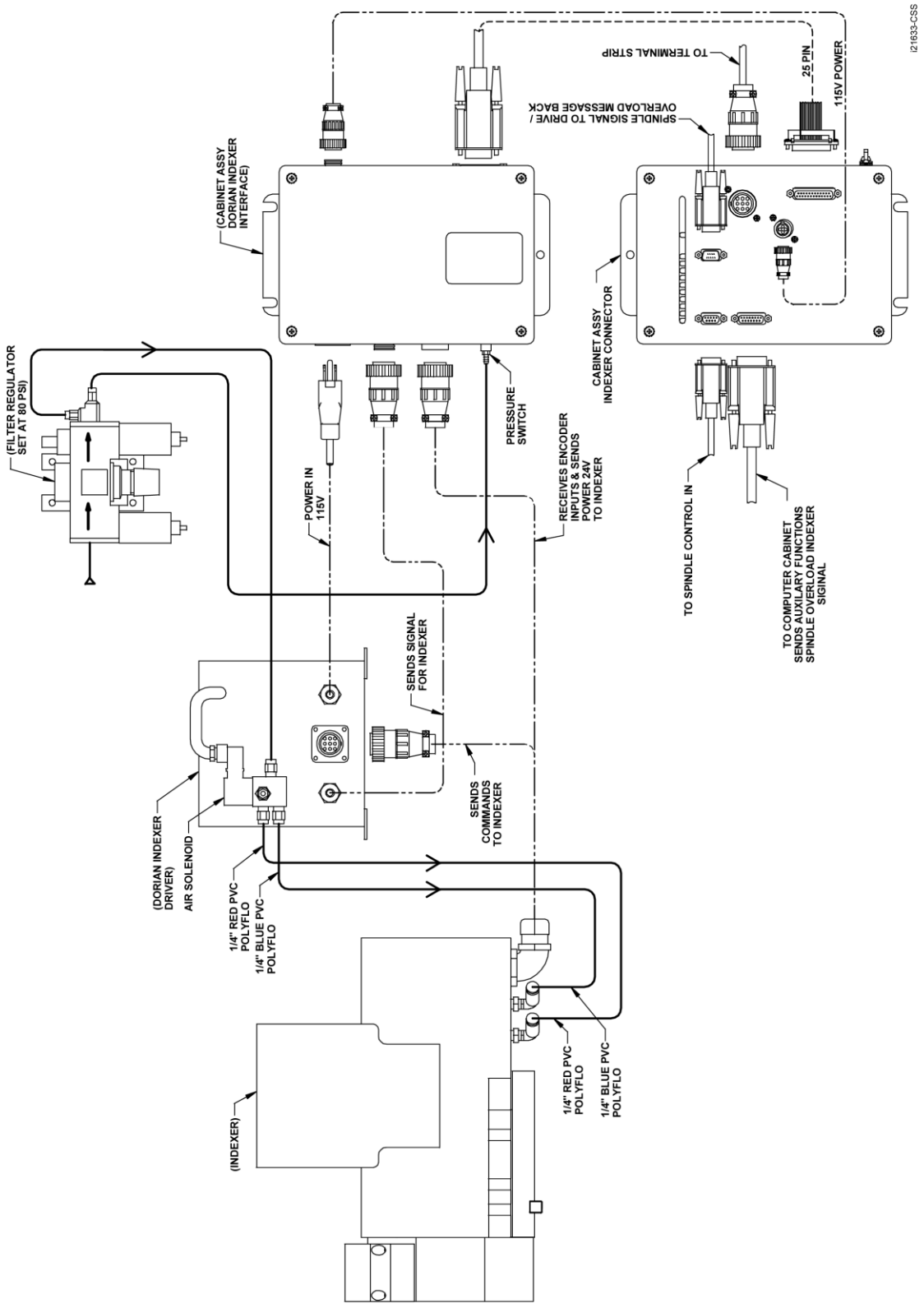


Figure 1 - Cable Map - Dorian Indexer