

Release

1

**HH Roberts**

**GL CNC**

Operation

Manual

**ANILAM 5000M**



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## SECTION

## 1

## CAUTION

- **IMPROPER OPERATION AND OR IMPROPER MAINTENANCE OF THIS MACHINE MAY CAUSE SERIOUS BODILY INJURY.**
- **DO NOT OPERATE THIS MACHINE UNTIL YOU HAVE RECEIVED OPERATING AND SAFETY INSTRUCTIONS FROM YOUR EMPLOYER.**
- **FOLLOW ALL SAFETY PRACTICES PRESCRIBED BY YOUR EMPLOYER AND OUTLINED IN THE OPERATION MANUAL.**
- **ALWAYS AVOID UNSAFE CONDITIONS OF OPERATION SUCH AS EXCESSIVE FEEDS AND SPEEDS.**
- **ALWAYS BE SURE ALL SAFETY DEVICES ARE IN GOOD OPERATING CONDITION.**
- **ALWAYS BE CERTAIN THAT ONLY QUALIFIED PERSONNEL PERFORM SERVICE ON THIS MACHINE.**

# Machine Safety

Every effort has been made in the design and production of this piece of equipment to comply with statutory requirements and to provide a fundamentally safe machine tool. In the further interest of safety, attention should be given to the following notes:

## Machine Use

Responsibility for the following points with respect to machining a part must ultimately rest with the machine operator.

- Ensure that the operator has had suitable training and possesses the required degree of skill and experience to undertake the work.
- Provide suitable work holding and/or supporting equipment: chucks, steadies, revolving centers, vises etc.
- Ensure that suitable tooling is provided and correctly mounted.
- Ensure that suitable feeds and speeds are selected.
- Use the guards that are provided with the machine.
- Wear suitable protective devices: safety glasses, shields.



## Safety Rules

- Know how to stop the machine before starting it.
- Read and understand all manuals for your machine.
- Keep your machine and work area clean.
- Before operating spinning tools, note and observe the maximum operating speed of the selected device as marked on the nameplate by the manufacturer.
- Remove chuck keys immediately after use.
- Check the load capacity of revolving centers and drivers.
- Ensure guards are in position before operating the machine.
- Do not use cracked or chipped tools.
- Stop the machine immediately if anything unexpected happens.
- Do not touch revolving chucks or tools.
- Do not remove tools or work from a machine without retracting the tool to a safe position and stopping the spindle.
- Always use the Emergency stop button when working in the machine envelope or when leaving the machine unattended.

## Personal Safety Rules

- Report any accident to your direct supervisor as soon as it happens.
- Always wear safety glasses or shields when operating machinery.
- Always wear safety shoes when in a machine shop area.
- Use barrier creams to protect your skin if provided.
- Always wear your overalls buttoned up to prevent hot chips from burning you skin.
- Always roll your sleeves up or button the cuffs to prevent them from being entangled in the machinery.
- If you have long hair use of a suitable cap is required to prevent your hair from being entangled in the machinery.
- Always use the correct tool for the job at hand.
- Always be careful of, and remove burrs and sharp edges.
- When lifting heavy a work-piece or fixture, use the correct type of sling, ensure that it is not worn or damaged and that its safe workload is not exceeded.
- Always stand clear when lifting a work-piece or equipment by crane.

- Obtain assistance when lifting heavy or awkward work-pieces or fixtures.
- Do not wear rings, watches, ties, etc. when operating a machine.
- Do not keep sharp tools in pockets.
- Always keep your work area clean and floor space clear of obstacles.
- Do not wash hands in coolant.
- Do not remove chips or cuttings with bare hands; use a rake or chip hook.
- Do not use rakes or chip hooks with enclosed handles.
- Do not use files, scrapers, etc., on machines.
- Do not lean on the machine.
- Do not tamper with electrical equipment.

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## SECTION

## 2

## Machine Lifting

### Lifting The Machine

The machine should be lifted using a forklift truck or crane as illustrated in Figure 2-1. Ensure that the forklift truck has sufficient capacity. Approximate machine weight as follows.

Model	Axis Travel	Approx. Weight
3-GL CNC	X 32" x Y 16" x Z 4.4" (6" manual)	3,300 lbs
3-GL CNC	X 22" x Y 16" x Z 4.4" (6" manual)	3,200 lbs
4-GL CNC	X 32" x Y 16" x Z 4.4" (6" manual)	3,600 lbs
4-GL CNC	X 22" x Y 16" x Z 4.4" (6" manual)	3,500 lbs
5-GL CNC	X 32" x Y 16" x Z 4.4" (6" manual)	4,000 lbs
5-GL CNC	X 22" x Y 16" x Z 4.4" (6" manual)	3,900 lbs
5B-GL CNC	X 32" x Y 15" x Z 6.1"	4,400 lbs
5B-GL-S CNC	X 32" x Y 15" x Z 6.1"	4,200 lbs
5A-GL CNC	X 40" x Y 20" x Z 4.4" (6" manual)	6,200 lbs

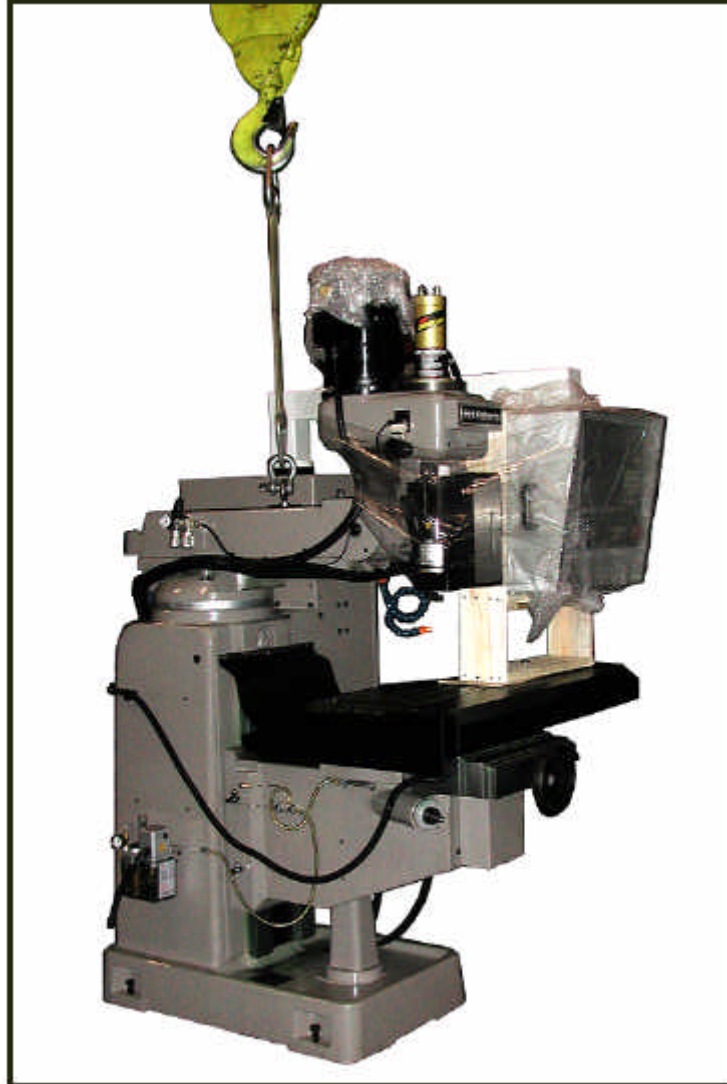


Figure 2-1

Above is the correct way to lift the machine frame with overhead crane or with a forklift from the side.

## Inspection

Check your delivery slip against the accessories that were ordered with the machine. If there is a shortage or error, report it to your dealer immediately, giving the serial number, which is stamped on the nameplate on the rear of the machine.

## Cleaning

When you first receive your machine all axes will be blocked and the control packed for shipping. All unpainted parts of the machine have been coated with an anti-rust compound. After you have unpacked the machine, removing all plastic covers and tie downs and any wooden block's please remove all anti-rust compounds from the machine before moving any axis. Remove anti-rust compound with varsol and a clean cloth. Do not use paint thinners. After all of the anti-rust compounds have been removed, all unpainted surfaces should be coated immediately with a light coat of oil to provide protection from rust as the varsol will strip all rust protection from the machine and leave it prone to rust.

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## SECTION

## 3

## Machine Installation

### Leveling

It is not required to level the GL CNC series machine nor install leveling bolts or pads but you may do so if you decide. Leveling bolts and pads are available to you at an extra cost and you are required to order them separately.

For proper operation the machine should be set on a substantial floor capable of supporting the weight of the machine. After the machine is in position, it may be required to install wedges in order to prevent rocking of the machine.

If leveling screws and pads are going to be used then level the machine by adjusting the leveling bolts. Use a precision level placed on the table, with the X and Y-axis in approximately the center of travel. Adjust the four corners of the machine to obtain optimum level. Then move the Y-axis along the travel and adjust the level from side to side. After the machine has been leveled, use a dial indicator to sweep the table to check if the head is square to the table. If required you must adjust the head left to right and or front to back in order to bring the head and column perpendicular to the table.

## Power Supply:

A fused branch circuit disconnect must be provided in front of the machine. All machines have a nameplate on the electrical cabinet with the rated horsepower and current. AC power wiring must be consistent with any local codes, national electric codes and be able to withstand the voltage and current ratings applied. It is suggested that the cable entrance to the electrical cabinet on the machine is at the side or bottom of the cabinet in order to prevent coolant and oils from contaminating the electrical enclosure.

## Grounding:

The 3-phase AC supply must be bonded to earth ground. Figure 3-1 shows the most common transformer secondary winding configurations, but not all possibilities, as there are too many transformers to depict all combinations.

Note 1: Failure to reference the secondary winding to earth ground could void warranty.

Note 2: Some types of delta wound transformers may cause problems with inverter drives.

Check incoming voltage on the three-phase supply before turning on the machine. See Powering Up The Control later in this section.

The machine must be securely bonded to earth ground. Conduit ground is not acceptable. The ground conductor must be equivalent in cross sectional area to the supply conductors minimum #8 AWG and have a green or green / yellow jacket or bare wire. The ground resistance must not exceed 4 ohms

Grounds are provided for two reasons:

1. Establish a low impedance path between the equipment enclosure and other material parts of the system for the protection of personnel against electrical shock in the event of an electrical failure in the machine electrics.
2. Establish a neutral reference common to all voltage sources in the system for the protection of electronic equipment against interference generated both in the machine itself and in electrical equipment in the vicinity of the machine. This interference may cause damage and / or defective operation of the equipment.

In as much, many safety requirements may vary with geographic location, be sure to consult the local governing Codes, which take precedence over the following guidelines that are, in general, considered practical. These guidelines are based on the following references:

National Electrical Code 1975

California "Electrical Safety Orders" 1967

Pennsylvania "Electrical Safety Regulations" 1965

### Typical Earth Ground Effectiveness:

1. Continuous copper water pipe. Properly buried length, depending on condition of soil. Installed below permanent moisture level. (Impedance typically 3 ohms)

2. Man-made buried electrodes properly installed length depending on condition of electrodes Soil. Installed below permanent moisture level. (Impedance typically below 5 ohms)
  
3. Other available electrodes such as metal frames of buildings must be well chosen and tested that they do not exceed 5 ohms.

Ground connections, wire and electrodes should not exceed 5 ohms, as measured from the equipment ground stud through the primary electrode, through earth, to another independent electrode separated by 20 feet of earth. Additional ground should be installed when necessary to insure that the impedance does not exceed 5 ohms. The ohmic measurement should be made in terms of a voltage-current relation, such as the current of a 120-volt, 100watt light bulb. When longer lengths of ground conductor are required, use a larger size cable, so that the total resistance of the cable is less than 0.075 ohms.

## Multi tap isolation transformers

An isolation transformer is completely different than an autotransformer. The difference is that in isolation transformers there are six sets of windings whereas an autotransformer only has three sets of windings. Because of this there is no means of surge protection or power balancing. In isolation transformer the first three sets of windings are only used by the primary side (incoming power) and the second set of windings are used on the secondary side (outgoing power) this is done in order to generate clean balanced power. As the two sets of windings are not connected by any means. With using the two sets of windings in this manner you get a buffering effect between the incoming power and outgoing power. Spikes generated in the power lines will be absorbed in the windings by a fair amount.

The following will explain the basics of reading the nameplate and connecting an isolation transformer. See figure 3-1.

REX MANUFACTURING		
<b>CAT. NO.</b> DC20HISIK4	<b>KVA</b> 20	<b>ENCL</b> OPEN
<b>SERIAL</b> B 27449	<b>HZ</b> 60	<b>TYPE</b> ANN
<b>TRANSFORMER</b> 3 PH ISO	<b>% IMP</b> 5.5	<b>AT</b> 170 C
<b>INSULATION CLASS</b> 220 C	<b>TEMPERATURE RISE</b> 150 C	
<b>PRI. VOLTAGE</b> 480 DELTA H1-H2-H3	<b>BIL.</b> 10KV	
<b>SEC. VOLTAGE</b> 230Y/133 X0-X1-X2-X3	<b>WT.</b> 275 LB	
<b>PRI. VOLTAGE CONNECTION</b>		
105.0%	1-1-1	
102.5%	2-2-2	
100.0%	3-3-3	
97.5%	4-4-4	
95.0%	5-5-5	

FIGURE 3-1

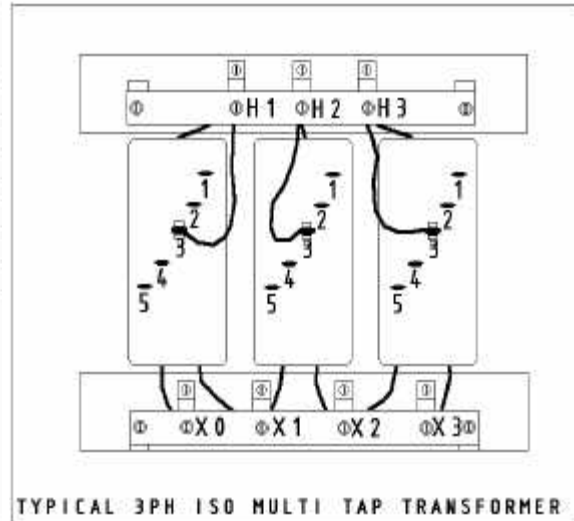


FIGURE 3-2

Please note the following on the nameplate you will find **PRI. VOLTAGE** this is the incoming power from the building on this e.g., it is **460 V DELTA H1-H2-H3**, the H1, H2 and H3 represent that the incoming 3PH gets connected to the terminal blocks with these labels. See figure 3-2.

Below this you will find **SEC. VOLTAGE** this is the outgoing power to the machine tool **230Y/133 X0-X1-X2-X3**, the X1, X2 and X3 represent that the outgoing 3PH gets connected to the terminal blocks with these labels. See figure 3-2. The X0 terminal block gets connected to ground this is called referencing the transformer to ground, which balances the three phases by making each line the same voltage. This is a very important part of any CNC machine tool installation. With out grounding the X0 you will be asking for all types of problems. If a your machine is acting funny but you can't find any problem you will most likely find the X0 is not connected to ground.

Below this you will find the Multi tap specifications. In this example the Primary Voltage has 5 different input adjustments. They are 105.0%, 102.5%, 100.0%, 97.5% and 95% this means if your incoming power is not exactly 460 Volts you can adjust the output of the transformer by changing the taps, below is a table for this example.

Input Voltage	Percentage	Connection Taps
483V	105.0%	1-1-1
471V	102.5%	2-2-2
460V	100.0%	3-3-3
448V	97.5%	4-4-4
437V	95.0%	5-5-5

In order to make this adjustment if you refer to figure 3-2 you can see the multi taps located on the main body of each winding. There are three different wires going to the rings that are mounted on each winding. Each ring is labeled with numbers and you must move these wires to the corresponding number. For this example you have 480V incoming to the transformer, so you must move the wires to the rings labeled 1 on each winding. Now the incoming power is 480V and by using the multi taps we can adjust the transformer to output 230V. If you input 480V to this transformer and didn't adjust the multi taps then the transformer would output 241V to the machine, which is too high and may cause problems.

The last part of checking the power going to the machine is to check the line voltage to the machine by comparing the line voltage of each leg of power. This is done by using your meter and checking each phase to ground. If the transformer is grounded correctly then each phase to ground should be within 5 Volts.

## Air Supply

If the machine is equipped with an auto power draw bar you will be required to install a 3/8" air supply line (minimum) from the compressor or from a main header supply capable of supplying a steady 90 PSI. at 3 CFM. for maximum operation of the power draw bar system.



## Powering up control

When you are ready to power up the control for the first time you must make the following checks.

1. Incoming power: check that the incoming power is within the following tolerance:

For 230V machines the incoming voltage must be between 208V - 240V

2. Control Transformer: check that the control voltage is between 110V-120V. You can adjust the output voltage by changing the input taps on the transformer.
3. 5V DC power: check the 5V DC supply to the control. This can be done by removing the cover on the computer case and measuring the 5V DC plug on the hard drive mounted inside the case. The tolerance of this voltage is 5.0V - 5.2V. If you need to adjust the voltage you will find the power supply mounted inside the computer case on the top of the case. Make the required adjustment using the adjustment pot.
4. Check the axis drive setup and tuning. See section 4 Maintenance under Axis Drive Setup and Tuning.

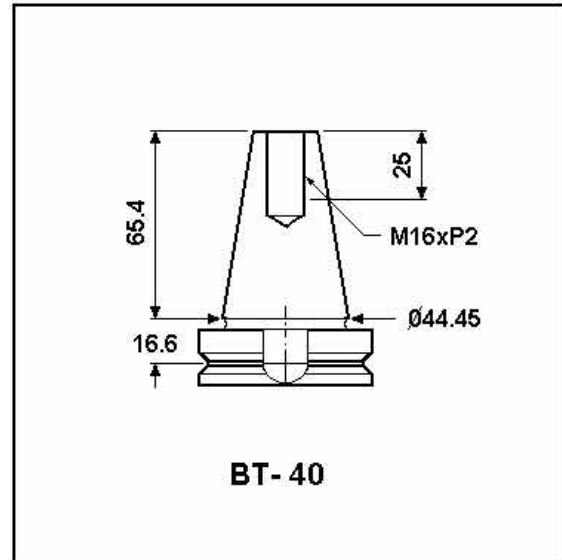
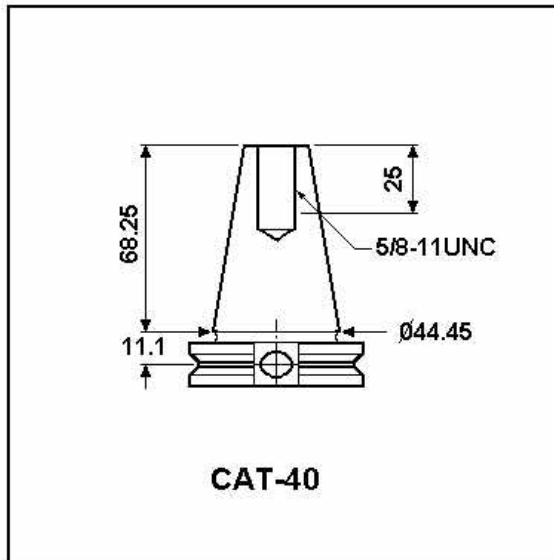
## Additional Devices

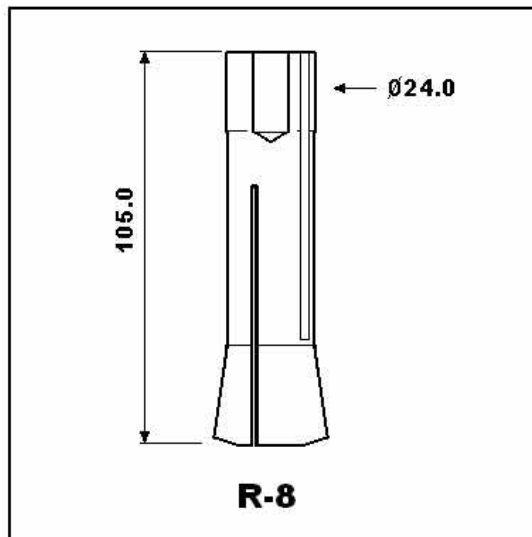
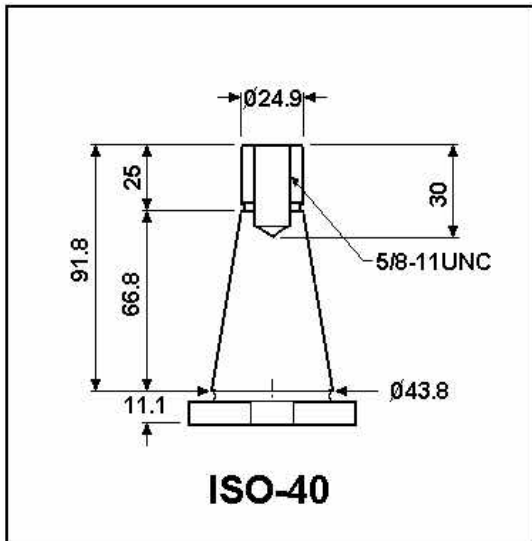
If additional devices are to be mounted and driven off the machine supply, make sure they are suppressed in accordance with Anilam's requirements as described in their installation manual.

**We only recommend these modifications be done by trained service engineers familiar with the Anilam controls.**

## Tool Holders

The GL CNC series machines can be ordered with six different types of tooling. Either R-8, #30 Erickson, #40 Erickson, CAT-40, BT-40, or ISO-40 tooling. This must be specified when ordering the machine, as we will have to change the draw bar and or spindle. Below are dimensional drawings of the three types of 40 taper tool holders the R-8 holders are standard and only come in one configuration. As well as the Erickson series tool holders they are only available in one configuration.





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## SECTION

## 4

# Maintenance

## Daily Maintenance:

- Check and fill auto way lube tank. (See figure 4-3)
- Check and fill the oil reservoir located on the air regulator separator / oilier, be sure to use air tool oil. (See figure 4-1)
- Drain water from the water trap bowl located on the air regulator separator / oilier. (See figure 4-1)
- Clean all home and over-travel limit switches located on the front of the table (X axis) and below the right side of the table (Y axis).
- Clean and inspect the spindle taper making sure that there is no coolant or metal chips in the taper.

## Weekly Maintenance:

- Check and fill auto way lube tank. (See figure 4-3)
- Check and fill the oil reservoir located on the air regulator separator / oilier, be sure to use air tool oil. (See figure 4-1)
- Drain water from the water trap bowl located on the air regulator separator / oilier. (See figure 4-1)
- Clean all home and over-travel limit switches located on the front of the table (X axis) and below the right side of the table (Y axis).
- Clean and inspect the spindle taper making sure that there is no coolant or metal chips in the taper.
- Clean all cooling fan filters and check that all fans are working, there is a cooling fan located on the electrical cabinet door as well as the rear of the operator console.
- Check the coolant system tank located on the rear of the machine open the access door and check that the coolant level is adequate and check and clean out sludge or cuttings that may have collected in the bottom of the tank.

- Monthly Maintenance:
- Check and fill auto way lube tank. (See figure 4-3)
- Check and fill the oil reservoir located on the air regulator separator / oilier, be sure to use air tool oil. (See figure 4-1)
- Drain water from the water trap bowl located on the air regulator separator / oilier. (See figure 4-1)
- Clean all home and over-travel limit switches located on the front of the table (X axis) and below the right side of the table (Y axis).
- Clean and inspect the spindle taper making sure that there is no coolant or metal chips in the taper.
- Clean all cooling fan filters and check that all fans are working, there is a cooling fan located on the electrical cabinet door as well as the rear of the operator console.
- Check the coolant system tank located on the rear of the machine open the access door and check that the coolant level is adequate and check and clean out sludge or cuttings that may have collected in the bottom of the tank.
- Check way lube delivery to all axis slides, if necessary remove way covers and wipers and clean all slide ways, do not allow contaminants to get under slides.

## Twice Yearly Maintenance:

- Check and fill auto way lube tanks. (See figure 4-3)
- Check and fill the oil reservoir located on the air regulator separator / oilier, be sure to use air tool oil. (See figure 4-1)
- Drain water from the water trap bowl located on the air regulator separator / oilier. (See figure 4-1)
- Clean all home and over-travel limit switches located on the front of the table (X axis) and below the right side of the table (Y axis).
- Clean and inspect the spindle taper making sure that there is no coolant or metal chips in the taper.
- Clean all cooling fan filters and check that all fans are working, there is a cooling fan located on the electrical cabinet door as well as the rear of the operator console.
- Check the coolant system tank located on the rear of the machine open the access door and check that the coolant level is adequate and check and clean out sludge or cuttings that may have collected in the bottom of the tank.
- Check way lube delivery to all axis slides, if necessary remove way covers and wipers and clean all slide ways, do not allow contaminants to get under slides.



- Clean machine top to bottom if necessary remove all axis slide way covers and repair if required.
- Check all cables for signs of chafing or connectors that have come loose.
- Check all hoses for signs of chafing or fittings or clamps that have come loose.
- Adjust axis gibs where necessary.
- Remove front cover of z-axis assemblies and inspect and grease the ballscrew checking all home and over travel switches.

## Adjusting Air Regulator Oiler

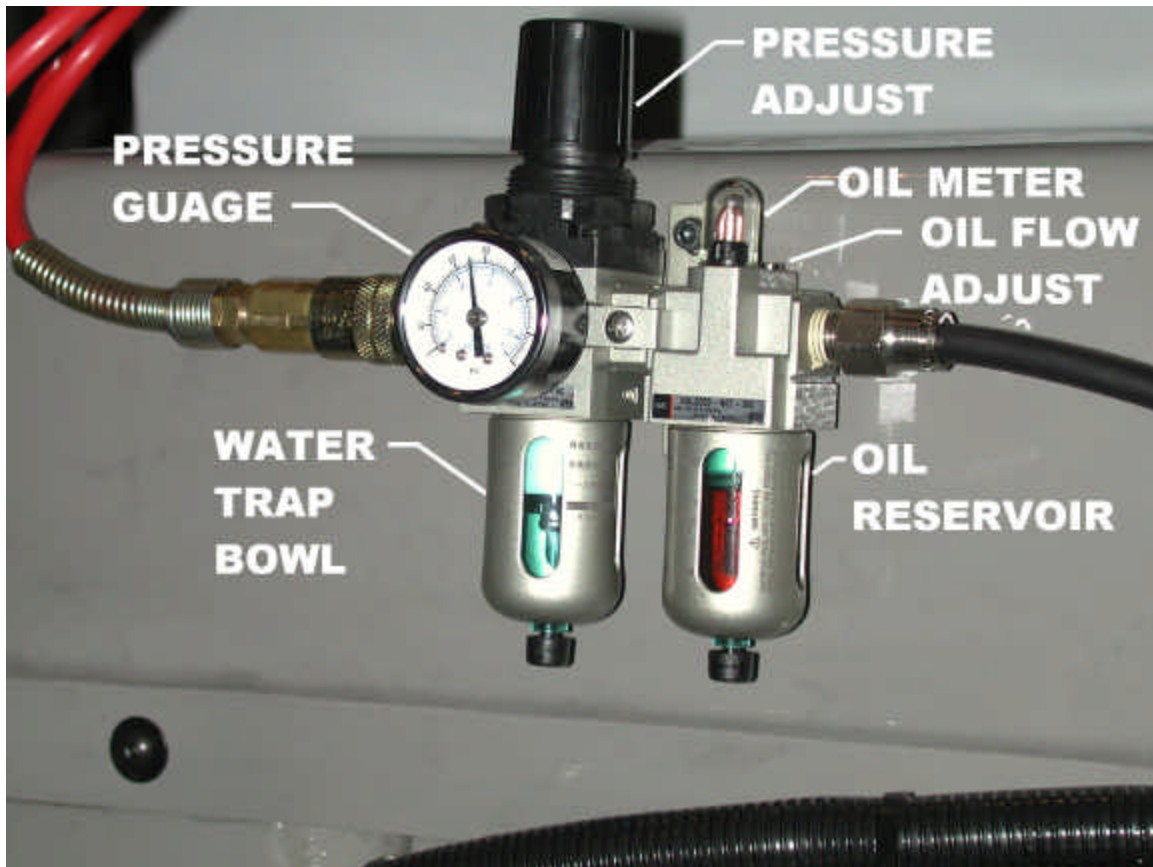


Figure 4-1

The air regulator oiler that comes on the GL CNC series machines is equipped with an automatic water separator, the water trap bowl will drain the water collected automatically when the air supply is disconnected or turned off. The recommended operating air pressure for the GL CNC machine is 95 – 100 PSI or 6.5 – 7 Kg/cm<sup>2</sup>. To adjust the air pressure pull up on the Pressure Adjuster knob (See figure 4-1) until it is free of the lock then turn the knob clock wise to increase the pressure or counter clock wise to decrease the pressure, When the required pressure is set, lock the knob in place by pushing down on the knob.

To fill the reservoir, remove the air pressure and then remove the cap on top of the lubricator. Fill the reservoir about 2/3 full using Air Tool Oil. Replace cap.

To adjust the oiler open (C.C.W.) the oil flow adjustment screw (2) turns. Lower the quill Approx. 2" and lock the quill in place. Press IN and OUT button on the control head in short (1 second) bursts until oil is seen dripping from the oil tube site bowl located on top of the lubricator. After about (7) drops of oil stop. Close (C.W.) the oil flow adjustment screw. (DON'T OVER TIGHTEN). Then open (C.C.W.) the oil flow adjustment screw  $\frac{1}{2}$  to  $\frac{3}{4}$  of a turn. Fine Adjustment may be needed later. Below is the recommended adjustment.

2 to 4 drops per day – light usage.

3 to 5 drops per day – medium usage.

4 to 6 drops per day – heavy usage.

## Power Draw Bar Operation

Turn off the spindle and wait until it has stopped. Retract the quill back to the UP position using the following command line "G00 Z0.000 T0" if your machine is a two axis system then manually move the quill to the top of the travel. Take the tool holder and insert it in to the spindle until you feel contact with the drawbar. Then push the IN button on the control box, the tool will be pulled in to the spindle. The longer you hold the IN button the tighter the tool will become. (Under normal conditions  $\frac{1}{2}$  to  $1\frac{1}{2}$  seconds is all that is required). To remove the tool, turn off the spindle and wait until it has stopped. Retract the quill back to the UP position using the same command line "G00 Z0.000 T0" or move the quill to the top of travel. Hold the tool and at the same time push the OUT button on the control panel until the tool becomes free.

## Power Draw Bar Trouble Shooting

Tips to prevent sticky tool holders.

- Do not leave tool holder in the spindle over night.
- Clean all nicks, dirt, oil and heavy tarnish off tool holders
- Inspect and clean inside of the spindle taper for nicks, dirt, oil and heavy tarnish
- Do not over tighten the tool holder.

PROBLEM	SOLUTION
Power head goes up and down and air motor is running but the drawbar doesn't tighten or loosen	Make sure the quill is all the way up and locked in position
Power head runs sluggish / Power head blowing heavy oil mist out of exhaust during operation.	Too much oil. Correct by adjusting lubricator to minimum oil flow. Drop quill down approx. 2" so power head will run freely and run power head until heavy oil mist stops.
Drawbar rattles when spindle is running and quill is in the up position	Loosen power head base from bearing cap and move slightly to center power head to drawbar. Check top of spindle for damage.
Drawbar stripping threads	Tool holder sticking in spindle taper. Quill is being pushed down instead of tool holder coming out of spindle. Inserting double ended mills to far into tool holder and cutting the end of the draw bar. Check tool holder for bad threads or chips in threads.

### Automatic Way Lubricator

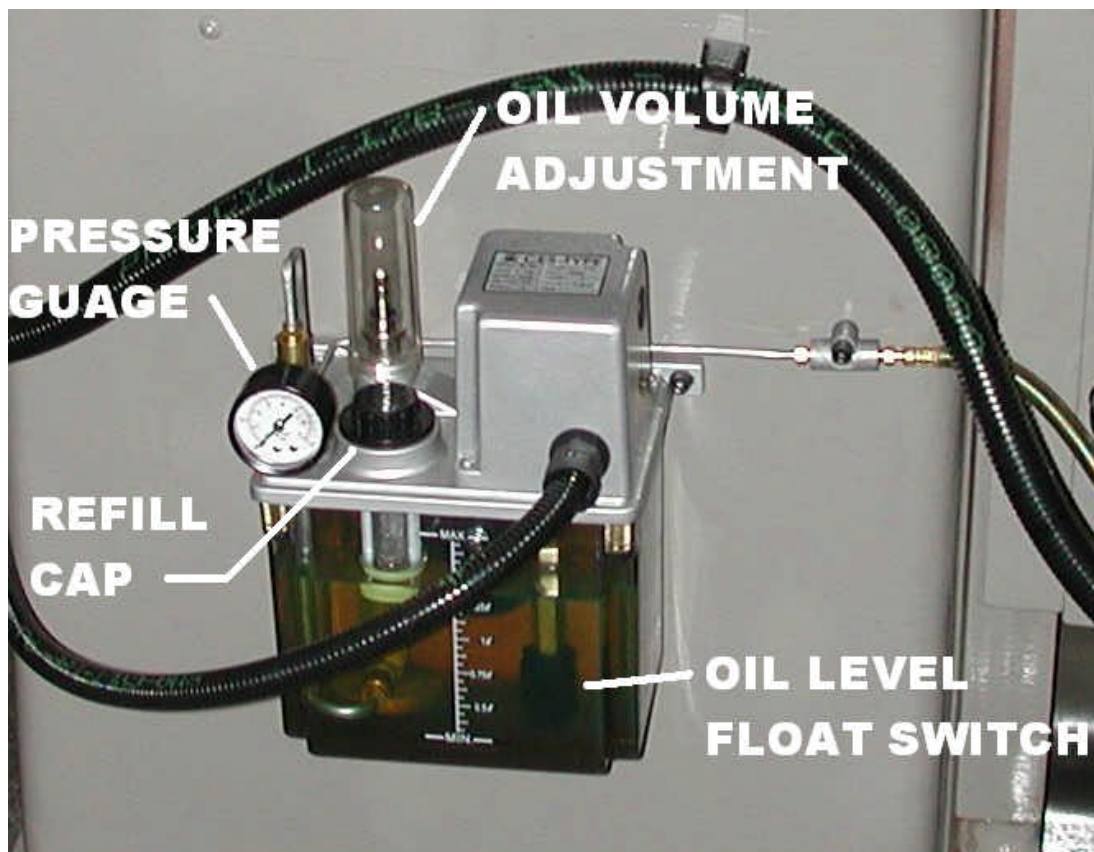
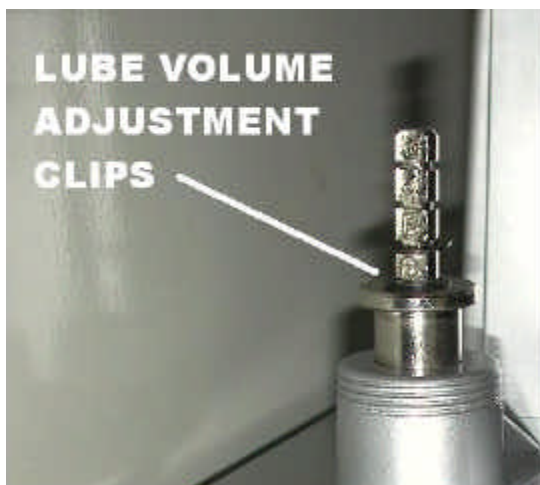


Figure 4-3

A lubricator located on the left side of the column automatically lubricates the X and Y-axis ball screw nuts as well as all slide way surfaces at timed intervals. (Figure 4-3) The pump is factory set as to the timed intervals but you can adjust the volume of oil delivered at each cycle.



Regular inspections of the slide ways to insure that they always have a film of oil. If the lubricant in the reservoir is not replenished, a float level switch will automatically disable the automatic mode of the machine and display a warning alarm message. It is recommended that the lubrication be topped up every eight hours. A lubricant with a viscosity of 300 - 350 SUS at 100°F is recommended. (See oil chart) The Z-axis ball-screw bearings are pre lubricated with grease and only require greasing every six months.

### Oil Chart

Company	Way lube	Power Draw Bar	Coolant
Oil type	S.A.E. No. 68	S.U.S. No. 32	Semi-Synthetic
Sunoco	WAY LUBE 68	SUNVIS 832	N/A
Shell	TONNA T68	TELLUS 32	DROMAS B
Esso	FEBIS K68	NUTO H32	EXXCOOL 2000
Mobil	VECTRA # 2	DTE 24	N/A

### IPI Monitor

The IPI monitor is a diagnostic tool used to view the current state of the different registers used to run the machine. To access the IPI monitor screen when the control is in manual mode, press the “P” key on the keypad. Below is a break down of the screen and how to interpret the information.

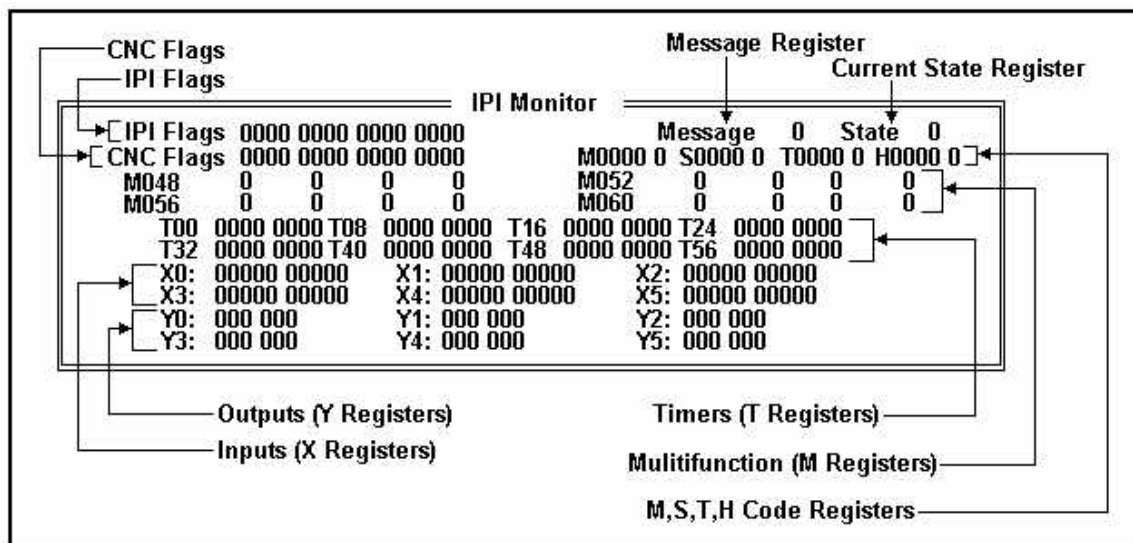


Figure 4-4

The following will explain how to read the IPI monitor screen.

IPI Flags are signals that are sent from the IPI program to the CNC control.

CNC Flags are signals that are sent from the CNC control to the IPI program.

Message Register will display the current message that is active. If the field next to the word Message is 0 then there are no active messages. If there is a number value in this field then the IPI has generated this message to be displayed. All messages are given a numeric value in the builders message setup.

Current State Register will display the current register's value.

M, S, T, H Code Registers this group of registers show the current M Codes, S Codes, T Codes and H Codes.

For example, when a command is given to the CNC control to start the spindle you command M3. The control will send the command to the IPI. At this point the command will be displayed on the screen as M0003 1. This shows that the IPI is executing the command. When the IPI is finished the command it will clear the register. So for this example you will see the M0003 1 on the screen until the spindle starts and achieves the RPM it was commanded to run at.

The same is true for all other codes. If the command cannot be executed within the preset time allowed in the setup utility you will get the alarm "TIME OUT IN FINISH SEQUENCE" If you do get this alarm by viewing the IPI monitor you can see the command that is not being completed.

Multifunction (M Registers) are the registers that are used in writing the IPI program our IPI program will always have a value in the M64, This value will be the current IPI revision. These registers are laid out in the following format.

M64            0    0    0    0    M68            0    0    0    0

The first value is register M64, the second is M65, the third is M66 and the fourth is M67 the same applies for the next set of registers, M68, M69, M70 and M71.



Timers (T Registers) are the state of all the timers used by the IPI. These registers are laid out in the following format.

T00 0000 0000 T08 0000 0000

The first value is timer T0 the second is T1, the third is T2 and the fourth is T3 the same applies for the next set T4, T5, T6, T7 and so on.

Inputs (X Registers) are the state of all the inputs that are inputted to the IPI via the Can Nodes. These registers are laid out in the following format.

X0: 0000 00000 X1: 00000 00000 X2: 00000 00000

Can Node number 0											Can Node number 1											
#	Input number										#	Input number										
0	0	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	
	Input state											Input state										
X0:	0	0	0	0	0	0	0	0	0	0	X1:	0	0	0	0	0	0	0	0	0	0	0

The above table is a break down of the input registers. See the table below for the assigned input labels.

Outputs (Y Registers) are the state of all the outputs that are outputted to the Can Nodes via the IPI. These registers are laid out in the following format.

Y0: 000 000 Y1: 000 000 Y2: 000 000

Can Node number 0							Can Node number 1						
#	Output number						#	Output number					
0	0	1	2	3	4	5	1	0	1	2	3	4	5
	Output state							Output state					
Y0:	0	0	0	0	0	0	Y1:	0	0	0	0	0	0

The above table is a break down of the output registers. See the table below for the assigned output labels.

Can Node 0			
Input	Label	Output	Label
IN 0	Spindle At Speed	OUT0	Unused
IN 1	X Axis Home Switch	OUT1	Unused
IN 2	Y Axis Home Switch	OUT2	Unused
IN 3	Spindle Drive Fault	OUT3	Coolant Pump Motor
IN 4	Z Axis Home Switch	OUT4	Spindle Drive Enable
IN 5	Way Lube Low Switch	OUT5	Spindle Load Meter
IN 6	Unused		
IN 7	Coolant override Switch		
IN 8	Spindle Lock		
IN 9	Spindle Disabled		

## CAN I/O Test facility

The CAN I/O Test facility provided in the CNC makes the trouble-shooting of the Can Nodes very easy and efficient. This test utility helps to trouble-shoot problems with all Can Nodes on the machine tool.

From the boot up menu select MOTION SETUP/TESTING then select the CAN TEST soft key. Below are the conditions you should see when all operations are normal.

### POWER ON STATUS WITH EMERGENCY STOP PUSHED IN

Estop	Will not be highlighted.
SvOn	Will be highlighted.
+24	Will be highlighted.
SvoEn	Will not be highlighted.

POWER ON STATUS WITH EMERGENCY STOP PULLED OUT AND SERVO'S OFF

Estop	Will be highlighted if the Emg. Stop switch is working.
SvOn	Will be highlighted.
+24	Will be highlighted.
SvoEn	Will be highlighted if all elements of the Emg. Stop loop is closed.

POWER ON STATUS WITH EMERGENCY STOP PULLED OUT AND SERVO'S ON

Estop	Will be highlighted if the Emg. Stop switch is working.
SvOn	Will not be highlighted if the reset is seen by the CNC.
+24	Will be highlighted.
SvoEn	Will be highlighted if all elements of the Emg. Stop loop is closed.

## Axis Drive Setup and Tuning

The following will explain how to set up and tune the axis drives. There are four basic steps to follow laid out below.

1. Balancing the DSP board;

In order to balance the DSP you must remove the cover on the control box and have the control powered up at the main CNC screen with the EMG stop pushed in.

Then you must find and disconnect the command signal wire going to each of the drives. These wires are connected to the 24-pin connector on each drive, (See figure 4-5) Pin 1 and 2. Please note which wire colour goes to these pins, as it is very important to reinstall these wires in the correct place as this determines the motor direction.

Then attach your meter to these wires and adjust the DSP pots until the voltage is 0VDC. Repeat for each drive. When you are finished replace the command signal wire.

2. Balancing the axis drive card;

On the control you must go to the motion setup\Testing utility then repeat the following for each axis drive.

Select the axis drive you are going to set by pushing the drive letter on the keypad. Then push the soft key F6 for balance test, at this point you will be asked for the password, enter the password then push enter, then push the cycle start button.

At this point the selected axis will display four digits beside it. Now adjust the pot on the drive card labeled ZERO (See figure 4-5) until the display reads zero, when the drive is adjusted push the soft key F4 Manual, to cancel the test.

### 3. Balancing and setting the drive speed;

On the control you must go to the motion setup\Testing utility then repeat the following for each axis drive.

Select the axis drive you are going to set by pushing the drive letter on the keypad. Then push the soft key F7 for signal gain test, at this point you will be asked for the password, enter the password then push enter. Enter a time, we use 2 sec. then push the cycle start button.

At this point the selected axis will begin moving back and forth. You will see a display beside F located between RPM and DWELL. Now adjust the pot on the drive card labeled SPEED (See figure 4-5) until the display reads 30.000, then adjust the AC gain pot labeled AC.G (See figure 4-5) until the rise time is between 11 – 14 and the overshoot is between 1.0 – 1.5% you can use the DC gain pot labeled DC.G (See figure 4-5) to balance the over shoot in both directions.

Check the torque and O.L. pots (See figure 4-5) and make sure they are both set to the maximum (full CW). When the drive is adjusted push the soft key F4 Manual, to cancel the test.

#### 4. Tuning the motor gains;

On the control you must go to the motion setup\Testing utility then select the axis drive you are going to set by pushing the drive letter on the keypad. Then push the soft key F8 for Tuning gain test, at this point you will be asked for the password, enter the password then push enter, then select tuning setup enter YES for all parameters (Ki, Kd, all axis, match lag). Press F10 to exit setup.

Press F8 again and select tuning test, enter 2 for Kp ovs%, 1 for Kd ovs% and 5 for Kp min. At this point the control will test cycle all axis. When the test has finished press F8 for tuning. Select save results to feed table only. Do not use these values for rapid gain, as it will overheat the drives.

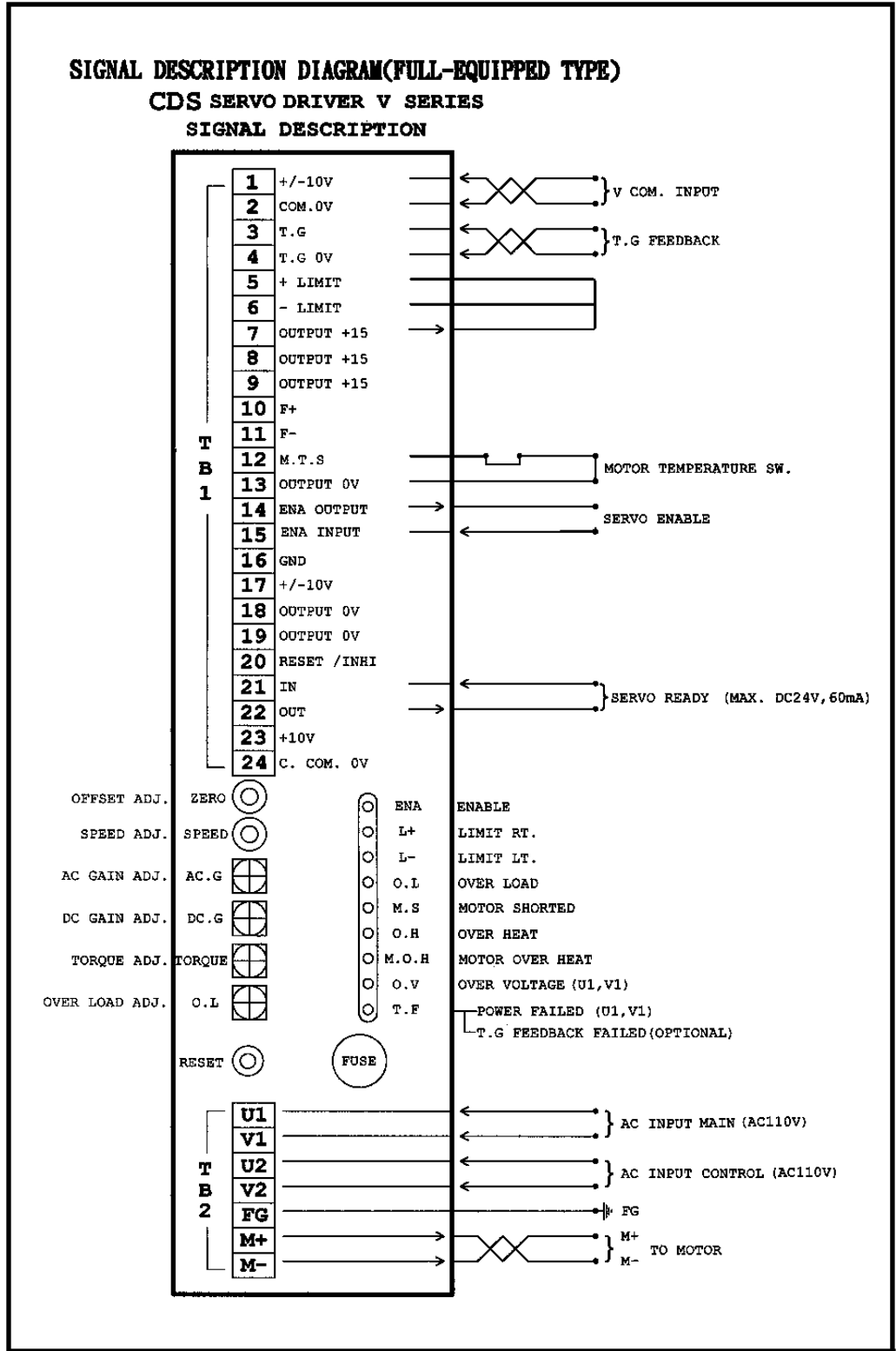


Figure 4-5

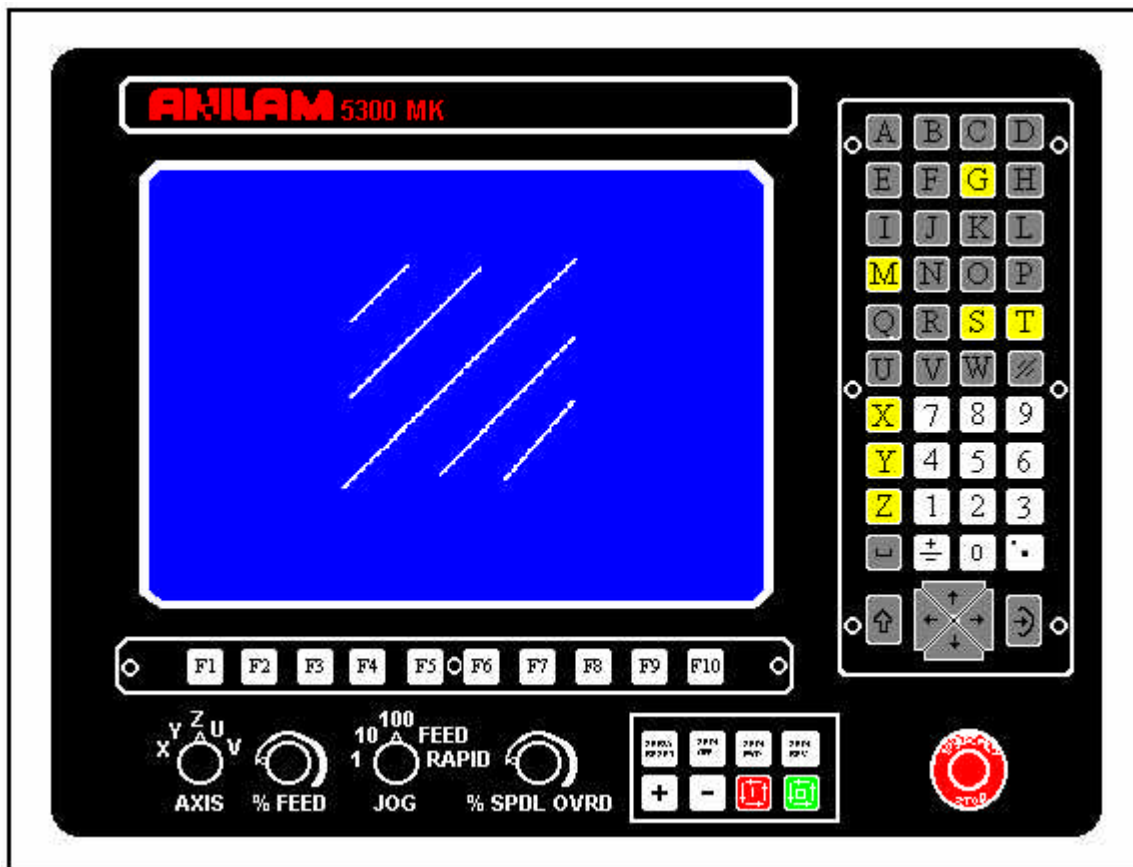
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SECTION  
**5**

# Machine Operation

## Powering Up The Control



## Powering On The Machine

Turn on the main disconnect on the right side of the machine. After the computer has booted up the software version screen will appear. Push F10 (Soft-key 10) to continue. Then depending on the machines configuration either a selection menu is displayed on the screen, with the cursor keys, highlight CNC Control and push ENTER, this will start CNC software or the CNC software will start by its self.

Release the emergency-stop push button and then push the Servo Reset button.

## Powering Off The Machine

Push in the emergency-stop button. Wait for all functions on the machine to stop and then turn off the main disconnect on the right side of the machine.

## Manual Operation

### Homing The Machine

When at the main CNC screen push the shift key. A new set of function keys will be displayed. Select HOME. All axes will be homed with the Z-axis homing first. Or at the command line type "G28 X Y Z" then push cycle start.

### Jogging The Axis in Feed Mode

Set the jog selector switch on the operator panel to FEED and the axis selector switch to the axis to be jogged then use the + / - keys to jog the axis. The % Feed override selector switch will modify the feed rate

### Jogging The Axis in Rapid Mode

Set the jog selector switch on the operator panel to RAPID and the axis selector switch to the axis to be jogged then use the + / - keys to jog the axis. The % Feed override selector switch will modify the feed rate.

## Using The Hand wheel

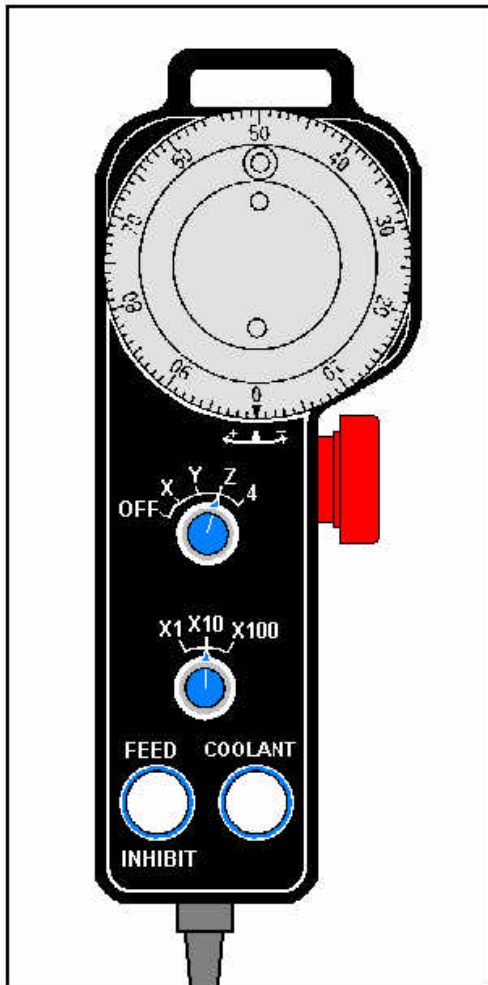
The standard hand wheel that comes on the GL CNC series machine is mounted on the left side of the operator panel and must have the F10 (hand wheel key) active in order for the hand wheel to be operational as well the jog selector switch must be at one of the following increment values as set out below

100X = 0.0100" or 0.100 mm

10X = 0.0010" or 0.010 mm

1X = 0.0001" or 0.001 mm

The units are either inch or metric depending on the mode the control is in at the time of operation.



The Hand-wheel Shown to the left is optional. This hand wheel comes with the following features

Emergency stop button

Axis selector switch

Incremental selector switch

Two push buttons.

The Axis selector switch is used to turn off the hand wheel when in the off position or select the axis you want to jog.

The Incremental selector switch is used to set the increment value of each division of the wheel.

The left push button is used for feed inhibit when pushed the lamp will flash and place the machine in to a feed hold condition, until pushed again then the machine will continue.

The right push button is used for coolant over ride. If the coolant is off it will turn it on, if the coolant is on it will turn it off. The lamp on indicates that the coolant pump is running.

## Jogging The Axis Using Incremental Jog Mode

Select the jog mode by pushing the hand on the keypad and then push the corresponding axis button to be jogged. The % Feed override selector switch will modify the feed rate

Note the increment values are as set out below

$$100X = 0.0100" \text{ or } 0.100 \text{ mm}$$

$$10X = 0.0010" \text{ or } 0.010 \text{ mm}$$

$$1X = 0.0001" \text{ or } 0.001 \text{ mm}$$

The units are either inch or metric depending on the mode the control is in at the time of operation.

## Over travel release

If for any reason the machine's axes are driven past the soft limits in to a hard over travel, the servos will become disabled. At this point the only way to reset the servos is to jog the axis off the hard limit switches. By using the manual hand wheels jog the axis off the hard limit switch then reset the servo's.

## MDI Operations

In the Manual mode certain functions can be executed without creating a part program. Commands are executed by typing an instruction on the COMMAND line of Manual Mode then pressing the CYCLE START key. Most programmable functions may be executed in this manner, but only one at a time. For more information on MDI operations please read the Anilam 5300MK Programming manual

## Running The Spindle

Enter a spindle speed range by entering S50 to S6000 and enter the direction of rotation M3 (CW.) or M4 (CCW.) on the COMMAND line and push the CYCLE START key. The spindle may be stopped and started in both CW. and CCW. from the operator panel by pushing the SPDL STOP, SPDL FWD and SPDL REV push buttons. The % SPDL override selector switch on the Operator panel will modify the spindle speed.

For all other operations of the machine and programming refer the Anilam 5000M-programming manual supplied with your machine.

M-Code List		
M00	Infinite dwell	Control waits for cycle start or manual key. Similar to pressing Hold key.
M02	End of Program	Signals end of program to control. Spindle, coolant pump and work air blast turn off.
M03	Spindle on forward	Signals the interface to run the spindle drive in the CW. direction
M04	Spindle on reverse	Signals the interface to run the spindle drive in the CCW'S. direction
M05	Spindle off	Signals the interface to stop the spindle drive.
M08	Coolant on	Signals the interface to start the coolant pump
M07 (Option)	Mist coolant on	Signals the interface to start the coolant mist pump
M09	Coolant and air off	Signals the interface to stop the coolant pumps and work air blast.
M10 (Option)	4 <sup>th</sup> Axis clamp	Signals the interface to turn on the 4 <sup>th</sup> axis brake
M11 (Option)	4 <sup>th</sup> Axis unclamp	Signals the interface to turn off the 4 <sup>th</sup> axis brake
M12 (Option)	Stand alone 4 <sup>th</sup> Axis controller start	Signals the interface to run a 4 <sup>th</sup> axis stand alone controller  EG. HAAS or SMW

M13 (Option)	Chip conveyor on	Signals the interface to turn on the chip conveyor motor
M14 (Option)	Chip conveyor off	Signals the interface to turn on the chip conveyor motor
M18 (Option)	Work air on	Signals the interface to turn on the work air blast.
M30	End of program	Signals end of program to control. Spindle, coolant pump and work air blast turn off.
M91	Maintenance mode on	Signals the interface to allow changing the active tool number in the spindle. SEE RESETTING TOOL NUMBER on page 27.
M92	Maintenance mode off	Signals the interface to turn off the Maintenance mode. SEE RESETTING TOOL NUMBER on page 27.
M98	Subprogram Call	Call subprogram Pp. EG. M98 PP [L] P=subprogram number L=loop count
M99	End of Subprogram	End of current subprogram. Error if not in subprogram. CNC continuous execution in the block after subprogram call.

## Builder Alarm List

There are two types of Messages: Error and Warnings. The differences between the two are that an Error message is fatal and a Warning is to inform you that something is wrong and the operator must correct the problem. Generally with an Error Message the machine will come to a complete stop and the problem must get fixed before the machine can run again. Below is a complete list of messages

generated by H. H. Roberts and not the messages generated by Anilam for a complete list see the Anilam 5000M-programming manual or call your Dealer.

## Error Messages

- **SPINDLE DRIVE FAULT MUST RESET SERVO'S**

This fault is generated by the spindle drive. You can reset this error by completely powering down the machine and wait at least 5 minutes to allow the spindle drive to reset and then power the machine back up and try to run the spindle again. If it will run you should note what the machine was doing before the fault in order to avoid the problem again if the problem persists or this will not clear the fault then call your dealer.

## Warning Messages

- **LOW WAY LUBE**

This warning is generated from the float switch mounted in the lube tank. If the switch is not in the state that the control thinks they should be in it will generate this warning. The following are the conditions that will create this warning.

1. The oil level is below the minimum and needs to be refilled.
2. The input from the switch is missing, check and adjust the limit switch it's input is can node 0 input 5 (X0: 5).

- **MAINTENANCE MODE ACTIVE**

This warning is generated when the M91 Maintenance Mode is active. To clear this message you must turn off Maintenance Mode by using M92

- **SPINDLE LOCK ACTIVE**

This warning is generated from the limit switch mounted on the left side of the head indicating that the spindle lock pin is engaged. To clear this message disengage the spindle lock pin.



- **MUST UNLOCK SPINDLE BEFORE STARTING**

This warning is generated when the spindle lock is engaged and the spindle has been commanded to run. To clear this message disengage the spindle lock pin.

- **COOLANT LOW**

This warning is generated from the float switch mounted in the coolant tank (optional). If the switch is not in the state that the control thinks they should be in it will generate this warning. No action other than the warning will be displayed if the machine is in auto mode until the machine is put into manual mode then the cycle start button becomes inactive until the warning is cleared. The following are the conditions that will create this warning.

1. The coolant level is below the minimum and needs to be refilled.
2. The input from the switch is missing: check and adjust the limit switch; its input is can node 0 input 7 (X0: 7).

- **CYCLE START INACTIVE MUST CLEAR FAULT**

This warning is generated when the COOLANT LOW or LOW WAY LUBE warning is active and the operator pushes the cycle start button. To clear this warning you must first clear the COOLANT LOW or LOW WAY LUBE warning.

## Maintenance Mode

Maintenance mode is used to set specific registers in the IPI program. It can be used for setting registers to bypass some alarms. We call these keep relays, presently there are two keep relays; They are H50 for bypassing the Low Coolant alarm and H51 for bypassing the door interlock, to allow the machine to be run for testing or trouble shooting.

H-Code List		
H50	Sets ignore coolant low alarm	Can only be used when Maintenance mode active
H51	Sets ignore work door interlock	Can only be used when Maintenance mode active
H81	Displays IPI Registers Range M0-M15	Can only be used when Maintenance mode active
H82	Displays IPI Registers Range M16-M31	Can only be used when Maintenance mode active
H83	Displays IPI Registers Range M32-M47	Can only be used when Maintenance mode active
H84	Displays IPI Registers Range M48-M63	Can only be used when Maintenance mode active
H85	Displays IPI Registers Range M64-M79	Can only be used when Maintenance mode active
H86	Displays IPI Registers Range M80-M95	Can only be used when Maintenance mode active
H87	Displays IPI Registers Range M96-M111	Can only be used when Maintenance mode active

H88	Displays IPI Registers Range M112-M127	Can only be used when Maintenance mode active
H89	Displays IPI Registers Range M128-M143	Can only be used when Maintenance mode active
H90	Displays IPI Registers Range M144-M159	Can only be used when Maintenance mode active
H91	Displays IPI Registers Range M160-M175	Can only be used when Maintenance mode active
H92	Displays IPI Registers Range M176-M191	Can only be used when Maintenance mode active
H93	Displays IPI Registers Range M192-M207	Can only be used when Maintenance mode active
H94	Displays IPI Registers Range M208-M207	Can only be used when Maintenance mode active
H95	Displays IPI Registers Range M192-M223	Can only be used when Maintenance mode active
H96	Displays IPI Registers Range M224-M239	Can only be used when Maintenance mode active  M224-VAR1100  M239-VAR1139