1. SL-SERIES INSTALLATION INSTRUCTIONS

Machine footprints and operating dimensions are available in the brochure and Pre-Installation Guide

General Requirements

Operating Temperature Range 41°F to 104°F (5 to 40°C)
Storage Temperature Range -4°F to 158°F (-20 to 70°C)
Ambient Humidity: 20% – 95% relative humidity, non-condensing
Altitude: 0-7000 ft.

Electricity Requirements

IMPORTANT! REFER TO LOCAL CODE REQUIREMENTS BEFORE WIRING MACHINES.

ALL MACHINES REQUIRE:
Three phase 50 or 60Hz power supply.
Line voltage that does not fluctuate more than +/-5%

15 HP System	Voltage Requirements	High Voltage Requirements
SL-10	(195-260V)	(354-488V)
Power Supply	50 AMP	25 AMP
Haas Circuit Breaker	40 AMP	20 AMP
If service run from elec. panel is less than 100' use:	8 GA. WIRE	12 GA. WIRE
If service run from elec. panel is more than 100' use:	6 GA. WIRE	10 GA. WIRE

20 HP System	Voltage Requirements	High Voltage Requirements
[1]SL-20, TL-15	(195-260V)	(354-488V)
Power Supply	50 AMP	25 AMP
Haas Circuit Breaker	40 AMP	20 AMP
If service run from elec. panel is less than 100' use:	8 GA. WIRE	12 GA. WIRE
If service run from elec. panel is more than 100' use:	6 GA. WIRE	10 GA. WIRE

30-40 HP System	Voltage Requirements	High Voltage Requirements[2]
TL-15BB, SL-20BB, SL-30, SL-30BB, [1]SL-40, SL-40BB	(195-260V)	(354-488V)
Power Supply	100 AMP	50 AMP
Haas Circuit Breaker	80 AMP	40 AMP
If service run from elec. panel is less than 100' use:	4 GA. WIRE	8 GA. WIRE
If service run from elec. panel is more than 100' use:	2 GA. WIRE	6 GA. WIRE

55HP System	Voltage Requirements	High Voltage Requirements
[1]SL-40, SL-40BB, SL-40L	(195-260V)	(354-488V)
Power Supply	170 AMP	**Must use an external transformer**
Haas Circuit Breaker	150 AMP	
If service run from elec. panel is less than 100' use:	0 GA. WIRE	
If service run from elec. panel is more than 100' use:	0 GA. WIRE	

WARNING!
A separate earth ground wire of the same conductor size as the input power is required to be connected to the chassis of the machine. This ground wire is required for operator safety and for proper operation. This ground must be supplied from the main plant ground at the service entrance, and should be routed in the same conduit as the input power to the machine. A local cold water pipe, or ground rod adjacent to the machine cannot be used for this purpose.

Input power to the machine must be grounded. For wye power, the neutral must be grounded. For delta power, a central leg ground or one leg ground should be used. The machine will not function properly on ungrounded power. (This is not a factor with the External 480V Option)

The rated horsepower of the machine may not be achieved if the imbalance of the incoming voltage is beyond an acceptable limit. The machine may function properly, yet may not deliver the advertised power. This is noticed more often when using phase converters. A phase converter should only be used if all other methods cannot be used.

The maximum leg-to-leg or leg-to-ground voltage should not exceed 260 volts, or 504 volts for high-voltage machines with the Internal High Voltage Option.

[1] The current requirements shown in the table reflect the circuit breaker size internal to the machine. This breaker has an extremely slow trip time. It may be necessary to size the external service breaker up by 20-25%, as indicated by “power supply”, for proper operation.

[2] The high-voltage requirements shown reflect the Internal 400V configuration which is standard on Europeon machines. Domestic and all other users must use the External 480V option.

Air Requirements

The CNC Lathe requires a minimum of 100 PSI at 4 scfm at the input to the pressure regulator on the back of the machine. This should be supplied by at least a two horsepower compressor, with a minimum 20-gallon tank, that turns on when the pressure drops to 100 PSI.

Machine Type	Main Air Regulator	Input Airline Hose Size
SL-Series	85 psi	3/8" I.D.

The recommended method of attaching the air hose is to the barb fitting at the back of the machine with a hose clamp. If a quick coupler is desired, use at least a 3/8".

NOTE: Excessive oil and water in the air supply will cause the machine to malfunction. The air filter/regulator has an automatic bowl dump that should be empty before starting the machine. This must be checked for proper operation monthly. Also, excessive contaminants in the air line may clog the dump valve and cause oil and/or water to pass into the machine.

NOTE: The nipple between the air filter/regulator and the Bijur oil lubricator (See illustration in "Air Connection" section) reservoir tank below the control box on the back of the machine is for the optional rotary table. DO NOT use this as a connection for an auxiliary air line. Auxiliary connections should be made on the left side of the air filter/regulator.

1.1 Moving the Crate

TOOLS REQUIRED

Precision bubble level (0.0005 inch per 10")
1 1/8" hex wrench or ratchet
1 1/2" wrench
Test indicator (0.0005)
3/4" wrench
Claw hammer

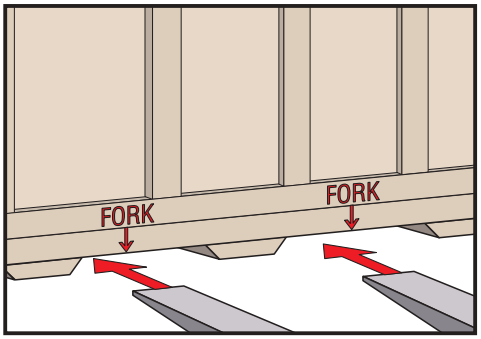
A forklift capable of lifting more than 9,000 pounds (14,000 pounds for the SL-30, 23,000 pounds for SL-40), with forks at least 5' long by 6" wide (6' by 6" wide for SL-30 and 8' by 8" wide for SL-40).

MATERIALS REQUIRED

Wire and air hose or piping as specified in the Service Requirements section
A small amount of grease
Way lube for the lubricator (Vactra #2)

WARNING!

THE LATHE CRATE CAN ONLY BE MOVED WITH A FORKLIFT.



CAUTION! The fork positions are marked on the crate. (Also, note that there are three skids at each side of the pallet. The heavy part of the machine [the back] is positioned over the two skids that are closest together.) If the fork positions are ignored, there is a good chance that the retaining bolts will be sheared off by the forks and also that the machine will tip over when it is picked up.

1.2 Unpacking the Lathe

Uncrating

NOTE: Unless you are certain that you will not be shipping the machine, the crate and packing materials should be stored for reuse. Be careful not to damage the crate and the other packing materials.

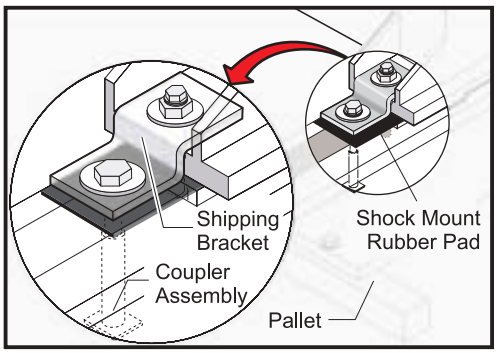
1. Pry off the clips around the top of the crate with a claw hammer and remove the top panel.
2. Pry off all but one clip at each corner of the crate.
3. Remove the plastic cover.

CAUTION! Do not put undue pressure on the top of the machine as you remove the plastic.

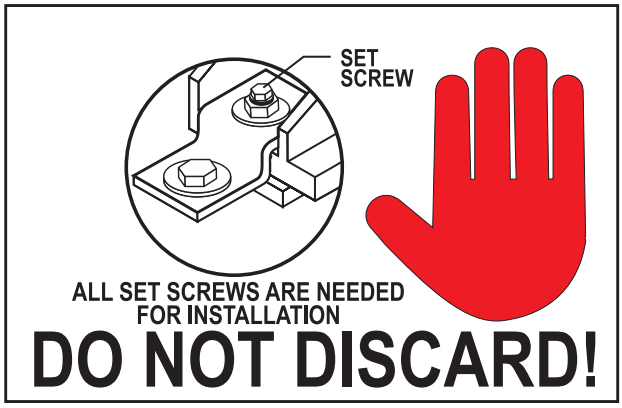
4. Pry off the last clip at each corner and remove the side panels.

CAUTION! The side panels are heavy — be careful that they do not drop on your feet or tip over on you.

5. Lift out the coolant tank. Remove the cleats that held them in place.



6. Remove the ¾" bolts holding the base to the pallet and the plastic thread protecting sleeve from the base.
7. Remove the nuts, on the leveling screws, holding the shipping bracket to the base casting. Remove the shipping brackets.
8. Lift the machine off the pallet.



Setting in Place

CAUTION! Do not lift the machine any farther than necessary off the floor when moving it, and move as slowly and cautiously as possible. Dropping the machine, even from a height of a few inches, can cause injury, result in expensive repairs, and void the warranty.

1. Unbolt clamp plates. Lift the machine until the bolts clear the pallet.

2. Thread the leveling screws through the casting until thread is approximately 3/8" above the top of the casting. If a screw is excessively hard to turn, remove it, dress the threads in the hole with a 1-14 tap, and inspect the screw. If the screw has dings, dress the threads with a 60° V file. Install the lock nuts on the leveling screws, but do not tighten. **SL-20 machines require the lock nuts to be installed under the leveling foot.**

3. Move the machine to where it will be located. Take leveling pads out of the tote kit, grease the dimple in each pad, and locate them under the leveling screws at the four corners. Lower the machine.

4. Remove all banding and packing material around the control panel, monitor and doors.

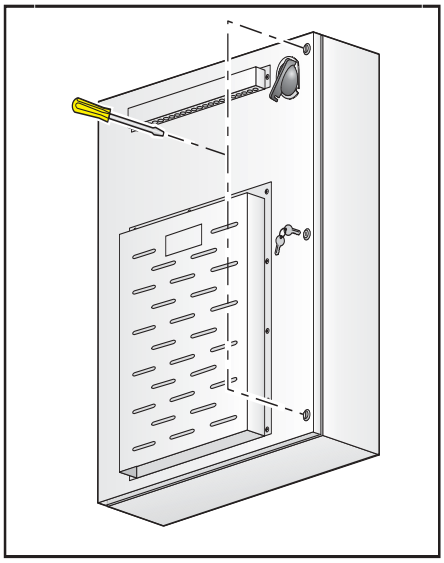
5. Remove foot switches from inside machine and attach cable to socket located at left end of front support beam, with cable facing downward.

1.3 Initial Setup

WARNING!

At this point, there should be NO electrical connection to the machine. The electrical panel should be closed and the three latches on the door should be secured at all times except during installation and service. At those times, only qualified electricians should have access to the panel. When the main switch is on, there is high voltage throughout the electrical panel (including the circuit boards and logic circuits) and some components operate at high temperatures. Therefore, you must exercise extreme caution when you are working in the panel.

1. Set the main switch at the upper right of the electrical panel on the back of the machine to OFF.



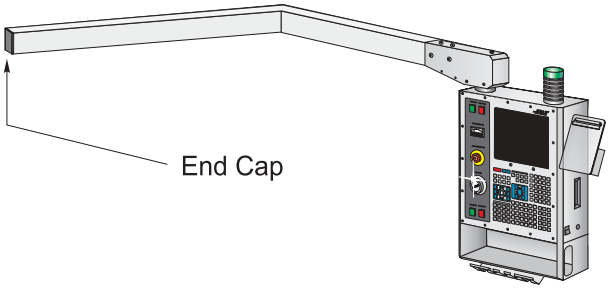
2. Using a screwdriver to unlock the two latches on the panel door, unlock the cabinet with the key, and open the door.

3. Take sufficient time to check all the components and connectors associated with the circuit boards. With the power off, push on them gently to make sure that they are seated in their sockets. Look for any cables that have become disconnected, look for any signs of damage and loose parts in the bottom of the panel box. If there are any signs that the machine was mishandled, be extremely careful in powering up the machine (be ready to shut it off IMMEDIATELY). Or if there are obvious problems, call the factory BEFORE proceeding.

Support Arm End Cap

For all Lathes except SL-10

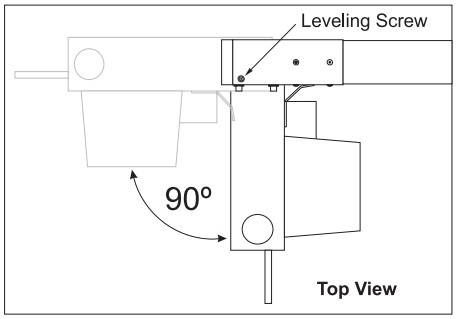
The Tote Kit Supplied will include one Support arm End Cap with an O-ring. The End Cap is to be placed on the machine end of the Controller Support Arm.

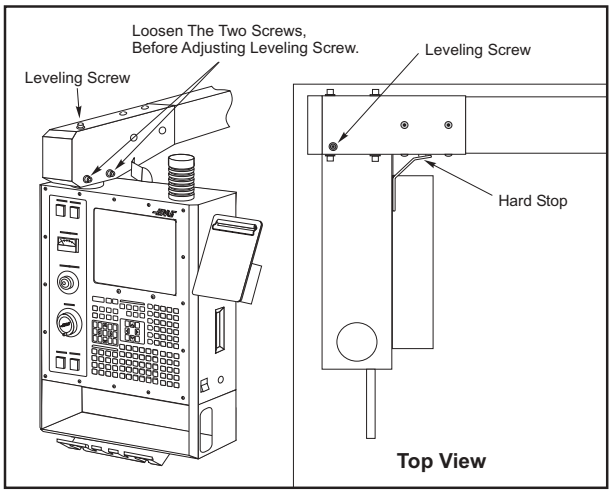


Pendant Leveling

The pendant leveling feature allows the angle of the pendant to be adjusted during installation.

1. Rotate the pendant to the position in the following figure for proper leveling.



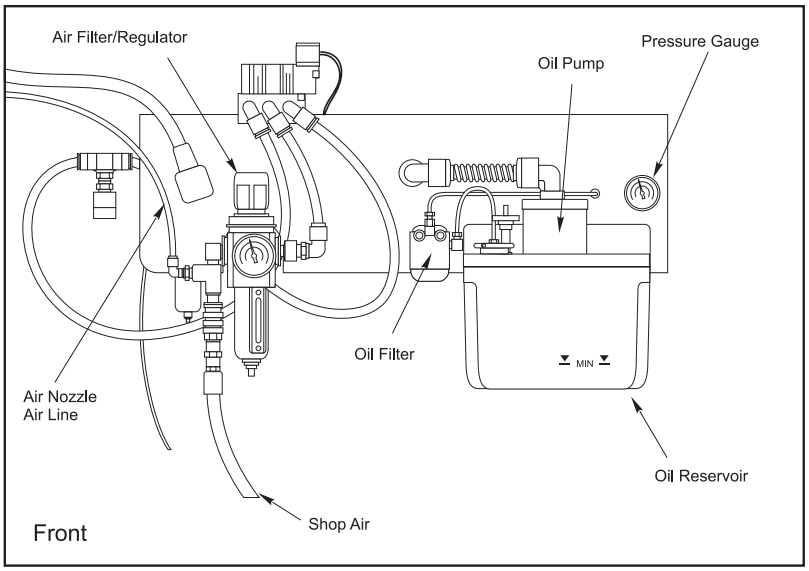


2. Loosen the two (2) screws on the end cap before adjusting the leveling screw.
3. Use a wrench on the leveling screw to change the angle of the pendant.
4. Tighten the two (2) screws on the end cap once the pendant is level.
5. Rotate the pendant 90° forward and check the level again. Repeat the procedure if necessary.

AIR CONNECTION

CAUTION! Working with the air service required for LATHE can be hazardous. Make sure that pressure has been removed from the air line before you connect it to the machine, disconnect it from the machine, or service parts of the air system on the machine.

1. When the machine leaves the factory, the air filter is empty, and air lubricator and the lubricator reservoir tank are full. However, they should be checked and serviced if required before compressed air is supplied to the machine.



2. With the pressure off in the air line, connect the air supply to the hose barb next to the air filter/regulator (below the electrical panel). If the fitting supplied is not compatible, simply replace it.

3. Start the compressor, set it between 100 and 150 PSI. Set the regulator on the machine to 85 to 90 PSI.

4. Prime the lubricator to make sure it is working. To prime the lubrication system, pull up on the handle on top of the reservoir tank.

CAUTION! NEVER push down on the primer handle! It gradually returns to the down position by itself, and the corresponding pressure increase can be seen on the pressure gauge.

NOTE: Depending on the position of the cam that drives it, the lubrication system may not activate until a few minutes after the machine is started. However, if there is a problem with the system, an alarm will stop the machine.

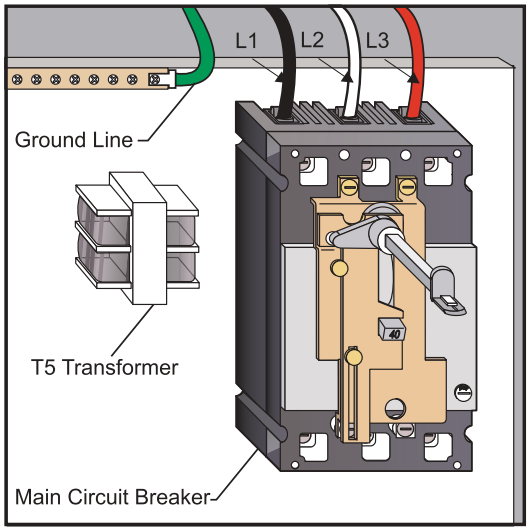
ELECTRICAL CONNECTIONS

NOTE: The machine must have air pressure at the air gauge, or a "Low Air Pressure" alarm will be present on power up.

CAUTION! Working with the electrical services required for the lathe can be extremely hazardous. The electrical power must be off and steps must be taken to ensure that it will not be turned on while you are working with it. In most cases this means turning off a circuit breaker in a panel and then locking the panel door. However, if your connection is different or you are not sure how to do this, check with the appropriate personnel in your organization or otherwise obtain the necessary help BEFORE you continue.

WARNING!

The electrical panel should be closed and the three latches on the door should be secured at all times except during installation and service. At those times, only qualified electricians should have access to the panel. When the main circuit breaker is on, there is high voltage throughout the electrical panel (including the circuit boards and logic circuits) and some components operate at high temperatures. Therefore, extreme caution is required.



1. Hook up the three power lines to the terminals on top of the main switch at upper right of electrical panel and the separate ground line to the ground bus to the left of the terminals.

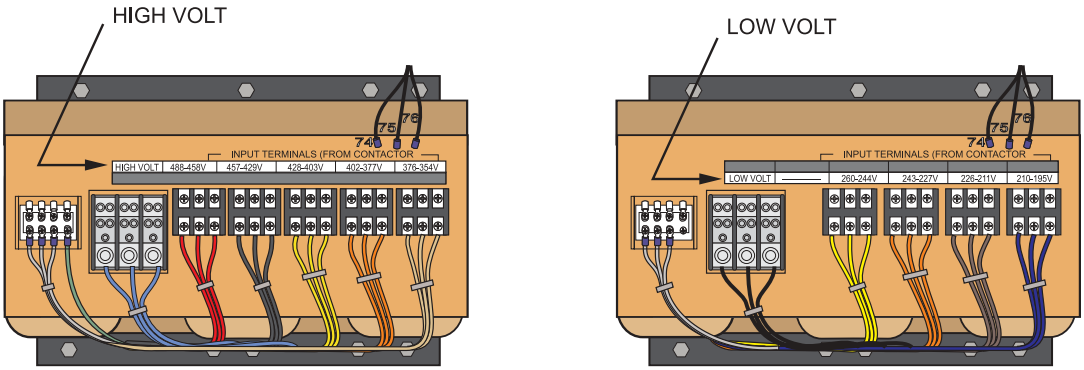
NOTE: Make sure that the service wires actually go into the terminal-block clamps. (It is easy to miss the clamp and tighten the screw. The connection looks fine but the machine runs intermittently or has other problems, such as servo overloads.) To check, simply pull on the wires after the screws are tightened.

2. After the line voltage is connected to the machine, make sure that main circuit breaker (at top-right of rear cabinet) is OFF (rotate the shaft that connects to the breaker counterclockwise until it snaps OFF). Turn ON the power at the source. Using an accurate digital voltmeter and appropriate safety procedures, measure the voltage between all three pair phases at the main circuit breaker and write down the readings. The voltage must be between 195 and 260 volts (360 and 480 volts for high voltage option).

NOTE: Wide voltage fluctuations are common in many industrial areas; you need to know the minimum and maximum voltage which will be supplied to the machine while it is in operation. U.S. National Electrical Code specifies that machines should operate with a variation of +5% to -5% around an average supply voltage. If problems with the line voltage occur, or low line voltage is suspected, an external transformer may be required. If you suspect voltage problems, the voltage should be checked every hour or two during a typical day to make sure that it does not fluctuate more than +5% or -5% from an average.

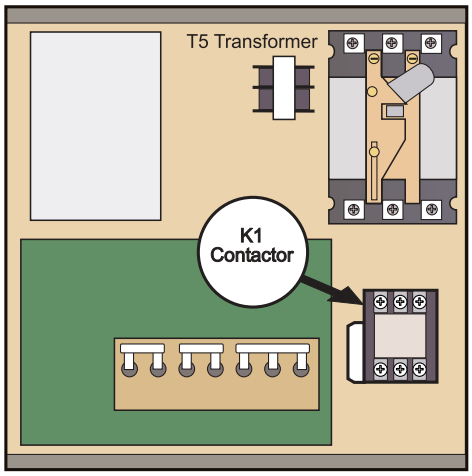
CAUTION! Make sure that the main breaker is set to OFF and the power is off at your supply panel BEFORE you change the transformer connections. Make sure that all three black wires are moved to the correct terminal block and that they are tight.

3. Check the connections on the transformer at the bottom-right corner of the rear cabinet. The three black wires labeled **74, 75,** and **76** must be moved to the terminal block triple which corresponds to the average voltage measured in **step 2** above. There are four positions for the input power for the 260 volt transformer and five positions for the 480 volt transformer. The labels showing the input voltage range for each terminal position is shown in the following illustration:



4. Transformer T5 supplies 24VAC used to power the main contactor. The transformer has two input connectors located about two inches from the transformer, which allow it to be connected to either 240V or 200V. Users that have 220V-240V RMS input power should use the connector labeled 240V, while users with 190-220V input power should use the connector labeled 200V. Failure to use the correct input connector will result in either overheating of the main contactor or failure to reliably engage the main contactor.

5. Set the main switch to ON (rotate the shaft that engages the handle on the panel door clockwise until it snaps into the ON position). Check for evidence of problems, such as the smell of overheating components or smoke. If such problems are indicated, set the main switch to OFF immediately and call the factory before proceeding.



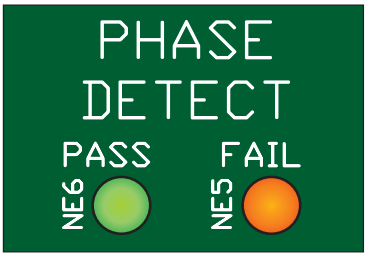
WARNING!

High Pressure Coolant (HPC) pump is a three phase pump and must be phased correctly! Improper phasing will cause damage to the HPC pump and void the warranty. Refer to the HPC start up section IF YOUR MACHINE IS EQUIPPED WITH HPC.

6. After the power is on, measure the voltage across the upper terminals on the contactor K1 (located below the main circuit breaker). It should be the same as the measurements where the input power connects to the main breaker. If there are any problems, check the wiring.

7. Apply power to the control by pressing the Power-On switch on the front panel. Check the high voltage buss on the Vector Drive (pin 2 with respect to pin 3 on the terminal bus at the bottom of the drive). It must be between 310 and 360 volts. If the voltage is outside these limits, turn off the power and recheck steps 2 and 3. If the voltage is still outside these limits, call the factory. Next, check the DC voltage displayed in the second page of the Diagnostic data on the CRT. It is labeled DC BUS. Verify that the displayed voltage matches the voltage measured at pins 2 and 3 of the Vector Drive +/- 7 VDC.

8. Electrical power must be phased properly to avoid damage to your equipment. The Power Supply Assembly PC board incorporates a "Phase Detect" circuit with neon indicators, shown below. When the orange neon is lit (NE5), the phasing is incorrect. If the green neon is lit (NE6), the phasing is correct. If both neon indicators are lit, then you have a loose wire. Adjust phasing by swapping L1 and L2 of the incoming power lines at the main circuit breaker.



WARNING!

ALL POWER MUST BE TURNED OFF AT THE SOURCE PRIOR TO ADJUSTING PHASING.

9. Turn off the power (rotate the shaft that engages the handle on the panel door counterclockwise until it snaps into the OFF position). Also, set the main switch handle on the panel door to OFF. (Both the handle and the switch must be set to OFF before the door can be closed). Close the door, lock the latches, and turn the power back on.

10. Remove the key from the control cabinet and give it to the shop manager.

INSTALLATION PROCEDURE FOR EXTERNAL 480V TRANSFORMER

Introduction

The external transformer adds to overall machine reliability and performance, however it does require extra wiring and a place to locate it. The external transformer provides electrostatically shielded isolation. This type of transformer acts to isolate all common mode line transients and improve EMI conducted emissions.

The external transformer has a 45 KVA rating. It is a 480V 60Hz only transformer.

Installation

The transformer should be located as close to the machine as possible. The input and output wiring of the transformer should conform to the local electrical codes and should be performed by a licensed electrician. The following is for guidance only, and should not be construed to alter the requirements of local regulations.

The input wire should not be smaller than the 6AWG for the 45KVA transformer. Cable runs longer than 100” will require at least one size larger wire. The output wire size should be 4 AWG.

The transformer is 480V to 240V isolation transformers with delta wound primary and secondary windings. The primary windings offer 7 tap positions, 2 above and 4 below the nominal input voltage of 480V.

The primary side should be wired as follows:

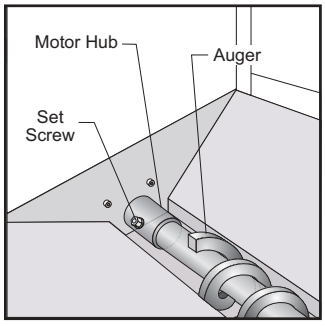
Input Voltage Range	Tap
493-510	1 (504)
481-492	2 (492)
469-480	3 (480)
457-468	4 (468)
445-456	5 (456)
433-444	6 (444)
420-432	7 (432)

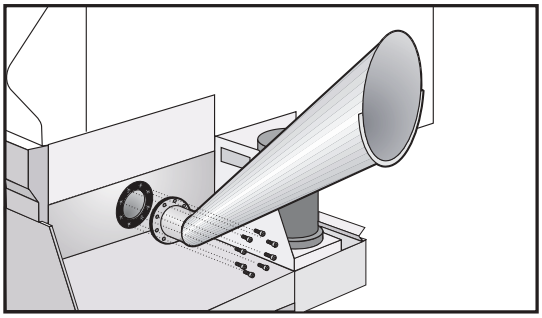
This should produce a voltage on the secondary side of 234-243 V RMS L-L. Verify this and readjust the taps as required. At the machine, connect the cables at the input of the internal 230V transformer to the 227-243V taps. Apply power to the machine and verify that the DC voltage between pins 2 and 3 of the Vector Drive (2nd and 3rd pins from the left) is 329-345VDC. If not, return to the 480V isolation transformer and readjust the taps as required. Do not use the taps on the internal 230V transformer to adjust the voltage.

Optional Chip Auger Installation

1. Unpack the auger and discharge tube.

2. Slide the auger into the discharge tube opening and then slip opposite end onto motor hub. Fasten to motor hub with the 5/16-18 x 2½" bolt.





3. Install gasket and slide the discharge tube into the opening. Attach the discharge tube with bolts and locking washers and tighten uniformly.

4. After machine start-up, check the operation of the auger to ensure the direction of rotation will move the chips toward the discharge tube. If the auger is turning so that the chips are not being moved toward the discharge tube, change PARAM 209 bit 12 from 1 to 0 or 0 to 1 to establish a new forward direction.

MAINTENANCE

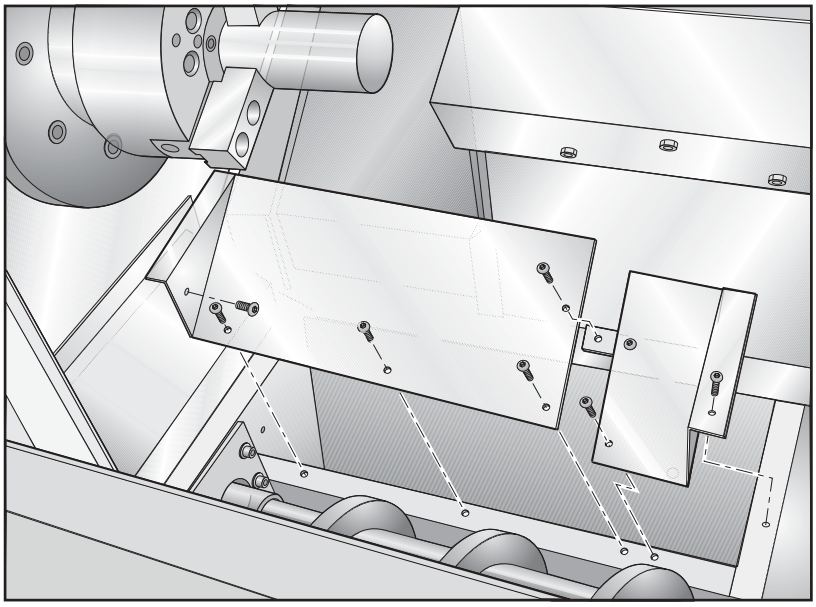
During normal operation, most chips are discharged from the machine at the discharge tube. However, very small chips may flow through the drain and collect in the coolant tank strainer and pan coolant drain (under the pan). To prevent drain blockage, clean this trap regularly. Should the drain become clogged and cause coolant to collect in the machine's pan, stop the machine, loosen the chips blocking the drain, and allow the coolant to drain. Empty the coolant tank strainer, then resume operation.

NOTE: Auger and discharge tube are subject to wear. Abrasive swarf, hard steel chips and continuous use will accelerate this wear.

NOTE: On a machine with a safety circuit, the chip auger will only run with the door closed regardless of the Conveyor Door Override bit.

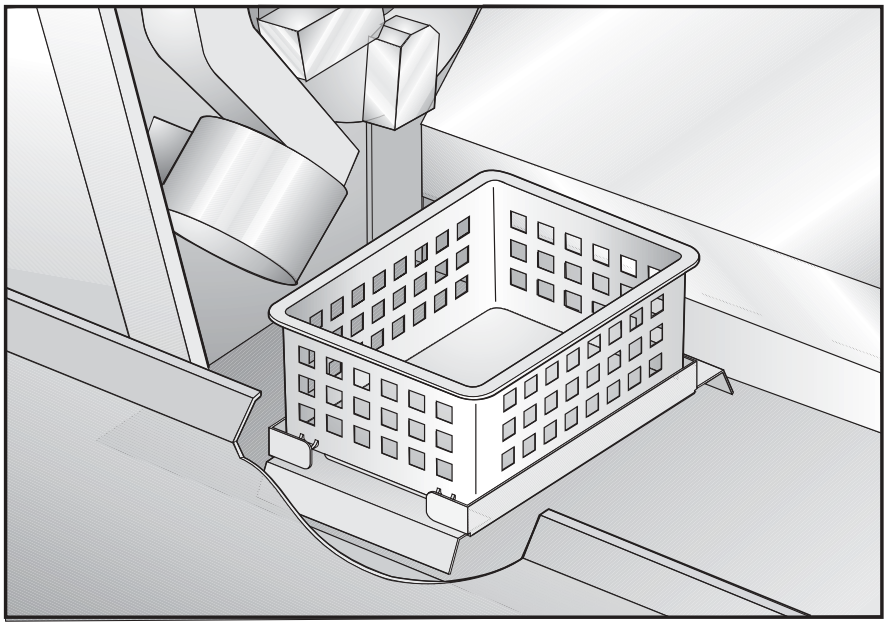
SL-10 Chip Auger Discharge Tube Installation

1. Locate and remove the BHCS that secure the inner front and rear wings. Remove the inner front and rear wings.



2. Slide the chip auger assembly towards the rear of the machine.
3. Unpack the discharge tube.
4. Install gasket and slide the discharge tube into the opening. Attach the discharge tube with bolts and locking washers and tighten uniformly.
5. Slide the chip auger assembly back into its original location.
6. Reinstall the inner front and rear wings using the BHCS removed in step 1.
7. After machine start-up, check the operation of the auger to ensure the direction of rotation will move the chips toward the discharge tube. If the auger is turning so that the chips are not being moved toward the discharge tube, change PARAM 209 bit 12 from 1 to 0 or 0 to 1 to establish a new forward direction.

SL-10 Parts Basket

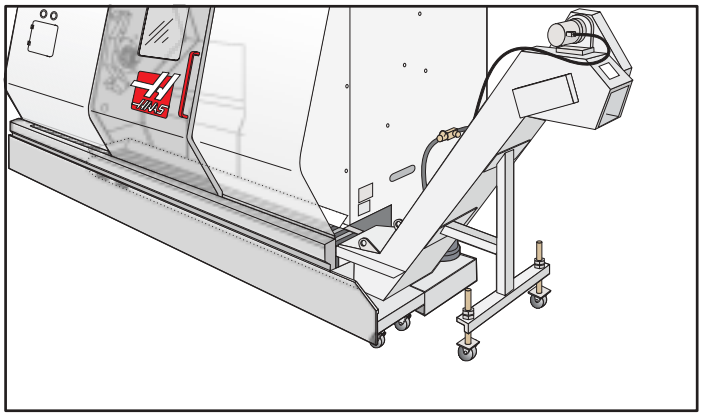


The Parts Basket for the SL-10 provides a convenient and simple method of containing finished parts. When combined with the Barfeeder option, you can run consecutive parts without having to stop the machine and fetch each finished part. The basket has dimensions of 11” x 8” x 4.8”.

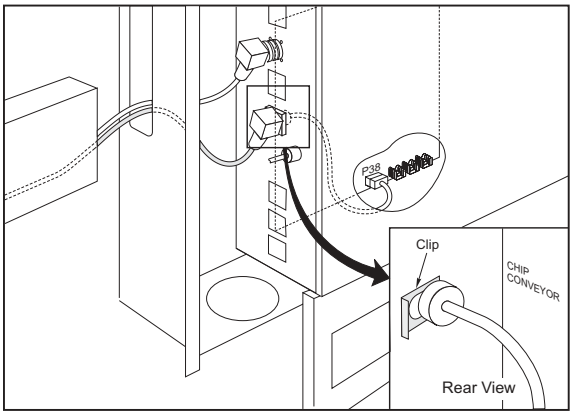
Installation

1. Place the Parts Basket Tray over the chip auger trough.
2. Set the Parts Basket on the Parts Catcher Tray. Position the basket underneath the chuck.

Optional Chip Conveyor



1. Unpack the chip conveyor and locate the conveyor discharge cover.
2. Remove the side and nose wings from the conveyor pickup area.
3. Use the hoist loops at the incline start point to raise the conveyor high enough to remove the caster wheels and reinstall them in the operating position.
4. Slide the nose of the conveyor into the opening on the right side of the machine until the incline start point is near the machine enclosure.
5. With the nose resting in the enclosure adjust the caster wheels to support the conveyor 1/8” to1/4” above the lip of the enclosure pan.
6. Install the side, nose wings and discharge cover.
7. Punch-out the hole in the side of the cabinet and run the cable through at the location shown.
8. Fasten the cable molding to the cabinet by attaching the clip as shown.
9. Plug the connector to the I.O. board at input P38.



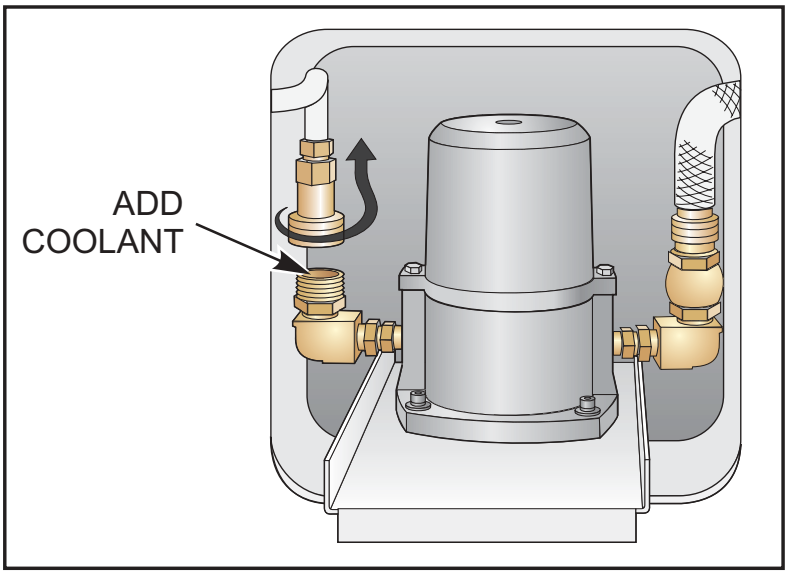
NOTE: On a machine with a safety circuit, the chip conveyor will only run with the door closed regardless of the Conveyor Door Override bit.

1.4 Coolant System

SL-10 Coolant Pump

Priming the Coolant pump

After machine installation, or after extended periods of non-use, add coolant to the inlet side of the pump as shown, until full.



Coolant Tank

1. Position the coolant tank under the front of the machine.
2. Connect the coolant pump and the auger power lines to the connectors located on the side of the control cabinet.
3. Attach the coolant hose to the pump fitting located at the base of the coolant pump
4. Fill the tank with the approximately 35 gallons of coolant (50 gallons for SL-30, 75 gallons for the SL-40). Fill with water based coolant only.*

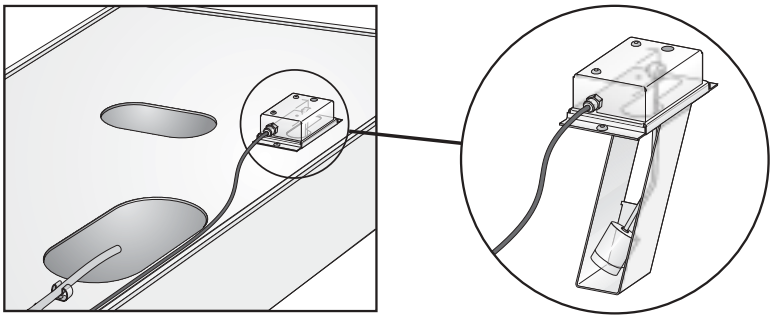
   ***Mineral cutting oils will damage rubber based components throughout the machine.**

COOLANT TANK MAINTENANCE

Clean the chips out that collect in the holes of the auger trough.
Clean the chips out of the baffles of the coolant tank. The baffles are accessible by lifting the lid of the coolant tank.

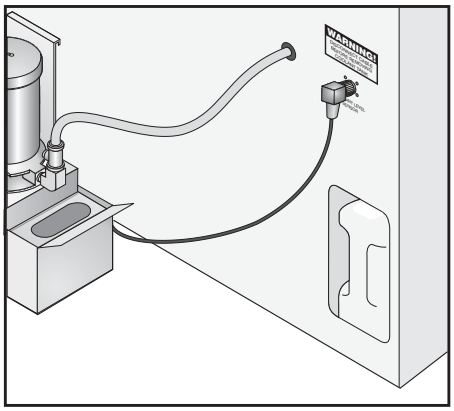
Coolant Level Gauge Installation

1. Position coolant tank as described in this manual.



Coolant Tank and Float Assembly

2. Route the cable along the inside edge of the coolant tank to the right side of the machine, then under the coolant pump. Connect the plug to the marked socket.



Electrical connection for SL series lathes.
The cable is connected to the right side.

3. Parameter values are noted on the float assembly. Once the machine is powered up these values will be entered for Parameter 603 Coolant Level Min and Parameter 604 Coolant Level Max.

4. Go to the Current Commands page. The vertical “CLNT” bar, in the lower right, should indicate an empty coolant tank, and should be blinking.

5. Fill the tank with coolant. The control should indicate that the tank is full. If it does not read full, the float needs to be calibrated.

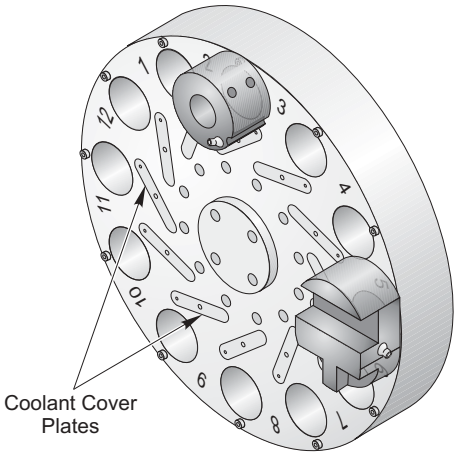
To calibrate the float, go to the diagnostics display and page down until “COOLANT LEVEL” appears. With the float at the bottom (push the float to the low position), record the coolant level value (5 digit number). Let the float return to the high (full) position, and record this value. Enter the low number (empty coolant tank) for Parameter 603 and the high number (full coolant tank) for Parameter 604.

6. Go back to the Current Commands page and verify that the gauge is working correctly.

Coolant Flow

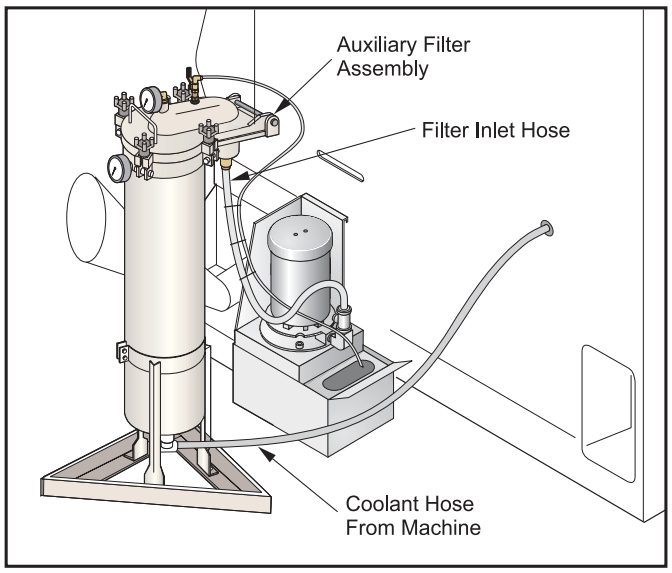
The volume of coolant flow may be controlled manually by using the valve handle to the right of the turret. This handle can be turned to shut the coolant flow off completely, or to select any volume of flow desired.

1. There are 10 or 12 coolant plate covers on the turret; one for each tool holder . To allow coolant to flow through a tool holder, the coolant plate cover must be in place. Otherwise, the plate covers must be removed.



12 Pocket Turret

Auxiliary Filter for Standard Coolant Systems



1. Place the Auxiliary Filter system next to the coolant tank of the machine.
2. Connect the output of the Standard Coolant pump to the input of the Auxiliary Filter.

3. Connect the Auxiliary Filter output hose to the coolant hose of the machine.

4. The Auxiliary Filter tank must be filled with coolant before use.

5. To fill the Auxiliary Filter tank from the Standard Coolant tank, perform the following steps:

   •Turn on the Standard Coolant Pump.
   •Open the ball valve, located on the top of the Auxiliary Filter tank.
   •Wait for coolant to appear in the drain-back hose.
   •Close the ball valve; the Auxiliary Filter tank is full.

Auxiliary Filter Replacement (Standard Coolant)

The condition of the filter element should be inspected regularly to ensure proper operation. With a clean filter, the two pressure gauges will read equally. A pressure difference of 10 psi indicates the filter is dirty and needs to be replaced. The pressure difference between the two gauges should not exceed 15 psi. Pressure should be checked with the coolant pump running and the coolant ball valves open.

NOTE: The bottom pressure gauge will drop in pressure as the filter becomes dirty.

HAAS recommends using 25-micron rated filter bags; one is provided with the unit. Replacement bags can be purchased from your local filter supplier or from HAAS (P/N 93-9130). Finer micron ratings can be used if desired.

Optional High Pressure Coolant System

APPLICATION

The High Pressure Coolant System for Haas CNC lathes is a dual coolant system, having both standard and high pressure coolant pumps. Both pumps are controlled by M codes. The standard pump delivers coolant to the tool at low pressure. The high pressure coolant pump delivers coolant to the tool at up to 300 psi, with a maximum volume of 5 gallons per minute.

INSTALLATION

1. Connect the intake filter hose to the coolant pickup connection next to the coolant pump on the coolant tank.

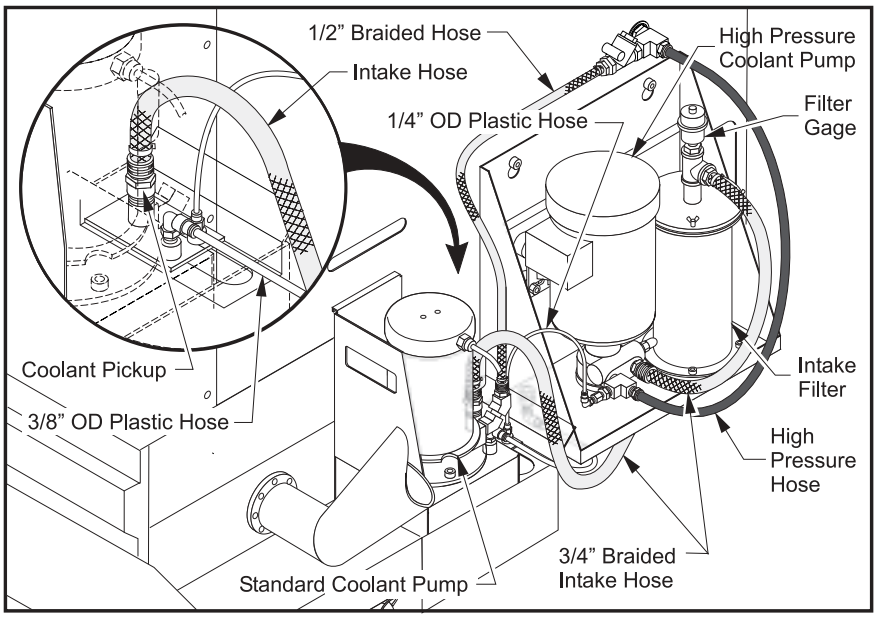
2. Route the 1/4" OD plastic hose attached to the high pressure coolant pump down into the coolant tank. Insert it in to the 1/4" OD connector next to the coolant pickup.

3. Route the 3/8" OD plastic hose from the bottom of the HPC unit to the 3/8" OD push-in elbow next to the coolant pump.

4. Attach the 1/2" braided hose to the standard coolant pump.

5. Prime the high pressure coolant system.

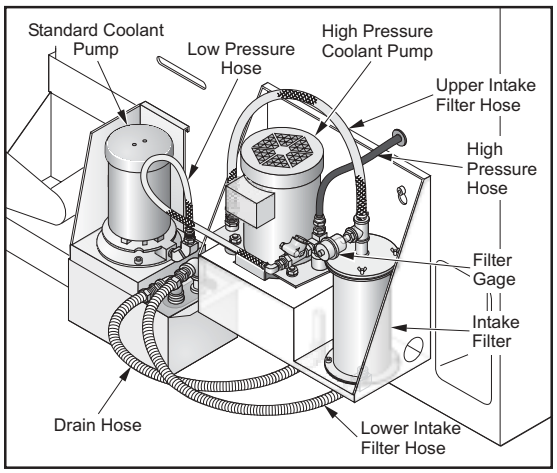
6. Run the standard coolant pump and check all connections for leaks.



Installed High Pressure Coolant System

OPTIONAL AUXILIARY FILTER FOR HIGH PRESSURE COOLANT

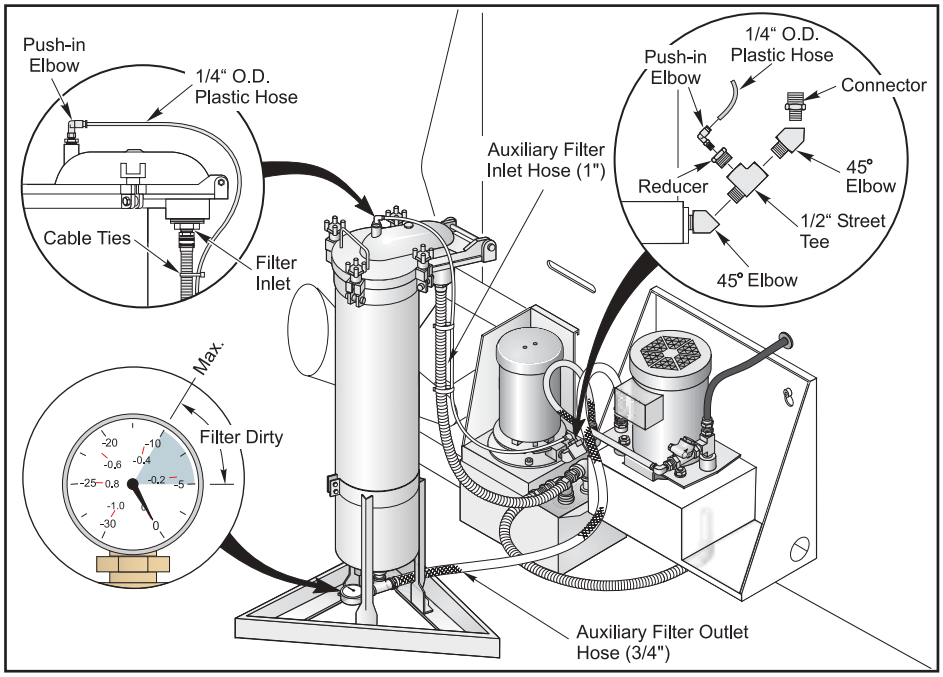
Installation:



Standard Filtration Setup

1. Attach the hose from the top of the auxiliary filter to the hose connector on the coolant pickup.

2. Install the 1/2" street-tee from the kit between the two 45^0 elbows on the primary coolant pump. Install the pipe reducer from the kit into the side outlet of the street-tee. Install the 1/4" push-in elbow into the pipe reducer. (See figure below).



Auxiliary Filter Priming System

3. Insert the 1/4" OD plastic hose into the push-in elbow on the pump. Route the hose along the intake filter hose and around the hinge of the auxiliary filter. Trim the plastic hose to length and insert it into the push-in elbow at the top of the filter. Secure the plastic hose to the inlet hose with the supplied cable ties. (See figure 3.0).

4. Attach the hose from the bottom of the auxiliary filter to the inlet of the high pressure pump.

5. Check that the filter lid is securely closed. Using a wrench handle or metal bar, tighten the two rear bar nuts first and then the front pair. Torque the bar nuts according to the manufacturer's recommendations. (approximately 30-50 ft-lbs)

6. Run the primary coolant system for four minutes to prime the bag filter housing before using the high pressure system.

Note: the intake filter on high pressure coolant is not used when the auxiliary filter is installed.

Replacement Filter Bags

Change the filter bag when the filter gauge indicator displays a vacuum level of -5 in. Hg or more. Do not allow the suction to exceed -10 in. Hg or pump damage may occur (refer to the figure above). HAAS recommends using 25-micron rated filter bags (one is provided with the unit). Replacement bags can be purchased from local filter suppliers or from HAAS (Part No. 93-9130). (Finer micron ratings can be used if desired.)

1.5 Machine Power On

WARNING!

DO NOT press POWER UP/RESTART on the control panel while the shipping bracket is in place.

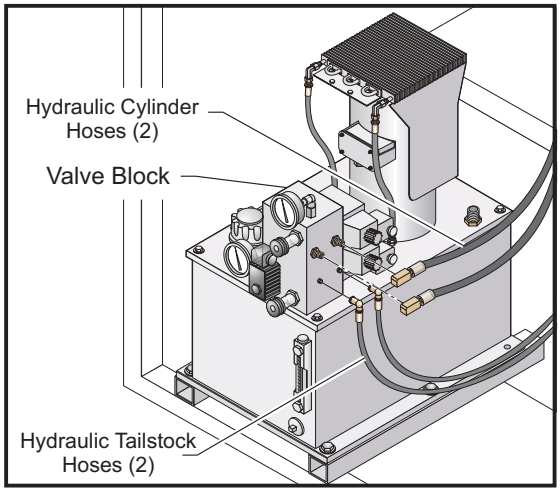
1. With the main switch on the electrical panel set to ON, press and release POWER ON at the upper left of the control panel. You will hear a click in the back of the machine and the fans will energize. (If you don't hear these sounds, the machine is not getting power and, with all necessary safety precautions, you should check the connections to the electrical panel.) After a few seconds, the display will appear on the screen.

Hydraulic Unit Phasing

MACHINE MUST BE PHASED PROPERLY!! Improper phasing will cause damage to the hydraulic unit and void the warranty.

2. Press and release the RESET button twice, or until you have no alarms, to turn the servos on. (The message "ALARM" appears at the lower right of the screen if one or more alarms are in effect.)

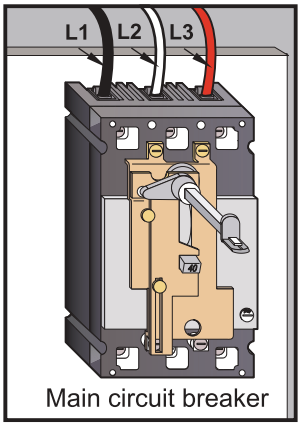
NOTE: The hydraulic pump runs whenever the servo is on.



3. Check the pump pressure gauge on the hydraulic unit (see figure). If the pressure reads zero, IMMEDIATELY POWER OFF THE MACHINE.

CAUTION! If the hydraulic pump is allowed to run for more than 30 seconds in this condition, serious damage will occur.

NOTE: When the pressure reads zero, it means the machine is not properly phased, and the pump is rotating backwards. If the pressure gauge shows a proper pressure, the phasing is correct, and no further action is required.



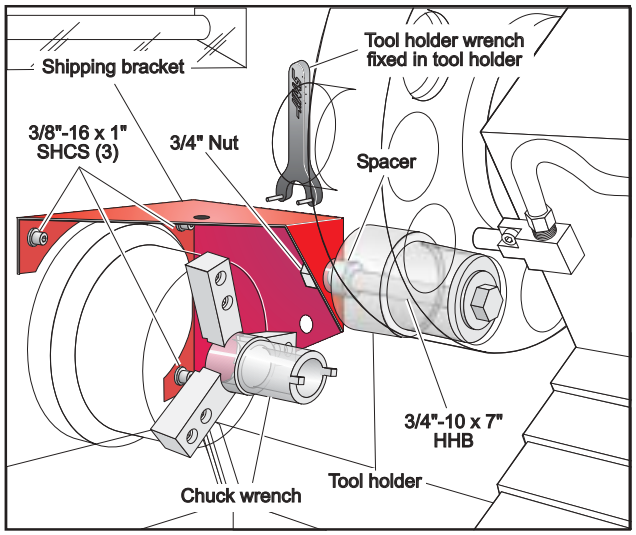
Main circuit breaker

4. To properly phase the machine:
   - •Make sure there is no power at the input side (top) of the main circuit breaker. MEASURE THE VOLTAGE!
   - •Exchange any two wires at the input side (top) of the main circuit breaker
   - •Close the control box.
   - •Return to Step 1 and retest for proper phasing.

Removing Shipping Bracket

5. With a 1 1/4" box wrench, remove the 3/4-10" x 7" HHB, nut and spacer.

6. Press ZERO RET key, Z key, then ZERO SINGL AXIS key (the turret will move away from the spindle). **DO NOT PRESS POWER UP/RESTART !!**



7. Remove the three 3/8"-16 x 1" SHCS then remove the shipping bracket (see figure).

8. Replace the three 3/8"-16 x 1" SHCS with the three 3/8"- 16 x 1/2" BHCS that are in bag attached to the turret.

9. Unclamp the chuck, to release the chuck wrench. Loosen and release the tool holder wrench from the tool holder on the turret.

10. Press and release the SETNG / GRAPH key. Then page down to the last page (press and release PAGE DOWN several times). Cursor to Setting 53, JOG W/O ZERO RETURN (with the cursor **down** key). To turn this setting on, press and release the **right** cursor key and then press and release the WRITE key at the extreme lower right of the control panel. Turning on JOG W/O ZERO RETURN bypasses the zero return interlock.

NOTE: This setting, like many others, resets to OFF when the machine is powered up. This prevents the machine from operating until a zero return has been executed — the machine control cannot determine position until it has been set by a zero return routine. For this reason, it is important that you execute a zero return immediately each time the machine is started for normal operation BUT NOT FOR THIS START-UP ROUTINE.

11. Press and release the RESET button twice, or until you have no alarms, to turn the servos on. (The message “ALARM” appears at the lower right of the screen if one or more alarms are in effect.)

NOTE: If any alarms are present and cannot be cleared with the RESET button, press and release the ALARM / MESGS key for more information on the alarms. If you are unable to clear the alarms, write down the alarm numbers and call the factory.

12. Press and release the HANDLE JOG button and check the screen for the “JOGGING Z AXIS HANDLE .001” message. Verify that the carriage will travel SLOWLY (not more than 0.001 inch per impulse — the ".001" part of the Z-axis message). If the message does not read .001, press and release the .001 button next to the HANDLE JOG button.

NOTE: The upper numbers on the buttons next to HANDLE JOG are for jog handle use, and the lower numbers are the jog speed in inches per minute when using the JOG buttons on the keypad.

13. Once you are certain that the Z-axis is working correctly (that it operates smoothly and there are no strange noises, etc.), make sure that all alarms are clear — check for the “ALARM” message at the lower right of the screen. Next, close the doors and press and release the ZERO RETURN button followed by the AUTO ALL AXES button. The Z-axis moves to the right slowly. Then, after it has reached its home position, the X- axis moves to its home position.

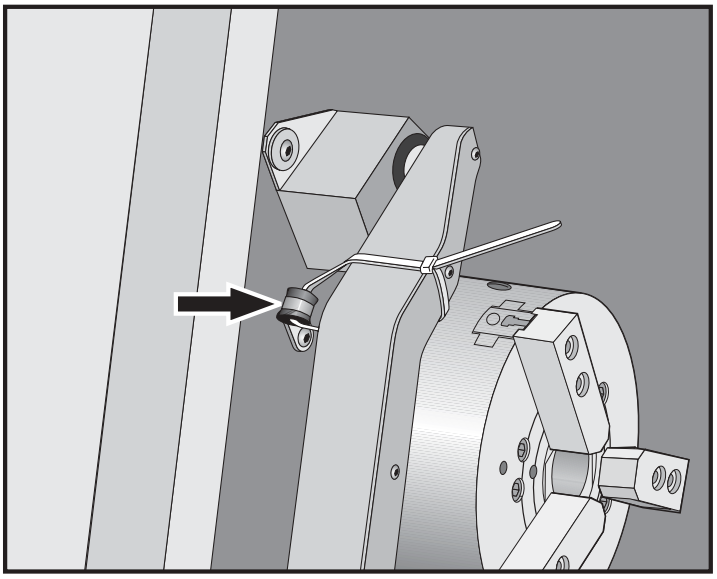
CAUTION! If you hear any strange noises, hit the EMERGENCY STOP button immediately and call the factory.

14. The machine is now ready for leveling.

Optional Tool Probe

The Tool Probe is secured in place for shipping using a cable tie.

Before operating the turning center, cut the cable tie. Remove the screw which holds the cable clamp in place, remove the cable clamp and re-install the screw.



1.6 Leveling The Lathe (SL 20-40)

Leveling the machine is required to provide proper coolant and lubrication drainage and to ensure equal loading on all four of the casting feet for consistent cutting performance. Please read through entire sequence before starting.

1. Position the turret close to the chuck (this is how the machine was shipped). Remove right-end rear panel to access the Z-axis linear guide rails.

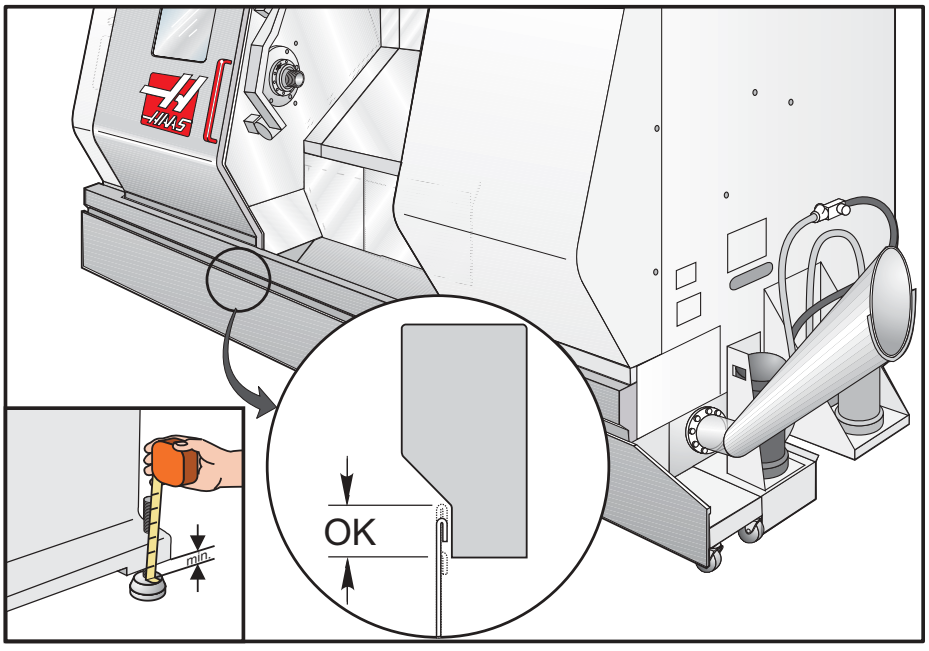
2. Place a machinist's level **across** linear guides to level front-to-back. Place level **along** linear guides to level machine left-to-right.**Take care to avoid damage to linear guide rails.**

3. Level machine by rotating leveling screws. Adjust adjacent screws alternately to maintain proper loading.

4. Adjust machine height (see figure).

5. Verify that each leveling screw requires approximately the same torque to turn. This will ensure proper loading.

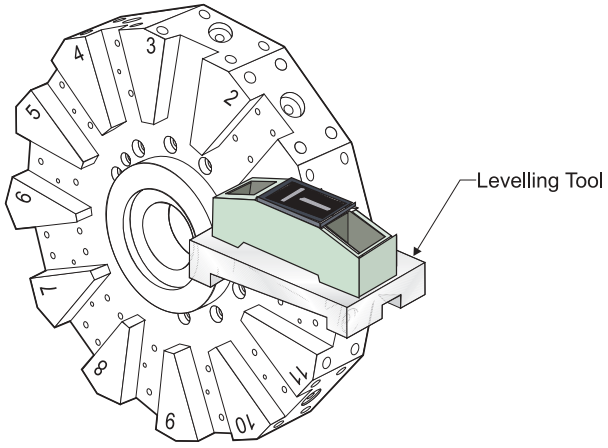
6. Tighten lock nuts.



SL-10 Leveling

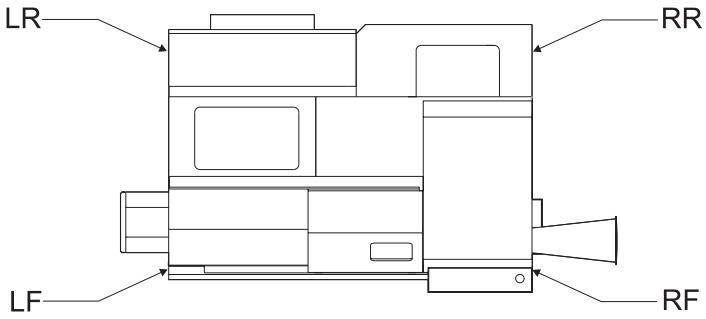
1. Remove all weight from the right-front (RF) levelling screw.

2. Place a machinist's level on the Levelling Tool as shown. Use the remaining 3 levelling screws to put the machine base within the measuring range of the level.



3. Jog the Z-axis back and forth and adjust the pressure on the RF screw to remove roll from the Z-axis. Maximum acceptable roll deviation is 0.0005"/10 throughout the entire Z-axis travel.

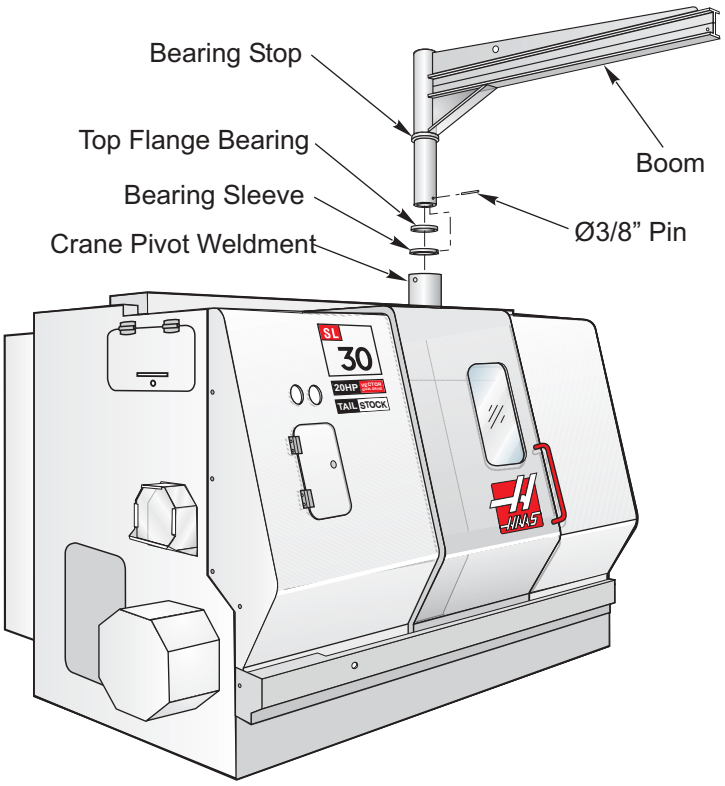
SL-10 Top View



Levelling Screw Nomenclature

1.7 Crane Arm Installation Instructions for SL-30 and SL-40

1. Remove Crane Arm from the shipping base.
2. Slide the Top Flange Bearing onto the shaft of the boom with the flange facing the bearing stop.
3. Slide the Lower Bearing onto the shaft and fasten in place with the Ø.38” pin.
4. Lift the Crane Arm into position over the Crane Pivot Weldment. There is a hole in the boom especially for lifting.
5. Lower the Crane Arm into place inside the Crane Pivot Weldment.



Crane Arm Capacity: 300 Lbs. Max.

Note: Does not include lift chain device of trolly.

2. TECHNICAL REFERENCE

2.1 Spindle

Spindle speed functions are controlled primarily by the **S** address code. The **S** address specifies RPM in integer values from 1 to maximum spindle speed (Parameter 131). NOT TO BE CHANGED BY USER!

Two **M** codes, M41 (Low Gear) and M42 (High Gear), can be used for gear selection. Spindle speed accuracy is best at the higher speeds and in low gear.

The spindle is hardened and ground with a A2-6, A2-8, A2-11 spindle nose.

2.2 Two-Speed Gear Transmission (SL-30 and 40)

The spindle motor is directly coupled to the transmission, which is between the motor and the spindle casting, The transmission is V belt-coupled to the spindle pulley. An electric motor drives the gearbox shifter into high or low gear.

Lubrication

The gearbox is lubricated and cooled with Mobil DTE 25 oil.

Operation

High gear and low gear are selected by programming an M41 (Low Gear) or M42 (High Gear). **The spindle will not change gears automatically.** The spindle will come to a complete stop when changing gears.

The machine will remain in its current gear (until changed with an M41 or M42) even after the machine is powered off. When the machine is powered up, it will be in the same gear (or between gears) as when it was powered off.

The current gear status is monitored by discrete outputs SP HIG (Spindle High) and SP LOW (Spindle Low). A "0" (zero) in either of these outputs indicates it is the current gear. If the outputs are the same, neither gear is selected. If the gearbox remains in this condition (between gears) for a certain amount of time, Alarm 126, "Gear Fault", is generated. The only way to reset this alarm is to press the POWER UP/RESTART key. The current gear can also be monitored by pressing the CURNT COMDS key. This display will show whether the machine is currently in "HIGH GEAR", "LOW GEAR", or "NO GEAR".

There are a number of parameters related to the gearbox. Their values should not be changed by the operator.

2.3 Live Tooling Operation

Live tool motor speed functions are controlled primarily by the **Q** address code. The **Q** address specifies RPM in integer values from 1 to maximum spindle speed (Parameter 131). NOT TO BE CHANGED BY USER! The maximum spindle speed is 5000 RPM.

Speeds from S1 to the value in Macro variable 730 (usually 1200) will automatically select low gear and speeds above the value in Macro variable 730 will select high gear. Two **M** codes, M41 and M42 can be used to override the gear selection. M41 for low gear and M42 for high gear. Low gear operation above S1250 is not recommended. High gear operation below S100 may lack torque or speed accuracy. Accuracy is best at the higher speeds and in low gear.

Live Tool Warm-Up Program

Live tooling motors, which have been idle for more than 4 days, must be thermally cycled prior to operation. This will prevent possible overheating of the motor due to settling of lubrication. A 20-minute warm-up program has been supplied with the machine, which will bring the motor up to speed slowly and allow the motor to thermally stabilize. This program may also be used daily for warm-up prior to high-speed use. The program number is O02020 (Live Tool Warm-Up).

```
O02020 (Live Tooling Warm–Up)
M133 Q250;
G04 P200.;
M133 Q500;
G04 P200.;
M133 Q1250;
G04 P200.;
M133 Q2500;
G04 P200.;
M133 Q3750;
G04 P200.;
M133 Q5000;
G04 P200.;
M30;
```

Live Tooling Run-In Program

Live tooling motors must go through a run-in cycle at the time of machine installation prior to operating at speeds above 1,000 RPM. A program has been supplied with the machine that will run-in the live tooling motor during machine installation and should also be used after long periods of machine down-time (two weeks or more). The program number is O02021 (Live Tool motor Run-In). Cycle Time: 2 hours. See Installation Section for copy of the program.

Live Tooling Orientation

Orientation of the spindle is automatically performed for tool changes and can be programmed with M119 commands. Orientation is performed by turning the spindle until the encoder reference is reached, the spindle motor holds the spindle locked in position. If the spindle is orientated and electronically locked, commanding spindle forward or reverse will release the lock.

2.4 Servos (brushless)

Servo Encoders (brushless)

Haas machines are equipped with brushless motors, which provide for better performance, and no maintenance. In addition to the performance differences, these machines differ from brush type machines in the following areas:

•The brushless motors have 8192 line encoders built in, which result in a resolution of 32768 parts per revolution.

•"In Position" parameters 101, 102, 103, 104 and 165 also affect brushless motors.

•The motor controller board has a dedicated processor which does all the servo control algorithm.

•There is no servo distribution board anymore, therefore there is no CHARGE light present. Care should still be taken however, since there are high voltages present on the amplifiers, even when power is shut off. The high voltage comes from the vector drive, which does have a CHARGE light.

•The servo drive cards are replaced by Brushless Servo Amplifiers, and are controlled differently.

•A low voltage power supply card is added to the servo drive assembly to supply the low voltage requirement to the amplifiers.

•The user interface and motion profiling have not changed however, and the user should not see any functional differences between a brush type machine and a brushless machine.

Servo Amplifiers (brushless)

The brushless servo amplifier is a PWM based current source. The PWM outputs control the current to a three phase brushless motor. The PWM frequency is either 12.5 KHz or 16 KHz. The amplifiers are current limited to 30 amps peak (45A peak for a medium amplifier). However there are fuse limits both in hardware and software to protect the amplifiers and motors from over current. The nominal voltage for these amplifiers is 320 volts. Therefore the peak power is about 9600 watts or 13 H.P. The amplifiers also have short circuit, over temperature and over voltage protection.

There is a 15 amp (20A for a medium amplifier) supply fuse for failure protection. This fuse is relatively slow, therefore it can handle the 30 amp peak. Continuous current limit to the motor is controlled by software.

The user should never attempt to replace these fuses.

Commands to the amplifier are +/-5 volts current in two legs of the motor and a digital enable signal. A signal from the amplifier indicates drive fault or sustained high current in a stalled motor.

The connectors on the amplifiers are:

+H.V.	+ 320 volts DC
-H.V.	320 volts return
A	motor lead phase A
B	motor lead phase B
C	motor lead phase C
J1	Three pin Molex connector used for +/-12 and GND.
J2	Eight pin Molex connector used for input signals.

2.5 Input/Output Assembly

The IOPCB contains a circuit for sensing a ground fault condition of the servo power supply. If more than 0.5 amps is detected flowing through the grounding connection of the 160V DC buss, a ground fault alarm is generated and the control will turn off servos and stop.

Relay K6 is for the coolant pump 230V AC It is a plug-in type and is double-pole. Relays K9 and K10 are used for the Barfeeder (when equipped).

The Input/Output Assembly consists of a single printed circuit board called the IOPCB.

2.6 Control Pendant

Jog Handle

The JOG handle is actually a 100-line-per-revolution encoder. We use 100 steps per revolution to move one of the servo axes. If no axis is selected for jogging, turning of the crank has no effect. When the axis being moved reaches its travel limits, the handle inputs will be ignored in the direction that would exceed the travel limits.

Parameter 57 can be used to reverse the direction of operation of the handle.

Power On/Off Switches

The POWER ON switch engages the main contactor. The on switch applies power to the contactor coil and the contactor thereafter maintains power to its coil. The POWER OFF switch interrupts power to the contactor coil and will always turn power off. POWER ON is a normally open switch and POWER OFF is normally closed. The maximum voltage on the POWER ON and POWER OFF switches is 24V AC and this voltage is present any time the main circuit breaker is on.

Spindle Load Meter

The Load meter measures the load on the spindle motor as a percentage of the rated continuous power of the motor. There is a slight delay between a load and the actual reflection of the meter. The eighth A-to-D input also provides a measure of the spindle load for cutter wear detection. The second page of diagnostic data will display % of spindle load. The meter should agree with this display within 5%. The spindle drive display #7 should also agree with the load meter within 5%.

There are different types of spindle drive that are used in the control. They are all adjusted differently.

Emergency Stop Switch

The EMERGENCY STOP switch is normally closed. If the switch opens or is broken, power to the servos will be removed instantly. This will also shut off the turret, spindle drive, and coolant pump. The EMERGENCY STOP switch will shut down motion even if the switch opens for as little 0.005 seconds.

Be careful of the fact that Parameter 57 contains a status switch that, if set, will cause the control to be powered down when EMERGENCY STOP is pressed.

You should not normally stop a tool change with EMERGENCY STOP as this will leave the tool changer in an abnormal position that takes special action to correct.

NOTE Tool changer alarms can be easily corrected by first correcting any mechanical problem, pressing RESET until the alarms are clear, selecting ZERO RETURN mode, and selecting AUTO ALL AXES.

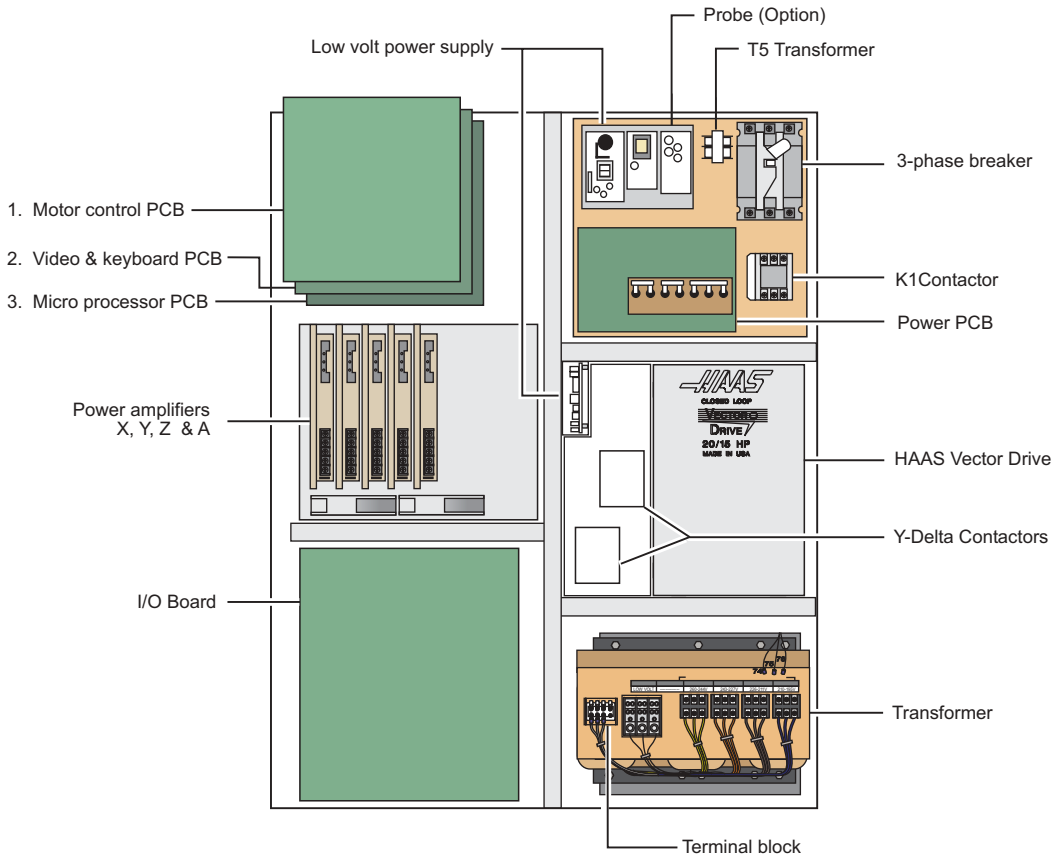
If the turret should become jammed, the control will automatically come to an alarm state. To correct this, push the EMERGENCY STOP button and remove the cause of the jam. Push the RESET key to clear any alarms. Push the ZERO RETURN and the AUTO ALL AXES keys to reset the Z-axis and turret. Never put your hands near the turret when powered unless the EMERGENCY STOP button is pressed.

Keyboard Beeper

There is a beeper under the control panel that is used as an audible response to pressing keyboard buttons and as a warning beeper. The beeper is a one kHz signal that sounds for about 0.1 seconds when any keypad key, CYCLE START, or FEED HOLD is pressed. The beeper also sounds for longer periods when an auto-shutdown is about to occur and when the “BEEP AT M30” setting is selected.

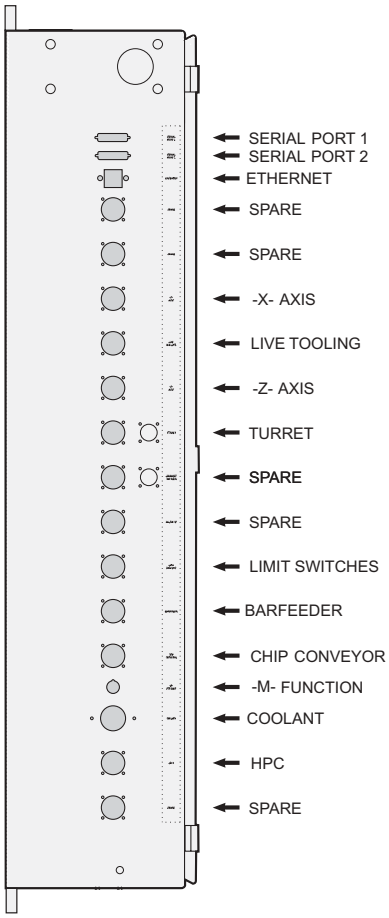
If the beeper is not audible when buttons are pressed, the problem could be in the keypad, keyboard interface PCB or in the speaker. Check that the problem occurs with more than one button and check that the beeper volume is not turned down.

SL-Series Control Cabinet



Control cabinet general overview.

The following illustration shows the connectors on the side of the control cabinet.



Side of SL-Series control cabinet.

2.7 Microprocessor Assembly

The microprocessor assembly is in the rear cabinet at the top left position. It contains three large boards. They are: microprocessor, the video and the MOCON. All three boards of the processor assembly receive power from the low voltage power supply. The three PCB's are interconnected by a local buss on dual 50-pin connectors. At power-on of the control, some diagnostic tests are performed on the processor assembly and any problems found will generate alarms 157 or 158. In addition, while the control is operating, it continually tests itself and a self test failure will generate Alarm 152.

Microprocessor PCB (68ECO30)

The Microprocessor PCB contains the 68ECO30 processor running at 40 MHz, one 128K EPROM; between 1MB and 16MB of CMOS RAM and between 512K and 1.5MB of FAST STATIC RAM. It also contains a dual serial port, a five year battery to backup RAM, buffering to the system buss, and eight system status LED's.

Two ports on this board are used to set the point at which an NMI* is generated during power down and the point at which RESET* is generated during power down.

The eight LED's are used to diagnose internal processor problems. As the system completes power up testing, the lights are turned on sequentially to indicate the completion of a step. The lights and meanings are:

RUN **Program Running Without Fault Exception. (Normally On)**
If this light does not come on or goes out after coming on, there is a problem with the microproces sor or the software running in it. Check all of the buss connectors to the other two PCB's and ensure all three cards are getting power.

PGM **Program signature found in memory.(Normally On)**
If this light does not come on, it means that the main CNC program package was not found in memory or that the auto-start switch was not set. Check that switch S1-1 is on and the EPROM is plugged in.

CRT **CRT/VIDEO initialization complete. (Normally On)**
If this light does not come on, there is a problem communicating with the VIDEO PCB. Check the buss connectors and ensure the VIDEO PCB is getting power.

MSG **Power-on serial I/O message output complete. (Normally On)**
If this light does not come on, there is a problem with serial I/O or interrupts. Disconnect anything on the external RS-232 and test again.

SIO **Serial I/O initialization complete. (Normally On)**
If this light does not come on, there is a problem with the serial ports. Disconnect anything on the external RS-232 and test again.

POR **Power-on-reset complete. (Normally On)**
If this light does not come on, there is a serious problem with the processor PCB. Check that the EPROM is plugged in. Test the card with the buss connectors off.

HALT **Processor halted in catastrophic fault. (Normally Off)**
If this light comes on, there is a serious problem with the processor PCB. Check that the EPROM is plugged in. Test the card with the buss connectors off.

+5V **+5V logic power supply is present. (Normally On)**
If this light does not come on, check the low voltage power supply and check that all three phases of 230V input power are present.

There is a two-position DIP switch on the processor PCB labeled S1. Switch S1-1 must be ON to auto-start the CNC operational program. If S1-1 is OFF, the PGM light will remain off.

Switch S2-1 is used to enable FLASH. If it is disabled it will not be possible to write to FLASH.

The processor connectors are:

J1	Address buss
J2	Data buss
J4	Serial port #1 (for upload/download/DNC) (850)
J5	Serial port #2 (for auxiliary 5th axis) (850A)
J3	Power connector
J6	Battery

Memory Retention Battery

The memory retention battery is soldered into the process board. This is a 3.3V Lithium battery that maintains the contents of CMOS RAM during power off periods. Prior to this battery being unusable, an alarm will be generated indicating low battery. If the battery is replaced within 30 days, no data will be lost. The battery is not needed when the machine is powered on. Connector J6 on the processor PCB can be used to connect an external battery.

Video Keyboard Floppy Disk PCB

The VIDEO and KB PCB generates the video data signals for the monitor and the scanning signals for the keyboard. In addition, the keyboard beeper is generated on this board. There is a single jumper on this board used to select inverse video. The video PCB connectors are:

P1	Low Voltage Power Supply PCB (860)
P3*	Keyboard info. (700)
P4	Address Buss
P5	Data Buss
P10	Disk Dr. Power
P11	Spare
P12	Disk Dr. Signal
P13	Video Signal (760)
J9	RS422 B
J13	Serial Data (850)

Motor Controller (MOCON) Brushless

The brushless machining centers are equipped with a microprocessor based brushless motor controller board (MOCON) that replaces the motor interface in the brush type controls. It runs in parallel with the main processor, receiving servo commands and closing the servo loop around the servo motors.

In addition to controlling the servos and detecting servo faults, the motor controller board, (MOCON), is also in charge of processing discrete inputs, driving the I/O board relays, commanding the spindle and processing the jog handle input. Another significant feature is that it controls 6 axes, so there is no need for an additional board for a 5 axis machine.

2.8 Haas Vector Drive

The Haas vector drive is a current amplifier controlled by the MOCON software, using the C axis output. The vector drive parameters are a part of the machine parameters and are accessible through the Haas front panel. The spindle encoder is used for the closed loop control and spindle orientation, as well as rigid tapping if the option is available. Spindle speed is very accurate since this is a closed loop control, and the torque output at low speeds is superior to non vector drive spindles.

Never work on the spindle drive until the small red CHARGE light goes out. Until this light goes out, there are dangerous voltages inside the drive, even when power is shut off.

2.9 Resistor Assembly

The Resistor Assembly is located on top of the control cabinet. It contains the servo and spindle drive regen load resistors.

Spindle Drive Regen Resistor

A 5.6-ohm (8.6-ohm (6-ohm for SL-30 and 40) for older machines), 300-watt resistor bank is used by the vector drive to dissipate excess power caused by the regenerative effects of decelerating the spindle motor. If the spindle motor is accelerated and decelerated again in rapid succession repeatedly, this resistor will get hot. In addition, if the line voltage into the control is above 255V, this resistor will begin to heat. If the resistor is removed from the circuit, an alarm may subsequently occur because of an overvoltage condition inside the spindle drive.

Overheat Sense Switch (older machines)

There is an overtemperature sense switch mounted near the above-mentioned regen resistors. This sensor is a normally-closed switch that opens at about 100^0 C. It will generate an alarm and all motion will stop. After the time period, specified by parameter 297, of an overheat condition, an automatic shutdown will occur in the control.

2.10 Power Supply Assembly

All power to the control passes through the power supply assembly. It is located on the upper right corner of the control cabinet.

Main Circuit Breaker CB1

Circuit breaker CB1 is rated at 40 amps (20 amps for High Voltage option, 80 amps for SL-30 and 40) and is used to protect the vector drive and to shut off all power to the control. The locking On/Off handle on the outside of the control cabinet will shut this breaker off when it is unlocked. A trip of this breaker indicates a SERIOUS overload problem and should not be reset without investigating the cause of the trip. The full circuit breaker rating corresponds to as much as 15 horsepower.

Circuit Breakers

The main circuit breaker is used to protect the wiring in the machine and to shut off all power to the control. The locking On/Off handle on the outside of the control cabinet will shut this breaker OFF when it is unlocked. The main circuit breaker furnishes power to the spindle and sub-spindle circuit breakers. These breakers do not have extended handles and can be set/reset only with the cabinet door open. Normally, the spindle and Subspindle circuit breakers would be left ON at all times. Since power is removed from the control by turning the main circuit breaker OFF (turn the handle counterclockwise), there is no danger in leaving the other two breakers ON at all times. However, when troubleshooting a power fault, it may be necessary to have the main breaker ON after the door is opened, in which case the operator may decide to turn either the spindle or sub-spindle breaker to the OFF position. It should be remembered that turning the sub-spindle breaker OFF will removes power to the spindle contactor as well as the sub-spindle contactor, but the reverse is not true. Turning the spindle breaker OFF will not remove power from any control electronics except for the spindle transformer and spindle vector drive.

A trip of any of these breakers indicates a serious overload problem and this should not be reset without investigating the cause of the trip.

Main Contactor K1

Main contactor K1 is used to turn the control on and off. The POWER ON switch applies power to the coil of K1 and after it is energized, an auxiliary switch on K1 continues to apply power to the coil. The POWER OFF switch on the front panel will always remove power from this contactor.

When the main contactor is off, the only power used by the control is supplied through two ½ amp fuses to the circuit that activates the contactor. An overvoltage or lightning strike will blow these fuses and shut off the main contactor.

The power to operate the main contactor is supplied from a 24V AC control transformer that is primary fused at ½ amp. This ensures that the only circuit powered when the machine is turned off is this transformer and only low voltage is present at the front panel on/off switches.

Low Voltage Power Supply

There are two low voltage power supplies. One, the stack supply, operates from 118VAC and provides +5V, +12V and -12V power to all of the logic sections of the control. Mouned on top of this supply is the servo power supply, which furnishes +12V and -12V power to the servo amplifiers. This supply is powered from the 335VDC bus from the sub-spindle vector drive.

Low Voltage Power Supply

The low voltage power supply provides +5V DC, +12V DC, and -12V DC to all of the logic sections of the control. It operates from 115V AC nominal input power. It will continue to operate correctly over a 90V AC to 133V AC range.

Power PCB (POWER)

The low voltage power distribution and high voltage fuses and circuit breakers are mounted on a circuit board called the POWER PCB.

Power-Up Low Voltage Control Transformer (T5)

The low voltage control transformer, T5, supplies power to the coil of the main contactor K1. It guarantees that the maximum voltage leaving the Power Supply assembly when power is off is 12V AC to earth ground. It is connected via P5 to the POWER PCB.

Secondary Circuit Breakers

The following circuit breakers are located on the Power supply assembly.

CB2 controls the 115 volt power from the main transformer to the servo transformers and, if tripped, will turn off the servo motors and air solenoids. CB2 could be blown by a severe servo overload.

CB3 controls the power to coolant pump only. It can be blown by an overload of the coolant pump motor or a short in the wiring to the motor.

CB4 controls the 115V AC to the air solenoids and the oiler. It is never expected to trip. If it does trip, it is likely caused by a short circuit in the wiring on the I/O assembly or the wiring to the solenoids on the spindle head.

Operator's Lamp

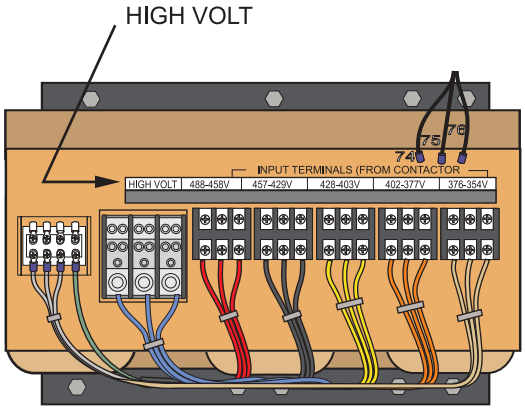
The operator's lamp is using 115 VAC taken from P19 on the main power distribution.

2.11 Power Transformer Assembly (T1)

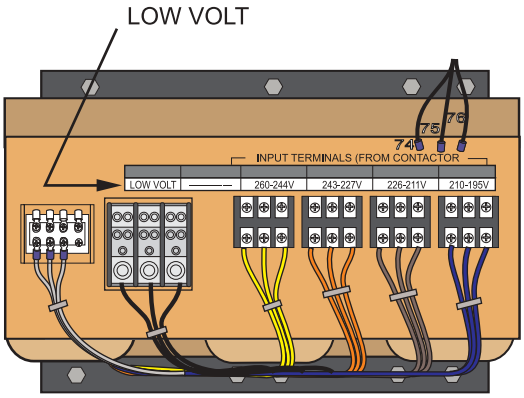
The power transformer assembly is used to convert three-phase input power (50/60Hz) to three phase 230V and 115V power. Two different transformers are used depending on the input voltage range. The low voltage transformer has four different input connections to allow for a range of voltages from 195 V RMS to 260 V RMS. The high voltage transformer has five different input connections and will accept a range of voltages from 354V RMS to 488 V RMS.

The 230 V is used to power the spindle drive, which also develops the 325 VDC power for the axis servo amplifiers. The 115 V is used by the video monitor, solenoids, fans and pumps, in addition to supplying power to the main LVPS used by the control electronics.

The transformer assembly is located in the lower right hand corner of the main cabinet. Besides the high/low voltage variations, two different power levels are available depending on the spindle motor used. The small and large transformers have power ratings of 14 KVA and 28 KVA, respectively. They are protected by the main circuit breaker to the levels shown in the preceding table.



Transformer with 354-488V range



Transformer with 195-260V range

Optional 480V 60Hz Transformer

For domestic installations and all others using 60Hz power, the primary side should be wired as follows:

Input Voltage Range	Tap
493-510	1 (504)
481-492	2 (492)
469-480	3 (480)
457-468	4 (468)
445-456	5 (456)
433-444	6 (444)
420-432	7 (432)

Primary Connection To T1

Input power to T1 is supplied through CB1, the 40 amp or 80 amp three-phase main circuit breaker. Three-phase 230 to T1 is connected to the first three terminals of TB10.

Voltage Selection Taps

There are four labeled plastic terminal blocks for . Each block has three connections for wires labeled 74, 75, and 76. Follow the instructions printed on the transformer.

Secondary Connection To T1

The secondary output from T1 is 115V AC three-phase CB2 protects the secondary of transformer T1 and is rated at 25 amps.

Optional 480V 60Hz Transformer

The external transformers have either 30 or 45 KVA ratings depending on the size of the machine to which they will be attached. SL-20 5K, SL-20 BB, SL-30 and SL-40 machines will get the 45KVA transformer while the smaller machines will get the 30KVA transformers.

For domestic installations and all others using 60Hz power, the primary side should be wired as follows:

Input Voltage Range	Tap	Input Voltage Range	Tap
493-510	1 (504)	445-456	5 (456)
481-492	2 (492)	433-444	6 (444)
469-480	3 (480)	420-432	7 (432)
457-468	4 (468)		

Optional 480V 50Hz Transformer

Input Voltage Range	Tap	Input Voltage Range	Tap
423-440	1 (504)	381-390	5 (456)
412-422	2 (492)	371-380	6 (444)
401-411	3 (480)	355-370	7 (432)
391-400	4 (468)		

2.12 Fuses

The brushless amplifier has one fuse, F1 15 amps. This fuse protects the amplifier itself from drastic damage. If this fuse is ever blown, the associated motor will stop. This will only happen if there is a failure of the amplifier card. **The user should never attempt to replace these fuses.**

The POWER PCB contains three ½-amp fuses located at the top right (FU1, FU2, FU3). If the machine is subject to a severe overvoltage or a lightning strike, these fuses will blow and turn off all of the power. Replace these fuses only with the same type and ratings. FU 4,5 and 5A protect the chip conveyor (FU6 is only used with 3 phase motors). FU7-12 are ultra fast 20A fuses. They will only blow in the case of a cable short for either the TSC or coolant pump. Spare fuses for the power card are located above the breakers on the spare fuse PCB.

SIZE	FUSE NAME	TYPE	RATING (amps)	VOLTAGE	LOCATION
5mm	FU1	Slo-Blo	½	250V	PSUP pcb, upper right
5mm	FU2	AGC	½	250V	" "
5mm	FU3	AGC	½	250V	" "
1/4	FU1	Ultra fast	10	250V	I/O PCB
1/4	F1	Ultra fast	15	250V	Amplifier (X,Y,Z,A,B)
5mm	FU4,5	Fast blow	5A	250V	PSUP, bottom right corner
1/4	FU7-12	Ultra fast	20A	250V	PSUP, bottom

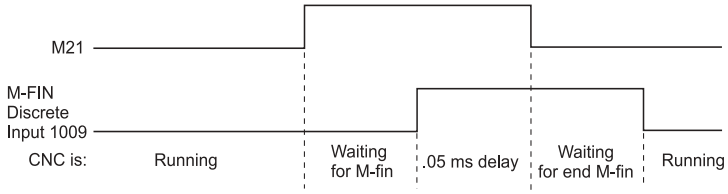
FU2 on the IOPCB is a spare.

2.13 Spare User M code Interface

The M code interface uses outputs M21-25 and one discrete input circuit. M codes M21 through M25 will activate relays labeled M21-25. These relay contacts are isolated from all other circuits and may switch up to 120V AC at three amps. The relays are SPDT. **WARNING!** Power circuits and inductive loads must have snubber protection.

The M-FIN circuit is a normally open circuit that is made active by bringing it to ground. The one M-FIN applies to all of the user M codes.

The timing of a user M function must begin with all circuits inactive, that is, all circuits open. The timing is as follows:



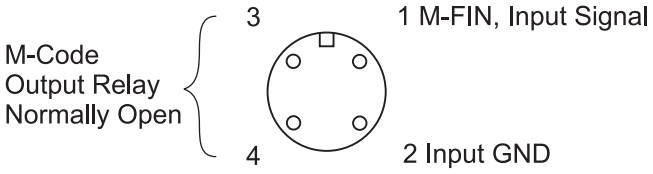
The Diagnostic Data display page may be used to observe the state of these signals.

NOTE: See the 8M option section for more details.

M Function Relays

The M code relay board has five relays (M21-25) that may be available to the user. M21 is already wired out to P12 at the side of the control cabinet. This is a four-pin DIN connector and includes the M-FIN signal.

NOTE: Refer to the Diagnostic section in the manual for specific machine Inputs and Outputs.



NOTE: Some or all of the M21-25 on the I/O PCB may be used for factory installed options. Inspect the relays for existing wires to determine which have been used. Contact the Haas factory for more details.

M-FIN Discrete Input

The M-FIN discrete input is a low voltage circuit. When the circuit is open, there is +12V DC at this signal. When this line is brought to ground, there will be about 10 milliamps of current. M-FIN is discrete input #10 and is wired from input #10 on the I/O PCB. The return line for grounding the circuit should also be picked up from that PCB. For reliability, these two wires should be routed in a shielded cable where the shield is grounded at one end only. The diagnostic display will show this signal a “1” when the circuit is open and a “0” when this circuit is grounded.

Turning M Functions On And Off

The M code relays can also be separately turned on and off using M codes M51-M55 and M61-M65. M51 to M55 will turn on one of the eight relays and M61 to M65 will turn the relays off. M51 and M61 correspond to M21, etc.

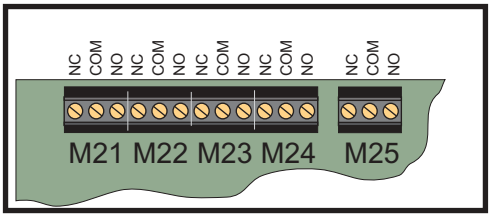
NOTE: Refer to the Diagnostic section in the manual for specific machine Inputs and Outputs.

Wiring the Relays

The relays are marked on the IOPCB, with their respective terminals forward of them. If the optional 8M relay board is installed then the connections on the IOPCB are to be left unused as they are replaced by the relays on the optional board. Refer to the figure, and the Probe Option figure in the Electrical Diagrams section for the terminal labeling.

WARNING!

Power circuits and inductive loads must have snubber protection.



IOPCB Relays

CAUTION! If a screw terminal is already in use **DO NOT** connect anything else to it. Call your dealer.

2.14 Lubrication Pump

The lubrication system is a resistance type system which forces oil through metering units at each of the 16 lubricating points within the machine. The system uses one metering unit at each of the lubricating points: one for each linear guide pad, one for each lead screw and one for spindle lubrication. A single oil pump is used to lubricate the system. The pump is powered only when the spindle and/or an axis moves. Once powered the pump squirts approximately 3 cc of oil every 30 minutes with 60 Hz power (36 minutes with 50 Hz power) throughout the oil lines to the lube points. Each lube point receives approximately 1/16 of oil.

The lube pump and spindle fan are on the same circuit. This circuit is turned on whenever a program is running, and it remains on after a program is stopped for the time specified by SPIN. FAN OFF DELAY(Parameter 208).

There is an internal level switch in the reservoir and external pressure switch on the lube panel. These are wired in series and provide a signal to the control system. An input value of 0 means that oil level and pressure are high. A value of 1 means low pressure or low oil level. Under normal conditions the pressure will remain high for a period of several minutes after each pump cycle.

The control system monitors both the amount of time the input is 0 and the amount of time its 1. If the input value is 0, meaning acceptable, for at least two minutes, the low-time counter is restarted. If the input value is 1, meaning unacceptable, even for an instant, the high-time counter is restarted. If the low-time counter exceeds the LUBE CYCLE TIME, (Parameter 117), nominally 36 minutes, and the control is not running a program or in jog lock, Alarm 121 shall be generated. Lube pressure is checked only when the pump is activated.

2.15 Switches

Lamp On/Off Switch

An on/off switch is supplied for the operator's lamp. It is located on the front panel.

The operator's lamp is using 115 VAC taken from P19 on the main power distribution.

Door Open Sense Switch

The DOOR OPEN switch is in the open position when the door is open and closed when the door is fully closed.

When the doors open, the switch will open and the machine will stop with a “Door Hold” function. When the door is closed again, operation will continue normally.

If the doors are open, you will not be able to start a program. Door Hold will not stop a tool change operation or a tapping operation, and will not turn off the coolant pump. Also, if the doors are open, the spindle speed will be limited to 500 RPM.

The Door Hold function can be temporarily disabled by turning Setting 51 **on**, if Parameter 57 bits DOOR STOP SP and SAFETY CIRC are set to zero, but this setting will return to OFF when the control is turned off.

Limit Switches

TURRET CLAMP/UNCLAMP SWITCHES
There are two switches used to sense the position of the turret. They are both normally closed and one will activate at the end of travel during unclamping and the other during clamping. When both switches are closed, it indicates that the turret is between positions.

The diagnostic display can be used to display the status of the relay outputs and the switch inputs.

DOOR HOLD SWITCH
The switch is normally closed. When the door opens, the switch will open and the machine will stop with a “Door Hold” function. When the door is closed again, operation will continue normally.

If the door is open, you will not be able to start a program. Door hold will not stop a tool change operation, will not turn off the spindle, and will not turn off the coolant pump.

The door hold function can be temporarily disabled with Setting 51, but this setting will return to OFF when the control is turned off.

X AND Z LIMIT SWITCHES
Prior to performing a POWER UP/RESTART or an AUTO ALL AXES operation, there are no travel limits. Thus, you can jog into the hard stops in either direction for X and Z. After a ZERO RETURN has been performed, the travel limits will operate unless an axis hits the limit switch. When the limit switch is hit, the zero returned condition is reset and an AUTO ALL AXES must be done again. This is to ensure that if you hit the limit switch, you can still move the servo back away from it.

The limit switches are normally closed. When a search for zero operation is being performed, the X and Z axes will move towards the limit switch unless it is already active (open); then they will move away from the switch until it closes again; then they will continue to move until the encoder Z channel is found. This position is machine zero.

TURRET HOME SWITCH

The tool rotation turret has a switch that is activated when tool #1 is in the cutting position. At POWER ON this switch indicates that tool #1 is in the cutting position. If this switch is not active at power-on, the first tool change will rotate the turret until the switch engages and then move to the selected tool. The diagnostic display will show this status of this input switch as “TOOL #1”. A “1” indicates that tool #1 is in position.

What Can Go Wrong With Limit Switches?

If the machine is operated without connector P5, a LOW LUBE and DOOR OPEN alarm will be generated. In addition, the Home search will not stop at the limit switch and will instead run into the physical stops on each axis.

If the switch is damaged and permanently open, the zero search for that axis will move in the negative direction at about 0.5 in/min until it reaches the physical travel stops at the opposite end of travel.

If the switch is damaged and permanently closed, the zero search for that axis will move at about 10 in/min in the positive direction until it reaches the physical stops.

If the switch opens or a wire breaks after the zero search completes, an alarm is generated, the servos are turned off, and all motion stops. The control will operate as though the zero search was never performed. The RESET can be used to turn servos on but you can jog that axis only slowly.

2.16 Diagnostic Data

The ALARM MSGS display is the most important source of diagnostic data. At any time after the machine completes its power-up sequence, it will either perform a requested function or stop with an alarm. Refer to the alarms list for, their possible causes, and some corrective action.

If there is an electronics problem, the controller may not complete the power-up sequence and the CRT will remain blank. In this case, there are two sources of diagnostic data; these are the audible beeper and the LED's on the processor PCB. If the audible beeper is alternating a ½ second beep, there is a problem with the main control program stored in EPROM's on the processor PCB. If any of the processor electronics cannot be accessed correctly, the LED's on the processor PCB will or will not be lit.

If the machine powers up but has a fault in one of its power supplies, it may not be possible to flag an alarm condition. If this happens, all motors will be kept off and the top left corner of the CRT will have the message:

POWER FAILURE ALARM

and all other functions of the control will be locked out.

When the machine is operating normally, a second push of the PARAM/DGNOS key will select the diagnostics display page. The PAGE UP and PAGE DOWN keys are then used to select one of two different displays. These are for diagnostic purposes only and the user will not normally need them. The diagnostic data consists of 32 discrete input signals, 32 discrete output relays and several internal control signals. Each can have the value of 0 or 1. In addition, there are up to three analog data displays and an optional spindle RPM display. Their number and functions are:

Discrete Inputs / Outputs

DISCRETE INPUTS

#	Name	#	Name
1000	Tool Turret Unlock	1016	Spare
1001	Tool Turret Lock	1017	Spare
1002	Spare	1018	Spare
1003	Low Coolant	1019	Spare
1004	Automatic Door	1020	Low hyd pressure
1005	Spindle In Hi Gear	1021	T.S. Foot Switch
1006	Spindle In Low Gear	1022	Probe Not Home
1007	Emergency Stop	1023	Spare 2b
1008	Door Switch	1024	Tool Unclamp Rmt*
1009	M Code Finish	1025	Low Phasing 115V
1010	Over Voltage	1026	B F End of Bar
1011	Low Air Pressure	1027	Bar Feeder Fault
1012	Low Lube Press.	1028	Ground Fault
1013	Regen Overheat	1029	G31 Block Skip
1014	Spare	1030	B F Spindle Intlk
1015	Spare	1031	Conveyr Overcrnts

DISCRETE OUTPUTS

#	Name	#	Name
1100	Hyd Pump Enable	1116	Move Spigot CW
1101	Spare	1117	Move Spigot CCW
1102	Spare	1118	Pal Ready Light
1103	Spare	1119	T.S. High Pressure
1104	Spindle Brake	1120	Tool Turret Out
1105	Coolant Pump on	1121	T.S. Reverse
1106	Power Off	1122	T.S. Forward
1107	Way Lube Pump	1123	(CE) Door Locked
1108	SB Motor Load PR	1124	M21 (Auto Door Clutch)
1109	SB Motor Load Bar	1125	M22 (Parts Catcher)
1110	Auto Door Open	1126	M23 (C Axis Engage)
1111	Auto Door Close	1127	HPC Coolant
1112	Spindle Hi Gear	1128	Green Beacon On
1113	Spindle Low Gear	1129	Red Beacon On
1114	Unclamp Chuck	1130	Enable Conveyor
1115	Lock Spindle	1131	Reverse Conveyor

The names of discrete outputs **1124, 1125** and **1126** will change if options are installed. The options and associated Discrete Outputs are:

1124 Auto Door Clutch
1125 Parts Catcher
1126 C axis Engage

If the machine does not have these options the discrete outputs will remain M21, M22 and M23.

The 32 inputs are numbered the same as the 32 connections on the inputs printed circuit board. The last eight outputs are reserved for expansion by HAAS.

The second page of diagnostic data is displayed using the PAGE UP and PAGE DOWN keys. It contains:

INPUTS 2

Name	Name
X-axis Z Channel	X Motor Over Heat
Y-Axis Z Channel	Y Motor Over Heat
Z-axis Z Channel	Z Motor Over Heat
A-axis Z Channel	A Motor Over Heat
B-axis Z Channel	B Motor Over Heat
C-axis Z Channel	C Motor Over Heat
X Home Switch	X drive fault
Y Home Switch	Y drive fault
Z Home Switch	Z drive fault
A Home Switch	A drive fault
B Home Switch	B drive fault
C Home Switch	C drive fault

X Cable Input
Y Cable Input
Z Cable Input
A Cable Input
B Cable Input
C Cable Input

S Z CH Spindle Z Channel

When equipped with the Temp-Track option, the X and Z ball screw temperatures are now displayed on the INPUTS2 diagnostics screen just above SP LOAD when parameter 266 or 268 (respectively) bit 9 TEMP SENSOR is set to 1.

The following inputs and outputs pertain to the Haas Vector Drive. If it is not enabled, these will display a value of *. Otherwise, it will display a 1 or 0.

HAAS VECTOR DRIVE

Name	Name
Spindle Forward	Spindle Fault
Spindle Reverse	Spindle Locked
Spindle Lock	Spindle Cable Fault
Spindle At Speed	Spindle Overheat
Spindle Stopped	

ANALOG DATA

Name	Description
SP LOAD	Spindle load in %
SP SPEED	Spindle RPM CW or CCW
RUN TIME	Total machine run time
TOOL CHANGES	Number of tool changes
VER X.XXX	Software version number
YY/MM/DD	Today's date
MDL SL-__	Model number
DC BUSS	Mocon II

2.17 Live Tooling

Live Tooling provides the ability to utilize standard 40mm VDI-driven tools, operated by a 5-HP motor. This auxiliary motor is capable of 0-3,000 RPM, controllable in 1 RPM increments.

Brake

13.25” (348mm) diameter disc, 500 psi (34 bar), with 1,000 lbs. (4450 N) clamp force.

A solenoid actuates a hydraulically operated brake. The brake is located on the main spindle and can be CLAMPED with an M14 command and UNCLAMPED with an M15 command.

A clamped brake will unclamp at any spindle speed command or while the spindle is at rest.

2.18 The Equations of Motion

An analysis of the physics of motion of a machine tool can give some important insights into the famous “blocks per second” issue. The following mathematics calculates the block per second requirement in order to achieve a worst case chordal deviation error while moving around a curve made up of a series of points:

Let:

a = acceleration,
v=speed (or feed rate),
r = radius of curvature,
e = error from chordal deviation
l = block length (or travel length from point to point)
b = blocks per second

The following are known:
For a circular motion:

a = v*v/r (1)

and in motion:

v = b * l (2)

which gives:

b = v / l (3)

and

e = r – sqrt(r*r-l*l/4) (4)

which gives:

r*r – 2*r*e + e*e = r*r – l*l/4 (5)

and:

l= sqrt(8*r*e – 4*e*e) (6)

Since r>>e, e*e is small compare to r*e and we can assume:

l = sqrt(8*r*e) (7)

And combining we get:

b = sqrt(a*r) / sqrt (8*r*e) (8)

Or

b = sqrt(a / (8*e)) (9)

Thus, block per second is dependent only on the machine acceleration and the maximum chordal error allowed.

Note also that an important equation (7) is the relationship between radius of curvature (r), chordal error (e) and block length (l). If you have a radius or curvature close to 1/4 inch and your maximum chordal error is 0.00005 inch, the recommended block length is 0.01 inch. This shows that it is not always required to use very short blocks.

2.19 FORMULAS

TO FIND:

S.F.M

TO FIND THE SFM OF A CUTTER OR WORKPIECE

EXAMPLE: To find the SFM of a cutter rotating at 600 RPM with a diameter of 10 inches.

$$SFM = \frac{3.1416 \times d \times RPM}{12} = .262 \times d \times RPM$$

R.P.M.

TO FIND THE RPM OF A CUTTER OR WORKPIECE

EXAMPLE: To find the RPM of a cutter rotating at 150 SFM with a diameter of 8 inches.

$$SFM = \frac{12 \times SFM}{3.1416 \times d} = \frac{3.82 \times SFM}{d}$$

I.P.M.

TO FIND THE FEED (table travel in inches per minute)

EXAMPLE: To find the feed of a 10 tooth cutter rotating at 200 RPM with a feed per tooth of 0.012".

IPM = F.P.T. x T x RPM

TO FIND:

F.P.R.

TO FIND THE FEED PER REVOLUTION (in inches) OF A CUTTER.

EXAMPLE: To find the feed per revolution of a cutter rotating at 200 RPM with a table travel of 22 inches per minute.

$$F.P.R. = \frac{I.P.M.}{R.P.M.}$$

F.P.T.

TO FIND THE FEED PER TOOTH OF A CUTTER.

EXAMPLE: To find the feed per tooth of a cutter rotating at 200 RPM with a table travel of 22 inches per minute.

$$F.P.T. = \frac{I.P.M.}{T \times R.P.M.}$$

D = Depth of cut
d = diameter of cutter
I.P.M. = Feed (table travel in inches per minute)
K = Constant (cubic inches per minute per HPc). Power required to remove 1 cubic inch per minute.
HPc = Horsepower at the cutter
F.P.R. = Feed per revolution
R.P.M. = Revolutions per minute
T = Number of teeth in cutter
W = Width of cut (in inches)

3. PARAMETERS

Parameters are seldom-modified values that change the operation of the machine. These include servo motor types, gear ratios, speeds, stored stroke limits, ball screw compensations, motor control delays and macro call selections. These are all rarely changed by the user and should be protected from being changed by the parameter lock setting. If you need to change parameters, contact HAAS or your dealer. Parameters are protected from being changed by Setting 7.

The Settings page lists some parameters that the user may need to change during normal operation and these are simply called "Settings". Under normal conditions, the parameter displays should not be modified. A complete list of the parameters is provided here.

The PAGE UP, PAGE DOWN, up and down cursor keys , and the jog handle can be used to scroll through the parameter display screens in the control. The left and right cursor keys are used to scroll through the bits in a single parameter.

PARAMETER LIST

1 X SWITCHES

Parameter 1 is a collection of single-bit flags used to turn servo related functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 REV ENCODER	Used to reverse the direction of encoder data.
1 REV POWER	Used to reverse direction of power to motor.
2 REV PHASING	Used to reverse motor phasing.
3 DISABLED	Used to disable the X-axis.
4 Z CH ONLY	With **A** only, indicates that no home switch.
5 AIR BRAKE	With **A** only, indicates that air brake is used.
6 DISABLE Z T	Disables encoder **Z** test (for testing only).
7 SERVO HIST	Graph of servo error (for diagnostics only).
8 INV HOME SW	Inverted home switch (N.C. switch).
9 INV Z CH	Inverted **Z** channel (normally high).
10 CIRC. WRAP.	With **A** only, causes 360 wrap to return to 0. Note for parameter 498 bit 10: When the bit is set to 1, the lathe will automatically unwind the C-axis no more than half a rotation. When the bit is set to zero, it behaves as if the C axis had been rotated many times then disengaged, when it is engaged again, the control will zero it by unwinding as many times as it had been wound.
11 NO I IN BRAK	With **A** only, removes **I** feedback when brake is active.
12 LOW PASS +1X	Adds 1 term to low pass filter.
13 LOW PASS +2X	Adds two terms to low pass filter.
14 OVER TEMP NC	Selects a normally closed overheat sensor in motor.
15 CABLE TEST	Enables test of encoder signals and cabling.
16 Z TEST HIST	History plot of Z channel test data.
17 SCALE FACT/X	If set to 1, the scale ratio is interpreted as divided by X; where X depends on bits SCALE/X LO and SCALE/X HI.
18 INVIS AXIS	Used to create an invisible axis.

19 DIAMETER PRG	Used to set diameter programming. When set to 1, it will interpret inputs as diameters instead of radii.
20 TRAVL LIMITS	Travel limits are used.
21 NO LIMSW ALM	Alarms are not generated at the limit switches.
22 D FILTER X8	Enables the 8 tap FIR filter. Used to eliminate high frequency vibrations, depending on the axis motor.
23 D FILTER X4	Enables the 4 tap FIR filter. Used to eliminate high frequency vibrations, depending on the axis motor.
24 TORQUE ONLY	For HAAS Service use only.
25 3 EREV/MREV	The 2 EREV/MREV and 3 EREV/MREV bits have two definitions depending on whether one or two encoders are present. For single encoder systems, the bits are used to define the ratio between the electrical rotation of the spindle motor and the mechanical rotation of the motor. For two encoder systems, the definition is the electrical rotation of the motor to the mechanical rotation of the spindle motor encoder, which includes any pulley ratio between the motor and the motor encoder.
26 2 EREV/MREV	The 2 EREV/MREV and 3 EREV/MREV bits have two definitions depending on whether one or two encoders are present. For single encoder systems, the bits are used to define the ratio between the electrical rotation of the spindle motor and the mechanical rotation of the motor. For two encoder systems, the definition is the electrical rotation of the motor to the mechanical rotation of the spindle motor encoder, which includes any pulley ratio between the motor and the motor encoder.
27 NON MUX PHAS	For HAAS Service use only.
28 BRUSH MOTOR	Enables the brush motor option.
29 ROTARY AXIS	When set to 1, the axis is treated as a rotary axis. Position will be displayed in degrees, and inputs will be interpreted as angles.
30 SCALE/X LO	With SCALE/X HI bit, determines the scale factor used in bit SCALE FACT/X,
31 SCALE/X HI	With SCALE/X LO bit, determines the scale factor used in bit SCALE FACT/X. See below **HI LO** 0 0 3 0 1 5 1 0 7 1 1 9

2 X P GAIN

Proportional gain in servo loop.

3 X D GAIN

Derivative gain in servo loop.

4 X I GAIN

Integral gain in servo loop.

5 X RATIO (STEPS/UNIT)

The number of steps of the encoder per unit of travel. Encoder steps supply four (4) times their line count per revolution. Thus, an 8192 line encoder and 6mm pitch screw give:

8192 x 4 x 25.4 / 6 = 138718

6 X MAX TRAVEL (STEPS)

Max negative direction of travel from machine zero in encoder steps. Does not apply to A-axis. Thus, a 20 inch travel, 8192 line encoder and 6 mm pitch screw give:
20.0 x 138718 = 2774360

7 X ACCELERATION

Maximum acceleration of axis in steps per second per second.

8 X MAX SPEED

Max speed for this axis in steps per second.

9 X MAX ERROR

Max error allowed in servo loop before alarm is generated. Units are encoder steps.

10 X FUSE LEVEL

Used to limit average power to motor. If not set correctly, this parameter can cause an "overload" alarm.

11 X BACK EMF

Back EMF of motor in volts per 1000 RPM times 10. Thus a 63 volt/KRPM motor gives 630.

12 X STEPS/REVOLUTION

Encoder steps per revolution of motor. Thus, an 8192 line encoder gives: **8192 x 4 = 32768**

13 X BACKLASH

Backlash correction in encoder steps.

14 X DEAD ZONE

Dead zone correction for driver electronics. Units are 0.0000001 seconds.

15 Y SWITCHES

See Parameter 1 for description.

16 Y P GAIN

See Parameter 2 for description.

17 Y D GAIN

See Parameter 3 for description.

18 Y I GAIN

See Parameter 4 for description.

19 Y RATIO (STEPS/UNIT)

See Parameter 5 for description.

20 Y MAX TRAVEL (STEPS)

See Parameter 6 for description.

21 Y ACCELERATION

See Parameter 7 for description.

22 Y MAX SPEED

See Parameter 8 for description.

23 Y MAX ERROR

See Parameter 9 for description.

24 Y FUSE LEVEL
See Parameter 10 for description.

25 Y BACK EMF
See Parameter 11 for description.

26 Y STEPS/REVOLUTION
See Parameter 12 for description.

27 Y BACKLASH
See Parameter 13 for description.

28 Y DEAD ZONE
See Parameter 14 for description.

29 Z SWITCHES
See Parameter 1 for description.

30 Z P GAIN
See Parameter 2 for description.

31 Z D GAIN
See Parameter 3 for description.

32 Z I GAIN
See Parameter 4 for description.

33 Z RATIO (STEPS/UNIT)
See Parameter 5 for description.

34 Z MAX TRAVEL (STEPS)
See Parameter 6 for description.

35 Z ACCELERATION
See Parameter 7 for description.

36 Z MAX SPEED
See Parameter 8 for description.

37 Z MAX ERROR
See Parameter 9 for description.

38 Z FUSE LEVEL
See Parameter 10 for description.

39 Z BACK EMF
See Parameter 11 for description.

40 Z STEPS/REVOLUTION
See Parameter 12 for description.

41 Z BACKLASH
See Parameter 13 for description.

42 Z DEAD ZONE
See Parameter 14 for description.

43 A SWITCHES
See Parameter 1 for description.

44 TURRET P GAIN
See Parameter 2 for description.

45 TURRET D GAIN
See Parameter 3 for description.

46 TURRET I GAIN
See Parameter 4 for description.

47 TURRET RATIO (STEPS/UNIT)
See Parameter 5 for description.

48 TURRET MAX TRAVEL (STEPS)
See Parameter 6 for description.

49 TURRET ACCELERATION
See Parameter 7 for description.

50 TURRET MAX SPEED
See Parameter 8 for description.

51 TURRET MAX ERROR
See Parameter 9 for description.

52 TURRET FUSE LEVEL
See Parameter 10 for description.

53 TURRET BACK EMF
See Parameter 11 for description.

54 TURRET STEPS/REVOLUTION
See Parameter 12 for description

55 TURRET BACKLASH
See Parameter 13 for description.

56 TURRET DEAD ZONE
See Parameter 14 for description.

Parameters 57 through 128 are used to control other machine dependent functions. They are:

57 COMMON SWITCH 1
Parameter 57 is a collection of general purpose single bit flags used to turn some functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 REV CRANK	Reverses direction of jog handle.
1 DISABLE T.C.	Disables tool changer operations.
2 DISABLE G.B.	Disables gear box functions.
3 POF AT E-STP	Stops spindle then turns the power off at EMERGENCY STOP.
4 RIGID TAP	Indicates hardware option for rigid tap.
5 REV SPIN ENC	Reverses sense direction of spindle encoder.
6 REPT RIG TAP	This parameter affects both the main spindle and subspindle, but not live tooling.

7 EX ST MD CHG	Selects exact stop in moves when mode changes.
8 SAFETY CIRC	This enables safety hardware, if machine is so equipped.
9 SP DR LIN AC	Selects linear deceleration for rigid tapping. 0 is quadratic.
10 UNUSED	
12 OVER T IS NC	Selects Regen over temp sensor as N.C.
13 SKIP OVERSHT	Causes Skip (G31) to act like Fanuc and overshoot sense point.
14 NONINV SP ST	Non-inverted spindle stopped status.
15 SP LOAD MONI	Spindle load monitor option is enabled.
16 SP TEMP MONI	Spindle temperature monitor option is enabled.
18 ENABLE DNC	Enables DNC selection from MDI.
19 ENABLE BGEDT	Enables BACKGROUND EDIT mode.
20 ENA GRND FLT	Enables ground fault detector.
21 M19 SPND ORT	This bit makes the P and R codes a protected feature which can only be enabled with an unlock code. The unlock code will be printed on the parameter listing of all new machines. If this bit is set to 0, an M19 will orient the spindle to 0 degrees regardless of the value of any P or R code in the same block. If this is set to 1, a P code in the block will cause the spindle to be oriented to the specified angle such as P180. Alternately, a decimal R code can be used, such as R180.53. Note that the P and R codes only work on a vector drive machine.
22 ENABLE MACRO	Enables macro functions.
23 INVERT SKIP	Invert sense of skip to active low=closed.
24 HANDLE CURSR	Enable use of jog handle to move cursor.
25 NEG WORK OFS	Selects use of work offsets in negative direction.
26 TRANS OIL	When this parameter is set to 1, it enables transmission low oil pressure detection via input 1014.
27 ENA QUIKCODE	Enables conversational programming.
28 OILER ON/OFF	Enables oiler power when servos or spindle is in motion.
29 NC OVER VOLT	Inverts sense of over voltage signal.
30 SP MOTOR ENC	This parameter bit enables a second encoder that is mounted on the spindle motor and wired into the “C” axis input of the Mocon. It is required to control the vector algorithm on a belted machine when the belts slip at high load. When two encoders are present, the first is mounted on the spindle or output of the transmission, and is wired to the “spindle” input on the MOCON. Most mills use a single encoder that is mounted on either the spindle (transmission output) or spindle motor but always connected to the spindle input on the Mocon.
31 DOOR STOP SP	Enables functions to stop spindle and manual operations at door switch.

58 LEAD COMPENS SHIFT

Shift factor when applying lead screw compensation. Lead screw compensation is based on a table of 256 offsets; each +\-127 encoder steps. A single entry in the table applies over a distance equal to two raised to this parameter power encoder steps.

59 MAX FEED RATE (INCH)

Maximum feed rate in inches per minute.

60 TURRET IN POS DELAY

Amount of time to delay after the turret rotates to the tool position. This delay allows the turret to settle.

61 TURRET LOCK DELAY

Amount of time to delay after the turret is sensed to be locked. This delay allows for mechanical settling.

62 TURRET UNLOCK ERROR TIME

Maximum delay allowed for tool turret to unlock. Units are milliseconds. After this time, an alarm is generated.

63 TURRET LOCK ERRTIME

Maximum delay allowed for tool turret to lock. Units are milliseconds. After this time, an alarm is generated.

64 Z TOOL CHANGE OFFSET

For turret, displacement from home switch to tool 0.

65 NUMBER OF TOOLS

Number of tool positions in tool changer. This number must be set to the lathe's configuration.

66 SPINDLE ORI DELAY

Maximum delay allowed when orienting spindle. Units are in milliseconds. After this time, an alarm is generated.

67 GEAR CHANGE DELAY

Maximum delay allowed when changing gears. Units are milliseconds. After this time, an alarm is generated.

68 DRAWBAR MAX DELAY

Maximum delay allowed when clamping and unclamping tool. Units are milliseconds. After this time, an alarm is generated.

69 A AIR BRAKE DELAY

Delay provided for air to release from brake prior to moving. Units are milliseconds.

70 MIN SPIN DELAY TIME

Minimum delay time in program after commanding new spindle speed and before proceeding. Units are milliseconds.

71 SPIN STALL DET DLAY

Time to delay after spindle is started before spindle stall checking is started. Each unit represents 1/50 of a second.

72 LIVE TOOL CHNG DLAY

This parameter specifies the amount of time (in milli seconds) to wait after commanding the Live Tooling Drive motor to turn at the velocity specified by parameter 143. This process is required to engage the live tooling motor and tool and is only performed prior to the first M133 or M134 after a tool change.

73 SP HIGH G/MIN SPEED

Command speed used to rotate spindle motor when orienting spindle in high gear. Units are maximum spindle RPM divided by 4096.

74 SP LOW G/MIN SPEED

Command speed used to rotate spindle motor when orienting spindle in low gear. Units are maximum spindle RPM divided by 4096.

75 GEAR CHANGE SPEED

Command speed used to rotate spindle motor when changing gears. Units are maximum spindle RPM divided by 4096.

76 LOW AIR DELAY

Delay allowed after sensing low air pressure before alarm is generated. Alarm skipped if air pressure returns before delay. Units are 1/50 seconds.

77 SP LOCK SETTLE TIME

Required time in milliseconds that the spindle lock must be in place and stable before spindle orientation is considered complete.

78 GEAR CH REV TIME

Time in milliseconds before motor direction is reversed while in a gear change.

79 SPINDLE STEPS/REV

Sets the number of spindle encoder steps per revolution of the spindle. This number takes into account the pulley ratio between transmission and spindle, plus transmission and encoder. If there are 2 encoders employed, this number applies to the encoder on the spindle (connected to the SP input of the mocon) If only 1 encoder is employed, it will be for that encoder. In most installations, the single encoder will be mounted on the motor but will still connect to the SP input of the mocon.

80 MAX SPIN DELAY TIME

The maximum delay time control will wait for spindle to get to commanded speed or to get to zero speed. Units are milliseconds.

81 M MACRO CALL O9000

M code that will call O9000. This parameter can contain a value from 1 through 98, inclusive, zero causes no call. However it is best to use a value that is not already in use (see current M code list). Using M37 the value 37 would be entered in parameter 81 (for example). A program would be written to include the M37, such as:

```
G X0...
M37
.
.
M30
```

The control would run the program until it got to the M37, It would call program O9000, run that, and then return to the point that it left, and continue the main program.

Be aware that, if program O9000 contains another M37, it will call itself, and keep calling until it fills the stack (9 times) and then alarm out with 307 SUBROUTINE NESTING TOO DEEP.

Note that if M33 (for example) is used, it would override the normal M33 Conveyor Stop function.

82 M MACRO CALL O9001

Same as 81.

83 M MACRO CALL O9002

Same as 81.

84 M MACRO CALL O9003

Same as 81.

85 M MACRO CALL O9004
Same as 81.

86 M MACRO CALL O9005
Same as 81.

87 M MACRO CALL O9006
Same as 81.

88 M MACRO CALL O9007
Same as 81.

89 M MACRO CALL O9008
Same as 81.

90 M MACRO CALL O9009
Same as 81.

91 G MACRO CALL O9010
G code that will call O9010. This parameter can contain a value from 1 through 98, inclusive, zero causes no call. However it is best to use a value that is not already in use (see current G code list). Using G45 the value 45 would be entered in parameter 91 (for example). A program would be written to include the G45, such as:

```
G X0...
G45
.
.
M30
```

The control would run the program until it got to the G45, It would call program O9010, run that, and then return to the point that it left, and continue the main program.
Be aware that, if program O9010 contains another G45, it will call itself, and keep calling until it fills the stack (4 times) and then alarm out with 531 MACRO NESTING TOO DEEP.
Note that if G84 (for example) is used, it would override the normal G84 Tapping Canned Cycle.

92 G MACRO CALL O9011
Same as 91.

93 G MACRO CALL O9012
Same as 91.

94 G MACRO CALL O9013
Same as 91.

95 G MACRO CALL O9014
Same as 91.

96 G MACRO CALL O9015
Same as 91.

97 G MACRO CALL O9016
Same as 91.

98 G MACRO CALL O9017
Same as 91.

99 G MACRO CALL O9018
Same as 91.

100 G MACRO CALL O9019
Same as 91.

101 IN POSITION LIMIT X
How close motor must be to endpoint before any move is considered complete when not in exact stop (G09 or G61). Units are encoder steps.

102 IN POSITION LIMIT Y
Same definition as Parameter 101.

103 IN POSITION LIMIT Z
Same definition as Parameter 101.

104 IN POSITION LIMIT A
Same definition as Parameter 101.

105 X MAX CURRENT
Fuse level in % of max power to motor. Applies only when motor is stopped.

106 Y MAX CURRENT
Same definition as Parameter 105.

107 Z MAX CURRENT
Same definition as Parameter 105.

108 A MAX CURRENT
Same definition as Parameter 105.

109 D*D GAIN FOR X
Second derivative gain in servo loop.

110 D*D GAIN FOR Y
Second derivative gain in servo loop.

111 D*D GAIN FOR Z
Second derivative gain in servo loop.

112 D*D GAIN FOR A
Second derivative gain in servo loop.

113 X ACC/DEC T CONST
Exponential acceleration time constant. Units are 1/10000 seconds. This parameter provides for a constant ratio between profiling lag and servo velocity. It is also the ratio between velocity and acceleration.

114 Y ACC/DEC T CONST
Same definition as Parameter 113.

115 Z ACC/DEC T CONST
Same definition as Parameter 113.

116 A ACC/DEC T CONST
Same definition as Parameter 113.

117 LUB CYCLE TIME
If this is set nonzero, it is the cycle time for the lube pump and the lube pressure switch option is checked for cycling in this time. It is in units of 1/50 seconds.

118 SPINDLE REV TIME
Time in milliseconds to reverse spindle motor.

119 SPINDLE DECEL DELAY
Time in milliseconds to decelerate spindle motor.

120 SPINDLE ACC/DECEL
Accel/decel time constant in 200ths of a step/ms/ms for spindle motor.

121 X PHASE OFFSET
The motor phase offset for **X** motor. This is arbitrary units.

122 Y PHASE OFFSET
See Parameter 121 for description.

123 Z PHASE OFFSET
See Parameter 121 for description.

124 A PHASE OFFSET
See Parameter 121 for description.

125 X GRID OFFSET
This parameter shifts the effective position of the encoder **Z** pulse. It can correct for a positioning error of the motor or home switch.

126 Y GRID OFFSET
See Parameter 125 for description.

127 Z GRID OFFSET
See Parameter 125 for description.

128 A GRID OFFSET
See Parameter 125 for description.

129 GEAR CH SETTLE TIME
Gear change settle time. This is the number of one millisecond samples that the gear status must be stable before considered in gear.

130 GEAR STROKE DELAY
This parameter controls the delay time to the gear change solenoids when performing a gear change.

131 MAX SPINDLE RPM
This is the maximum RPM available to the spindle. When this speed is programmed, the D-to-A output will be +10V and the spindle drive must be calibrated to provide this.

132 Y SCREW COMP. COEF.
This parameter is used to hold the thermal compensation coefficient. This is the coefficient of heating of the ball screw. This parameter should be set to zero.

133 Z SCREW COMP. COEF.
This parameter is used to hold the thermal compensation coefficient. This is the coefficient of heating of the ball screw. The value entered for this parameter is always negative as it is used to shorten the screw length. It should be set to -6000000.

134 X EXACT STOP DIST.

135 Y EXACT STOP DIST.

136 Z EXACT STOP DIST.

137 A EXACT STOP DIST.

These parameters control how close each axis must be to its end point when exact stop is programmed. They apply only in G09 and G64. They are in units of encoder steps. A value of 34 would give 34/138718 = 0.00025 inch.

NOTE: To change the values of parameters 134-137 permanently the machine must be rebooted.

138 X FRICTION COMPENSATION

139 Y FRICTION COMPENSATION

140 Z FRICTION COMPENSATION

141 A FRICTION COMPENSATION

These parameters compensate for friction on each of the four axes. The units are in 0.004V.

142 HIGH/LOW GEAR CHANG

This parameter sets the spindle speed at which an automatic gear change is performed. Below this parameter, low gear is the default; above this, high gear is the default.

143 LIVE TOOL CHNG VEL

This parameter specifies the velocity to command the Live Tooling Drive motor for the period specified by parameter 72. This process is required to engage the live tooling motor and tool, and is only performed prior to the first M133 or M134 after a tool change.

144 RIG TAP FINISH DIST

This parameter sets the finish tolerance for determining the end point of a hard tapping operation. Units are encoder counts.

145 X ACCEL FEED FORWARD

This parameter sets the feed forward gain for the X-axis servo. It has no units.

146 Y ACCEL FEED FORWARD

Same as Parameter 145.

147 Z ACCEL FEED FORWARD

Same as Parameter 145.

148 A ACCEL FEED FORWARD

Same as Parameter 145.

150 MAX SP RPM LOW GEAR

Maximum spindle RPM in low gear.

151 B SWITCHES

See Parameter 1 for description.

152 B P GAIN

See Parameter 2 for description.

153 B D GAIN

See Parameter 3 for description.

154 B I GAIN
See Parameter 4 for description.

155 B RATIO (STEPS/UNIT)
See Parameter 5 for description.

156 B MAX TRAVEL (STEPS)
See Parameter 6 for description.

157 B ACCELERATION
See Parameter 7 for description.

158 B MAX SPEED
See Parameter 8 for description.

159 B MAX ERROR
See Parameter 9 for description.

160 B FUSE LEVEL
See Parameter 10 for description.

161 B BACK EMF
See Parameter 11 for description.

162 B STEPS/REVOLUTION
See Parameter 12 for description.

163 B BACKLASH
See Parameter 13 for description.

164 B DEAD ZONE
See Parameter 14 for description.

165 IN POSITION LIMIT B
See Parameter 101 for description.

166 B MAX CURRENT
See Parameter 105 for description.

167 B D*D GAIN
See Parameter 109 for description.

168 B ACC/DEC T CONST
See Parameter 113 for description.

169 B PHASE OFFSET
See Parameter 121 for description.

170 B GRID OFFSET
See Parameter 125 for description.

171 B EXACT STOP DIST.
See Parameter 134 for description.

172 B FRICTION COMPENSATION
See Parameter 138 for description.

173 B ACCEL FEED FORWARD

See Parameter 145 for description.

174 B SCREW COMP. COEF.

This parameter is used to hold the thermal compensation coefficient. This is the coefficient of heating of the ball screw. This parameter should be set to zero.

175 B AIR BRAKE DELAY

See Parameter 69 for description.

176 Sp SWITCHES

See Parameter 1 for description.

177 C P GAIN

See Parameter 2 for description.

178 C D GAIN

See Parameter 3 for description.

179 C I GAIN

This parameter is used when a Vector Drive is installed, see Parameter 4 for description. If Vector Drive is not installed this parameter is not used

180 SLIP GAIN

This name is used when a Vector Drive is installed. The slip rate calculated depends on two other variables: speed and current.

Slip rate = slip gain x (speed/max speed) x (current/max current)

The slip gain value is the value that slip rate would assume at maximum speed, and maximum current (16.384=1 Hz). If a Vector Drive is not installed, this parameter is called: C AXIS RATIO (STEPS/UNIT) and is not used.

181 MIN SLIP

This name is used when a Vector Drive is installed. The minimum value allowed from the slip rate. From the equation:

Slip rate = slip gain x (speed/max speed) x (current/max current)

It can be seen that at a zero speed, the slip rate would become zero. Therefore a minimum value for slip rate is required. (16.384 =1Hz). If a Vector Drive is not installed, this parameter is called: C AXIS MAX TRAVEL (STEPS) and is not used.

182 C ACCELERATION

This name is used when a Vector Drive is installed. See Parameter 7 for description. If a Vector Drive is not installed this parameter is not used.

183 C MAX SPEED

This name is used when a Vector Drive is installed. See Parameter 8 for description. If a Vector Drive is not installed this parameter is not used.

184 C MAX ERROR

See Parameter 9 for description.

185 C FUSE LEVEL

See Parameter 10 for description.

186 C BACK EMF

This name is used when a Vector Drive is installed. See Parameter 11 for description. If a Vector Drive is not installed this parameter is not used.

187 C sp MOT HI GEAR ST/REV

This name is used when a Vector Drive is installed. This function takes on two meanings depending on how many spindle encoders are used on the machine. If only one encoder is present, it is the number of encoder steps per mechanical revolution of the spindle motor when the transmission is in high gear. (On direct drive machines, the encoder is mounted on the motor, while on others, it is on the spindle or transmission output.) N = (Encoder steps/enc rev)/(Enc pulley ratio X High Gear Ratio) For machines with a spindle and spindle motor encoder, it is the number of spindle motor encoder steps per mechanical revolution of the encoder. Its purpose is to specify the resolution of the spindle motor encoder. This parameter is used in conjunction with parameter 176 bits 25 and 26, which control the ratio between the electrical revolution of the motor to the mechanical revolution of the encoder.
If a vector drive is not installed, this parameter is called: STEPS/REVOLUTION and is not used.

188 C ORIENT GAIN

This name is used when a Vector Drive is installed. The proportional gain is used in the position control loop when performing a spindle orientation. If a Vector Drive is not installed this parameter si called, C axis BACKLASH, and is not used.

189 C BASE FREQ

This name is used when a Vector Drive is installed. This is the rated frequency of the motor. If a Vector Drive is not installed this parameter is called, C axis DEAD ZONE, and is not used.

190 C HI SP CURR LIM

This name is used when a Vector Drive is installed. At speeds higher than the base frequency, the maximum current that is applied to the motor must be reduced. This is done linearly from base to maximum frequency. The value set in this parameter is the maximum current at the maximum frequency. If a Vector Drive is not installed this parameter is called, C axis IN POSITION LIMIT, and is not used.

191 C MAX CURRENT

See Parameter 105 for description.

192 C MAG CURRENT

This name is used when a Vector Drive is installed. This is the magnetization component of the current in the motor, also called the flux or the field current. If a Vector Drive is not installed this parameter is called, C axis D*D GAIN, and is not used.

193 C SPIN ORIENT MARGIN

This name is used when a Vector Drive is installed. When a spindle orientation is done, if the actual position of the spindle is within this value (plus or minus), the spindle will be considered locked. Otherwise, the spindle will not be locked. If a Vector Drive is not installed this parameter is called, C axis ACC / DEC T CONST, and is not used.

194 C SP STOP SPEED

This name is used when a Vector Drive is installed. The spindle is considered to be stopped (discrete input SP ST*=0) when the speed drops below this value. Units are encoder steps/millisecond. If a Vector Drive is not installed this parameter is called, C axis PHASE OFFSET, and is not used.

195 C START / STOP DELAY

This name is used when a Vector Drive is installed. This delay is used at the start of motion to magnetize the rotor before acceleration starts. Also when the motor comes to a stop, it remains energized for this amount of time. Units are milliseconds. If a Vector Drive is not installed this parameter is called, C axis GRID OFFSET, and is not used.

196 ACCEL LIMIT LOAD

This name is used when a Vector Drive is installed. This is the percent of load limit during acceleration. If the load reaches this limit during acceleration, the control slows the acceleration. If a Vector Drive is not installed this parameter is called, C axis EXACT STOP DIST, and is not used.

197 SWITCH FREQUENCY

This name is used when a Vector Drive is installed. This is the frequency at which the spindle motor windings are switched. Note that there is a hysteresis band around this point, defined by parameter 198. If a Vector Drive is not installed this parameter is called, C axis FRICTION FACTOR, and is not used.

198 SWITCH HYSTERESIS

This name is used when a Vector Drive is installed. This defines the ± hysteresis band around parameter 197. For example if par. 197 is 85Hz, and par. 198 is 5Hz, switching will take place at 90Hz when the spindle is speeding up, and at 80Hz when the spindle is slowing down. If a Vector Drive is not installed this parameter is called, C axis FEED FORWARD, and is not used.

199 PRE-SWITCH DELAY

This name is used when a Vector Drive is installed. This is the amount of time allowed for the current in the motor to drop before the winding change contactors are switched. Units are in microseconds. If a Vector Drive is not installed this parameter is called, C axis THERMAL COMP. COEF., and is not used.

200 POST SWITCH DELAY

This name is used when a Vector Drive is installed. This is the amount of time allowed for the contactors to stabilize after a switch is commanded, before current is applied to the motor. Units are in microseconds. If a Vector Drive is not installed this parameter is called, C axis AIR BRAKE DELAY, and is not used.

201 X SCREW COMP. COEF.

This parameter is used to hold the thermal compensation coefficient. This is the coefficient of heating of the ball screw. The value entered for this parameter is always negative as it is used to shorten the screw length. It should be set to -12000000.

205 A SCREW COMP. COEF.

This parameter is used to hold the thermal compensation coefficient. This is the coefficient of heating of the ball screw. This parameter should be set to zero.

206 RESERVED

207 RESERVED

208 SPIN. FAN OFF DELAY

Delay for turning the spindle fan off after the spindle has been turned off.

209 COMMON SWITCH 2

This is a collection of general purpose single bit flags used to turn some functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 LATHE T.C.	Designates control as a lathe.
1 RST STOPS T.C.	Tool changer can be stopped with RESET button.
2 BRIDGE	Not Used
3 ENA CONVEYOR	Enables chip conveyor, if machine is so equipped.
4 50% RPD KBD	When (1) the control will support the new style keyboards with the 50% rapid traverse key. For controls without a 50% rapid keypad set this bit to (0).
5 FRONT DOOR	When enabled the control will look for an additional door switch and will generate an operator message.
10 T SUBROUTINE	Not Used
11 RESERVED	
12 REV CONVEYOR	Reverses the direction of the chip conveyor.
13 M27-M28 CONVYR	Usually the chip conveyor motor and direction relays are attached to the user relays M21 M22. When this bit is set, the control expects to see the conveyor hooked up to M27 and M28.
15 GREEN BEACON	When (1) user relay M25 is used to flash a beacon. If the control is in a reset state, the beacon will be off. If the control is running normally, the beacon will be steadily on. If the control is in a M00, M01, M02, M30 feedhold, or single block state, then the beacon will flash.
16 RED BEACON	When (1) user relay M26 is used to flash a beacon. The beacon flashes if the control is experiencing an alarm or emergency stop condition.
17 CONVY DR OVRD	When (1) the conveyor will continue to run with the door open. When (0) the conveyor will stop when the door is open, but will resume when the door is closed. For safety it is recommended that the bit be set to (0).
18 RESERVED	
19 TC FWD CW	Determines the direction that the turret moves as viewed from the spindle, when the turret is commanded forward. When (1), the turret will rotate clockwise for a forward command, and when (0), it will rotate counterclockwise. The default is 1.
20 RMT TOOL RLS	This bit supports the VTC-48. It specifies that the machine has a remote tool release button. It should be set to 1 on the VTC-48 and zero on all other lathes.
21 DISK ENABL	Enables an installed floppy disk drive.
23 MCD RLY BRD	If set to 1, adds 16 additional relays, for a total of 56.
24 HPC ENABLE	When this parameter bit is set to zero the machine will behave normally. When it is set to 1, the High Pressure Coolant pump can be turned on with M88 (this will first turn off the regular coolant if it was on, just like an M9). High Pressure Coolant can be turned off with M89. Note also that if a tool change is commanded when the HPC pump is running, it will be turned off, followed by a pause of the length specified by parameter 237. HPC must then be turned back on by the user's program.
25 AUX JOG NACC	Does not allow accumulation on auxiliary axis jog. If the jog handle is moved rapidly the auxiliary axis will not develop extremely large lags.

27 RAPID EXSTOP	Default is 1. When this bit is set to 1, the control will execute an exact stop after all rapid motions, regardless of the next motion. When set to zero, the control will exact stop after a rapid only if the next motion is not a rapid move.
29 HYDRAULICS	This bit must be set to 1 if a lathe has the hydraulic chuck clamping option.
30 STALL DETECT	Enables detection of spindle stall. If spindle stalls, the spindle motor is stopped and an alarm is generated.
31 SPNDL NOWAIT	When (1), the machine will not wait for the spindle to come up to speed immediately after an M03 or M04 command. Instead, it will check and/or wait for the spindle to come up to speed immediately before the next interpolated motion is initiated. This bit does not affect rigid tapping.

214 D:Y CURRENT RATIO%

This name is used when a Vector Drive is installed. This defines the ratio between the two winding configurations. This default winding is Y, and the parameters are set for the Y winding. This number is used to adjust the parameters for the delta winding when the windings are switched. If a Vector Drive is not installed, this parameter is called C axis TOOL CHANGE OFFSET, and is not used.

215 CAROUSEL OFFSET

Parameter used to align tool 1 of tool changing carousel precisely. Units are encoder steps.

216 CNVYR RELAY DELAY

Delay time in 1/50 seconds required on conveyor relays before another action can be commanded. Default is 5.

217 CNVYR IGNORE OC TIM

Amount of time in 1/50 seconds before overcurrent is checked after conveyor motor is turned on. Default is 50.

218 CONVYR RETRY REV TIM

Amount of time that the conveyor is reversed in 1/50 seconds after overcurrent is sensed. Default is 200.

219 CONVYR RETRY LIMIT

Number of times that the conveyor will cycle through the reverse/forward sequencing when an overcurrent is sensed before the conveyor will shut down. An overcurrent is sensed when chips jam the conveyor. By reversing and then forwarding the conveyor, the chip jam may be broken. Default is 3.

220 CONVYR RETRY TIMEOUT

Amount of time in 1/50 seconds between consecutive overcurrents in which the overcurrents is considered another retry. If this amount of time passes between overcurrents then the retry count is set to (0). Default is 1500, 30 seconds.

221 MAX TIME NO DISPLAY

The maximum time (in 1/50 sec.) between screen updates. When executing short blocks at a high feed rate, the control will use the resources available for interpreting G-code and generation of motion blocks. The display may not update until this time is exceeded. For high speed operation, updating of the display may cause the motion queue to become exhausted. This will manifest itself as a pause in motion. See M76 and M77 to disable the display completely.

222 LOW HYD. IGNORE

The amount of time that the control ignores the LO HYD input bit after servos have been engaged. The hydraulic unit requires a short period of time to come up to pressure. The default value is 50, which is equal to 1 second.

226 EDITOR CLIPBOARD

This parameter assigns a program number (nnnnn) to the contents of the clipboard (for the advanced editor).

227 DISK DIR NAME

When the floppy disk drive is enabled and a floppy disk directory is read. The directory listing is placed into a program as comments. The program is then made the current program so the user can read the contents of the floppy disk drive. This parameter designates what program is used to write the directory listing to. Program O8999 is the default value.

228 QUICKCODE FILE

This parameter set the program numbers to store in the Quick Code definition.

229 X LEAD COMP 10E9

This parameter sets the X-axis lead screw compensation signed parts per billion.

230 Y LEAD COMP 10E9

This parameter sets the Y-axis lead screw compensation signed parts per billion.

231 Z LEAD COMP 10E9

This parameter sets the Z-axis lead screw compensation signed parts per billion.

232 A LEAD COMP 10E9

This parameter sets the A-axis lead screw compensation signed parts per billion.

233 B LEAD COMP 10E9

This parameter sets the B-axis lead screw compensation signed parts per billion.

234 C BELT COMPENSATION

This parameter sets the belt compensation.

235 AUTO DOOR PAUSE

This parameter that supports the Auto-Door feature. It specifies the length of a pause (in 50ths of a second) that occurs during the door close sequence. As the door closes and the switch is activated, the motor is turned off for this amount of time and the door coasts. This allows the door to close smoothly. This parameter should be set to 3 (0.06 seconds) nominally. It works in conjunction with parameter 236.

236 AUTO DOOR BUMP

This parameter that supports the Auto-Door feature. It specifies the length of time (in 50ths of a second) that the motor should be reactivated after the pause specified by parameter 235. This causes the motor to close the door fully and smoothly. This parameter should be set to 15 (0.3 seconds) nominally.

237 HPC PRESSURE BLEED

This parameter is for the HPC (High Pressure Coolant) feature. It is the amount of time given for the coolant to purge when the HPC system is shut off. This should be set to 250 on all lathes.

238 SPINDLE AT SPEED %

This parameter is used to allow a program to command the spindle to a certain speed and then continue to the next block before the spindle has actually reached that speed. This is intended to make G-code programs run faster because the spindle can usually finish accelerating while approaching the part. It is recommended that this parameter be set to 20. The result will be that the lathe will act as though the spindle is at speed when it is within +/- 20% of the commanded speed.

239 SPNDL ENC STEPS/REV

This parameter sets the number of encoder steps per revolution of the spindle encoder.

240 1ST AUX MAX TRAVEL

This parameter sets the maximum travel of the first auxiliary axis in the positive direction.

241 2ND AUX MAX TRAVEL

This parameter sets the maximum travel of the second auxiliary axis in the positive direction.

242 3RD AUX MAX TRAVEL

This parameter sets the maximum travel of the third auxiliary axis in the positive direction.

243 4TH AUX MAX TRAVEL

This parameter sets the maximum travel of the fourth auxiliary axis in the positive direction.

244 1ST AUX MIN TRAVEL

This parameter sets the maximum travel of the first auxiliary axis in the negative direction.

245 2ND AUX MIN TRAVEL

This parameter sets the maximum travel of the second auxiliary axis in the negative direction.

246 3RD AUX MIN TRAVEL

This parameter sets the maximum travel of the third auxiliary axis in the negative direction.

247 4TH AUX AXIS MIN TRAVEL

This parameter sets the maximum travel of the fourth auxiliary axis in the negative direction.

248 MAX SPINDLE SPEED ALLOWED

The RPM above which the chuck will not operate. If the spindle is spinning faster than this value the chuck will not open, and if it is spinning slower than this value the chuck will open. The default is 0, for safety.

249 DLY AFTER CHUCK IS CLMPED

The dwell time that is allowed after clamping the chuck (an M10 command). Program execution will not continue until this time has expired. Units are in milliseconds.

250 DLY AFTER CHUCK IS UNCLMP

The dwell time that is allowed after unclamping the chuck (an M11 command). Program execution will not continue until this time has expired. Units are in milliseconds.

251 A DOOR OPEN ERRTIME

This parameter specifies the number of milliseconds allowed for the door to open (move away from the door-closed switch). If the door is commanded to open, and does not open within the allowed time, alarm 127 DOOR FAULT is generated. Also, the value of this parameter plus one second specifies the number of milliseconds allowed for the door to close (activate the door-closed switch). If the door is commanded to close, and does not close within the allowed time, alarm 127 DOOR FAULT is generated. If an automatic door is installed, this parameter should be set to 2400 (2.4 seconds) nominally, otherwise it should be set to zero.

252 TAILSTOCK OVERLOAD -DIR

Determines the overload limit when the tailstock is traveling in the minus direction, toward the spindle. This is an arbitrary value based on the effective voltage being sent to the tailstock servo motor. If this value is too low, you may not be able to move the tailstock. Increase the value until you are able to move the tailstock. The value for Parameter 252 should be approximately 1/2 the value of Parameter 253. This parameter is used for ballscrew tailstock or TL-15.

253 TAIL STOCK OVERLOAD +DIR

Determines the overload limit when the tailstock is traveling in the positive direction, away from the spindle. The value for Parameter 253 should be approximately twice the value of Parameter 252. This parameter is used for ballscrew tailstock or TL-15.

254 SPINDLE CENTER

Reserved for service use only.

255 CONVEYOR TIMEOUT

The amount of time the conveyor will operate without any motion or keyboard action. After this time, the conveyor will automatically shut off. Note that this parameter value will cause the conveyor to shut off even if the intermittent feature is functioning. Note also that if this parameter is set to zero, the chip conveyor will shut off immediately, i.e., pressing CHIP FWD or CHIP REV will not turn it on.

256 PALLET LOCK INPUT

It should be set to zero on all machines.

257 SPINDLE ORIENT OFSET

This is used for the Vector Drive and the value is determined at the time of assembly.

266 X SWITCHES

Parameter 266 is a collection of single-bit flags used to turn servo related functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 X LIN SCALE EN	Used to enable linear scales for the X-axis.
1 X INVRT LN SCL	Used to invert the X-axis linear scale.
2 X DSBL LS ZTST	Used to disable the linear scale Z test.
3 TH SNSR COMP	This parameter is used for Ball Screw Thermal Compensation via a temperature sensor attached to the ball nut. When this bit is set to 1, the feature is activated for that axis. Note that the feature can only be used when temperature sensors are installed. The following parameters must be set appropriately: 201, 133 XZ SCREW COMP. COEF. =-190000000 272, 274 XZ SCREW COMP T. CONST =-27000000 351 TEMP PROBE OFFSET =450000
4 X 2ND HOME BTN	Used to move axis to coordinate specified in Work Ofset G129
5 X NEG COMP DIR	Used to negate the direction of thermal compensation
7 MAX TRAV INP	

8 NO ZERO/NOHOME	This feature is intended for lathes that have extra tools mounted on the outside of the turret. If this bit is set to zero, it will have no effect. If it is set to 1, the associated axis will not move when POWER UP/RESTART, HOME G28 or AUTO ALL AXES is pressed. The reason for this feature is to help prevent collisions between tools mounted on the outside of the turret and a sub-spindle mounted on the tailstock. It is important to note that a single axis HOME G28 (e.g., press Z then HOME G28) and any G28 specified in a program will still cause the axis to move regardless of the value of this parameter bit. The operator must exercise care when commanding any axis move.

267 Y SWITCHES

Parameter 267 is a collection of single-bit flags used to turn servo related functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are

0 Y LIN SCALE EN	Used to enable linear scales for the Y axis.
1 Y INVRT LN SCL	Used to invert the Y axis linear scale.
2 Y DSBL LS ZTST	Used to disable the linear scale Z test.
3 TH SNSR COMP	This parameter is used for Ball Screw Thermal Compensation via a temperature sensor attached to the ball nut. When this bit is set to 1, the feature is activated for that axis. Note that the feature can only be used when temperature sensors are installed. The following parameters must be set appropriately: 201, 133 XZ SCREW COMP. COEF. =-190000000 272, 274 XZ SCREW COMP T. CONST =-27000000 351 TEMP PROBE OFFSET =450000
4 Y 2ND HOME BTN	Used to move axis to coordinate specified in Work Ofset G129
5 Y NEG COMP DIR	Used to negate the direction of thermal compensation
7 MAX TRAV INP	
8 NO ZERO/NOHOME	This feature is intended for lathes that have extra tools mounted on the outside of the turret. If this bit is set to zero, it will have no effect. If it is set to 1, the associated axis will not move when POWER UP/RESTART, HOME G28 or AUTO ALL AXES is pressed. The reason for this feature is to help prevent collisions between tools mounted on the outside of the turret and a sub-spindle mounted on the tailstock. It is important to note that a single axis HOME G28 (e.g., press Z then HOME G28) and any G28 specified in a program will still cause the axis to move regardless of the value of this parameter bit. The operator must exercise care when commanding any axis move.

268 Z SWITCHES

Parameter 268 is a collection of single-bit flags used to turn servo related functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 Z LIN SCALE EN	Used to enable linear scales for the Z axis.
1 Z INVRT LN SCL	Used to invert the Z axis linear scale.
2 Z DSBL LS ZTST	Used to disable the linear scale Z test.
3 TH SNSR COMP	This parameter is used for Ball Screw Thermal Compensation via a temperature sensor attached to the ball nut. When this bit is set to 1, the feature is activated for that axis. Note that the feature can only be used when temperature sensors are installed. The following parameters must be set appropriately: 201, 133 XZ SCREW COMP. COEF. =-190000000 272, 274 XZ SCREW COMP T. CONST =-27000000 351 TEMP PROBE OFFSET =450000

4 Z 2ND HOME BTN	Used to move axis to coordinate specified in Work Ofset G129
5 Z NEG COMP DIR	Used to negate the direction of thermal compensation
7 MAX TRAV INP	
8 NO ZERO/NOHOME	This feature is intended for lathes that have extra tools mounted on the outside of the turret. If this bit is set to zero, it will have no effect. If it is set to 1, the associated axis will not move when POWER UP/RESTART, HOME G28 or AUTO ALL AXES is pressed. The reason for this feature is to help prevent collisions between tools mounted on the outside of the turret and a sub-spindle mounted on the tailstock. It is important to note that a single axis HOME G28 (e.g., press Z then HOME G28) and any G28 specified in a program will still cause the axis to move regardless of the value of this parameter bit. The operator must exercise care when commanding any axis move.

269 A SWITCHES

Parameter 269 is a collection of single-bit flags used to turn servo related functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 A LIN SCALE EN	Used to enable linear scales for the A axis.
1 A INVRT LN SCL	Used to invert the A axis linear scale.
2 A DSBL LS ZTST	Used to disable the linear scale Z test.
3 TH SNSR COMP	This parameter is used for Ball Screw Thermal Compensation via a temperature sensor attached to the ball nut. When this bit is set to 1, the feature is activated for that axis. Note that the feature can only be used when temperature sensors are installed. The following parameters must be set appropriately: 201, 133 XZ SCREW COMP. COEF. =-190000000 272, 274 XZ SCREW COMP T. CONST =-27000000 351 TEMP PROBE OFFSET =450000
4 A 2ND HOME BTN	Used to move axis to coordinate specified in Work Ofset G129
5 A NEG COMP DIR	Used to negate the direction of thermal compensation
7 MAX TRAV INP	
8 NO ZERO/NOHOME	This feature is intended for lathes that have extra tools mounted on the outside of the turret. If this bit is set to zero, it will have no effect. If it is set to 1, the associated axis will not move when POWER UP/RESTART, HOME G28 or AUTO ALL AXES is pressed. The reason for this feature is to help prevent collisions between tools mounted on the outside of the turret and a sub-spindle mounted on the tailstock. It is important to note that a single axis HOME G28 (e.g., press Z then HOME G28) and any G28 specified in a program will still cause the axis to move regardless of the value of this parameter bit. The operator must exercise care when commanding any axis move.

270 B SWITCHES

Parameter 270 is a collection of single-bit flags used to turn servo related functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 B LIN SCALE EN	Used to enable linear scales for the B axis.
1 B INVRT LN SCL	Used to invert the B axis linear scale.
2 B DSBL LS ZTST	Used to disable the linear scale Z test.

3 TH SNSR COMP	This parameter is used for Ball Screw Thermal Compensation via a temperature sensor attached to the ball nut. When this bit is set to 1, the feature is activated for that axis. Note that the feature can only be used when temperature sensors are installed. The following parameters must be set appropriately: 201, 133 XZ SCREW COMP. COEF. =-190000000 272, 274 XZ SCREW COMP T. CONST =-27000000 351 TEMP PROBE OFFSET =450000
4 B 2ND HOME BTN	Used to move axis to coordinate specified in Work Ofset G129
5 B NEG COMP DIR	Used to negate the direction of thermal compensation
7 MAX TRAV INP	
8 NO ZERO/NOHOME	This feature is intended for lathes that have extra tools mounted on the outside of the turret. If this bit is set to zero, it will have no effect. If it is set to 1, the associated axis will not move when POWER UP/RESTART, HOME G28 or AUTO ALL AXES is pressed. The reason for this feature is to help prevent collisions between tools mounted on the outside of the turret and a sub-spindle mounted on the tailstock. It is important to note that a single axis HOME G28 (e.g., press Z then HOME G28) and any G28 specified in a program will still cause the axis to move regardless of the value of this parameter bit. The operator must exercise care when commanding any axis move.

271 C SWITCHES

Parameter 271 is a collection of single-bit flags used to turn servo related functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 C LIN SCALE EN	Used to enable linear scales for the C axis.
1 C INVRT LN SCL	Used to invert the C axis linear scale.
2 C DSBL LS ZTST	Used to disable the linear scale Z test.
3 TH SNSR COMP	This parameter is used for Ball Screw Thermal Compensation via a temperature sensor attached to the ball nut. When this bit is set to 1, the feature is activated for that axis. Note that the feature can only be used when temperature sensors are installed. The following parameters must be set appropriately: 201, 133 XZ SCREW COMP. COEF. =-190000000 272, 274 XZ SCREW COMP T. CONST =-27000000 351 TEMP PROBE OFFSET =450000
4 C 2ND HOME BTN	Used to move axis to coordinate specified in Work Ofset G129
5 C NEG COMP DIR	Used to negate the direction of thermal compensation
7 MAX TRAV INP	
8 NO ZERO/NOHOME	This feature is intended for lathes that have extra tools mounted on the outside of the turret. If this bit is set to zero, it will have no effect. If it is set to 1, the associated axis will not move when POWER UP/RESTART, HOME G28 or AUTO ALL AXES is pressed. The reason for this feature is to help prevent collisions between tools mounted on the outside of the turret and a sub-spindle mounted on the tailstock. It is important to note that a single axis HOME G28 (e.g., press Z then HOME G28) and any G28 specified in a program will still cause the axis to move regardless of the value of this parameter bit. The operator must exercise care when commanding any axis move.

272 X THERM COMP T. CONST

This parameter supports Ball Screw Thermal Compensation. The value is the time constant that govern the rate of cool down of the screw. This parameter should be set to -5000.

273 Y THERM COMP T. CONST

This parameter supports Ball Screw Thermal Compensation. The value is the time constant that govern the rate of cool down of the screw. This parameter should be set to 0.

274 Z THERM COMP T. CONST

This parameter supports Ball Screw Thermal Compensation. The value is the time constant that govern the rate of cool down of the screw. This parameter should be set to -3000.

275 A THERM COMP T. CONST

This parameter supports Ball Screw thermal Compensation. The value is the time constant that govern the rate of cool down of the screw. This parameter should be set to 0.

276 B THERM COMP T. CONST

This parameter supports Ball Screw thermal compensation. The value is the time constant that govern the rate of cool down of the screw. This parameter should be set to zero.

278 COMMON SWITCH 3

Parameter 278 is a collection of general purpose single bit flags used to turn some functions on and off. The left and right cursor arrows are used to select the function being changed. All values are 0 or 1 only. The function names are:

0 INVERT G.B.	Default is 0. When this bit is set to 1, the sense of the discrete inputs for SP HIGH and SP LOW (high and low gear) are inverted.
1 DPR SERIAL	Causes the main serial inputs/outputs to go through the floppy disk video board.
2 CK PALLET IN	
3 CK HIDDN VAR	
4 DISPLAY ACT	When set to 1, displays the actual spindle speed on the Current Commands display page.
6 HYDRAULIC TS	This bit enables the hydraulic tailstock
7 SPND DRV LCK	This bit must be set to 0 if machine is equipped with a Haas vector spindle drive.
8 CHUCK OPN CS	When set to 1, the user can press CYCLE START and run a program with the chuck unclamped. If the spindle is commanded with this bit set to 1, the spindle will not exceed the CHUCK UNCLAMP RPM (Parameter 248). The default for this bit is 0. This feature is ineffective when the CE safety circuit is enabled.
9 CNCR SPINDLE	When set to 0, spindle start occurs at the end of a block, as in normal M code operation. When set to 1, spindle start occurs at the beginning of a block and concurrent with axis motion.
10 TL SET PROBE	This bit must be set to 1 in order to enable the Tool Pre-Setter.
11 HAAS VECT DR	(Haas Vector Drive) This bit must be set to 1 if machine is equipped with a HAAS vector spindle drive. When set to 1, voltage to the Haas vector drive is displayed in the diagnostics display as DC BUSS.
12 uP ENCL TEMP	(Microprocessor enclosure temperature) When set to 1, the enclosure temperature will be displayed on INPUTS2 screen of the diagnostics display.
13 HAAS RJH	Haas remote jog handle. This bit must be set to 1 if the machine is equipped with a Haas 5-axis Remote jog handle.

14 SP MOT OT NC	Spindle Motor Over Temperature Normally Closed. This bit specifies the type (normally open normally closed) of the spindle temperature sensor. This bit should be set to 1 for machines with a Haas Vector Drive, and 0 for machines without a Vector Drive.
15 SUBSP TMP NC	(Subspindle Temperature Sensor Normally Closed) This bit specifies the type, normally open or normally closed, of the subspindle temperature sensor.
17 NO MFIN CKPU	When it is set, it will prevent checking of MFIN at power-up. It should be set to 1 for all machines that have the new Haas Automatic Pallet Changer attached, and 0 for all other machines.
18 D:Y SW ENABL	Delta Wye switch enable, this is used for machine with a Vector Drive. If this switch is set, but bit 19 is not, then winding switching will only be done when the spindle is at rest, depending on the target speed of the spindle
19 DY SW ON FLY	Delta Wye switch enable, this is used for machine with a Vector Drive. This parameter enables switching on the fly, as the spindle motor is accelerating or decelerating through the switch point.
20 CK BF STATUS	This bit has been added for the improved Bar Feeder interface. When this bit is set to 1, the control will constantly check the Bar Feeder Status on discrete input 1027. If this input goes high, alarm 450 BAR FEEDER FAULT will be generated and the servos and spindle will be turned off. Note that the spindle will simply coast to a stop.
21 CK BF SP ILK	This bit has been added for the improved Bar Feeder interface. When this bit is set to 1, the control will constantly check the Bar Feeder Spindle Interlock on discrete input 1030. If this input goes high, and the spindle is being commanded to turn, or coasting or being manually turned at 10rpm or more, alarm 451 BAR FEEDER SPINDLE INTERLOCK will be generated and the servos and spindle will be turned off. Note that the spindle will simply coast to a stop.
24 LIVE TOOLING	Lathes fitted with the Live Tooling drive this bit must be set to 1. For all other lathes, this bit is set to 0.
25 SUBSPINDLE	This bit enables G14, G15, M143, M144, M145. It must be set to 1 for all lathes with the subspindle. When this bit is set to 1, the control will display FUNCTION LOCKED when the AUTO ALL AXES, HOME G28, or POWER UP/RESTART buttons are pressed.
26 C AXIS DRIVE	This bit enables M154 and M155. It must be set to 1 for all lathes with the C axis.
29 SAFETY INVERT	This bit supports the CE door interlock that locks when power is turned off. For machines that have the regular door lock that locks when power is applied, this bit must be set to 0. For machines that have the inverted door lock, this bit must be set to 1.
31 INV SPD DCEL	Inverse spindle speed deceleration. When this parameter is set to 1, the spindle decelerates faster at lower speeds, resulting in a shorter deceleration time.

285 X LINEAR SCREW OFFS

Reserved for future use; set to zero.

286 Y LINEAR SCREW OFFS

Reserved for future use; set to zero.

287 Z LINEAR SCREW OFFS

Reserved for future use; set to zero.

291 HYDRAULIC TAIL STK NO MOTION DETEC TIME

The number in milliseconds that must pass with no B-axis encoder change before the control decides that the tailstock has stopped. The parameter affects homing and alarm situations on the tailstock. If the tailstock pressure is set low and the tailstock does not home properly then increase this parameter.

292 HYD TS RTRACT MARGN (Hydraulic Tailstock Retract Margin)

This parameter sets the acceptable range, in encoder steps, for the retract point. When the tailstock stops anywhere within this range, the control assumes it is at the retract point. The default is 5 encoder steps. This means that a 10 encoder step range is set around the retract point.

293 HYD TS SLOW DISTNCE (Hydraulic Tailstock Slow Distance)

This parameter sets the distance, prior to a target point, where the tailstock will transition from a rapid movement to a feed. For example, if this parameter is set to 30 (the default), this means the tailstock will slow to a feed 30 encoder steps before reaching the target point. Units are in encoder steps.

294 MIN BUSS VOLTAGE

This parameter specifies the minimum Haas Vector Drive buss voltage. If the machine has a Haas Vector Drive, the parameter should be set to 270 (volts). Machines without a Vector Drive should be set to 0. Alarm 160 LOW VOLTAGE will be generated if the voltage falls below the minimum specified.

296 MAX OVER VOLT TIME

Specifies the amount of time (in 50ths of a second) that an overvoltage condition (alarm 119 OVER VOLTAGE) will be tolerated before the automatic shut down process is started.

297 MAX OVERHEAT TIME

Specifies the amount of time (in 50ths of a second) that an overheat condition (alarm 122 REGEN OVERHEAT) will be tolerated before the automatic shut down process is started.

298 YAX RTAP BACKLASH

This parameter is normally set to zero, but can be adjusted by the user (to a number typically between 0 and 1000) to compensate for play in the center of the main spindle. It takes effect during G95 SUBSPIDLE RIGID TAP when the tool has reached the bottom of the hole and must reverse direction to back out.

299 AUTOFEED STEP-UP

This parameter works with the AUTOFEED feature. It specifies the feed rate step-up percentage per second and should initially be set to 10.

300 AUTOFEED-STEP-DOWN

This parameter works with the AUTOFEED feature. It specifies the feed rate step-down percentage per second and should initially be set to 20.

301 AUTOFEED-MIN-LIMIT

This parameter works with the AUTOFEED feature. It specifies the minimum allowable feed rate override percentage that the AUTOFEED feature can use and should initially be set to 1. For more information see AUTOFEED under the new features section.

NOTE: When tapping, the feed and spindle overrides will be locked out, so the AUTOFEED feature will be ineffective (although the display will appear to respond to the override buttons.)

NOTE: The last commanded feed rate will be restored at the end of the program execution, or when the operator presses RESET or turns off the AUTOFEED feature.

NOTE: The operator may use the feed rate override buttons while the AUTOFEED feature is active. As long as tool load limit is not exceeded, these buttons will have the expected effect and the overridden feed rate will be recognized as the new commanded feed rate by the AUTOFEED feature. However, if the tool load limit has already been exceeded, the control will ignore the feed rate override buttons and the commanded feed rate will remain unchanged.

304 SPINDLE BRAKE DELAY

This parameter specifies the amount of time (in milliseconds) to wait for the main spindle brake to unclamp when spindle speed has been commanded, and also the amount of time to wait after the main spindle has been commanded to stop before clamping it.

305 SERVO PO BRK DLY

Specifies the time (in milliseconds) that the control should wait after turning off the Hyd Pump Enable relay (which will activate the brake) before turning off power to the servo motors via the MOCON. This is intended to allow time for the brake to engage. This parameter should be set to 200.

315 COMMON SWITCH 4

0 ALIS M GRPHC	All user defined M codes (such as M50) will be ignored when a program is run in graphics mode if this bit is set to 0. If it is necessary to have graphics recognize such M codes, this bit should be set to 1.
5 DOOR OPEN SW	This ensures that when the door is opened automatically, it opens all the way. It is intended to be used in conjunction with an automatic parts loader. If this bit is set to zero, the control behaves as before. If this bit is set to 1, the control will look for a second door switch when the door is opened automatically. If the switch is not found, alarm 127 DOOR FAULT will be generated. This bit should be set to 1 on all machines fitted with the second door switch.
6 SIMPLE T.S.	This parameter supports the SL-10 tailstock, which has no encoder. It should be set to 1 only on an SL-10 with a hydraulic tailstock. It should be set to zero on all other machines.
7 BRLESS BF	This parameter bit supports the brushless bar feeder. When it is set to 1, it indicates that a brushless bar feeder is present.
8 MINI PWRSPLY	This parameter bit is intended for the Mini Lathe. When it is set to zero, the control behaves as before. This parameter bit must be set to 1 on all Mini Lathes. Note: Parameter 294 MIN BUSS VOLTAGE must be set to zero on all Mini Lathes.
9 APL	This parameter indicates that a Haas Lathe APL is installed. When this bit is set to 1, a COMMANDS screen for the HAAS APL is displayed.
10 ZRET C ENG	This parameter bit controls what the C-axis will do upon engagement. If this bit is set to zero, the C-axis will rapid to zero upon engagement. When this bit is set to 1, the C-axis will perform a zero return upon engagement. Note that in either case, the spindle is oriented upon C-axis engagement. Note also, that in order to avoid spindle oscillation during movement of the C-axis, the spindle is shifted to high gear (on lathes with a gear box) before engaging the C-axis.

11 SETING 92 EN	This parameter bit is intended to prevent damage to lathes fitted with a pneumatic double-chuck. If setting 92 CHUCK CLAMPING is switched from O.D. to I.D. or back while the spindle is turning, the chuck will be considered clamped in the opposite direction and will move immediately. A pneumatic double-chuck will be damaged if it is moved while the spindle is turning. This parameter bit must be set to 1 before setting 92 can be altered, and since parameters can only be altered after ESTOP has been pressed, this ensures that the spindle will be at rest when the bit is altered. It is strongly advised that this bit be returned to zero immediately after use.
16 SS REV SPN E	Reverses sense direction of subspindle encoder
17 SS VEC D ENC	Enables a second encoder that is mounted on the subspindle motor and wired into the “C” axis input of the Mocon. It is required to control the vector algorithm when the lathe’s belts might slip at high load.
18 SS VEC DRIVE	This bit must be set to 1 if the machine is equipped with a HAAS vector subspindle drive. When set to 1, voltage to the Haas vector drive is displayed in the diagnostics display as DC BUSS. For the TL-15 and VTC-48, this bit must be set to 1. For all others, it must be set to 0.
19 SS D:Y SW EN	Delta Wye switch enable. This is used for the Vector Drive. If this switch is set, but bit 19 is not, then winding switching will only be done when the subspindle is at rest, depending on the target speed of the subspindle.
20 SS DY SW FLY	Delta Wye switch on the fly. This is used for the Vector Drive. Enables switching on the fly, as the subspindle motor is accelerating or decelerating through the switch point. If bit 18 (SS VEC DRIVE) is not set, this switch will be ignored.
21 SS IN SPD DC	Subspindle Inverse Speed Deceleration. When this parameter is set to 1, the subspindle decelerates faster at lower speeds, resulting in a shorter deceleration time.
22 SS DISBLE GB	Disables gear box functions. For the TL-15 and VTC-48, this bit must be set to 1. For all others, it must be set to 0.
23 VERT TRN CTR	This bit is used for the VTC-48.
24 SS INVERT GB	This bit allows an alternate gearbox configuration. It inverts the sense of the gearbox inputs. The default is 0. When this bit is set to 1, the sense of the discrete inputs for SP HIG and SP LOW (high and low gear) are inverted.
25 PWR DIS RLY	This parameter when set to 1, with parameter 57 (SAFETY CIRC) set to 1, and the door is opened, I GAIN on all the axes is cleared. This feature is intended to be used in conjunction with customer supplied hardware who require the servo power to be cut when the door is opened.

316 MEASURE BAR RATE

This parameter supports the Haas Servo Bar 300 barfeeder. It is the rate at which the bars are measured. Units are inches*1000.

317 MEASURE BAR INC

This parameter supports the Haas Servo Bar 300 barfeeder. This is the increment used for bar measurement. Units are inches*10,000

318 GEAR MOTOR TIMEOUT

This parameter supports the Haas Servo Bar 300 barfeeder. This is the timeout value for gearmotor operations. Units are in milliseconds.

319 MAX RETRACT POS

This parameter supports the Haas Servo Bar 300 barfeeder. This is the maximum V axis position when retracted. Units are inches * 10000.

320 MIN RETRACT POS

This parameter supports the Haas Servo Bar 300 barfeeder. This is the minimum space between bar and push rod when retracted. Units are inches*10,000

321 PUSH ROD ZERO POS

This parameter supports the Haas Servo Bar 300 barfeeder. This is the V axis position for loading and unloading a bar. Units are in inches*10,000.

322 GEARMOTOR BUMP TIME

This parameter supports the Haas Servo Bar 300 barfeeder. Gear motor run time for bump and internal functions. Units are in milliseconds.

323 PUSH RATE

This parameter supports the Haas Servo Bar 300 barfeeder. This is the rate at which the last 1/4 inch of feed is done. Units are inches per minute*1000.

324 GEAR MOTOR SETTLE

This parameter supports the Haas Servo Bar 300 barfeeder. This is the minimum dwell time for reversing the gear motor direction. Units are in milliseconds.

325 STANDARD BAR LEN

This parameter supports the Haas Servo Bar 300 barfeeder. This is the length of bar for G105 Q5. Units are in inches per minute*1000.

326 G5 DECELERATION

This parameter supports the G05 FINE SPINDLE CTRL feature. This is the rate at which to decelerate the spindle during G5. Units are in encoder steps per second. It should be set to 15000.

327 X LS PER INCH

This parameter is used on machines equipped with linear scales. It should be set to zero.

328 Y LS PER INCH

Same as parameter 327.

329 Z LS PER INCH

Same as parameter 327.

330 A LS PER INCH

Same as parameter 327.

331 B LS PER INCH

Same as parameter 327.

333 X LS PER REV

This parameter is used on machines equipped with linear scales. It should be set to zero.

334 Y LS PER REV

Same as parameter 333.

335 Z LS PER REV

Same as parameter 333.

336 A LS PER REV

Same as parameter 333.

337 B LS PER REV

Same as parameter 333.

339 X SPINDLE THERM COEF.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to 8000.

340 Y SPINDLE THERM COEF.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to 0.

341 Z SPINDLE THERM COEF.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to 3692.

342 A SPINDLE THERM COEF.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to 0.

343 B SPINDLE THERM COEF.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to 0.

345 X SPINDLE THERM T.C.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to -12561.

346 Y SPINDLE THERM T.C.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to 0.

347 Z SPINDLE THERM T.C.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to -20000.

348 A SPINDLE THERM T.C.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to 0.

349 B SPINDLE THERM T.C.

This parameter supports the Spindle Head Thermal Compensation feature. It should be set to 0.

351 THRML SENSOR OFFSET

This parameter is used for Ball Screw Thermal Compensation via a temperature sensor attached to the ball nut.

352 RELAY BANK SELECT

In all previous versions, parameter 209 bit 23 MCD RLY BRD assumes that relay bank zero is to be used. This parameter allows the user to change which bank is to be used. It may be set to a number from 0 to 3 (inclusive). M codes M21 through M28 will be switched to the selected bank. Note that this feature requires the I/O-S board. If a previous board is installed without the additional banks of relays, this parameter should be set to zero.

353 MAX SUBSPINDLE RPM

This is the maximum RPM available to the subspindle. This parameter works in conjunction with parameters 570 and 571

354 U SWITCH A

See Parameter 1 for description.

390 V SWITCH A

See Parameter 1 for description.

426 W SWITCH A

See Parameter 1 for description.

498 C SWITCH A

See Parameter 1 for description.

570 SUBSPIN ENC ST/REV

This parameter sets the number of encoder steps per revolution of the subspindle encoder.

571 SUBSPINDLE ST/REV

This parameter sets the number of encoder steps per revolution of the subspindle. This parameter only applies to the subspindle rigid tapping option.

572 C AXIS ENG TIMEOUT

Specifies the C axis timeout value for seeing the engaged switch on engagement or the disengaged switch on disengage. The units are in milliseconds and it should be set to 1000 for all lathes.

573 C AXIS ENG DELAY 1

Specifies the C axis delay after spindle orientation and before engagement. Its purpose is to let the spindle orientation settle. The units are milliseconds and it should be set to 250 for all lathes.

574 C AXIS ENG DELAY 2

Specifies the C axis delay after engagement before the motion completes. Its purpose is to allow the C axis engagement to come up to pressure. The units are milliseconds and it should be set to 250 for all lathes.

575 THRD PTCH FACT PPM

This allows the customer to factor the feed rate on G32, G76 and G92 threading as necessary for particular applications. The units are ppm (parts per million.) This parameter can be adjusted as necessary, for example, increasing the value by 100 will advance the lead of the thread by 1 ten-thousandth of an inch per inch. Note that this parameter is internally limited to 1000. All lathes should be shipped with this parameter set to 200.

576 MAX SS RPM LOW GEAR

Max subspindle RPM in low gear. This is the maximum RPM available to the subspindle. When this speed is programmed, the D-to-A output will be +10V and the subspindle drive must be calibrated to provide this. Gear ratio low to high is 4.1:1.

577 SS ORIENT OFFSET

Subspindle Orientation Offset. It is used to orient the subspindle properly anytime it needs to be locked such as prior to a tool change, or orient subspindle command. This is used for the vector drive and the value is determined at assembly time. The Subspindle position is displayed on the POS-RAW DAT screen just to the right of SYSTEM TIME.

578 SS HIGH GR MIN SPD

Command speed used to rotate subspindle motor when orienting subspindle in high gear. Units are maximum subspindle RPM divided by 4096.

579 SS LOW GR MIN SPD

Command speed used to rotate subspindle motor when orienting subspindle in low gear. Units are maximum subspindle RPM divided by 4096.

580 TS HYD RETRACT TIME

This parameter has been added for the SL-10 hydraulic no-encoder tailstock. It specifies the amount of time (in ms) that the tailstock center will be commanded to retract as a result of commanding an M22 and only takes effect when SIMPLE TS is set to 1.

581 APL FLIPPER SETTLE

This parameter supports the Haas Lathe APL. It specifies the rotational time for the gripper after the switch is encountered and should be set to 100. Units are milliseconds.

582 APL FLIPPER TIME OT

This parameter supports the Haas Lathe APL. It specifies the allowed rotational time when searching for the home switch and should be set to 2000. Units are milliseconds.

583 APL MAX POSITIONS

This parameter supports the Haas Lathe APL. It specifies the number of switch positions in rotation and should be set to 7.

584 APL GRIP OPEN TIME

This parameter supports the Haas Lathe APL. It specifies the maximum allowable time for opening the gripper and should be set to 500. Units are milliseconds.

585 APL GRIP CLOSE TIME

This parameter supports the Haas Lathe APL. It specifies the maximum allowable time for closing the gripper and should be set to 500. Units are milliseconds.

586 MAX DOOR OPN SP RPM

This parameter that specifies the maximum allowable spindle RPM while the door is open. If the door is open when the spindle is commanded to turn faster than this value, or already turning faster than this value when the door is opened, alarm 230 DOOR OPEN will be generated. For safety, this parameter should be set to a low value such as 100.

587 EXTENDED PUSH TIME

This parameter supports the barfeeder pusher rod which is mounted on the barfeeder trolley (for barfeeders with the 1-foot extension option.) The units are 50th's of a second. It causes a delay of the amount of time specified to enable the pusher rod to full extend before the trolley begins to travel back to the home position. This parameter should be set to 150 (3 seconds) on the SL-30 Big Bore and SL-40 only. For all other lathes, it should be set to zero. On older lathes without the pusher rod, this parameter will have no effect. Note also that with this change, the I/O board discrete output has been changed from #23 to #1.

588 X ENC. SCALE FACTOR

These are new axis parameters that work in place of the axis parameters called SCALE/X LO and SCALE/X HI. If SCALE FACT/X is set to 1, the scale ratio is determined by SCALE/X LO and SCALE/X HI as follows:

HI	LO	
0	0	3
0	1	5
1	0	7
1	1	9

If, however, SCALE FACT/X is set to zero, the value of ENC. SCALE FACTOR will be used for the scale ratio instead. Note that any value outside the range of 1 to 100 will be ignored and the scale ratio will remain unaffected. Note also that currently, these parameters are intended for use only on rotary axes (A and B).

589 Y ENC. SCALE FACTOR

See parameter 588 for description

590 Z ENC. SCALE FACTOR

See parameter 588 for description

591 A ENC. SCALE FACTOR

See parameter 588 for description

592 B ENC. SCALE FACTOR

See parameter 588 for description

593 Sp ENC. SCALE FACTOR

See parameter 588 for description

594 U ENC. SCALE FACTOR

See parameter 588 for description

595 V ENC. SCALE FACTOR

See parameter 588 for description

596 W ENC. SCALE FACTOR

See parameter 588 for description

597 C ENC. SCALE FACTOR

See parameter 588 for description

598 Tt ENC. SCALE FACTOR

See parameter 588 for description

599 Ss ENC. SCALE FACTOR

See parameter 588 for description

600 PEAK SPIN. PWR - KW

This parameter supports the spindle kilowatt (KW) load display which appears on the current commands page, next to the spindle load percentage. This parameter should be set to the peak power output in KW for the spindle motor.

602 CHUCK FACE DISTANCE

This parameter supports the brushless bar feeder. When executing G105 Q4, a new bar is loaded, measured and pushed through the spindle and halted just before the chuck face. This parameter specifies the distance (in 1/10000 inch) that should be left between the bar and the chuck face. It should be set as follows:

Mini-Lathe 440000
SL-10 500000
SL-20 540000
SL-30 540000
SL-30BB 650000
SL-40 650000
TL-15 540000

611 BARFEEDER TYPE

This parameter supports the Bar 100 Air-Driven bar feeder. It should be set to 2 on all lathes fitted with the Bar 100, lathes without the Bar 100 should be set to zero.

616 SS LUBE CYCLE TIME

This parameter supports the VTC-48. It controls the subspindle lubrication in the same manner as parameter 117. The units are 50ths of a second. If a subspindle low lube condition is found, alarm 121 LOW LUBE OR LOW PRESSURE is generated and both the main spindle and the subspindle are shut down. It should be set to 108000.

617 SS SPIN.FAN OFF DEL

This parameter supports the VTC-48. It specifies the time that the subspindle fan should continue to run after the subspindle has stopped. The units are 1/1000 of a second. It should be set to 6000.

618 LUBE CHECK DELAY

This parameter supports the VTC-48. It specifies the time between checks on the status of the oil pressure on a VTC main spindle.

619 PRE GEAR CHANGE DLY

It specifies the delay time (in ms) after the spindle has been commanded to stop and before the solenoid for the gear change is commanded to start. It should be set to 100 on all machines.

632 X AXIS MOCON CHANNEL

This parameter enables each axis to be mapped to a particular mocon channel.

633 Y AXIS MOCON CHANNEL

Same as Parameter 632. Set to 7 on machines originally shipped with 5.02 and later software.

634 Z AXIS MOCON CHANNEL

Same as Parameter 632 Set to 2 on 5.02 and later software.

635 A AXIS MOCON CHANNEL

Same as Parameter 632 Set to 3 on 5.02 and later software.

636 B AXIS MOCON CHANNEL

Same as Parameter 632 Set to 4 on 5.02 and later software.

637 C AXIS MOCON CHANNEL

Same as Parameter 632 Set to 5 on 5.02 and later software.

638 X AXIS MOCON CHANNEL

Same as Parameter 632 Set to 6 on 5.02 and later software.

639 Y AXIS MOCON CHANNEL

Same as Parameter 632 Set to 1 on machines originally shipped with 5.02 and later software.

640 Z AXIS MOCON CHANNEL

Same as Parameter 632 Set to 8 on 5.02 and later software.

641 A AXIS MOCON CHANNEL

Same as Parameter 632 Set to 9 on 5.02 and later software.

642 B AXIS MOCON CHANNEL

Same as Parameter 632 Set to 10 on 5.02 and later software.

643 C AXIS MOCON CHANNEL

Same as Parameter 632 Set to 11 on 5.02 and later software.

692 STDY REST OUT RELAY

This parameter supports the steady rest option. If a lathe has the option, this parameter must be set to the output relay number that activates the clamping mechanism. This number can be 32 through 55 for relays #1132 through #1155, respectively. For lathes without the steady rest option, it must be zero.

693 STDY REST INP RELAY

This parameter supports the steady rest option. If a lathe has the option and a foot pedal for the steady rest, this parameter must be set to the input relay number for the foot pedal switch. This number can be 1 through 49 for relays #1101 through #1049, respectively. For lathes without a steady rest foot pedal, this parameter should be zero.

715 Color Message

Used to change the color of the text messages displayed at the bottom of an LCD monitor. Any value from 0 to 255 can be used. The following are some suggestions:

Black: 0
Red: 5, 6, 13, 143
Yellow: 30, 31, 39, 55, 63
Purple: 67, 75, 77, 83, 140, 141, 198, 215
Green: 24, 40, 56, 104, 120
Brown: 3, 4, 11, 12, 19, 20
Orange: 7, 15, 23
Pink: 95, 103, 111, 119, 159, 167, 175, 183
Blue: 64, 88, 210, 248

716 Color CMD Position

Used to change the color of the positions text displayed on the Current Commands page on an LCD monitor. See color values listed for parameter 715.

717 Color CMD G-Code

Used to change the color of the active G and M code text displayed on the Current Commands page on an LCD monitor. See color values listed for parameter 715.

718 Color CMD Axes Load

Used to change the color of the axis load text displayed on the Current Commands page on an LCD monitor. See color values listed for parameter 715.

719 Color CMD Bold Text

Used to change the color of the large feed and speed text displayed on the Current Commands page on an LCD monitor. See color values listed for parameter 715.

720 Coor Override

Used to change the color of the spindle and axis override text displayed on the Current Commands page on an LCD monitor. See color values listed for parameter 715.

Electronic Thermal Compensation

When ballscrews rotate they generate heat. Heat causes the ballscrews to expand. In constant duty cycles, the resultant ball screw growth can lead to cutting errors on the next morning start up. Haas' ETC algorithm can accurately model this heating and cooling effect and electronically expand and contract the screw to give near glass scale accuracy and consistency.

This compensation is based on a model of the ball screw which calculates heating based on the distance traveled and the torque applied to the motor. This compensation does not correct for thermal growth due to changes in ambient temperature or due to part expansion.

Electronic thermal compensation works by estimating the heating of the screw based on the total amount of travel over its length and including the amount of torque applied to the screw. This heat is then turned into a thermal coefficient of expansion and the position of the axis is multiplied by the coefficient to get a correction amount.

If the machine is turned off when there is some compensation applied (due to motion and heating of screw), when the machine is turned back on, the compensation will be adjusted by the clock indicated elapsed time.

Spindle Head Thermal Compensation

This feature integrates spindle speed over time and builds a model of thermal growth. As the model shows the spindle head warming up, the control adjusts the axes to compensate for thermal growth.

X-Axis Thermal Compensation

During machining, the heating of the ballscrews transfers heat by conduction to the thermal sensor body. This causes the resistance of the sensor to vary according to the temperature. The resistance value is read by the software which compensates for the change in temperature by adjusting the accuracy of the program accordingly.

The thermal sensor is connected to the ballscrew and compensates program accuracy for changes in ballscrew temperature.

4. ALARMS

Any time an alarm is present, the lower right hand corner of the screen will have a blinking "ALARM". Push the ALARM display key to view the current alarm. All alarms are displayed with a reference number and a complete description. If the RESET key is pressed, one alarm will be removed from the list of alarms. If there are more than 18 alarms, only the last 18 are displayed and the RESET must be used to see the rest. The presence of any alarm will prevent the operator from starting a program.

The **ALARMS DISPLAY** can be selected at any time by pressing the ALARM MESGS button. When there are no alarms, the display will show NO ALARM. If there are any alarms, they will be listed with the most recent alarm at the bottom of the list. The CURSOR and PAGE UP and PAGE DOWN buttons can be used to move through a large number of alarms. The CURSOR **right** and **left** buttons can be used to turn on and off the ALARM history display.

Note that tool changer alarms can be easily corrected by first correcting any mechanical problem, pressing RESET until the alarms are clear, selecting ZERO RET mode, and selecting AUTO ALL AXES. Some messages are displayed while editing to tell the operator what is wrong but these are not alarms. See the editing topic for those errors.

The following alarm list shows the alarm numbers, the text displayed along with the alarm, and a detailed description of the alarm, what can cause it, when it can happen, and how to correct it.

Alarm number and text:	Possible causes:
101 MOCON Comm. Failure	During a self-test of communications between the MOCON and main processor the main processor does not respond, and one of them is possibly bad. Check cable connections and boards. This alarm could also be caused by a memory fault, which was detected on the MOCON.
102 Servos Off	Indicates that the servo motors are off, the tool changer is disabled, the coolant pump is off, and the spindle motor is stopped. Caused by EMERGENCY STOP, motor faults, tool changer problems, or power fail.
103 X Servo Error Too Large	Too much load or speed on X-axis motor. The difference between the motor position and the commanded position has exceeded a parameter. The servos will be turned off and a RESET must be done to restart. This alarm can be caused by problems with the driver, motor, or the slide being run into the mechanical stops. The motor may also be stalled, disconnected, or the driver failed.
104 Y Servo Error Too Large	Same as alarm 103.
105 Z Servo Error Too Large	Same as alarm 103.
106 A Servo Error Too Large	Same as alarm 103.
107 Emergency Off	EMERGENCY STOP button was pressed. Servos are also turned off. After the E-STOP is released, the RESET button must be pressed at least twice to correct this; once to clear the E-STOP alarm and once to clear the Servos Off alarm.
108 X Servo Overload	Excessive load on X-axis motor. This can occur if the load on the motor is large enough to exceed the continuous rating of the motor over a period of several seconds or even minutes. The servos will be turned off when this occurs. This can be caused by running into the mechanical stops but not much past them. It can also be caused by anything that causes a very high load on the motors.

109	Y Servo Overload	Same as alarm 108.
110	Z Servo Overload	Same as alarm 108.
111	A Servo Overload	Same as alarm 108.
112	No Interrupt	Electronics fault. Call your dealer.
113	Turret Unlock Fault	The turret took longer to unlock and come to rotation position than allowed for in Parameter 62. The value in Parameter 62 is in milliseconds. This may occur if the air pressure is too low, the tool turret clamp switch is faulty or needs adjustment, or there is a mechanical problem.
114	Turret Lock Fault	The turret took longer to lock and seat than allowed for in Parameter 63. The value in Parameter 63 is in milliseconds. This may occur if the air pressure is too low, the tool turret clamp switch is faulty or needs adjustment, or there is a mechanical problem.
115	Turret Rotate Fault	During a tool changer operation the tool turret failed to start moving or failed to stop at the right position. Parameters 62 and 63 can adjust the time-out times. This alarm can be caused by anything that jams the rotation of the turret. A loss of power to the tool changer can also cause this, so check CB5 and relays 1-8, 2-3, and 2-4.
116	Spindle Orientation Fault	Spindle did not orient correctly. During a spindle orientation function, the spindle is rotated until the lock pin drops in; but the lock pin never dropped. Parameters 66, 70, 73, and 74 can adjust the delays and orient spindle speed. This can be caused by a trip of circuit breaker CB4, a lack of air pressure, or too much friction with the orientation pin.
117	Spindle High Gear Fault	Gearbox did not shift into high gear. During a change to high gear, the high gear sensor was not detected in time. Parameters 67, 70 and 75 can adjust the delays. Check circuit breaker CB4, the circuit breaker for the air pressure solenoids and the spindle drive.
118	Spindle Low Gear Fault	Gearbox did not shift into low gear. During a change to low gear, the low gear sensor was not detected in time. Parameters 67, 70 and 75 can adjust the delays. Check the solenoid's circuit breaker CB4, and the spindle drive.
119	Over Voltage	Incoming line voltage is above maximum. The tool changer, and coolant pump will stop. If this condition persists, an automatic shutdown will begin after the time specified by parameter 296.
120	Low Air Pressure	Air pressure dropped below 80 PSI for a period of time defined by Parameter 76. Check your incoming air pressure for at least 100 PSI and ensure that the regulator is set at 85 PSI.
121	Low Lub or Low Pressure	Way lube is low or empty or there is no lube pressure or too high a pressure. Check tank at rear of machine and below control cabinet. Also check connector on the side of the control cabinet. Check that the lube lines are not blocked.
122	Regen Overheat	The control is overheating. This alarm will turn off the spindle drive, coolant pump, and tool changer. One common cause of this overheat condition is an input line voltage too high. If this condition persists, an automatic shutdown will begin after the interval specified by parameter 297. It can also be caused by a high start/stop duty cycle of the spindle.

123	Spindle Drive Fault	Overheat or failure of spindle drive or motor. The exact cause is indicated in the LED window of the spindle drive inside the control cabinet. This can be caused by a stalled motor, shorted motor, overvoltage, undervoltage, overcurrent, overheat of motor, or drive failure.
124	Low Battery	Memory batteries need replacing within 30 days. This alarm is only generated at power on and indicates that the 3.3 volt Lithium battery is below 2.5 volts. If this is not corrected within 30 days, you may lose your stored programs, parameters, offsets, and settings.
125	Tool Turret Fault	Turret has not seated itself properly. There may be something obstructing the turret between the housing and the turret itself.
126	Gear Fault	Transmission is out of position when a command is given to start a program or rotate the spindle. This means that the two speed transmission is not in either high or low gear but is somewhere in between. Check the air pressure, the solenoid's circuit breaker CB4, and the spindle drive. Use the POWER UP/RESTART button to correct the problem.
127	Door Fault	The control failed to detect a low signal at the Door Switch input after the door was commanded and the Door Switch input was not received after the door was commanded to close and the time set in parameter #251 has elapsed.
129	M Fin Fault	M-code relays were active at power on. Check the wiring to your **M** code interfaces. This test is only performed at power-on.
130	Chuck Unclamped	The control detected that the chuck is unclamped. This is a possible fault in the air solenoids, relays on the I/O Assembly, or wiring.
131	Tool Not Clamped	When clamping or powering up the machine, the Tool Release Piston is not Home. This is a possible fault in the air solenoids, relays on the I/O Assembly, the drawbar assembly, or wiring.
132	Power Down Failure	Machine did not turn off when an automatic power-down was commanded. Check wiring to the Power Interface card on power supply assembly, relays on the IO assembly, and the main contactor K1.
133	Spindle Brake Engaged	The brake is engaged. It must be released before the spindle can turn.
134	Low Hydraulic	Hydraulic pressure is sensed to be low. Check pump pressure and Pressure hydraulic tank oil level. Verify proper pump and machine phasing.
135	X Motor Over Heat	Servo motor overheat. The temperature sensor in the motor indicates over 150 degrees F. This can be caused by an extended overload of the motor such as leaving the axes at the stops for several minutes.
136	Y Motor Over Heat	Same as alarm 135.
137	Z Motor Over Heat	Same as alarm 135.
138	A Motor Over Heat	Same as alarm 135.
139	X Motor Z Fault	Encoder pulse count failure. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose connectors at P1-P4.

140	Y Motor Z Fault	Same as alarm 139.
141	Z Motor Z Fault	Same as alarm 139.
142	A Motor Z Fault	Same as alarm 139.
143	Spindle Not Locked	Shot pin not fully engaged when a tool change operation is being per formed. Check air pressure and solenoid circuit breaker CB4. This can also be caused by a fault in the sense switch that detects the position of the lock pin.
144	Time-out-Call Your Dealer	Time allocated for use prior to payment exceeded. Call your dealer.
145	X Limit Switch	Axis hit limit switch or switch disconnected. The stored stroke limits should stop the slides before they hit the limit switches. Verify the value of parameter Grid Offset and check the wiring to the limit switch and connector P5 at the side of the main cabinet. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw.
146	Y Limit Switch	Same as alarm 145.
147	Z Limit Switch	Same as alarm 145.
148	A Limit Switch	Normally disabled for rotary axis.
149	Spindle Turning	Spindle not at zero speed for tool change. A signal from the spindle drive indicating that the spindle drive is stopped is not present while a tool change operation is going on.
150	I Mode Out Of Range	Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
151	HPC LOW PRESSURE	A low coolant pressure condition has been detected. To disable this alarm, set parameter 209 Common Switch 2 DSBL CLNT IN to 1.
152	Self Test Fail	Control has detected an electronics fault. All motors and solenoids are shut down. This is most likely caused by a fault of the proces-sors. Call your dealer.
153	X-axis Z Ch Missing	Broken wires or encoder contamination. All servos are turned off. This can also be caused by loose connectors at P1-P4.
154	Y-axis Z Ch Missing	Same as alarm 153.
155	Z-axis Z Ch Missing	Same as alarm 153.
156	A-axis Z Ch Missing	Same as alarm 153.
157	MOCON Watchdog Fault	The self-test of the MOCON has failed. Call your dealer.
158	Video/Keyboard PCB Failure	During power-on tests, the control has detected a problem with either the keyboard or video memory. Call your dealer.
159	Keyboard Failure	Keyboard shorted or button pressed at power on. A power-on test of the membrane keypad has found a shorted button. It can also be caused by a short in the cable from the main cabinet or by holding a button down during power-on.
160	Low Voltage	The line voltage to control is too low. This alarm occurs when the AC line voltage drops below 190 when wired for 230 volts or drops below 165 when wired for 208 volts.

161	X-Axis Drive Fault	Current in **X** servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running into a mechanical stop. It can also be caused by a short in the motor or a short of one motor leads to ground.
162	Y-Axis Drive Fault	Same as alarm 161.
163	Z-Axis Drive Fault	Same as alarm 161.
164	A-Axis Drive Fault	Same as alarm 161.
165	X Zero Ret Margin Too Small	This alarm indicates that the zero return position may not be consistent from one zero return to the next. The encoder **Z** channel signal must occur between 1/8 and 7/8 revolution of where the home switch releases. This will not turn the servos off but will stop the zero return operation. This alarm can occur if the home/limit switches are moved or misadjusted.
166	Y Zero Ret Margin Too Small	Same as alarm 165.
167	Z Zero Ret Margin Too Small	Same as alarm 165.
168	A Zero Ret Margin Too Small	Same as alarm 165.
169	Spindle Direction Fault	Problem with rigid tapping hardware. The spindle started turning in the wrong direction.
170	Phase Loss	Problem with incoming line voltage between legs L1 and L2. This usually indicates that there was a transient loss of input power to the machine.
171	Rpm Too High To Unclamp	The spindle speed exceeded the max speed allowed in parameter 248 to unclamp.
173	Spindle Ref Signal Missing	The **Z** channel pulse from the spindle encoder is missing for hard tapping synchronization.
174	Tool Load Exceeded	The tool load monitor option is selected and the maximum load for a tool was exceeded in a feed. This alarm can only occur if the tool load monitor function is installed in your machine.
175	Ground Fault Detected	A ground fault condition was detected in the 115V AC supply. This can be caused by a short to ground in any of the servo motors, the tool change motors, the fans, or the oil pump.
176	Regen Overheat	An overheat condition persisted longer than the interval specified by parameter 297 and caused an automatic shutdown.
177	Over Voltage Shutdown	An overvoltage condition persisted longer than the interval specified by parameter 296 and caused an automatic shutdown.
178	Divide by Zero!	There are some parameters that are used as a divisor and therefore must never be set to zero. If the problem cannot be corrected by parameters, cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
179	Low Pressure Trans Oil	Transmission oil is low or low pressure condition in oil lines.
181	Macro not completed-spindle disabled	Macro code operating Haas optional equipment (bar feeder, etc.) was not completed for some reason (ESTOP, RESET, Power Down, etc.). Check optional equipment and run recovery procedure.

182	X Cable Fault	Cable from X-axis encoder does not have valid differential signals.
183	Live Tooling CAble Fault	Cable from LT motor encoder does not have valid differential signals.
184	Z Cable Fault	Same as alarm 82.
185	A Cable Fault	Same as alarm 182.
186	Spindle Not Turning	Trying to feed while spindle is in the stopped position.
187	B Servo Error Too Large	Same as alarm 103.
188	B Servo Overload	Same as alarm 108.
189	B Motor Overheat	Same as alarm 135.
190	B Motor Z Fault	Same as alarm 139.
191	B Limit Switch	Same as alarm 145.
192	B Axis Z Ch Missing	Same as alarm 153.
193	B Axis Drive Fault	Same as alarm 161.
194	B Zero Ret Margin Too Small	Same as alarm 165.
195	B Cable Fault	Same as 182.
198	Spindle Stalled	Control senses that no spindle fault has occurred, the spindle is at speed, yet the spindle is not turning. Possibly the belt between the spindle drive motor and spindle has slipped or is broken.
199	Negative RPM	Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
201	Parameter CRC Error	Parameters lost maybe by low battery. Check for a low battery and low battery alarm.
202	Setting CRC Error	Settings lost maybe by low battery. Check for a low battery and low battery alarm.
203	Ball Screw CRC Error	Ball screw compensation tables lost maybe by low battery. Check for Cyclic Redundancy Check error, low battery, and low battery alarm.
204	Offset CRC Error	Offsets lost maybe by low battery. Check for a low battery and low battery alarm.
205	Programs CRC Error	Users program lost maybe by low battery. Check for a low battery and low battery alarm.
206	Internal Program Error	Possible corrupted program. Save all programs to disk, delete all, then reload. Check for a low battery and low battery alarm.
207	Queue Advance Error	Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
208	Queue Allocation Error	Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
209	Queue Cutter Comp Error	Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.

210	Insufficient Memory	Not enough memory to store users program. Check the space available in the LIST PROG mode and possibly gain space by saving programs on disk.
211	Odd Prog Block	Possible corrupted program. Save all programs to disk, delete all, then reload.
212	Program Integrity Error	Possible corrupted program. Save all programs to disk, delete all, then reload. Check for a low battery and low battery alarm.
213	Program RAM CRC Error	Electronics fault; Call your dealer.
214	No. of Programs Changed	Indicates that the number of programs disagrees with the internal variable that keeps count of the loaded programs. Call your dealer.
215	Free Memory PTR Changed	Indicates the amount of memory used by the programs counted in the system disagrees with the variable that points to free memory. Call your dealer.
216	Probe Arm Down While Running	Indicates that the probe arm was pulled down while a program was running.
217	X Axis Phasing Error	Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.
218	Y Axis Phasing Error	Same as alarm 217.
219	Z Axis Phasing Error	Same as alarm 217.
220	A Axis Phasing Error	Same as alarm 217.
221	B Axis Phasing Error	Same as alarm 217.
222	C Axis Phasing Error	Same as alarm 217.
223	Door Lock Failure	In machines equipped with safety interlocks, this alarm occurs when the control senses the door is open but it is locked. Check the door lock circuit.
224	X Transition Fault	Illegal transition of encoder counts in X axis. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose connectors at the MOCON PCBs.
225	Y Transition Fault	Same as alarm 224.
226	Z Transition Fault	Same as alarm 224.
227	A Transition Fault	Same as alarm 224.
228	B Transition Fault	Same as alarm 224.
229	C Transition Fault	Same as alarm 224.
230	Door Open	The spindle RPM has exceeded the max value in parameter 586 while the door is open. Stop the spindle, close the door, or lower your spindle rpm to a value less than or equal to the value of parameter 586.
231	Jog Handle Transition Fault	Illegal transition of encoder counts in jog handle encoder. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose connectors.

232	Spindle Transition Fault	Illegal transition of encoder counts in spindle encoder. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose connectors at the MOCON.
233	Jog Handle Cable Fault	Cable from jog handle encoder does not have valid differential signals.
234	Spindle Enc. Cable Fault	Cable from spindle encoder does not have valid differential signals.
235	Spindle Z Fault	Encoder marker pulse count failure. This alarm usually indicates that the encoder mounted on the spindle has been damaged and encoder position data is unreliable. This can also be caused by loose encoder connectors.
236	Spindle Motor Overload	This Spindle motor is overloaded.
237	Spindle Following Error	The error between the commanded spindle speed and the actual speed has exceeded the maximum allowable (as set in Parameter 184).
239	Unknown MOCON Alarm1	Mocon has reported an alarm to the current software. See mocon software release notes for additional diagnostics.
240	Empty Prog or No EOB	DNC program not found, or no end of program found.
241	Invalid Code	RS-232 load bad. Data was stored as comment. Check the program being received.
242	Number Format Error or Too Long	Check input file for a number that has too many digits.
243	Bad Number	Data entered is not a number.
244	Missing)	Comment must end with a ") ".
245	Unknown Code	Check input line or data from RS-232. This alarm can occur while editing data into a program or loading from RS-232.
246	String Too Long	Input line is too long. The data entry line must be shortened.
247	Cursor Data Base Error	Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
248	Number Range Error	Number entry is out of range.
249	Prog Data Begins Odd	Possible corrupted program. Save all programs to disk, delete all, then reload.
250	Program Data Error	Same as alarm 249.
251	Prog Data Struct Error	Same as alarm 249.
252	Memory Overflow	Same as alarm 249.
253	Electronics Overheat	This alarm is generated if the control cabinet temperature exceeds 135°F. This can be caused by an electronics problem, high ambient temperature, or clogged air filter.
254	Spindle Motor Overheat	the motor driving the spindle is too hot. This alarm is only generated in machines with a Haas vector drive. The spindle motor temperature sensor sensed a high temperature for greater than 1.5 seconds.

257	Program Data Error	Same as alarm 249.
258	Invalid DPRNT Format	Macro DPRNT statement not structured properly.
259	Language Version	Problem with language files. Please reload foreign language files.
260	Language CRC	FLASH memory has been corrupted or damaged. Please reload foreign language files.
261	Rotary CRC Error	Rotary table saved parameters (used by Settings 30, 78) have a Cyclic Redundancy Check error.
262	Parameter CRC Missing	RS-232 or disk read of parameter had no Cyclic Redundancy Check when loading from disk or RS-232.
263	Ball Screw CRC Missing	Ball screw compensation tables have no Cyclic Redundancy Check when loading from disk or RS-232.
264	Rotary CRC Missing	Rotary table parameters have no Cyclic Redundancy Check when loading from disk or RS-232.
265	Macro Variable File CRC Error	Macro variables lost maybe by low battery. Check for a low battery and low battery alarm. Reload the macro variable file.
268	DOOR OPEN @ M95 START	Generated when an M95 (Sleep Mode) is encountered and the door is open. The door must be closed in order to start sleep mode.
270	C Servo Error Too Large	Same as alarm 103.
271	C Servo Overload	Same as alarm 108.
272	C Motor Overheat	Same as alarm 135.
273	C Motor Z Fault	Same as alarm 139.
274	C Limit Switczh	Same as alarm 145.
275	C Axis Z Ch Missing	Same as alarm 153.
276	C Axis Drive Fault	Current in C servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running a short distance into a mechanical stop. It can also be caused by a short in the motor or a short of one of the motor leads to ground.
277	C Zero Ret Margin Too Small	Same as alarm 165.
278	C Cable Fault	Cable from C-axis encoder does not have valid differential signals.
292	Mismatch Axis with I, K Chamfering	I, (K) was commanded as X axis (Z axis) in the block with chamfering.
293	Invalid I,K or R in G01	The move distance in the block commanded with chamfering, corner R is less than the chamfering, corner R amount.
294	Not G01 after	The command after the block commanded with chamfering, corner R is not Chamfering, Corner R G01.
295	Invalid Move After Chamfering	The command after the block commanded with chamfering, corner R is either missing or wrong. There must be a move perpendicular to that of the chamfering block.

296	Not One Axis Move	Consecutive blocks commanded with chamfering, corner R (i.e., G01 Xb Kk; with Chamfering G01 Zb Ii). After each chamfering block, there must be a single move perpendicular to the one with chamfering, corner R amount.
297	320V Power Supply Fault	320 Volt P.S. fault has occurred. This alarm will be generated when overvoltage, undervoltage, short circuit, over temperature, or shorted regen fault occurs. Check hexadecimal LED display on Power Supply for fault conditions.
302	Invalid R in G02 or G03	Check your geometry. **R** must be greater than or equal to half the distance from start to end.
303	Invalid X, B, or Z in G02 or G03	Check your geometry.
304	Invalid I, J, or K in G02 or G03	Check your geometry. Radius at start must match radius at end of arc within 0.001 inches (0.01 mm.)
305	Invalid Q in Canned Cycle	**Q** in a canned cycle must be greater than zero and must be a valid **N** number.
306	Invalid I, J, K, or Q in Canned Cycle	**I**, **J**, **K,** and **Q** in a canned cycle must be greater than zero.
307	Subroutine Nesting Too Deep	Subprogram nesting is limited to nine levels. Simplify your program.
308	Invalid Tool Offset	A tool offset not within the range of the control was used.
309	Exceeded Max Feed Rate	Use a lower feed rate.
310	Invalid G Code	**G** code not defined and is not a macro call.
311	Unknown Code	Possible corruption of memory by low battery. Call your dealer.
312	Program End	End of subroutine reached before M99. Need an M99 to return from sub-routine.
313	No P Code In M97, M98, or G65	Must put subprogram number in **P** code.
314	Subprogram or Macro Not In Memory	Check that a subroutine is in memory or that a macro is defined.
315	Invalid P Code In M97, M98 or M99	The **P** code must be the name of a program stored in memory without a decimal point for M98 and must be a valid **N** number for M99, G70, 71, 72, and 73.
316	X Over Travel Range	X-axis will exceed stored stroke limits. This is a parameter in negative direction and is machine zero in the positive direction. This will only occur during the operation of a user's program.
317	Y Over Travel Range	Same as alarm 316.
318	Z Over Travel Range	Same as alarm 316.
319	A Over Travel Range	Not normally possible with A-axis.
320	No Feed Rate Specified	Must have a valid **F** code for interpolation functions.
321	Auto Off Alarm	Occurs in debug mode only.
322	Sub Prog Without M99	Add an M99 code to the end of program called as a subroutine.

324	Delay Time Range Error	P code in G04 is greater than or equal to 1000 seconds (over 999999 milliseconds). This alarm can also be generated by entering an invalid M95 time format.
325	Queue Full	Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
326	G04 Without P Code	Put a **Pn.n** for seconds or a **Pn** for milliseconds.
327	No Loop For M Code Except M97, M98	**L** code not used here. Remove **L** Code.
328	Invalid Tool Number	Tool number must be between 1 and the value in Parameter 65.
329	Undefined M Code	That **M** code is not defined and is not a macro call.
330	Undefined Macro Call	Macro name O90nn not in memory. A macro call definition is in parameters and was accessed by user program but that macro was not loaded into memory.
331	Range Error	Number too large.
332	H and T Not Matched	This alarm is generated when Setting 15 is turned ON and an **H** code number in a running program does not match the tool number in the spindle. Correct the **Hn** codes, select the right tool, or turn off Setting 15.
333	X-Axis Disabled	Parameter has disabled this axis.
334	Y-Axis Disabled	Same as alarm 333.
335	Z-Axis Disabled	Same as alarm 333.
336	A-Axis Disabled	An attempt was made to program the A-axis while it was disabled (DISABLED bit in Parameter 43 set to 1).
337	GOTO or P line Not Found	Subprogram is not in memory, or **P** code is incorrect. or P's not found.
338	Invalid IJK and XYZ in G02 or G03	There is a problem with circle definition; check your geometry.
339	Multiple Codes	Only one **M, X, Y, Z, A , Q,** etc. allowed in any block or two **G** codes in the same group. Two or more **I,K,R** are commanded in the same block with chamfering, corner rounding.
340	Cutter Comp Begin With G02 or G03	Select cutter compensation earlier. Cutter Comp. Must begin on a linear move.
341	Cutter Comp End With G02 or G03	Disable Cutter Comp later.
342	Cutter Comp Path Too Small	Geometry not possible. Check your geometry.
343	Display Queue Record Full	Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
344	Cutter Comp With G18 and G19	Cutter comp only allowed in XY plane (G17).
345	Invalid R Value in M19 or G105	R value must be positive.
346	Illegal M Code	There was an M85 or M86 commanded. These commands are not allowed while Setting 51 DOOR HOLD OVERRIDE is OFF. Also check Setting 131 for AUTO DOOR and Parameter 57 for DOOR STOP SP.
348	Illegal Spiral Motion	Linear axis path is too long. For helical motions, the linear path must not be more than the length of the circular component.

349	Prog Stop W/O Cancel Cutter Comp	Cutter compensation has been cancelled without an exit move. Potential damage to part.
350	Cutter Comp Look Ahead Error	There are too many non-movement blocks between motions when cutter comp is being used. Remove some intervening blocks.
351	Invalid P Code	In a block with G103 (Block Lookahead Limit), a value between 0 and 15 must be used for the P code.
352	Aux Axis Power Off	Aux **B**, **C**, **U**, **V**, or **W** axis indicate servo off. Check auxiliary axes. Status from control was OFF.
353	Aux Axis No Home	A ZERO RET has not been done yet on the aux axes. Check auxiliary axes. Status from control was LOSS.
354	Aux Axis Disconnected	Aux axes not responding. Check auxiliary axes and RS-232 connections.
355	Aux Axis Position Mismatch	Mismatch between machine and aux axes position. Check aux axes and interfaces. Make sure no manual inputs occur to aux axes.
356	Aux Axis Travel Limit	Aux axes are attempting to travel past their limits.
357	Aux Axis Disabled	Aux axes are disabled.
358	Multiple Aux Axis	Can only move one auxiliary axis at a time.
359	Invalid I, J Or K In G12 Or G13	Check your geometry.
360	Tool Changer Disabled	Check Parameter 57. Not a normal condition for the Lathe.
361	Gear Change Disabled	Not used.
362	Tool Usage Alarm	Tool life limit was reached. To continue, reset the usage count in the Current Commands display and press RESET.
363	Coolant Locked Off	Override is off and program tried to turn on coolant.
364	No Circ Interp Aux Axis	Only rapid or feed is allowed with aux axes.
365	P Definition Error	P value not defined, or P value out of range. An M59 or M69 must have a P value between the range of 1100 and 1155.
366	Cutter Comp Interference	G01 cannot be done with tool size.
367	Cutter Comp Interference	G01 cannot be done with tool size.
368	Groove Too Small	Tool too big to enter cut.
369	Tool Too Big	Use a smaller tool for cut.
370	Tailstock Excessive Drift	The tailstock position has changed even though it has not been commanded to do so. Check for hydraulic leaks.
372	Tool Change in Canned Cycle	Tool change not allowed while canned cycle is active.
373	Invalid Code in DNC	A code found in a DNC program could not be interpreted because of DNC restrictions.
374	Missing XBZA in G31 or G36	G31 skip function requires an **X**, **B**, **Z**, or **A** move.
376	No Cutter Comp In Skip	Skip G31 function cannot be used with cutter compensation.

377	No Skip in Graph/Sim	Graphics mode cannot simulate skip function.
378	Skip Signal Found	Skip signal check code was included but skip was found when it was not expected.
379	Skip Signal Not Found	Skip signal check code was included but skip was not found when it was expected.
380	X,B,A Or G49 Not Allowed In G37	G37 may only specify Z-axis and must have tool offset defined.
381	G43,G44 Not Allowed In G36 Or G136	Auto work offset probing must be done without tool offset.
382	D Code Required In G35	A Dnn code is required in G35 in order to store the measured tool diameter.
383	Inch Is Not Selected	G20 was specified but settings have selected metric input.
384	Metric Is Not Selected	G21 was specified but settings have selected inches.
385	Invalid L, P, or R Code in G10	G10 was used to changes offsets but **L**, **P**, or **R** code is missing or invalid.
386	Invalid Address Format	An address A..Z was used improperly.
387	Cutter Comp Not Allowed With G103	If block buffering has been limited, Cutter Comp cannot be used
388	Cutter Comp Not Allowed With G10	Coordinates cannot be altered while Cutter Comp is active. Move G10 outside of Cutter Comp enablement.
389	G17, G18, G19 Illegal in G68	Planes of rotation cannot be changed while rotation is enabled.
390	No Spindle Speed	**S** code has not been encountered. Add an **S** code.
391	Feature Disabled	An attempt was made to use a control feature not enabled by a parameter bit. Set the parameter bit to 1.
392	B Axis Disabled	Same as alarm 333.
393	Invalid Motion in G84 or G184	Rigid Tapping can only be in the Z minus G74 or G84 direction. Make sure that the distance from the initial position to the commanded Z depth is in the minus direction.
394	B Over Travel Range	The tailstock (B-axis) has exceeded its maximum range of travel.
395	Invalid Code in Canned Cycle	Any canned cycle requiring a PQ path sequence may not have an M code in the same block. That is G70, G71, G72, and G73.
396	Conflicting Axes	An Incremental and Absolute command can not be used in the same block of code. For example, X and U cannot be used in the same block.
397	Invalid D Code	In the context that the D code was used it had an invalid value. Was it positive?
398	Aux Axis Servo Off	Aux. axis servo shut off due to a fault.
399	Invalid U Code	In the context that the U code was used it had an invalid value. Was it positive?
403	RS-232 Too Many Progs	Cannot have more than 200 programs in memory.

404	RS-232 No Program Name	Need name in programs when receiving ALL; otherwise has no way to store them.
405	RS-232 Illegal Prog Name	Check files being loaded. Program name must be **Onnnnn** and must be at beginning of a block.
406	RS-232 Missing Code	A receive found bad data. Check your program. The program will be stored but the bad data is turned into a comment.
407	RS-232 Invalid Code	Check your program. The program will be stored but the bad data is turned into a comment.
408	RS-232 Number Range Error	Check your program. The program will be stored but the bad data is turned into a comment.
409	RS-232 Invalid N Code	Bad Parameter or Setting data. User was loading settings or parameters and something was wrong with the data.
410	RS-232 Invalid V Code	Bad parameter or setting data. User was loading settings or parameters and something was wrong with the data.
411	RS-232 Empty Program	Check your program. Between **%** and **%** there was no program found.
412	RS-232 Unexpected End of Input	Check Your Program. An ASCII EOF code was found in the input data before the complete program was completely received. This is a decimal code 26.
413	RS-232 Load Insufficient Memory	Program received does not fit. Check the space available in the LIST PROG mode and possibly delete some programs.
414	RS-232 Buffer Overflow	Data sent too fast to CNC. Computer sending data may not respond to X-OFF
415	RS-232 Overrun	Data sent too fast to CNC.
416	RS-232 Parity Error	Data received by CNC has bad parity. Check parity settings, number of data bits and speed. Also check your cables.
417	RS-232 Framing Error	Data received was garbled and proper framing bits were not found. One or more characters of the data will be lost. Check parity settings, number of data bits and speed.
418	RS-232 Break	Break condition while receiving. The sending device set the line to a break condition. This might also be caused by a simple break in the cable.
419	Invalid Function For DNC	A code found on input of a DNC program could not be interpreted.
420	Program Number Mismatch	The **O** code in the program being loaded did not match the **O** code entered at the keyboard. Warning only.
423	Servo Bar Eob Switch Position Unknown	Place 12 inch standard bar in charging position and run G105 Q5 to set End of Bar Switch Position.
424	Servo Bar Metric Unsupported	Metric mode is currently unsupported. Change setting 9 to inch.
425	Servo Bar Length Unknown	Both the bar length and reference position are unknown. Unload bar, Run G105 Q4 followed by G105 Q2 or Q3.
426	Servo Bar Illegal Code	G105 (feed bar) commanded with an illegal code on block. Legal codes are I,J,K,P,Q,R

428	Servo Bar Switch Failure	One of the switches controlling the Servo Bar failed.
429	Disk Dir Insufficient Memory	Disk memory was almost full when an attempt was made to read the disk directory.
430	Disk Unexpected	Check your program. An ASCII EOF code was found in the input data End of Input before the complete program was received. This is a decimal code 26.
431	Disk No Prog	Need name in programs when receiving ALL; otherwise has no way to store them.
432	Disk Illegal Prog Name	Check files being loaded. Program must be **Onnnnn** and must be at the beginning of a block.
433	Disk Empty Prog Name	Check your program. Between % and % there was no program found.
434	Disk Load Insufficient Memory	Program received does not fit. Check the space available in the LIST PROG mode and possibly delete some programs.
435	Disk Abort	Could not read disk.
436	Disk File Not Found	Could not find disk file.
437	TS Under Shoot	The tailstock did not reach its intended destination point.
438	TS Moved While Holding Part	The tailstock moved more than a preset amount while holding a part (e.g., the part slips in the chuck).
439	TS Found No Part	During an M21 or G01, the tailstock reached the hold point without encountering the part.
440	Servo Bar Max Parts Reached	Job Complete. Reset Current # Parts Run on Servo Bar current commands page.
441	Servo Bar Max Bars Reached	Job Complete. Reset Current # Bars Run on Servo Bar current commands page.
442	Servo Bar Max Length Reached	Job Complete. Reset Current Length Run on Servo Bar current commands page.
443	Servo Bar Already Nested	An Illegal G105 Pnnn was found in cutoff subprogram.
445	Servo Bar Fault	SERVO BAR program error.
446	Servo Bar Bar Too Long	The Bar that was just loaded is longer than the Length of Longest Bar as displayed on the Servo Bar current commands page. The system was unable to accurately measure it.
447	Servo Bar Bar In Way	The end of bar switch was depressed and a load or unload bar was commanded. Remove the bar.
448	Servo Bar Out Of Bars	Add more Bars.
449	Servo Bar Cutter Comp Not Allowed	G105 cannot be executed while cutter compensation is invoked.
450	Bar Feeder Fault	This means that discrete input 1027 (BFSPLK) is too high. See parameter 278 bit 20 CK BF status.
451	Bar Feeder Spindle Interlock	This means that discrete input 1030 (BF FLT) is high. See parameter 278 bit 21 CK BF SP ILK.

452	Servo Bar Gearmotor Timeout	The motor which loads bars and the Push rod did not complete its motion in the allowed time. Check for jammed bars.
453	C Axis Engaged	A spindle command (M14, M41, M42, G05 or G77) was given with the C axis drive engaged. The C axis motormust be disengaged with M155 before a spindle brake or gear change.
454	C-Axis Not Engaged	A command was given to the C-axis without the C-axis engaged. The C-axis drive must be engaged with M154 before commanding the C-axis.
455	G112 Block Ends W/O Cancel Cutter Comp	An X/Y cutter compensation exit move is required before a G113 is issued to cancel the G112 block.
456	Parameter Conflict	There is a conflict between two or more of the AXIS MOCON CHANNEL parameters.
459	APL Door Fault	Door was not completely open while APL was inside CNC. Or parameter 315 bit 5 was set to zero.
460	APL Illegal Code	Internal software error; call your dealer.
461	APL Gripper Timeout	The gripper failed to reach its target position within the allowed time.
462	U Over Travel Range	Commanded U-axis move would exceed the allowed machine range. Machine coordinates are in the negative direction. This condition indicates either an error in the user's program or improper offsets.
463	V Over Travel Range	Commanded V-axis move would exceed the allowed machine range. Machine coordinates are in the negative direction. This condition indicates either an error in the user's program or improper offsets.
464	W Over Travel Range	Commanded W-axis move would exceed the allowed machine range. Machine coordinates are in the negative direction. This condition indicates either an error in the user's program or improper offsets.
465	U Axis Disabled	Parameter has disabled this axis.
466	V Axis Disabled	Parameter has disabled this axis.
467	W Axis Disabled	Parameter has disabled this axis.
468	U Lmiit Switch	Axis hit limit switch or switch disconnected. The stored stroke limits should stop the slides before they hit the limit switches. Verify the value of parameter Grid Offset and check the wiring to the limit switch and connector P5 at the side of the main cabinet. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw.
469	V Lmiit Switch	Axis hit limit switch or switch disconnected. The stored stroke limits should stop the slides before they hit the limit switches. Verify the value of parameter Grid Offset and check the wiring to the limit switch and connector P5 at the side of the main cabinet. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw.

470	W Lmiit Switch	Axis hit limit switch or switch disconnected. The stored stroke limits should stop the slides before they hit the limit switches. Verify the value of parameter Grid Offset and check the wiring to the limit switch and connector P5 at the side of the main cabinet. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw.
501	Too Many Assignments In One Block	Only one assignment "**=**" is allowed per block. Divide block in error into multiple blocks.
502	[Or = Not First Term In Expressn	An expression element was found where it was not preceded by "[" or "=", that start expressions.
503	Illegal Macro Variable Reference	A macro variable number was used that is not supported by this control, use another variable.
504	Unbalanced Brackets In Expression	Unbalanced brackets, "[" or "]", were found in an expression. Add or delete a bracket.
505	Value Stack Error	The macro expression value stack pointer is in error. Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
506	Operand Stack Error	The macro expression operand stack pointer is in error. Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
507	Too Few Operands On Stack	An expression operand found too few operands on the expression stack. Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.
508	Division By Zero	A division in a macro expression attempted to divide by zero. Re-configure expression.
509	Illegal Macro Variable Use	See "MACROS" section for valid variables.
510	Illegal Operator or Function Use	See "MACROS" section for valid operators.
511	Unbalanced Right Brackets	Number of right brackets not equal to the number of left brackets.
512	Illegal Assignment Use	Attempted to write to a read-only macro variable.
513	Var. Ref. Not Allowed With N Or O	Alphabetic addresses N and O cannot be combined with macro variables. Do not declare N#1, etc.
514	Illegal Macro Address Reference	A macro variable was used incorrectly with an alpha address. Same as 513.
515	Too Many Conditionals In a Block	Only one conditional expression is allowed in any WHILE or IF-THEN block.
516	Illegal Conditional Or No Then	A conditional expression was found outside of an IF-THEN, WHILE, or M99 block.
517	Exprsn. Not Allowed With N Or O	A macro expression cannot be concatenated to N or O. Do not declare O[#1], etc.
518	Illegal Macro Exprsn Reference	An alpha address with expression, such as A[#1+#2], evaluated incorrectly. Same as 517.
519	Term Expected	In the evaluation of a macro expression an operand was expected and not found.

520	Operator Expected	In the evaluation of a macro expression an operator was expected and not found.
521	Illegal Functional Parameter	An illegal value was passed to a function, such as SQRT[or ASIN[.
522	Illegal Assignment Var Or Value	A variable was referenced for writing. The variable referenced is read only.
523	Conditional Reqd Prior To THEN	THEN was encountered and a conditional statement was not processed in the same block.
524	END Found With No Matching DO	An END was encountered without encountering a previous matching DO. DO-END numbers must agree.
525	Var. Ref. Illegal During Movement	Variable cannot be read during axis movement.
526	Command Found On DO/END Line	A G-code command was found on a WHILE-DO or END macro block. Move the G-code to a separate block.
527	= Not Expected Or THEN Required	Only one Assignment is allowed per block, or a THEN statement is missing.
528	Parameter Precedes G65	On G65 lines all parameters must follow the G65 G-code. Place parameters after G65.
529	Illegal G65 Parameter	The addresses G, L, N, O, and P cannot be used to pass parameters.
530	Too Many I, J, or K's in G65	Only 10 occurrences of I, J, or K can occur in a G65 subroutine call. Reduce the I, J, or K count.
531	Macro Nesting Too Deep	Only four levels of macro nesting can occur. Reduce the amount of nested G65 calls.
532	Unknown Code In Pocket Pattern	Macro syntax is not allowed in a pocket pattern subroutine.
533	Macro Variable Undefined	A conditional expression evaluated to an UNDEFINED value, i.e. #0. Return True or False.
534	DO Or END Already In Use	Multiple use of a DO that has not been closed by and END in the same subroutine. Use another DO number.
535	Illegal DPRNT Statement	A DPRNT statement has been formatted improperly, or DPRNT does not begin block.
536	Command Found On DPRNT Line	A G-code was included on a DPRNT block. Make two separate blocks.
537	RS-232 Abort On DPRNT	While a DPRNT statement was executing, the RS-232 communications failed.
538	Matching END Not	A WHILE-DO statement does not contain a matching END statement. Add the proper END statement.
539	Illegal Goto	Expression after GOTO not valid.
540	Macro Syntax Not Allowed	A section of code was interpreted by the control where macro statement syntax is not permitted. In lathe controls, PQ sequences describing part geometry cannot use macro statements in the part path description.
541	Macro Alarm	This alarm was generated by a macro command in a program.

600	Code Not Expected In This Context	During program interpretation, the control found code out of context. This may indicate an invalid address code found in a PQ sequence. It may also indicate faulty memory hardware or lost memory. Look at the highlighted line for improper G-code.
601	Maximum PQ Blocks Exceeded	The maximum number of blocks making up a PQ sequence was exceeded. Currently, no more than 65535 blocks can be between P and Q.
602	Non Monotonous PQ Blocks in X	The path defined by PQ was not monotonic in the X axis. A monotonic path is one which does not change direction starting from the first motion block.
603	Non Monotonous PQ Blocks in Z	The path defined by PQ was not monotonic in the Z axis. A monotonic path is one which does not change direction starting from the first motion block.
604	Non Monotonous Arc In PQ Block	A complex arc was found in a PQ block. This will occur in PQ blocks within a G71 or G72 if the arc changes its X or Z direction. Increasing the arc radius will often correct this problem.
605	Invalid Tool Nose Angle	An invalid angle for the for the cutting tool tip was specified. This will occur in a G76 block if the A address has a value that is not from 0 to 120 degrees.
606	Invalid A Code	An invalid angle for linear interpolation was specified. This will occur in a G01 block if the A address was congruent to 0 or 180 degrees.
607	Invalid W Code	In the context that the W code was used it had an invalid value. Was it positive?
609	Tailstock Restricted Zone	This alarm is caused by an axis moving into the tailstock restricted zone during program execution. To eliminate the problem, change the program to avoid the restricted zone or change Setting 93 or Setting 94 to adjust the restricted zone. To recover, go to jog mode, press RESET twice to clear the alarm, then jog away from the restricted zone.
610	G71/G72 Domain Nesting Exceeded	The number of troughs nested has exceeded the control limit. Currently, no more than 10 levels of trough can be nested. Refer to the explanation of G71 for a description of trough nesting.
611	G71/G72 Type I Alarm	When G71 or G72 is executing and the control detects a problem in the defined PQ path. It is used to indicate which method of roughing has been selected by the control. It is generated to help the programmer when debugging G71 or G72 commands. The control often selects Type I roughing when the programmer has intended to use Type II roughing. To select Type II, add R1 to the G71/G72 command block (in YASNAC mode), or add a Z axis reference to the P block (in FANUC mode).
612	G71/G72 Type II Alarm	This alarm is similar to Alarm 611, but indicates that the control has selected Type II roughing.
613	Command Not Allowed In Cutter Comp.	A command (M96, for example) in the highlighted block cannot be executed while cutter comp. is invoked.

614	Invalid Q Code	A Q address code used a numeric value that was incorrect in the context used. Q used to reference tip codes in G10 can be 0...9. In M96 Q can reference only bits 0 to 31. Use an appropriate value for Q
615	No Intersection to	While cutter comp was in effect, a geometry was encountered whose Offsets in CC compensated paths had no solution given the tool offset used. This can occur when solving circular geometries. Correct the geometry or change the tool radius.
616	Canned Cycle Using P & Q is Active	A canned cycle using P & Q is already executing. A canned cycle can not be executed by another PQ canned cycle.
617	Missing Address	This alarm is generated if an address code is missing. This alarm supports G77.
618	INVALID ADDRESS	This alarm is generated if an address code is being used incorrectly. For example, a negative value is being used for an address code that should be positive.
619	Stroke Exceeds Start Position	This alarm is generated by an incorrect G71 or G72 type 2 command. It refers to a stroke in the PQ path of a G71 or G72 type 2 canned cycle has passed the starting point. Try adjusting the starting point in the block before the G71 or G72.
620	C Axis Disabled	Same as alarm 333.
621	C Over Travel Range	Same as alarm 316.
623	Invalid Code In G112	Only G00 to G03 and G17 are used in G112. G113 cancels G112. No incremental axes are used in G112. G18 cancels G17. G41 and G42 tool nose compensation are permitted.
629	Exceeded Max Feed Per Rev	This alarm supports G77 and G5. If the alarm is received during a G77, reduce diameter of part or change geometry. If the alarm is received during a G5, reduce X or Z travel.
664	U Axis Disabled	Parameter has disabled this axis.
665	V Axis Disabled	Parameter has disabled this axis.
666	W Axis Disabled	Parameter has disabled this axis.
701	U Servo Error Too Large MOCON2	Same as alarm 103.
702	V Servo Error Too Large Mocon2	Same as alarm 103.
703	W Servo Error Too Large Mocon2	Same as alarm 103.
704	C Servo Error Too Large Mocon2	Same as alarm 103.
705	Tt Servo Error Too Large Mocon2	Same as alarm 103.
706	Ss Servo Error Too Large Mocon2	Same as alarm 103.
707	J Servo Error Too Large Mocon2	Same as alarm 103.
708	S Servo Error Too Large Mocon2	Same as alarm 103.
711	U Servo Overload Mocon2	Same as alarm 108.
712	V Servo Overload Mocon2	Same as alarm 108.

713	W Servo Overload Mocon2	Same as alarm 108.
714	A Servo Overload Mocon2	Same as alarm 108.
715	B Servo Overload Mocon2	Same as alarm 108.
716	C Servo Overload Mocon2	Same as alarm 108.
717	J Servo Overload Mocon2	Same as alarm 108.
718	S Servo Overload Mocon2	Same as alarm 108.
721	U Motor Over Heat Mocon2	Same as alarm 135.
722	V Motor Over Heat Mocon2	Same as alarm 135.
723	W Motor Over Heat Mocon2	Same as alarm 135.
724	A Motor Over Heat Mocon2	Same as alarm 135.
725	B Motor Over Heat Mocon2	Same as alarm 135.
726	C Motor Over Heat Mocon2	Same as alarm 135.
727	J Motor Over Heat Mocon2	Same as alarm 135.
728	S Motor Over Heat Mocon2	Same as alarm 135.
731	U Motor Z Fault Mocon2	Same as alarm 139.
732	V Motor Z Fault Mocon2	Same as alarm 139.
733	W Motor Z Fault Mocon2	Same as alarm 139.
734	A Motor Z Fault Mocon2	Same as alarm 139.
735	B Motor Z Fault Mocon2	Same as alarm 139.
736	C Motor Z Fault Mocon2	Same as alarm 139.
737	J Motor Z Fault Mocon2	Same as alarm 139.
738	S Motor Z Fault Mocon2	Same as alarm 139.
741	U Axis Z Ch Missing Mocon2	Same as alarm 153.
742	V Axis Z Ch Missing Mocon2	Same as alarm 153.
743	W Axis Z Ch Missing Mocon2	Same as alarm 153.
744	A Axis Z Ch Missing Mocon2	Same as alarm 153.
745	B Axis Z Ch Missing Mocon2	Same as alarm 153.
746	C Axis Z Ch Missing Mocon2	Same as alarm 153.
747	J Axis Z Ch Missing Mocon2	Same as alarm 153.
748	S Axis Z Ch Missing Mocon2	Same as alarm 153.
751	U Axis Drive Fault Mocon2	Same as alarm 161.

752	V Axis Drive Fault Mocon2	Same as alarm 161.
753	W Axis Drive Fault Mocon2	Same as alarm 161.
754	A Axis Drive Fault Mocon2	Same as alarm 161.
755	B Axis Drive Fault Mocon2	Same as alarm 161.
756	C Axis Drive Fault Mocon2	Same as alarm 161.
757	J Axis Drive Fault Mocon2	Same as alarm 161.
758	S Axis Drive Fault Mocon2	Same as alarm 161.
761	U Cable Fault Mocon2	Same as alarm 182.
762	V Cable Fault Mocon2	Same as alarm 182.
763	W Cable Fault Mocon2	Same as alarm 182.
764	Sp Cable Fault	Cable from spindle motor encoder does not have valid differential signals.
765	B Cable Fault Mocon2	Same as alarm 182.
766	C Cable Fault Mocon2	Same as alarm 182.
767	J Cable Fault Mocon2	Same as alarm 182.
768	S Cable Fault Mocon2	Same as alarm 182.
771	U Phasing Error Mocon2	Same as alarm 217.
772	V Phasing Error Mocon2	Same as alarm 217.
773	W Phasing Error Mocon2	Same as alarm 217.
774	A Phasing Error Mocon2	Same as alarm 217.
775	B Phasing Error Mocon2	Same as alarm 217.
776	C Phasing Error Mocon2	Same as alarm 217.
777	J Phasing Error Mocon2	Same as alarm 217.
778	S Phasing Error Mocon2	Same as alarm 217.
781	U Transition Fault Mocon2	Same as alarm 224.
782	V Transition Fault Mocon2	Same as alarm 224.
783	W Transition Fault Mocon2	Same as alarm 224.
784	A Transition Fault Mocon2	Same as alarm 224.
785	B Transition Fault Mocon2	Same as alarm 224.
786	C Transition Fault Mocon2	Same as alarm 224.
787	J Transition Fault Mocon2	Same as alarm 224.

788	S Transition Fault Mocon2	Same as alarm 224.
791	Comm. Failure With Mocon2	Same as alarm 101.
792	MOCON2 Watchdog Fault	Same as alarm 157.
796	Sub Spindle Not Turning	Same as alarm 186.
797	Sub Spindle Orientation Fault	Spindle did not orient correctly. During a spindle orientation function, the spindle is rotated until the lock pin drops in; but the lock pin never dropped. This can be caused by a trip of circuit breaker CB4, a lack of air pressure, or too much friction with the orientation pin.
900	Manual Parameter Changes	When the operator alters the value of a parameter, alarm 900 “PAR NO xxx HAS CHANGED. OLD VALUE WAS xxx.” will be added to the alarm history. When the alarm history is displayed, the operator will be able to see the parameter number and the old value along with the date and time the change was made. Note that this is not a re-settable alarm, it is for information purposes only.
901	Parameter Changes Via Disk Load	This is a new feature. When a parameter file has been loaded from disk, alarm 901 PARAMETERS HAVE BEEN LOADED BY DISK will be added to the alarm history along with the date and time. Note that this alarm is not a re-settable alarm, it is for information purposes only.
902	Parameter Changes Via RS-232 Load	When a parameter file has been loaded via RS-232, alarm 902 PARAMETERS HAVE BEEN LOADED BY RS-232 will be added to the alarm history along with the date and time. Note that this alarm is not a re-settable alarm, it is for information purposes only.
903	Machine Power Up	When the machine is powered up, alarm 903 CNC MACHINE POWERED UP will be added to the alarm history along with the date and time. Note that this alarm is not a re-settable alarm, it is for information purposes only.
923	Low Oil Pressure	This alarm to supports the VTC-48. Oil Pump for platter gear has no pressure. Check that pump is pumping oil through lines. Check to make sure filter next to pump is not plugged. PARAMETER 618 determines delay to check pressure after start.
924	SS Low Lube Or Low Pressure	This alarm supports the VTC-48. Way lube is low or empty or there is no lube pressure or too high a pressure. Check tank at rear of mill and below control cabinet. Also check connector on the side of the control cabinet. Check that the lube lines are not blocked. PARAMETER 616 determines cycle time.
932	Bar 100- Zero Value	A non zero value must be entered for #3100 Part Length + Cutoff, #3102 Min Clamping Length and #3109 Length of Bar stock on the Bar 100 Commands page.
933	Bar 100- Maximum Parts Completed	Job Completed. To Continue, reset #3103 Max # Parts and/or #3106 Current # Parts Run on the Bar 100 Commands page.
934	Bar 100- Current Bar Finished	Load a new bar. Reset Alarm and press Cycle Start to continue.
935	Bar 100 Fault	Bar 100 program error. Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that lead to the alarm.

940 Mismatched X And Y Encoders	The explanation is: For G112 to work properly, X and Y encoder steps per unit must be identical. Please verify.

End Of List

NOTE: Alarms 1000-1999 are user defined.

The following alarms are for the VTC:

1001 SMTC FLT-Tool Not Found	Specified tool not found in tool table.
1002 SMTC Pocket Up Timeout	Pocket did not reach UP position within time limit.
1003 SMTC FLT MS Tool One SW	Carousel not on tool one when expected or when on tool one and not expected.
1004 SMTC FLT TC Mark Timeout	Carousel did not come off mark switch or did not reach next mark switch within time limits.
1007 Gear Fault	Machine did not reach specified gear within time limit.
1008 DB Clamp/Uncl Flt	Drawbar did not reach open or closed position within time limit.
1009 SMTC Fault Not Found	Errors in macro, call your dealer.
1010 TSC Fault	Through the tool coolant pressure not reached or not stabilized within time limit. Another cause coulbe that pressure is still present at completion of purge.
1012 SMTC ATC MTR Timeout	Arm did not reach destination within time specified.
1013 SMTC MIS Origin SW	Arm not at origin at start of tool change, start of carousel motion, or at the completion of arm motion.
1014 SMTC MIS Clamp SW	Arm not at the clamp/unclamp position at completion of motion.
1015 SMTC-Pocket DWN Timeout	Pocket did not reach the down position within time limit.
1017 SMTC Too HI Tool#	Specified tool exceeds max limit. Maximum number of tools is 26.
1018 SMTC SP Not In Gear	Live tooling spindle not in gear at start of tool change.
1021 No Depth of Cut Defined	Missing value on command line that is needed for canned cycle.
1022 No Depth of Hole Defined	Missing value on command line that is needed for canned cycle.
1023 No Feed Rate	Missing value on command line that is needed for canned cycle.
1024 No Peck Amount Defined	Missing value on command line that is needed for canned cycle.
1025 No R Plane Defined	Missing value on command line that is needed for canned cycle.
1026 No Start Diameter Defined	Missing value on command line that is needed for canned cycle.