



HAAS SERVICE AND OPERATOR MANUAL ARCHIVE

Electrical Service Manual 96-0284E RevE English June 2008

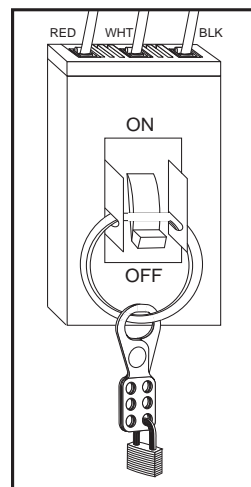
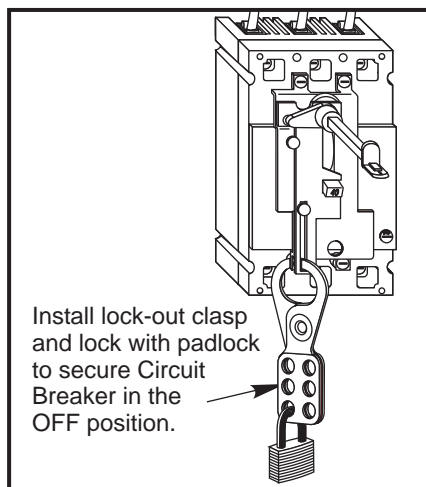
- This content is for illustrative purposes.
- Historic machine Service Manuals are posted here to provide information for Haas machine owners.
- Publications are intended for use only with machines built at the time of original publication.
- As machine designs change the content of these publications can become obsolete.
- You should not do mechanical or electrical machine repairs or service procedures unless you are qualified and knowledgeable about the processes.
- Only authorized personnel with the proper training and certification should do many repair procedures.

WARNING: Some mechanical and electrical service procedures can be extremely dangerous or life-threatening. Know your skill level and abilities.

All information herein is provided as a courtesy for Haas machine owners for reference and illustrative purposes only. Haas Automation cannot be held responsible for repairs you perform. Only those services and repairs that are provided by authorized Haas Factory Outlet distributors are guaranteed.

Only an authorized Haas Factory Outlet distributor should service or repair a Haas machine that is protected by the original factory warranty. Servicing by any other party automatically voids the factory warranty.

SAFETY



To avoid possible shock, make sure circuit breakers are appropriately locked off before attempting any electrical work.

CAUTION! Working with the electrical services required for the machine 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 screws/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.

GENERAL ELECTRICAL TROUBLESHOOTING

MACHINE NOT RUNNING

Machine cannot be powered on.

- Check input voltage to machine.
- Check main circuit breaker at top right of electrical cabinet; switch must be at the on position.
- Check overvoltage fuses.
- Check wiring to Power Off button on front control panel.
- Check wiring to Auto Off relay to I/O PCB.
- Check connection between 24V transformer (T5) and K1 contactor.
- Check 24V transformer (T5) bracket has jumper in correct position (measure voltage at main circuit breaker and connect jumper to corresponding connector on T5 transformer bracket).
- Check I/O PCB.
- Check Power PCB.

**Machine can be powered on, but turns off by itself.**

- Check Settings #1 and #2 for Auto Off Timer or Off at M30.
- Check alarm history for Overvoltage or Overheat shutdown.
- Check AC power supply lines for intermittent supply.
- Check low voltage power supply for intermittent supply.
- Check wiring to Power Off button on front control panel.
- Check connection between 24V transformer and K1 contactor.
- Check I/O PCB.
- Check Parameter 57 for Power off at E-Stop.
- Check MOTIF or MOCON PCB.

Machine turns on, keyboard beeps, but no LCD/CRT display.

- Check for power connections to LCD/CRT from I/O PCB (LVPS power from Power PCB for 15" monitor). Check for green Power LED at front of a CRT.
- Close doors and zero return machine (possible bad monitor).
- Check video cable from Video PCB to LCD/CRT.
- Check for lights on the processor.
- Replace LCD/CRT.

Machine turns on, LCD works, but keyboard keys do not work.

- Check keyboard cable (700) from Video to SKBIF PCB.
- Check keypad.
- Check SKBIF PCB.

Constant E-Stop Condition (will not reset) (Vertical Machines).

- Check hydraulic counterbalance pressure, low pressure switches, and cabling.

Quad APC trouble shooting

The Quad APC uses an additional PC board to control pallets 3 and 4.

The pallet chain motor receives 160VDC from plug 6A on this board (32-3078A). The PC board receives power (115V) from the power card, which plugs into P4 on the APC board.

The solenoid for the left, air operated, automatic door plugs into P3; this cable is part of 33-6038A. Pallet 3 and 4 signals are sent through cable 33-1516, which plugs into P1. The cable's other end plugs into the I/O board P62.

ELECTRICAL ALARM TROUBLESHOOTING**Axis Drive Fault Alarm**

- Blown amplifier - indicated by light at bottom of amplifier when power is on. Replace the fuse in the amplifier.
- Amplifier or MOCON is noise sensitive. If this is the case, the alarm can be cleared and the axis will run normally for a while.

To check an amplifier, switch the motor leads and control cables between the amplifier and the one next to it. If the same problem occurs with the other axis, the amplifier must be replaced. If the problem stays on the same axis, either the MOCON or control cable. The problem could also be the axis motor itself, with leads either shorted to each other or to ground.



- Amplifier faulting out for valid reason, such as overtemp, overvoltage, or +/-12V undervoltage condition. This usually results from running a servo intensive program, or unadjusted 12V power supply. Adjust voltage to correct specifications or replace the power supply.

Overvoltage could occur if regen load is not coming on, but this does not usually happen. The problem could also be the axis motor itself, with leads either shorted to each other or to ground.

Axis Overload

- The fuse function built into the MOCON has been overloaded. This may be caused by a lot of motor accel/ decels, or hitting a hard stop with the axis. This safety function protects the amplifier and motor. If the current program is the cause, change the program. If the axis hits a hard stop the travel limits may be set wrong.

Phasing Error

- The MOCON did not receive the proper phasing information from the motors. **Do not reset** the machine if this alarm occurs. Power the machine down and back up. If the problem persists, it is probably a broken wire or faulty MOCON connectors. This problem could also be related to the Low Voltage Power Supply. Check to see if the LVPS is functioning properly.

Servo Error Too Large

- This alarm occurs when the difference between the commanded axis position and the actual position becomes larger than the maximum that is set in the parameter.

This condition occurs when the amplifier is blown, is not receiving the commands, or the 320V power source is dead. If the MOCON is not sending the correct commands to the amplifier, it is probably due to a broken wire, or a Phasing Error that was generated.

Axis Z Fault or Z Channel Missing

- During a self-test, the number of encoder counts was found to be incorrect. This is usually caused by a noisy environment, and not a bad encoder. Check all shields and grounds on the encoder cables and the motor leads that come into the amplifiers. An alarm for one axis can be caused by a bad grounding on the motor leads of another axis.

Axis Cable Fault

- During a self-test, the encoder cable signals were found to be invalid. This alarm is usually caused by a bad cable, or a bad connection on the motor encoder connectors. Check the cable for any breaks, and the encoder connectors at the motor controller board. Machine noise can cause this alarm, although it is less common.

Alarm 101, "MOCON Comm. Failure"

- During a self-test of communications between the MOCON and main processor, the main processor does not respond, and is suspected to be dead. This alarm is generated and the servos are stopped. Check all ribbon cable connections, and all grounding. Machine noise can also cause this alarm, although it is less common.

Alarm 157, MOCON Watchdog Fault

- The self-test of the MOCON has failed. Replace the MOCON.

Alarm 212, Program Integrity Error/Alarm 250, Program Data Error

- If a program has been corrupted in the system or a corrupted program has been loaded into the machine, a Program Data Error (250) or Program Integrity Error (212) might occur. This occurrence can be recognized by an exclamation point (!) next to a program when turning to the list program page. Following is the common procedure to perform when this happens.

1. Save all programs to disk except the program with the exclamation point error signal. The exclamation point (!) indicates the program that is corrupt. This will be your back-up disk to reload the programs into the machine.
2. Delete all the programs. This should delete all the programs including the one with the "!" error signal.
3. If the program with the exclamation point (!) does not erase then the control needs to be initialized.



4. If the machine still has the program with the exclamation point or the control now refuses to load a good program, it may be necessary to clear memory and reload software.

5. If problem persists, replace main processor board.

Alarm 261, Rotary CRC Error (Horiz & Vert)

• This alarm is normally the result of an incomplete software installation. To correct this error, Change Setting 30 to any selection but Off (note the original selection), then go to Parameter 43 and change one of the bits from 1 to 0 or vice versa and press Write (the bit must be changed from its original value to its alternate value). Simply changing the Setting and Parameter bit from one value to another and then back again corrects the fault, and will clear any further occurrences of the alarm. Change the bit and Setting 30 back to their original values. Press Reset to clear the alarms or cycle power to the machine.

Alarm 354, Aux Axis Disconnected (Lathe)

When this alarm is generated, do not press **Reset**. Turn Setting 7 **Off**. Enter **Debug** mode, then view the Alarms/Messages page. On the Messages page, a code will appear similar to WO1. The list of codes and their descriptions follows:

- | | |
|------------|--|
| WO1 | Power was just turned on or failed. Check the ribbon cables from the Aux Axis PCB to the processor for correct routing. Check for communication problems between the processor and the Aux Axis PCB. |
| WO2 | Servo following error too large. Check the encoder for contamination or dirt. Check for an intermittent connection at both ends of the motor cable. |
| WO3 | Emergency Stop. The E-STOP button was pressed, or an E-STOP condition occurred. |
| WO4 | High load. Check for binding in the tool changer gearbox and motor. Rotate the carousel by hand and feel for any binding. Make sure the toolholders are the correct weight. |
| WO5 | Remote RS-232 commanded off. Check the ribbon cable and the voltage to the Aux Axis PCB. Check for 115V AC (minimum) to the Aux Axis PCB from the main transformer. Check the fuse holder and the fuse that is protecting this circuit. |
| WO6 | Air or limit switch or motor overheat. Check that the motor is not hot. Check for any binding in the motor. Check for overweight tooling. |
| WO7 | Z channel fault. Either the encoder or the cable is bad. Change the encoder first, as it is easier to change than the cable. If the problem persists, change the cable. |
| WO8 | Over-current limit, stalled or PCB fault. Check for binding in the tool changer gearbox. Make sure the belt is not too tight. Ohm out the motor cable, checking pins G to F (should be open), G to H (should be open), and F to H (should read between 2.5 and 5 ohms). Check all the connections on the Aux Axis PCB and motor cable. |
| WO9 | Encode ES. Z channel is missing. Bad encoder or cable. See WO7 . |
| WOA | High voltage. Check the incoming voltage to the Aux Axis PCB. Incoming voltage must be 115V AC. See WO5 . |
| WOB | Cable fault. Check the cable from the motor to the Aux Axis PCB. Check for loose connections at each end. |

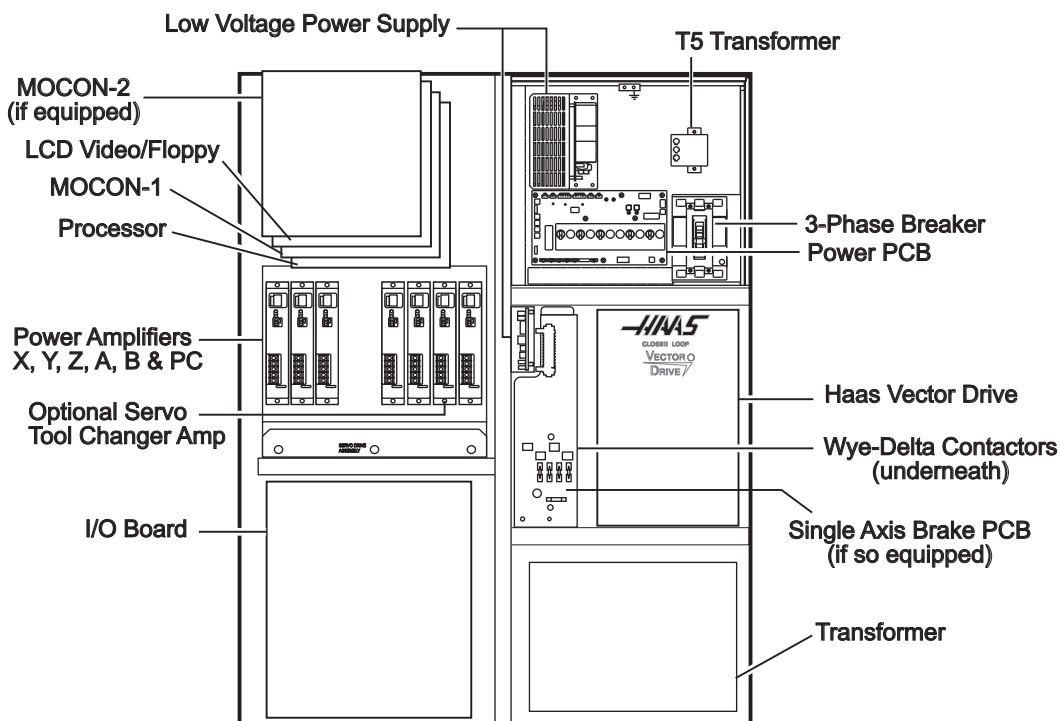


LINE VOLTAGE ADJUSTMENTS

Please read this section in its entirety before attempting to adjust the line voltage.

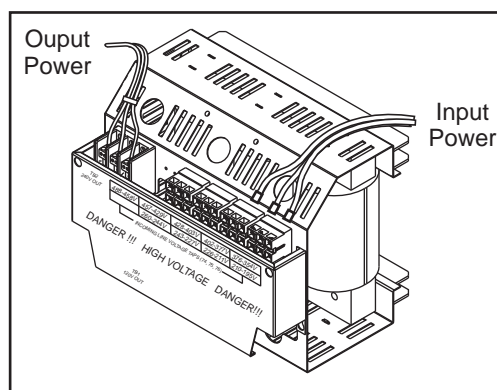
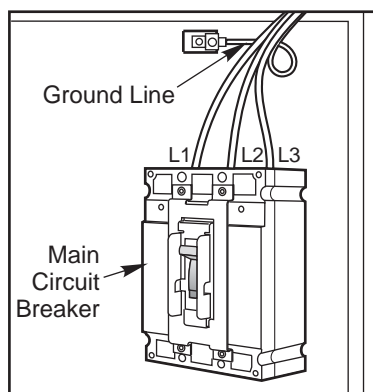
Tools Required: Large flat tip screwdriver, Digital voltmeter

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



Control Cabinet General Overview

ELECTRICAL CONNECTIONS



1. Place the main circuit breaker in the Off position and hook up the three power lines to the terminals on top of the main circuit breaker at the upper right-hand side of the electrical panel. Connect the separate ground line to the ground bus to the left of the terminals.

NOTE: Ensure service wires go into terminal-block clamps. (Do not miss clamp and tighten screw. Connection looks fine but machine runs poorly - servo overloads.) To check, pull on wires after screws are tightened.



2. After the line voltage is connected to the machine, make sure that main circuit breaker is 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 260V (360 and 480V 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 the main circuit breaker is set to off and the power is off at the supply panel before changing the transformer connections. Make sure that all three black wires are moved to the correct terminal block and are tight.

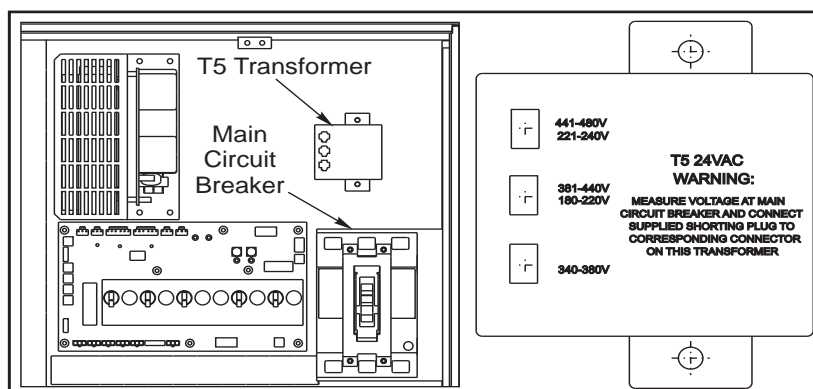
3. Check the connections on the transformer at the bottom-right corner of the rear cabinet. The three black wires labeled **74**, **75**, and **76** must be moved to the terminal block triple which corresponds to the average voltage measured in **step 2** above. There are four positions for the input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

4. Transformer T5 supplies 24VAC used to power the main contactor. There are two versions of this transformer for use on 240 and 400V machines (32-0964B and 32-0965B, respectively). The 240V transformer has two input connectors located on the transformer bracket, which allow it to be connected to either a 221-240V range or 180 to 220V range. Users that have 180-240V input power should place the jumper on the appropriate connector.

The 400V transformer has three input connectors located on the transformer bracket, which allow it to be connected to either a 441-480V range, 381-440V range or 340-380V range. Users with the External High Voltage Option should place the jumper on the connector marked with the appropriate input voltage. Failure to place the jumper on the correct input connector will result in either overheating of the main contactor or failure to reliably engage the main contactor.

A jumper must also be placed on the plate covering the T5 transformer, Measure the voltage at the main circuit breaker and connect the supplied shorting plug to the corresponding connector on the T5 transformer plate.

5. Set the main circuit breaker to ON and check for evidence of problems, such as the smell of overheating components or smoke. If such problems are indicated, immediately set the main circuit breaker to OFF and call the factory before proceeding.

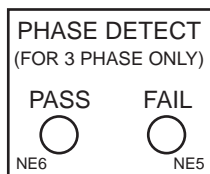




WARNING!

Through the Spindle Coolant (TSC) pump is a three phase pump and must be phased correctly! Improper phasing will cause damage to the TSC pump and void the warranty. Refer to the TSC start up section if your machine is equipped with TSC.

6. After the power is on, measure the voltage across the bottom terminals on the main circuit breaker. It should be the same as the measurements where the input power connects to the main circuit 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 360V. 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 display screen. It is labeled DC BUS. Verify that the displayed voltage matches the voltage measured at pins 2 and 3 of the Vector Drive +/- 7V DC.
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 (disregard for single phase machines). 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, you have a loose wire. Adjust phasing by placing the main circuit breaker in the Off position and 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. 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.



FUSE REPLACEMENT

Please read this section in its entirety before attempting to replace any fuses.

Some of the brushless amplifiers have one 15 amp fuse, F1. If this fuse blows, the associated motor will stop; a light on the amplifier will tell of a blown fuse. Use the Amplifier Fuse Kit (Haas P/N 93-1089) to replace the fuse. If the fuse blows again, the amplifier may be damaged, and needs to be replaced.

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 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).

Size	Fuse Name	Type	Rating (amps)	Voltage	Location
5mm	FU1-FU3	Slo-Blo	½	250V	PSUP pcb, upper right
1/4	F1	Ultra fast	15	250V	Amplifier (X, Y, Z, A, B)
5mm	FU4, 5	Fast blow	5A	250V	PSUP, bottom right corner

15" and Thin Pendant Machines

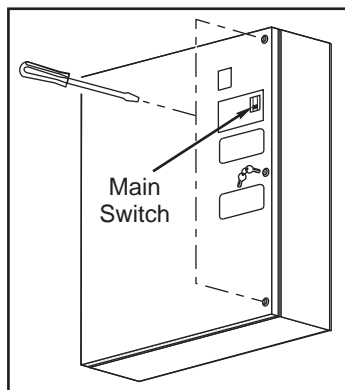
Size	Fuse Name	Type	Rating (amps)	Voltage	Location
5x20mm	F1/F3	Fast Acting	1	250V	PSUP pcb, upper right

OVERVOLTAGE FUSES

WARNING!

The electrical panel will have residual voltage, even after power has been shut off and/or disconnected . Never work inside this cabinet until the small green Power On light on the servo amplifiers (servo drive assembly on brush machines) goes out. The servo amplifiers/servo drive assembly is on the left side of the main control cabinet and about halfway down. This light(s) is at the top of the circuit card at the center of the assembly. Until this light goes out, there are dangerous voltages in the assembly even when power is shut off.

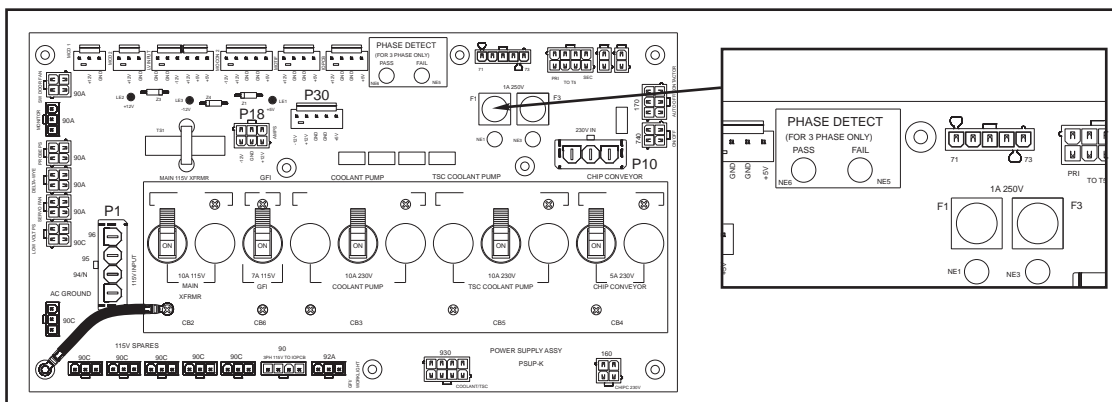
1. Turn machine power off.
2. Place the main circuit breaker (upper right of electrical cabinet) in the off position.



3. Open the cabinet door and wait until the red charge light on the servo drive assembly goes out before beginning any work inside the electrical cabinet.



4. The two overvoltage fuses are located beside each other at the upper right of the Power Supply board. An orange light will be on to indicate the blown fuse(s).



Power Supply Board; Fuse Locations

5. Using a flat tip screwdriver, turn the fuse(s) counterclockwise to remove the fuses. Replace the fuse(s) with one having the same type and rating ($\frac{1}{2}$ amp, type AGC, 250V).

CAUTION! When the left fuse is blown, it is still possible to operate the machine, thereby making an overvoltage situation possible. Verify absolute voltage to the machine does not exceed 200V (max 260 leg to leg or leg to ground, or 400V on high voltage machines - max 520V leg to leg or leg to ground).

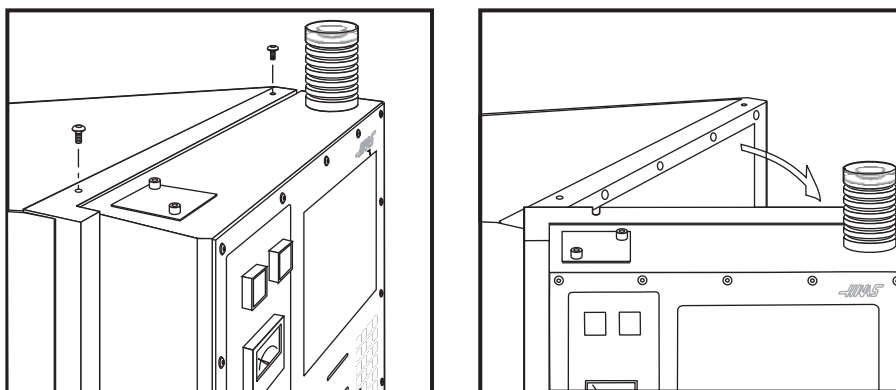
FRONT PANEL

Please read this section in its entirety before attempting to replace any control panel component.

SL-10 PENDANT COMPONENTS ACCESS

The SL-10 pendant door hinges on the left side. Remove the two (2) screws on top of the pendant in order to open the pendant door.

CAUTION! Do not pinch the cable as the door is closed.





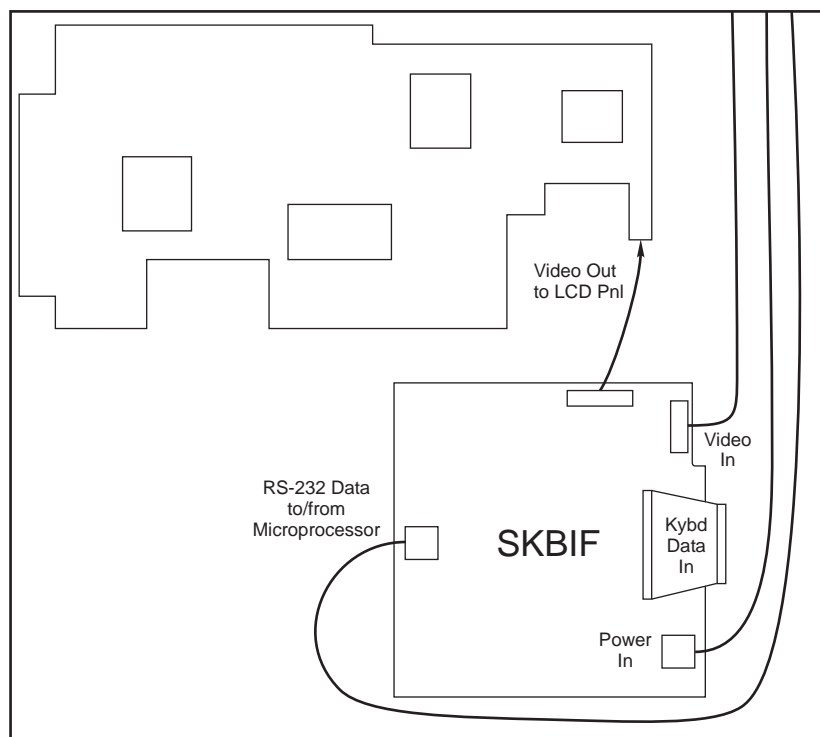
LCD ASSEMBLY REPLACEMENT

CAUTION! Use an electrostatic discharge (ESD) strap on wrist when working inside the pendant.

1. Turn the power off and disconnect power to the machine.
2. Remove the screws holding the cover on the back of the control panel. Take care to hold the cover in place until all screws have been removed.
3. Disconnect the data cable from the receiver board on the LCD assembly (J3). Disconnect the power cable and ground wire from the power supply board on the LCD assembly (TB1). Disconnect the cables to the key-board from the receiver assembly (P1) and power supply (TB2) on the LCD assembly.
4. Remove the four (4) hex nuts and washers beginning with the bottom, then remove the LCD assembly and set aside in a safe place.

CAUTION! Do not drop or damage the LCD when removing it from the control panel.

5. Use gloves to avoid getting fingerprints on the new LCD. Position the assembly onto the four bolts (two each on top and bottom). Place the washers and hex nuts on the bolts to hold in place. Once all washers have been attached and nuts have been hand-tightened, tighten down completely.



Back of Operator's Pendant

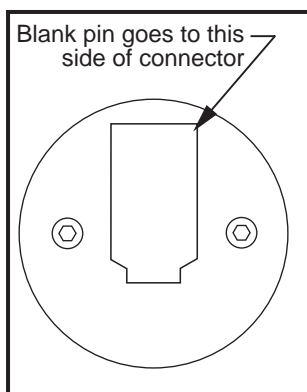
6. Plug the keyboard cables into the new receiver board (P1) and the power supply (TB2). Plug the power cable into the power supply board (TB1) and attach the green wire to ground. Plug the data cable into the receiver board (J3).
7. Replace the back cover panel and attach with the four screws previously removed.

JOG HANDLE

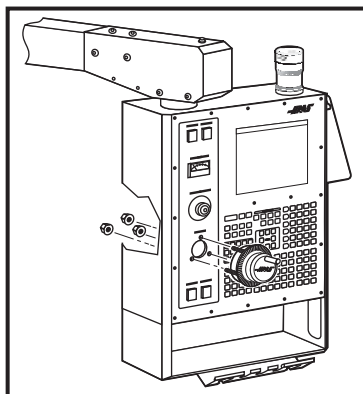
The Jog handle is actually a 100-line-per-revolution encoder, used to move one axis at a time. If no axis is selected for jogging, turning the handle has no effect. When the axis moved reaches its travel limits, the handle inputs will be ignored in the direction that would exceed the travel limits. Parameter 57 bit 0 can be used to reverse the direction of operation of the handle.

Jog Handle Replacement

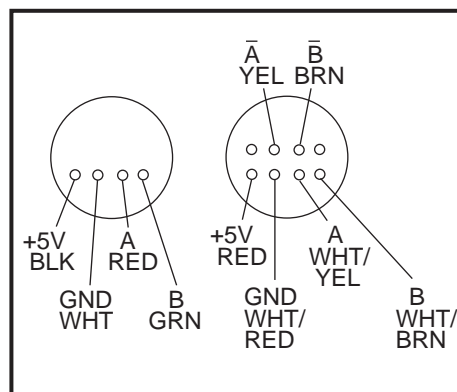
1. Turn the machine power off.
2. Remove the screws holding the cover on the back of the pendant. Take care to hold the cover in place until all screws have been removed.
3. Unplug the cable leading to the jog handle encoder.



Jog Handle Encoder



Jog Handle Removal



Jog Handle Wiring Diagram

4. Using the 5/64" allen wrench, loosen the two screws holding the knob to the control panel and remove.
5. Remove the three screws holding the jog handle encoder to the control panel and remove.
6. Replacement is reverse of removal. Important! The blank pin side of the connector must face as shown below when reconnecting; otherwise, damage may occur to the machine.

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 turns 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 is present any time the main circuit breaker is on.

EMERGENCY STOP SWITCH

The Emergency Stop switch is normally closed. If the switch opens or is broken, servo power is 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. Note that if Parameter 57 bit 3 is set to 1, it 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

If the lathe turret or mill tool changer (T/C) becomes 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 Zero Return and the Auto All Axes to reset the Z-axis and turret or T/C. Never put your hands near the turret or T/C when powered unless E-Stop 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 or disconnected. If lamps do not turn on, check the GFCI plug.

LAMP ON/OFF SWITCH

An on/off switch is supplied for the work lamp. It is located on the side of the operator's pendant. The lamp uses 115V AC taken from P19 on the main power distribution board.

SWITCH REPLACEMENT

1. Turn the machine power off. Remove the screws holding the cover on the back of the pendant. Take care to hold the cover in place until all screws have been removed.
2. Disconnect all leads to the switch connectors. Ensure all leads are properly marked for reconnecting later.
3. Unscrew the two small set screws, one on top and one on the bottom, and turn the switch counterclockwise to loosen. Separate from the front portion and pull out.
4. To replace, screw the front and rear portions together (reverse of removal) and tighten down the two small set screws when the switch is properly positioned.

NOTE: The Power On, Power Off, and Emergency Stop switches must all have the connectors on the bottom of the switch.

5. Reconnect all leads to the correct switch.

SPINDLE LOAD METER

Load meter measures load on spindle motor as a percentage of rated continuous power of motor, with a slight delay between a load and actual meter reflection. The eighth A-to-D input also provides a measure of spindle load for cutter wear detection. Second page of diagnostic data displays % of spindle load. Meter should agree with display within 5%. Spindle drive display #7 should also agree with load meter within 5%. There are different types of spindle drives used in the control, all are equivalent in performance but are adjusted differently.

Spindle Load Meter Replacement

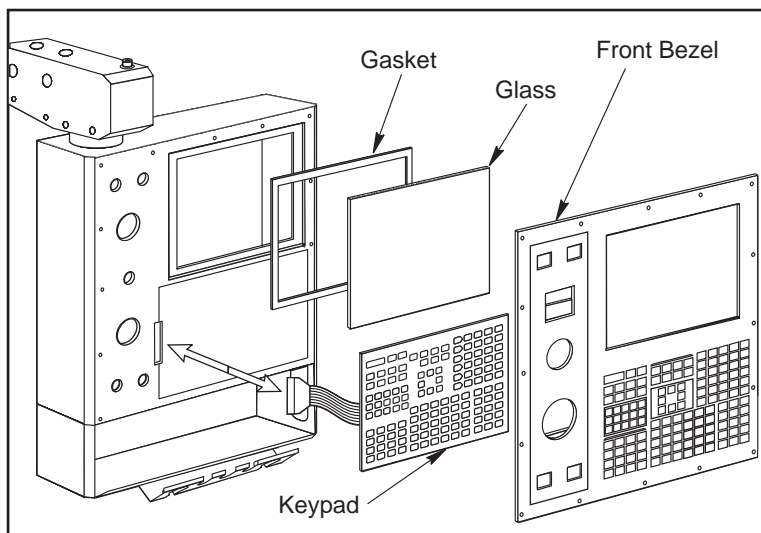
1. Turn the power off and disconnect power to the machine. Remove the screws holding the cover panel on the back of the pendant. Take care to hold the cover panel in place until all screws are removed.
2. Disconnect the two leads at the back of the spindle load meter assembly. Ensure the two leads are properly marked for reconnecting later.
3. Unscrew the four screws that hold the spindle load meter assembly to the control panel. Take care to hold the assembly in place until all screws have been removed. Remove the assembly.
4. Installation is reverse of removal. Ensure leads go to the correct location.

KEYPAD REPLACEMENT

1. Turn the power off and disconnect power to the machine. Remove the screws holding the rear cover to the back of the pendant. Take care to hold the cover in place until all screws are removed.
2. Unplug the keypad's 24-pin ribbon cable from the Keyboard Interface board.



3. Remove the screws from the front of the pendant. Take care to hold the cover in place until all screws have been removed. Remove the pieces and set aside in a safe place.
4. Using a flat, blunt tool, such as putty knife, pry the keypad away from the control panel. Pull the ribbon cable through the opening in the control to remove.
5. To replace, first put the bezel spacer in place and fasten temporarily with screws in the top corners.



Keypad Installation

6. Insert the ribbon cable through the opening in the control panel. Expose the adhesive strip on the back of the keypad and press it into place in the upper right corner of the keypad recess. Press to the control panel to mount. Plug the ribbon cable into the Keyboard Interface board, taking care to not bend the pins.
7. Replace the front and rear cover panels and fasten with the screws that were previously removed.

SERIAL KEYBOARD INTERFACE REPLACEMENT

NOTE: Refer to "Cable Locations" for a diagram of this board.

1. Follow all precautions noted previously before working in the control cabinet.
2. Turn the main switch (upper right of electrical cabinet) to the off position.
3. Remove the four screws on the back of the control box, then remove the cover panel. Take care to hold the panel in place until all screws have been removed.
4. Disconnect all leads to the Serial Keyboard Interface (SKBIF) board. Ensure all cables are properly labeled.
5. After all cables have been disconnected, unscrew the four screws holding the Serial KBIF board to the control box. Take care to hold the board in place until all screws have been removed. Place the screws and standoffs aside for later use.
6. Replace the Serial KBIF board, using the four screws previously removed. Starting at the top right, attach each screw and standoff loosely, until all are mounted, then tighten down.
7. Reconnect all cables to the Serial KBIF board at their proper locations.
8. Verify whether the machine is equipped with either a speaker or a beeper. Align the toggle switches of Switch 1 on the Serial KBIF board to their appropriate positions. Beeper operation requires that both S1 switches be set to 'B'; speaker operation requires that both S1 switches be set to 'S'.



SOLENOIDS

Please read this section in its entirety before attempting to replace any solenoid assemblies.

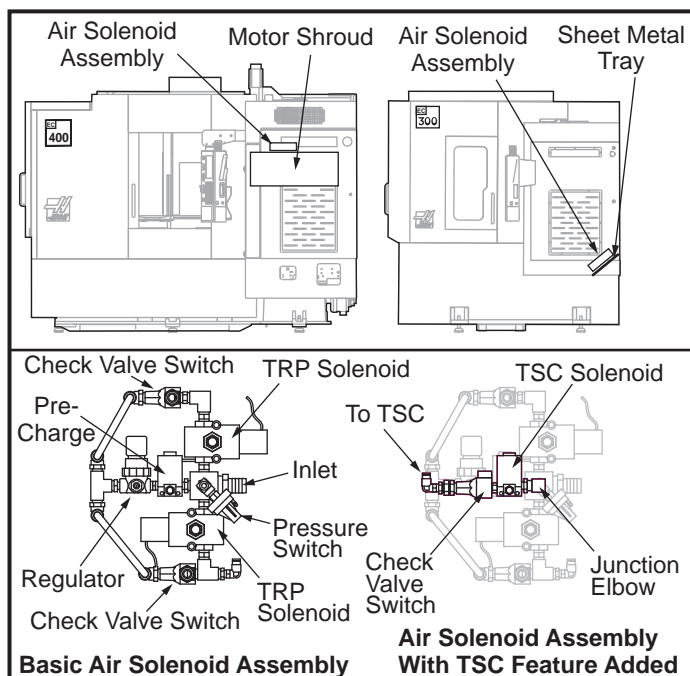
TOOL RELEASE PISTON (TRP) AIR SOLENOID ASSEMBLY (HORIZ & VERT)

Removal

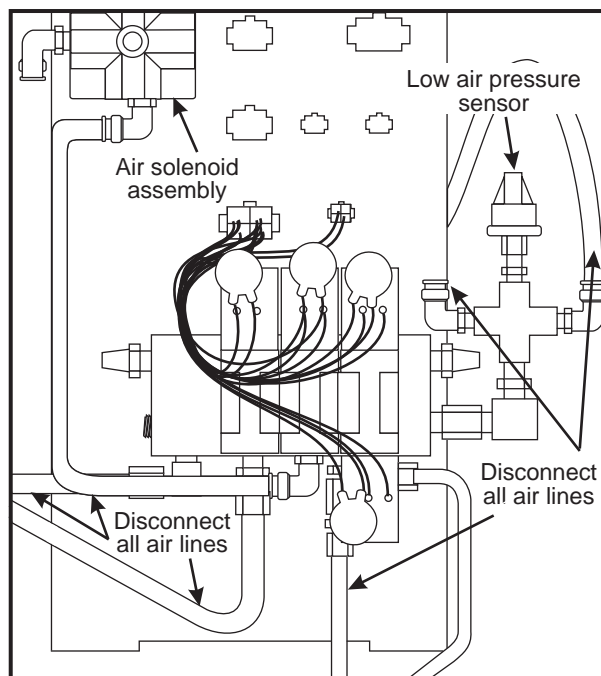
1. Turn machine power on and raise spindle head to uppermost position, then turn the power off. Remove air supply from machine.
2. Remove sheet metal at rear and/or top of machine to access the back of the spindle (Mechanical Service manual).
3. Disconnect all air lines from the air solenoid assembly (Do not remove fittings). Disconnect the two leads from the low air pressure sensor.
4. Unscrew the air solenoid assembly from the tool release piston assembly, taking care not disturb the position of the clamp/unclamp switches. It may be necessary to remove the tool release piston to access the solenoid assembly.
5. Unplug the wiring leading to the plug marked on the solenoid bracket as "880 from I/O PCB to Solenoid Valves" and the plug marked "Spare".
6. Unscrew the air solenoid from the air solenoid assembly. Remove the SHCS holding the assembly to the bracket and remove the assembly.

Installation

1. Install the new air solenoid. Take care to not disturb the position of the clamp/unclamp switches.
2. Replace air solenoid assembly and attach to bracket with the SHCS previously removed. Tighten securely.
3. Reinstall the tool release piston assembly if removed (see Mechanical Service).
4. Reconnect the two leads to the low air pressure sensor. Reconnect wiring to plugs on solenoid bracket.
5. Ensure all air lines are reconnected to their proper fittings. Reconnect air supply to the machine, and check for leaks.
6. Replace the sheet metal.



Locations of EC-300 and EC-400 TRP Solenoids

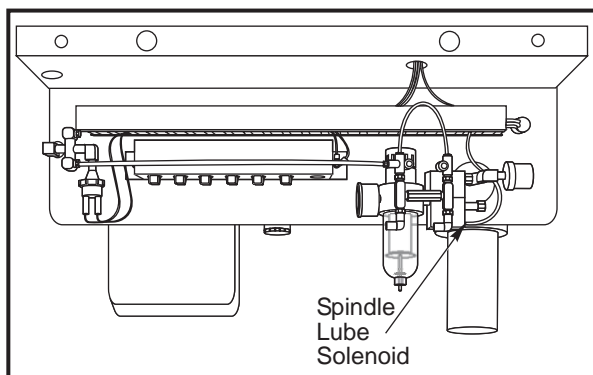


VF-Series Air Solenoid Assembly

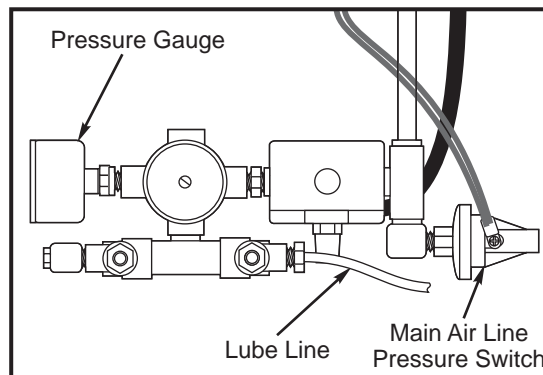
SPINDLE LUBE AIR SOLENOID

Removal

1. Turn the machine power off and remove the air supply from the machine.



Lube/Air Panel (Rear View)



Spindle Lube/Air Solenoid Assembly (Top View)

2. a. **Lathe:** Disconnect the lube line from the spindle lube air solenoid assembly.
b. **Mill:** Disconnect the air lines from the spindle lube air solenoid assembly.
3. Disconnect the electrical leads from the main air line pressure switch.
4. **Lathe:** Unscrew the solenoid assembly pressure gauge from the assembly.
5. Unscrew the entire solenoid assembly from the T-fitting.

Installation

1. Reattach the solenoid assembly at the T-fitting.
2. a. **Lathe:** Replace the pressure gauge on the solenoid assembly and reconnect the lube line.
b. **Mill:** Reconnect all air lines.



3. Reconnect the electrical leads to the main air line pressure switch.
4. Restore the air supply to the machine.

PNEUMATIC CHUCK/TURRET CLAMP/UNCLAMP SOLENOID (LATHE)

Removal

1. Turn machine power off and remove the air supply from the machine.
2. **Pneumatic Chuck:** Disconnect the two air hoses from the pneumatic chuck clamp/unclamp solenoid.
Turret: Disconnect the three air hoses from the turret clamp/unclamp solenoid (see the Turret In/Out Adjustment), and disconnect exhaust lines.
3. Unplug the solenoid electrical lead (located on the rear of the lube air panel).
4. Remove the two SHCS holding the assembly to the bracket and remove the assembly.

Installation

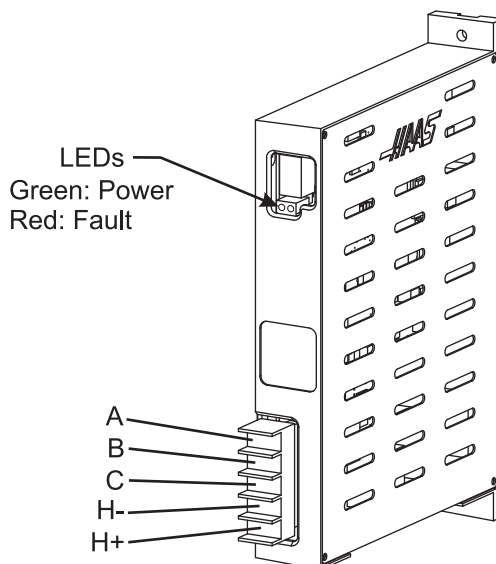
1. Replace the air solenoid assembly and attach it to the bracket with the two SHCS. Tighten securely.
2. Reconnect the electrical connection to the solenoid at the switch bracket.
3. Reconnect the two (three for Turret) air lines and turret exhaust lines, ensuring that all connections are tight and do not leak.
4. Restore the air supply to the machine.

SMART AMPLIFIER

The Smart Amplifier has a microprocessor incorporated in the design. This allows the amplifier to detect and report detailed alarms. The software level necessary to display these new alarms is 15.02A or newer.

The Smart Amplifier is backward compatible to any machine that has a Vector Drive. New Smart Amplifiers and standard amplifiers may be used in any combination in the machine. However, if the machine does not have at least 15.02A software or newer the specific Smart Amplifier will not be displayed. The Smart Amplifier and the standard amplifier use the same Parameters. On non-thin pendant machines, at least two of the standard amplifiers must be used.

The Smart Amplifier does not have a 12VDC connector, and both the Fault (Red LED) and the Run (Green LED) are relocated. The 320VDC (H+ and H-) and the X, Y and Z-axis connections are also relocated.

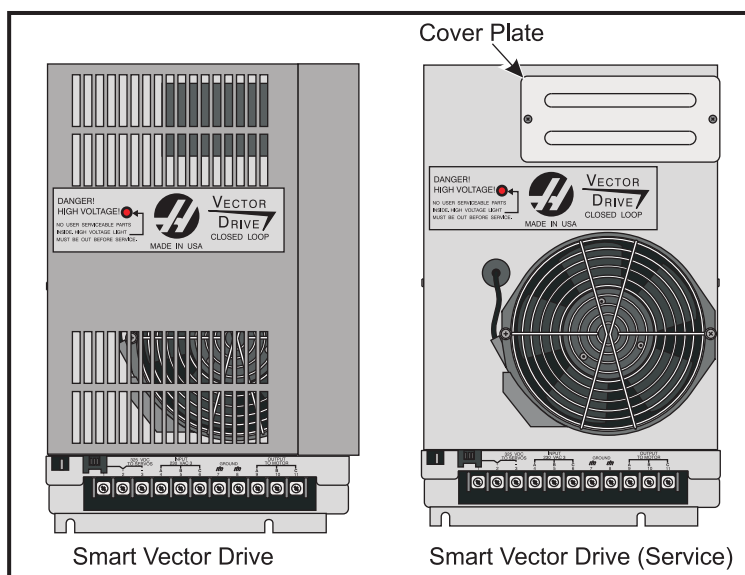




The smart amplifier will calibrate utilizing the microprocessor that is present in each of the Smart Amplifiers at power up. When power is applied to the Control Cabinet the Fault (Red LED) will illuminate and stay illuminated for a short time (approximately 5 seconds), this is called the “A” Phase Calibration. Then both LEDs will be out for a few seconds; this is called the “B” Phase Calibration. Next the Run (Green LED) will illuminate, indicating the Smart Amplifier is ready with no faults.

SMART VECTOR DRIVE

The smart vector drive features a microprocessor that allows it to detect and display specific alarms (software version 15.02A or newer only). It is backward compatible to any machine with a vector drive regardless of software version; however, the drive-specific alarms will not display in older software. Such alarms will display in the same way as with old-style drives.



Smart vector drives installed in new machines include a cover, and the machine's electrical cabinet door is cut to accommodate it. Service drives are shipped without the cover for installation in older machines. When replacing a drive in a machine built to accommodate the cover, use the cover from the old drive.

When installing a smart vector drive without the cover, install the cover plate to the front of the vector drive. When installing with the cover, install the cover plate to the top of the vector drive.

You will also need several cables. Please see 93-32-5558A for the 40 HP drive and 93-32-5559A for the 20 HP drive.

PCB REPLACEMENT

Please read this section in its entirety before attempting to replace any PCBs

MICROPROCESSOR ASSEMBLY

The microprocessor assembly is in the control cabinet at the top left position. It contains three large boards. They are: Microprocessor, the Video/Keyboard and the MOCON. All three boards of the processor assembly receive power from the low voltage power supply. The three PCBs are interconnected by a local buss on dual 50-pin connectors. At power-on, 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.



MOCON, VIDEO/KEYBOARD, & MICROPROCESSOR

WARNING!

The electrical panel will have residual voltage, even after power has been shut off and/or disconnected. Never work inside this cabinet until the small red Charge light on the servo amplifiers go out. The servo amplifiers are on the left side of the main control cabinet and about halfway down. This light is at the top of the circuit card at the center of the assembly. Until this light goes out, there are dangerous voltages in the assembly even when power is shut off.

Ground straps must be used when handling boards.

NOTE: Board arrangement may differ from the order of replacement that follows. Steps for replacement will only differ in which board may need to be removed before getting to the necessary board.

MOTOR CONTROLLER (MOCON)

Machines 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 axis commands and closing the loop around the axis motors.

In addition to controlling the axis and detecting axis 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. It also controls 6 axes, so there is no need for an additional board for a 5-axis machine. Four LEDs are used to diagnose MOCON problems:

The RUN LED will turn on, indicating that Mocon code was found in ROM and is being executed. This LED will turn off if a processor exception causes the Mocon code to abort execution.

The "STAT" LED indicates the following (Specific to Mocon 11.00 or later software)

- a. Continuously ON - Normal status. board has passed all power-on tests, and no problems have been encountered
- b. Blinks 3 times - Communication with main processor failed
- c. Blinks 4 times - Internal $\pm 12V$ testing failed
- d. Blinks 5 times - Internal watchdog circuit failed
- e. Blinks rapidly - EPROM CRC failed

The "Halt" LED glows when the board is in use (processing).

The "+5" LED lights when the board has power.

MOCON Board Replacement

1. Turn machine power off and turn the main switch (upper right of electrical cabinet) to the off position.
2. Open the cabinet door enough to safely work on the electrical panel. Wait until the red charge light on the servo amplifiers (servo drive assembly on brush machines) goes out before beginning any work.
3. Disconnect all leads to the Motor Controller (MOCON) board, and ensure all cables are properly labeled.
4. After all cables have been disconnected, unscrew the standoffs, taking care to hold the board in place until all standoffs have been removed.

NOTE: If the Video/Keyboard or Processor boards need replacing, skip the next step.

5. Replace the MOCON board, attaching it to the Video/Keyboard (beneath the MOCON board) with the standoffs, and reconnect all leads (previously removed) to their proper connections.
6. If a second MOCON board is present, be sure to connect the jumper on the second MOCON board.



VIDEO/KEYBOARD

The Video/Keyboard 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	Power connector	J11	SPARE
J3	Keyboard (700)	J12	Floppy
J4	Address bus	J13	Video (760)
J5	Data	J14	RS422 B
J10	Floppy V+	J15	RS422 A

Video/Keyboard Replacement

1. Remove the MOCON board as previously described.
2. Disconnect all leads to the Video/Keyboard. Ensure all cables are properly labeled for reconnecting later.
3. After all cables have been disconnected, unscrew the standoffs, taking care to hold the board in place until all standoffs have been removed.

NOTE: If the Processor board needs replacing, skip the next step.

4. Replace the Video/Keyboard, attaching it to the Processor board with the standoffs.
5. Reconnect all leads (previously removed) to their proper connections.
6. Replace the MOCON board.

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 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 LEDs 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 microprocessor or the software running in it. Check all of the buss connectors to the other two PCBs 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/LCD Video Initialization Complete. (Normally On)** - If the light does not come on, there is a problem communicating with the Video PCB. Check buss connectors to ensure it 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 retest.
- 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 problem with the Processor PCB. Check that the EPROM is plugged in. Test the card with buss connectors off.



HALT Processor Halted in Catastrophic Fault. (Normally Dim) - If this light comes on, there is a problem with the Processor PCB. Check that the EPROM is plugged in. Test the card with 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 1 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	J5	Serial port #2 (for auxiliary 5th axis) (850A)
J2	Data buss	J3	Power connector
J4	Serial port #1 (for upload/download/DNC) (850)	J6	Battery

Memory Retention Battery

The memory retention battery (3.3V Lithium battery) is soldered into the Processor PCB. It maintains the contents of CMOS RAM during power off periods. A minimum voltage of 2.5V DC is required for proper operation. Prior to this battery being unusable, an alarm is generated indicating low battery. If the battery is replaced within 30 days, no data is 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.

To replace the battery, the 4-pin jumper, attached to a fresh battery, has to be temporarily attached to J6 before the old battery is removed. With the jumper in place, un-solder the old battery and remove. Install a new battery and solder in place, then remove the temporary jumper.

NOTE: Do not attach the jumper after the old battery has been removed or remove the jumper if a fresh battery has not been installed. **This will result in complete machine memory loss**, which cannot be reversed.

Processor Board Replacement

1. Remove the MOCON board, and the Video/Keyboard as previously described.
2. Disconnect all leads to the Processor board. Ensure all cables are properly labeled for reconnecting later.
3. After all cables have been disconnected, unscrew the standoffs, taking care to hold the board in place until all standoffs have been removed.
4. Replace the Processor board, attaching it to the electrical cabinet with the standoffs, reconnect all leads (previously removed) to their proper connections, and replace Video/Keyboard and MOCON board.

INPUT/OUTPUT ASSEMBLY

The Input/Output Assembly consists of a single printed circuit board called the I/O PCB.

The I/O PCB also contains a circuit for sensing a ground fault condition of the servo power supply. If more than 1.75 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 through K12 are also plug-in types for controlling the tool changer motors.

I/O Board Replacement

1. Follow all precautions noted previously before working in the electrical cabinet.
2. Disconnect all leads to the Input/Output board and move aside for removal. Ensure all cables are properly labeled for reconnecting later.
3. Remove the board by first removing the twelve screws that fasten it to the cabinet. Take care to hold the board in place until all screws have been removed.



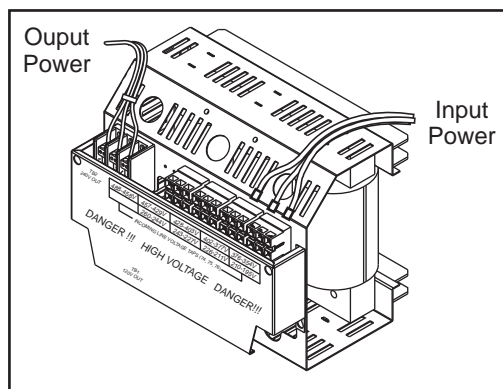
4. Replace the I/O board, attaching it to the cabinet with the twelve screws previously removed, and reconnect all leads to the I/O board. Check for any additional jumper settings per I/O release notes.

POWER TRANSFORMER ASSEMBLY (T1)

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

The 230V is used to power the spindle drive. The 230V also supplies the power to the vector drive, which supplies 325V DC power for the axis servo amplifiers. The 115V 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, and are protected by the main circuit breaker.



Polyphase Bank Transformer

Primary Connection To T1

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

Circuit breaker CB1 is used to protect the spindle drive and to shut off all power to the control. A trip of this breaker indicates a serious overload problem and 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, auxiliary contacts on K1 continue 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.

Voltage Selection Taps

There are four labeled plastic terminal blocks. 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 that protects the secondary of transformer T1 and is rated at 25 amps.

Optional 480V Transformer

60Hz		50Hz	
Input Voltage Range	Tap	Input Voltage Range	Tap
493-510	1 (504)	423-440	1 (504)
481-492	2 (492)	412-422	2 (492)
469-480	3 (480)	401-411	3 (480)
457-468	4 (468)	391-400	4 (468)
445-456	5 (456)	381-390	5 (456)
433-444	6 (444)	371-380	6 (444)
420-432	7 (432)	355-370	7 (432)

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.

Operator's Work Light

Main transformer (T1) outputs 115V AC to the work light.

POWER SUPPLY ASSEMBLY

All control power passes through a power supply assembly on the upper right corner of the control cabinet.

Power PCB (PSUP)

Low voltage power distribution and high voltage fuses and circuit breakers are mounted on a circuit board called the Power PCB.

Secondary Circuit Breakers

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

- CB2** Controls the 115V power from the main transformer to the I/O PCB and, if tripped, will turn off all inputs and outputs. CB2 could be tripped by a short circuit in the cables.
- CB3** Controls the power to coolant pump only. It can be tripped by an overload of the coolant pump motor or a short in the wiring to the TSC motor, or lathe hydraulic pump.
- CB4** Controls the power to chip conveyor only.
- CB5** Controls power to the TSC coolant pump only. It can be tripped by an overload of the TSC coolant pump motor or a short in the wiring to the motor.
- CB6** Single-phase 115V protected ground fault interrupt circuit and output for the worklight.

Power PCB (PSUP) Replacement

1. Follow all precautions noted previously before working in the electrical cabinet
2. Disconnect all leads to the Power PCB (PSUP) and set aside for removal. Ensure all cables are properly labeled for reconnecting later.
3. After all cables have been disconnected, remove the seven screws holding the Power board to the cabinet and remove the board. Take care to hold the Power board in place until all screws have been removed.

NOTE: If you need to replace the Low Voltage Power Supply board, please skip the next step.

4. Replace the Power board, attaching it with the seven screws previously removed. Do not forget to use the lower left screw for a ground connection.
5. Reconnect all cables to Power board at proper location. Refer to release notes for additional information.



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, and continues to operate correctly over 90 to 133V AC.

Low Voltage Power Supply (LVPS) Replacement

1. Remove the Power Distribution (Power) board as previously described.
2. Disconnect all leads to the Low Voltage Power Supply (LVPS) board. Ensure all cables are properly labeled for reconnecting later.
3. After all cables have been disconnected, unscrew the two standoffs at the bottom of the board. Unscrew the remaining two screws at the top of the LVPS board, taking care to hold the board in place until all screws have been removed.
4. Replace the LVPS board, attaching it to the cabinet with the two screws and standoffs previously removed.
5. Replace the Power board as previously described.

RS-232 SERIAL INTERFACE

There are two connectors used for the RS-232 interface. The RS-232 connector on most PCs is a male DB-25, so only one type of cable is required for connection to the controller, or between controllers. This cable must be a DB-25 male on one end and a DB-25 female on the other. Pins 1, 2, 3, 4, 5, 6, 7, 8, and 20 must be wired one-to-one. It cannot be a Null Modem cable, which inverts pins 2 and 3. To check cable type use a cable tester to check that communication lines are correct. The controller is DCE (Data Communication Equipment). This means that it transmits on the RXD line (pin 3) and receives on the TXD line (pin 2). The RS-232 connector on most PCs is wired for DTE (Data Terminal Equipment), requiring no special jumpers.

The Down Line DB-25 connector is only used when more than one controller is to be used. The first controller's down line connector goes to the second controller's up line connector, etc.

Interfacing a Haas Rotary Control to the mill

The RS-232 interface sends and receives seven data bits, even parity, and two stop bits. The interface must be set correctly. The data rate can be between 110 and 19200 bits per second. When using RS-232, it is important to make sure that Parameter 26 (RS-232 Speed) and 33 (X-on/X-off Enable) are set to the same value in the controller and PC.

If Parameter 33 is set to on, the controller uses X-on and X-off codes to control reception, so be sure your computer is able to process these. It also drops CTS (pin 5) at the same time it sends X-off and restores CTS when it sends X-on. The RTS line (pin 4) can be used to start/stop transmission by the controller or the X-on/X-off codes can be used. The DSR line (pin 6) is activated at power-on of the controller and the DTR line (pin 20 from the PC) is not used. If Parameter 33 is 0, the CTS line can still be used to synchronize output.

When more than one Haas controller is daisy-chained, data sent from the PC goes to all of the controllers at the same time, requiring an axis selection code (Parameter 21). Data sent back to the PC from the controllers is ORed together so that, if more than one box is transmitting, the data will be garbled. Because of this, the axis selection code must be unique for each controller.

RS-232 Remote Command Mode

Parameter 21 must be non-zero for the remote command mode to operate as the controller looks for an axis select code defined by this parameter. The controller must also be in RUN mode to respond to the interface. Since the controller powers-on in Run mode, remote unattended operation is thus possible.

RS-232 Line Noise

To minimize line noise on the serial port, reroute the cables straight up the left-hand side of the control to the processor stack. Do not run them above the I/O PCB or up the center wire channel to the processor.

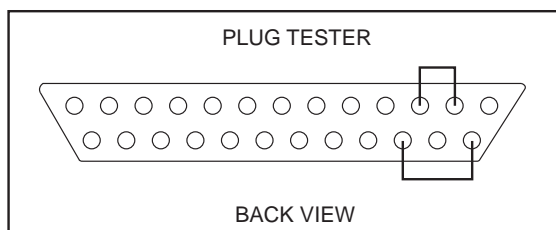
Transmission errors may be best minimized with a good common ground between the PC and CNC control.



RS-232 Loop Back Test

If you have a communications problem between Port #1 of the machine and your external computer, use the following procedure to isolate the problem to either internal or external causes.

1. Unplug the cable from Port #1 of the Control Panel, and plug the cable tester in (port #1).



The RS-232 Plug Tester is a 25-pin male connector with the following pins shorted.

Pins 2 & 3

Pins 14 & 16

In order to properly perform the test, Setting 14 must be set to CTS/RTS.

2. If the machine is on, cycle the power (power down then turn back on).
3. Press List Prog, followed by press Param Dgnos twice, then press Send RS232.
4. If the internal serial port is working, the lower left-hand part of the screen will display Serial Passed. (This means that the system, to the output of the control panel, is working. Check the cable to the computer set-up if you still have a communications problem.)

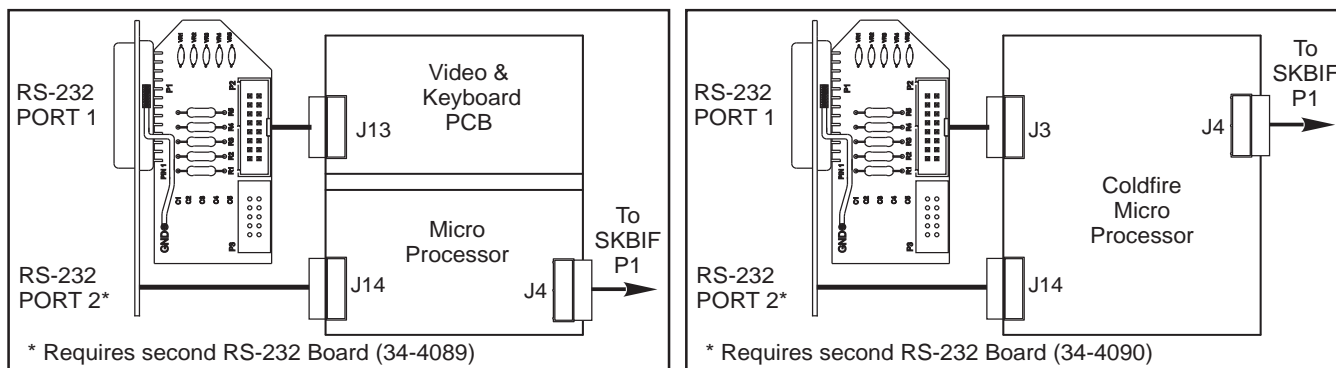
If the internal serial port is bad, the lower left-hand part of the screen will display Serial Failed. (This means there is a problem inside the control panel, or that the test connector is unplugged or missing.)

RS-232 PCB Replacement

1. Follow all precautions noted previously before working in the electrical cabinet.

NOTE: It is necessary, when replacing the RS-232 board, to work from the inside and outside of the cabinet at the same time.

2. On the left side of the cabinet, at the top of the side panel, are two serial port connections labeled "Serial Port #1" and "Serial Port #2". Serial Port #1 is the upper connection.



RS-232 Wiring Diagram (with Serial Keyboard)

3. To remove the RS-232 board, unscrew the two hex screws (on the exterior of the cabinet) holding the connector to the cabinet. From the inside of the cabinet, pull the connector through the panel, and disconnect the cable.



4. Replace the RS-232 board by first connecting the appropriate cable to the board (850 to Serial Port #1, 850A to Serial Port #2), then inserting the board (cable side up) through the left side panel. Attach with the two hex screws previously removed. Ensure the board for Serial Port #1 is the upper connector and the board for Serial Port #2 is the lower connector.

SPARE USER M CODE INTERFACE

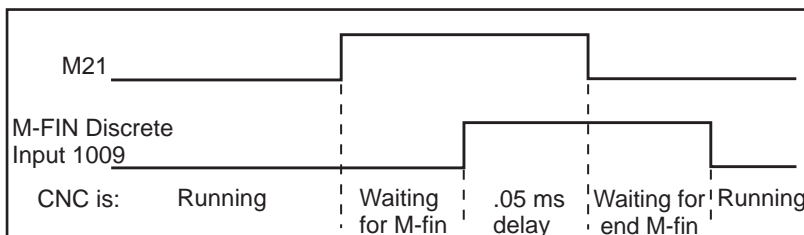
The M code interface uses outputs M21-25 and one discrete input circuit. M codes M21 through M25 will activate relays labeled M21-25. These relay contacts are isolated from all other circuits and may switch up to 120V AC at three amps. The relays are SPDT (Single Pole Double Throw).

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 (open). The timing is as follows:

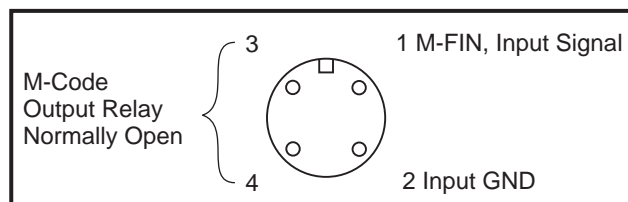


The Diagnostic Data display page may be used to observe the state of these signals.

M FUNCTION RELAYS (M-FIN)

The I/O PC board has relays that are 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 Diagnostic Data 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 are in use.

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 the line is brought to ground, there is about 10 milliamps of current. M-FIN is discrete input 1009 and is wired from input 1009 on the I/O PCB (usually P10). The return line for grounding the circuit should come 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 shows a "1" when the circuit is open and a "0" when it is grounded.



WIRING THE RELAYS

Relays are marked on the I/O PCB, with their respective terminals forward of them. If the optional 8M relay board is installed, connections on the I/O PCB are unused, since they are replaced by relays on the optional board. Refer to the figure, and the Probe Option figure in the Electrical Diagrams section for terminal labeling.

SWITCHES

X, Y, Z Travel Limit Switches

Machine zero position is defined by a limit switch for each of the X, Y, and Z axes. After the search for machine zero is complete, these switches are used to limit travel in the positive direction. Travel in the negative direction is limited by stored stroke limits. It is not normally possible to command the servo axes past the machine zero as servo travel lookahead will decelerate and stop each motor prior to exceeding the stroke limits.

Prior to performing a Power Up/Restart or an Auto All Axes operation, there are no travel limits. You can jog into the hard stops in either direction for X, Y, or 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 to ensure 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, Y, and Z axes will move towards the limit switch unless it is already active (open); then move away from the switch until it closes again; then continue to move until the encoder Z channel is found. This position is machine zero.

On some mills, the auto search for zero in the Z-axis is followed by a rapid move from the limit switch position down to the tool change position, making the Z-axis a little different from the other axes. The position found with the limit switch is not machine zero but is the position used to pull tools out of the spindle. Machine zero for Z is below this by Parameter 64. Be careful during the Z zero search and stay clear of that rapid move.

What Can Go Wrong With Switches?

Proximity switches are distance sensitive, and must be set no farther than .012" (3mm) away from an assembly or limit flag. An improperly set proximity switch will give inconsistency results, which may be interrupted as another problem. Any time a switch is replaced ensure the proper distance is set.

- If the machine is operated with Limit Switch inputs disabled, a Low Lube and Door Open alarm is generated. In addition, Home search will not stop at the limit switch and instead runs 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. Reset can be used to turn servos on, but you can jog that axis slowly.

Clamp/Unclamp Switches

There are two switches used to sense the position of the turret or tool clamping mechanism. 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 or drawbar 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 opens and the machine stops with a "Door Hold" function. When the door is closed again, operation continues normally.

If the door is open, it is not possible 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.



Tool #1 Sense Switch

The tool rotation turret has a switch that is activated when tool one is in position or facing toward the spindle. At Power On this switch can indicate that tool #1 is in the spindle. 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 the status of this input switch as “Tool #1”. A “1” indicates that tool #1 is in position.

Umbrella Tool Changer Geneva Wheel Position Mark (Vert)

The turret rotation mechanism has a switch mounted so that it is activated for about 30° of travel of the Geneva mechanism. When activated, this switch indicates that the turret is centered on a tool position. This switch is normally closed. The diagnostic display will show this status of this input switch as “TC MRK”. A “1” indicates the Geneva wheel is in position.

Umbrella Tool Changer Shuttle In/Out Switches (Vert)

Two switches are used to sense the position of the tool changer shuttle and the arm that moves it. One switch is activated when the shuttle is moved to full travel inward and one is activated when it is in full travel outward. These switches are normally closed, so that both are closed between in and out. The diagnostic display will show the status of the input switch. A “1” indicates the associated switch is activated or open.

Transmission High/Low Gear Position Switches

On machines with a two-speed transmission, there are two switches in the gearbox used to sense the position of the gears. One switch indicates “High” by opening and the other indicates “Low” by opening. Between gears, both switches are closed, indicating a between-gear condition. The diagnostic display shows the status of these switches and the Currt Comds display shows which gear is selected. If the switches indicate that the gearbox is between gears, the display will indicate “No Gear”.

NOTE: The Transmission High/Low Gear Position Switches are located at the bottom of the Gearbox Assembly and are difficult to reach. Removal of this assembly is necessary to replace these switches. See the Mechanical Components Service Manual, for Spindle Motor and Transmission removal.



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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 chapter 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 monitor will remain blank. In this case, there are two sources of diagnostic data; these are the audible beeper and the LEDs 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 EPROMs on the processor PCB. If any of the processor electronics cannot be accessed correctly, the LEDs 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 monitor will display a Power Failure Alarm message, 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 follow.

DISCRETE INPUTS/OUTPUTS (LATHE)

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 second page of diagnostic data is displayed using the Page Up and Page Down keys. It contains:

Inputs 2

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	S Z CH Spindle Z Channel
Y Cable Input	
Z Cable Input	
A Cable Input	
B Cable Input	
C Cable Input	

The Temp-Track option displays the X and Z ballscrew temperatures on the Inputs2 diagnostics screen just above "SP Load" when Parameter 266 or 268 bit 9 "Temp Sensor" is set to 1. The following inputs and outputs pertain to the Haas Vector Drive. If it is not enabled, a value of * is displayed. Otherwise, it displays 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

DISCRETE INPUTS/OUTPUTS (MILLS)

#	Name	#	Discrete Input Name
1000	TC Changer In/SMTC Pocket Down	1023	Spare 3/APC Pin Clr #2
1001	TC Changer Out/SMTC Pocket Up	1024	Tool Unclmp Rmt*
1002	Tool One In Pos.	1025	Spare
1003	Low TSC Pressure	1026	Spare 3A/APC Pal #2 Home
1004	Tool In Position	1027	Spare 3B/APC Pal #1 Home
1005	Spindle High Gear	1028	Ground Fault
1006	Spindle Low Gear	1029	G31 Block Skip
1007	Emergency Stop	1030	Spigot Position
1008	Door Safety Switch	1031	Conveyr Overcrnt
1009	M Code Finish*/APC: APC Pal Clamp	1032	Spare 4A
1010	Over Voltage (Mini-Mill - P.S. Fault)	1033	Spare 4B
1011	Low Air Pressure	1034	Spare 5A
1012	Low Lube Press.	1035	Spare 5B
1013	Regen Over Heat	1036	Spare 6A
1014	Drawbar Open	1037	Spare 6B
1015	Drawbar Closed	1038	Spare 7A
1016	Spare	1039	Spare 7B
1017	Spare	1040	Spare 8A
1018	Spare	1041	Spare 8B
1019	Spare	1042	Spare 9A (SMTC: Motor stop)
1020	Low Trans Oil Prs	1043	Spare 9B (SMTC: Origin)
1021	Spare 1/APC Door	1044	Spare 10A (SMTC: Clamp / Unclamp)
1022	Spare 2/APC Pin Clr #1	1045	Spare 10B

The inputs are numbered the same as the connections on the inputs printed circuit board. (*): active when = 0.



#	Discrete Output Name	#	Discrete Output Name
1100	Powered Servos	1120	Unclamp Pre-Chrg
1101	Spare	1121	HTC Shuttle Out (Air Drive Shuttle in/ APC Door)
1102	Spare	1122	Brake 5TH Axis
1103	Spare	1123	CE Door Lock
1104	Brake 4th Axis	1124	M21
1105	Coolant Pump On	1125	M22
1106	Auto Power Off	1126	M23 (Air Drive Shuttle: Move Shuttle Out)
1107	Spind. Motor Fan	1127	TSC Coolant
1108	Move T.C. In/APC Chain Dr Fwd	1128	Green Beacon On
1109	Move T.C. Out/APC Chain Dr Rev	1129	Red Beacon On
1110	Rotate T.C. CW	1130	Enable Conveyor
1111	Rotate T.C. CCW	1131	Reverse Conveyor
1112	Spindle Hi Gear	1132	M-fin
1113	Spindle Low Gear	1133	Probe
1114	Unclamp Tool	1134	spare
1115	Spare	1135	spare
1116	Move Spigot CW	1136	spare
1117	Move Spigot CCW	1137	spare
1118	Pal Ready Light	1138	spare
1119	TSC Purge	1139	spare

NOTE: The following inputs and outputs change for machines equipped with an APC.

#	Discrete Output Name	#	Discrete Output Name
1021	APC CE Door	1108	APC Chain Drive Forward
1022	APC Pin CLR #1	1109	APC Chain Drive Reverse
1023	APC Pin CLR #2	1121	PAL Clamp
1026	APC PAL #2 Home	1122	Door
1027	APC PAL #1 Home	1125	APC Motor
1046	APC Door Closed	1126	Beeper
1047	Door Open	1137	APC Chain Drive Power Enable
1048	APC Pallet Clamped	1138	Air Blast
1101	Pallet Clamped	1139	APC Beeper

The second page of diagnostic data is displayed using the Page Up and Page Down keys. It contains:

Inputs 2

Name	Name	Name
X Axis Z Channel	X Overheat	X Cable Input
Y Axis Z Channel	Y Overheat	Y Cable Input
Z Axis Z Channel	Z Overheat	Z Cable Input
A Axis Z Channel	A Overheat	A Cable Input
B Axis Z Channel	B Overheat	B Cable Input
X Home Switch	X Drive Fault	Spindle Z Channel
Y Home Switch	Y Drive Fault	
Z Home Switch	Z Drive Fault	
A Home Switch	A Drive Fault	
B Home Switch	B Drive Fault	



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.

Spindle Forward
Spindle Reverse
Spindle Lock
Spindle at Speed*
Spindle Stopped
Spindle Fault
Spindle Locked
Spindle Cable Fault
Spindle Over Heat

The following Discrete Inputs/Outputs 2 are available when Parameter 278 SMNT bit 1,2 or 3 (Side-Mount Tool Changer) is set and Parameter 209 MCD RLY BRD (M-Code relay board) is On.

Discrete Inputs 2

Name	Name
Spare Input 4A	Spare Input 8A
Spare Input 4B	Serp. Shot Pin*
Spare Input 5A	Motor Stop
Spare Input 5B	Origin
Spare Input 6A	Clamp/Unclamp
Spare Input 6B	Serp. Cam Count
Spare Input 7A	Spare Input 11A
Spare Input 7B	Spare Input 11 B

Discrete Outputs 2

Name	Name
Spare Output 32	Spare Output 44
Spare Output 33	Spare Output 45
Spare Output 34	Spare Output 46
Spare Output 35	Spare Output 47
Spare Output 36	Spare Output 48 (SMTC: Serp. ATC Enable)
TC MTR SW	Spare Output 49 (SMTC: Serp. ATC Rev.)
Spare Output 38	Spare Output 50 (SMTC: Serp. Carsl CW)
Spare Output 39	Spare Output 51 (SMTC: Serp. Carsl CCW)
Spare Output 40	Spare Output 52 (SMTC: Serp. Carsl Ena.)
Spare Output 41	Spare Output 53
Spare Output 42	Spare Output 54
Spare Output 43	Spare Output 55

Analog Data

Name	Description
DC BUSS	Voltage from Haas Vector Drive (if equipped)
uP TEMP	Displayed when Parameter 278 bit "uP Encl Temp" is set to 1)
SP LOAD	Spindle load in %
SP SPEED	Spindle rpm CW or CCW
RUN TIME	Machine total run time
TOOL CHANGES	Number of tool changes
VER X.XXX	Software version number
MOCON	MOCON software version
YY/MM/DD	Today's date
MDL HS__	Machine model
FV 2 11.0004	Floppy version (Ethernet Firmware)



CABLE LIST

WIRE/

TERMINAL NUMBER

FUNCTION NAME:

	INCOMING POWER 195-260 VAC (353-488 VAC OPTIONAL)
L1	INCOMING 195-260VAC, PHASE 1, TO CB1-1
L2	INCOMING 195-260VAC, PHASE 2, TO CB1-2
L3	INCOMING 195-260VAC, PHASE 3, TO CB1-3
71	PROTECTED 195-260 VAC FROM MAIN CB1-4 TO K1-1
72	PROTECTED 195-260 VAC FROM MAIN CB1-5 TO K1-2
73	PROTECTED 195-260 VAC FROM MAIN CB1-6 TO K1-3
74	195-260 VAC FROM K1-4 TO XFORMER T1
75	195-260 VAC FROM K1-5 TO XFORMER T1
76	195-260 VAC FROM K1-6 TO XFORMER T1
77	230VAC PHASE 1 , FROM XFORMER T1 TO VECTOR/CHIP CONV
78	230VAC PHASE 2 , FROM XFORMER T1 TO VECTOR/CHIP CONV
79	230VAC PHASE 3 , FROM XFORMER T1 TO VECTOR/CHIP CONV
90	115 VAC FROM TB2 (CB2 OUTPUT) TO IOPCB P33
91	STEPPED-DOWN 115 VAC (FROM XFRMR T1)
92	STEPPED-DOWN 115 VAC (FROM XFRMR T1)
93	STEPPED-DOWN 115 VAC (FROM XFRMR T1)
94	SHIELD DRAIN
—	115 VAC FROM XFORMER T1 TO TB1
94	STEPPED-DOWN 115 VAC (FROM XFRMR T1)
95	STEPPED-DOWN 115 VAC (FROM XFRMR T1)
96	STEPPED-DOWN 115 VAC (FROM XFRMR T1)
90A	115 VAC TO CRT
91A	LEG 1
92A	LEG 2
93A	SHIELD DRAIN
90B	115 VAC TO HEAT EXCHANGER (CABINET DOOR FAN)
91B	LEG 1
92B	LEG 2
93B	SHIELD DRAIN
90C	115 VAC TO CB4
91C	LEG 1
92C	LEG 2
93C	SHIELD DRAIN
100	M-FIN
101	SIGNAL
102	COMMON
103	SHIELD DRAIN
100A	MFIN OUTPUT M21 (MCD RELAY BOARD M21)
101A	UNSWITCHED LEG 1
102A	SWITCHED LEG 2
103A	SHIELD DRAIN
110	SPARE



120	TSC OVER TEMP THERMAL SENSOR (Vert)
121	THERMAL SENSOR SIGNAL
122	THERMAL SENSOR RETURN
123	SHIELD
140	230VAC 3PH POWER TO CHIP CONVEYOR MOTOR
141	PHASE A 230VAC
142	PHASE B 230VAC
143	PHASE C 230VAC
144	STARTING WINDING 230VAC
145	STARTING WINDING 230VAC
146	SHIELD DRAIN
140A	230VAC 3PH POWER IN CONDUIT TO CHIP CONVEYOR (Lathe)
141A	PHASE A 230VAC
142B	PHASE B 230VAC
143B	PHASE C 230VAC
160	3PH 230VAC TO CHIP CONVEYOR CONTROLLER
161	PHASE A 230VAC
162	PHASE B 230VAC
163	PHASE C 230VAC
164	SHIELD DRAIN
170	AUTO OFF FUNCTION
171	UNSWITCHED LEG 1
172	SWITCHED LEG 2
173	SHIELD DRAIN
180	COOLANT SPIGOT DETENT SWITCH (Mill) SPARE (Lathe & Horiz)
181	SIGNAL
182	COMMON
183	SHIELD DRAIN
190	UNCLAMP FROM SPINDLE HEAD TO IOASM
191	INPUT 25
192	DIGITAL RETURN
193	SHIELD DRAIN
200	COOLANT SPIGOT MOTOR (12VDC) (Mill) SPARE (Lathe & Horiz)
201	MOTOR +
202	MOTOR -
210	DATA CABLE TO 3" FLOPPY DISK DRIVE
220	SERVO BRAKE 115VAC (Mill)
221	115VAC COMMON
222	115VAC SWITCHED
223	SHIELD DRAIN
230	5'th AXIS BRAKE (Vert & Horiz) TAILSTOCK FORWARD OPTION (Lathe)
231	115VAC COMMON
232	115VAC SWITCHED
233	SHIELD DRAIN
240	PALLETS UP & DOWN INPUTS (Vert & Horiz) BARFEEDER LOAD BAR-BARFEEDER LOAD Q (Lathe)
241	PALLETS UP (Vert & Horiz) END OF BAR (Lathe)
242	PALLETS DOWN (Vert & Horiz) LOADER OK (Lathe)
243	COMMON
244	SHIELD DRAIN



250	VR SHUT IN / APC DOOR OPEN/ MD NIAGRA COOLANT ON (Vert option) HTC SHUTTLE/MORI MANUAL TOOL RELEASE (Horiz) TAILSTOCK REVERSE OPTION (Lathe)
251	LEG 1 (Mill) 115 VAC (Lathe)
252	LEG 2 (Mill) 115 VAC RETURN (Lathe)
253	SHIELD DRAIN
260	K210 CABLING FOR EC (Mill) SPARE (Lathe)
261	SWITCHED LED
262	UNSWITCHED LEG
263	SHIELD DRAIN
270	K111 CABLING FOR EC (Mill) TAILSTOCK RAPID OPTION (Lathe)
271	UNSWITCHED LEG 1 (Mill) 115 VAC (Lathe)
272	SWITCHED LEG 2 (Mill) 115 VAC RETURN (Lathe)
273	SHIELD DRAIN
280	RED/GREEN STATUS LIGHT WIRING
281	RED LAMP 115VAC
282	GREEN LAMP 115VAC
283	COMMON 115VAC
284	SHIELD DRAIN
290	115VAC TO XFORMER T2 10VAC OUTPUT (Horiz) CABLE OP LIGHT + SPINDLE MOTOR FAN (Lathe)
291	LEG 1 PRIMARY (Horiz) 115 VAC (Lathe)
292	LEG 2 PRIMARY (Horiz) 115 VAC RETURN (Lathe)
293	CENTER TAPPED (GROUND) (Horiz) SHIELD DRAIN (Lathe)
294	LEG 1 SECONDARY (Horiz)
295	LEG 2 SECONDARY (Horiz)
300	115VAC TO SPINDLE MOTOR FAN/OIL PUMP/OILER
301	LEG 1 115VAC PROTECTED
302	LEG 2 115VAC PROTECTED
303	SHIELD DRAIN
310	APC #2 DOOR OPEN (Vert) PC PALLET CW/CCW (Horiz) AUTO DOOR CLUTCH - PARTS CATCHER (Lathe)
330	230V 3PH FROM CB6 TO K2 (LATHE HYDRAULICS)
331	PHASE 1 230VAC
332	PHASE 2 230VAC
333	PHASE 3 230VAC
340	230V 3PH FROM K2 TO HYDRAULIC PUMP (LATHE)
341	PHASE 1 230VAC
342	PHASE 2 230VAC
343	PHASE 3 230VAC
350	SERVO BRAKE RELEASE 115VAC (Mill) 115VAC HYD PUMP ENABLE (Lathe)
351	LEG 1 COMMON (Mill) 115VAC (Lathe)
352	LEG 2 SWITCHED (Mill) 115VAC RETURN (Lathe)
353	SHIELD DRAIN
390	115VAC TO 4'TH AXIS BRAKE (LATHE PART DOOR)
391	LEG 1 COMMON
392	LEG 2 SWITCHED
393	SHIELD DRAIN
410	TOOL CHANGER DOOR/APC CE DOOR OPEN (Mill) TAILSTOCK FOOT SWITCH (Lathe)
411	SIGNAL (Lathe)
412	RETURN (Lathe)
413	SHIELD DRAIN
420	APC #2 PIN CLR #1 / APC #2 PIN CLR #2 / APC #2 PAL #2 HOME / APC #2 PAL #1 HOME (Vert) MORI ARM IN/OUT - SMTc ARM CW/CCW (Horiz)



430	APC PALLET CLAMP MD PAL UP (Mill) APL LIGHT/BF EXTENDED PUSH (Lathe)
440	AUTO DOOR OPEN (Vert) SMTC CAGE DOOR OPEN - MORI ARM OUT (Horiz) DOOR OPEN (Lathe)
450	APC #2 CE DOOR OPEN (Vert) MORI ARM CW/CCW (Horiz) STEADY REST FOOT SWITCH (Lathe)
460	APC #2 DOOR CLOSED - APC #2 DOOR OPEN (Vert) MORI SLIDE 1/2 WAY - MORI SLIDE LEFT (Horiz) APL ROTOR MARK - APL ROTOR HOME (Lathe)
470	SMTC MOTOR STOP (Vert) SMTC SHUTTLE MARK (Horiz)
490	ALL BRUSHLESS AXIS SERVO MOTOR DRIVE POWER CABLE
491	A PHASE
492	B PHASE
493	C PHASE
494	GROUND
490A	A AXIS MOTOR POWER (Vert) 320VDC FROM SPINDLE DRIVE TO AMPLIFIERS (Horiz & Lathe)
490B	B AXIS MOTOR POWER (Vert) 320VDC FROM AMPLIFIER TO SERVO POWER SUPPLY (Horiz & Lathe)
490X	X AXIS MOTOR POWER
490Y	Y AXIS MOTOR POWER
490Z	Z AXIS MOTOR POWER
491A	HIGH VOLT P1/+ RED (Horiz & Lathe)
492A	HIGH VOLT N/- BLACK (Horiz & Lathe)
493A	SHIELD DRAIN
491B	HIGH VOLT + RED (Horiz & Lathe)
492B	HIGH VOLT - BLACK (Horiz & Lathe)
500	OVERTEMP SENSOR FROM SPINDLE MOTOR
501	OVERTEMP WIRE 1
502	OVERTEMP WIRE 2
503	SHIELD DRAIN
510	RELAY CARD 1 DRIVE CABLE - 16 WIRE RIBBON
520	RELAY CARD 2 DRIVE CABLE - 16 WIRE RIBBON
530	RELAY CARD 3 DRIVE CABLE - 16 WIRE RIBBON
540	RELAY CARD 4 DRIVE CABLE - 16 WIRE RIBBON
550	INPUTS CARD CABLE (MOCON P10) 34 WIRE RIBBON
570	LOW VOLTAGE BRUSHLESS AMPLIFIER POWER CABLE ASSEMBLY (Horiz & Lathe)
571	+12VDC #22
572	COMMON
573	- 12VDC #22
610	X AXIS HAAS AMPLIFIER CABLE TO MOTOR CONTROLLER BOARD
610-1	+A CHANNEL
610-2	ANALOG GROUND
610-3	+B CHANNEL
610-4	ANALOG GROUND
610-5	ENABLE
610-6	LOGIC GROUND
610-7	FAULT
610-8	LOGIC GROUND
610-9	NOT USED
610-10	SHIELD/ANALOG GROUND
620	Y AXIS HAAS AMPLIFIER CABLE TO MOTOR CONTROLLER BOARD (SAME AS 610-1 THRU 610-10) (Mill)
630	Z AXIS HAAS AMPLIFIER CABLE TO MOTOR CONTROLLER BOARD (SAME AS 610-1 THRU 610-10)



640	A AXIS HAAS AMPLIFIER CABLE TO MOTOR CONTROLLER BOARD (SAME AS 610-1 THRU 610-10) (Lathe)
640A	A AXIS HAAS AMPLIFIER CABLE TO MOTOR CONTROLLER BOARD (SAME AS 610-1 THRU 610-10) (Mill)
640B	B AXIS HAAS AMPLIFIER CABLE TO MOTOR CONTROLLER BOARD (SAME AS 610-1 THRU 610-10) (Mill)
640C	C AXIS HAAS VECTOR CURRENT COMMAND CABLE TO MOTOR CONTROLLER BD. (SAME AS 610-1 THRU 610-10) (Vert)
640C	HAAS VECTOR DRIVE CURRENT COMMAND CABLE (Horiz & Lathe)
640C-1	A PHASE
640C-2	B PHASE
640C-3	ENABLE
640C-4	FAULT
640C-5	320VDC VOLTAGE MONITOR
640C-6	A PHASE RETURN
640C-7	B PHASE RETURN
640C-8	DIGITAL GROUND
640C-9	FAULT RETURN
640C-10	ANALOG GROUND
650	THREE PHASE POWER TO SPINDLE MOTOR
651	LEG 1 OF 230VAC
652	LEG 2
653	LEG 3
654	SHIELD DRAIN
650A	THREE PHASE POWER TO SPINDLE MOTOR
651A	LEG 1 OF 230VAC
652A	LEG 2
653A	LEG 3
654A	SHIELD DRAIN
650B	THREE PHASE POWER TO SPINDLE MOTOR
651B	LEG 1 OF 230VAC
652B	LEG 2
653B	LEG 3
654B	SHIELD DRAIN
660	X-AXIS ENCODER CABLE
660-1	LOGIC RETURN (D GROUND)
660-2	ENCODER A CHANNEL
660-3	ENCODER B CHANNEL
660-4	+5 VDC
660-5	ENCODER Z CHANNEL (OR C)
660-6	HOME/LIMIT SW
660-7	OVERHEAT SWITCH
660-8	ENCODER A*
660-9	ENCODER B*
660-10	ENCODER Z* (OR C*)
660-11	X HALL A (NOT USED)
660-12	X HALL B (NOT USED)
660-13	X HALL C (NOT USED)
660-14	X HALL D (NOT USED)
660-15	SHIELD DRAIN
660-16	(NOT USED)
670	Y-AXIS ENCODER CABLE (SAME AS 660-1 THRU 660-16) (Mill)
680	Z-AXIS ENCODER CABLE (SAME AS 660-1 THRU 660-16)



690	A-AXIS ENCODER CABLE (SAME AS 660-1 THRU 660-16) (Vert & Lathe)
690A	A-AXIS ENCODER CABLE (SAME AS 660-1 THRU 660-16) (Horiz)
690B	B-AXIS ENCODER CABLE (SAME AS 660-1 THRU 660-16) (Mill)
690C	C-AXIS ENCODER CABLE (SAME AS 660-1 THRU 660-16) (Mill)
700	KEYBOARD CABLE - 34 WIRE RIBBON WITH IDC (FROM VIDEO P4 TO KBIF P1)
710	APC #1 PALLET READY 1 / APC #1 PALLET READY 2 (Vert) P-COOL/BF COLLET OPEN - BF COLLET CLOSE (Horiz) APL GRIP 1,2 (Lathe)
711	FORWARD COMMAND (Vert)
712	REVERSE COMMAND (Vert)
713	RESET COMMAND (Vert)
714	COMMON (Vert)
715	SHIELD DRAIN
720	ANALOG SIGNAL FROM MOCON TO SPINDLE DRIVE TO LOAD METER (BRUSH SYSTEMS)
721	0 TO +10 VOLTS SPEED COMMAND (SPINDLE DRIVE CN1-1)
722	SPEED COMMAND REFERENCE (A GROUND) (CN1-17)
723	SHIELD DRAIN
730	POWER METER FROM SPINDLE DRIVE TO KBIF (Vert) (BRUSH SYSTEMS)
731	METER +
732	METER -
733	SHIELD DRAIN
730A	POWER METER FROM KBIF TO METER (Vert) (BRUSH SYSTEMS)
733	METER + AFTER TRIM POT
734	METER - AFTER TRIM POT
734	METER - AFTER TRIM POT
730B	ANALOG SIGNAL FROM SPINDLE DRIVE LOAD MONITOR (Vert) (BRUSH SYSTEMS)
731	SIGNAL 0.5V
732	GROUND
740	POWER ON/OFF CABLE TO FRONT PANEL
741	POWER ON SWITCH LEG 1 (24 VAC)
742	POWER ON SWITCH LEG 2 #24 N.O.
743	POWER OFF SWITCH LEG 1 (24 VAC)
744	POWER OFF SWITCH LEG 2 #24 N.C.
745	SHIELD DRAIN
750	JOG-CRANK DATA CABLE (REM JOG SIDE CONNECTION)
750-1	LOGIC RETURN (D GROUND) 0VDC
750-2	ENCODER A CHANNEL
750-3	ENCODER B CHANNEL
750-4	+5 VDC
750-5	NC (Vert) JUMPER TO 750-1 (0 VDC) (Horiz & Lathe)
750-6	X-AXIS
750-7	Y-AXIS
750-8	N/C (Vert) ENCODER A* CHANNEL (Horiz & Lathe)
750-9	N/C (Vert) ENCODER B* CHANNEL (Horiz & Lathe)
750-10	N/C (Vert) JUMPER TO 750-4 (+5 VDC) (Horiz & Lathe)
750-11	Z-AXIS
750-12	A-AXIS
750-13	X 10
750-14	X 1
750-15	SHIELD DRAIN
750-16	N/C (Vert) NOT USED (Horiz & Lathe)



750A	JOG HANDLE DATA CABLE (Horiz & Lathe)
751A	+5 VDC
752A	0 VDC
753A	ENCODER A CHANNEL
754A	ENCODER B CHANNEL
755A	SHIELD DRAIN
750B	JOG HANDLE DATA CABLE (Horiz)
750B-1	+5 VDC JOG HANDLE
750B-2	0VDC
750B-3	JOG HANDLE A CHANNEL
750B-4	JOG HANDLE A* CHANNEL
750B-5	JOG HANDLE B CHANNEL
750B-6	JOG HANDLE B* CHANNEL
760	MONITOR VIDEO DATA CABLE (FROM VIDEO P3 TO CRT)
770	EMERGENCY STOP INPUT CABLE
771	SIGNAL (INPUT 8)
772	RETURN (D GROUND) (65)
773	SHIELD DRAIN
770A	SECOND E-STOP INPUT / COUNTERBALANCE (Horiz) / BARFEEDER OPTION (Lathe)
771A	SIGNAL
772A	RETURN (D GROUND)
773A	SHIELD DRAIN
770B	THIRD E-STOP INPUT FOR APC (REMOTE CONTROL PANEL) (Vert)
790	APC PIN CLR #1 / MD OP DOOR OPEN - APC PIN CLR #2 / MD OP DOOR CLOSED (Vert) PALLET CHANGER CW/CCW (Horiz) SPARE INPUTS PROBE HOME OPTION (Lathe)
791	SPARE 1 (Vert & Lathe) PALLET CW (Horiz)
792	SPARE 2 (Vert & Lathe) PALLET CCW (Horiz)
793	COMMON
794	SHIELD DRAIN
800	10VAC TO PALLET READY LAMP (Horiz)
801	UNSWITCHED LEG 1
802	SWITCHED LEG 2
803	SHIELD DRAIN
800A	LAMP SWITCH JUMPER (Horiz)
801A	JUMPER TO 802A
802A	JUMPER TO 801A
810	TOOL CHANGER MOTORS
811	TURRET MOTOR + (IO P30-2 TO P6-J)
812	TURRET MOTOR - (IO P30-1 TO P6-I)
813	SHIELD DRAIN
810A	TOOL CHANGER MOTORS
811A	SHUTTLE MOTOR +
812A	SHUTTLE MOTOR -
813A	SHIELD DRAIN
820	TOOL CHANGER STATUS
821	LOGIC RETURN (Vert) TOOL CHANGER IN (Horiz) TURRET UNCLAMPED (Lathe)
822	GENEVA MARK (INPUT 5 TO P6-G) (Vert) TOOL CHANGER OUT (Horiz) TURRET CLAMPED (Lathe)
823	TOOL #1 (INPUT 3 TO P6-E) (Vert) MAIN DRAWBAR UP (Horiz) UNUSED (Lathe)
824	SHUTTLE IN (INPUT 1 TO P6-C) (Vert) MAIN DRAWBAR DOWN (Horiz) PART LOAD (Lathe)
825	SHUTTLE OUT (INPUT 2 TO P6-D) (Vert) COMMON (Horiz & Lathe)
826	SHIELD DRAIN



830	OVERHEAT THERMOSTAT
831	OVERHEAT SIGNAL (INPUT 14)
832	OVERHEAT RETURN (D GROUND) (65)
833	SHIELD DRAIN
840	CIRCUIT BREAKER FOR 160 VDC (Vert)
841	LEG 1 (TO 81)
842	LEG 2
843	SHIELD DRAIN
850	SERIAL PORT #1 TO SERIAL KEYBOARD INTERFACE CABLE
850A	SERIAL PORT #2 INTERFACE CABLE - AUXILIARY PORT TO ROTARY CONTROLLER
860	+12V/+5V/Gnd POWER CABLES (Vert) +5V/+12V/-12V/Gnd FROM MAIN POWER SUPPLY (Horiz & Lathe)
861	+12 VOLTS (Vert) +5 VOLTS (Horiz & Lathe)
862	-12 VOLTS FROM LOW V SUPPLY TO 68020 PCB (Vert) LOGIC POWER RETURN (Horiz & Lathe)
863	+5 VOLTS (Vert) LOGIC POWER RETURN (Horiz & Lathe)
864	-5 VOLTS (Vert) +12 VOLTS (Horiz & Lathe)
865	LOGIC POWER RETURN (D GROUND) (Vert) -12 VOLTS (Horiz & Lathe)
866	POWER GOOD SIGNAL FROM SUPPLY (Vert)
860A	12 VOLT POWER TO IOPCB (Vert & Lathe) 12 VDC POWER TO M CODE RELAY BOARD (Horiz)
861A	+12 VOLTS
862A	LOGIC POWER RETURN (D GROUND)
863A	SHIELD DRAIN
860B	+5 POWER TO 3" FLOPPY DRIVE (Vert & Lathe)
860C	+5,+12,-12 POWER TO 68030 (Vert & Lathe) 12 VDC POWER TO MONITOR FAN (Horiz)
861A	+12 VOLTS
862A	LOGIC POWER RETURN (D GROUND)
863A	SHIELD DRAIN
870	115VAC TO OILER (Vert & Lathe)
871	115VAC LEG 1
872	115VAC LEG 2
873	SHIELD DRAIN
880A	HIGH/LOW GEAR UNCLAMP/LOCK SOLENOID POWER (Vert)
	115 VAC TO SPINDLE HEAD SOLENOIDS (Horiz & Lathe)
881A	115 VAC SOLENOID COMMON (IO P12-5) (Vert) WYE-DELTA SWITCH COMMAND (Horiz)
	SPINDLE LOCK (Lathe)
882A	HIGH GEAR SOLENOID (IO P12-4) (Vert) TOOL UNCLAMP (Horiz & Lathe)
883A	LOW GEAR SOLENOID (IO P12-3)
884A	TOOL UNCLAMP SOLENOID (IO P12-2) (Vert) HIGH GEAR (Horiz & Lathe)
885A	SPINDLE LOCK SOLENOID (IO P12-1) (Vert) 115 VAC COMMON (Horiz & Lathe)
886A	PRE-CHARGE SOLENOID #18 (IO P12-7) (Vert) SHIELD DRAIN (Horiz & Lathe)
887A	SHIELD DRAIN (Vert) PRECHARGE (Horiz & Lathe)
880B	TRANSMISSION HIGH/LOW GEAR SOLENOIDS FOR LATHE (Vert & Lathe)
881B	115 VAC SOLENOID COMMON (IO P12-5)
882B	HIGH GEAR SOLENOID (IO P12-4)
883B	LOW GEAR SOLENOID (IO P12-3)
884B	SHIELD DRAIN
890	SPINDLE STATUS SWITCHES
891	SIGNAL RETURN (D GROUND) (Vert) HIGH GEAR (Horiz & Lathe)
892	HIGH GEAR (Vert) LOW GEAR (Horiz & Lathe)
893	LOW GEAR (Vert) TOOL UNCLAMPED (Horiz & Lathe)
894	TOOL UNCLAMPED (Vert) TOOL CLAMPED (Horiz & Lathe)
895	TOOL CLAMPED (Vert) SPARE (Horiz) SPINDLE LOCKED (Lathe)
896	SPINDLE LOCKED (Vert) COMMON (Horiz & Lathe)
897	SHIELD DRAIN



900	LOW COOLANT STATUS (Mill) SPARE (Lathe)
901	LOW COOLANT SIGNAL
902	LOW COOLANT RETURN (D GROUND)
903	SHIELD DRAIN
910	115 VAC CIRCUIT BREAKER TO SOLENOIDS
911	LEG 1
912	LEG 2
913	SHIELD DRAIN
910A	115VAC FROM CB4 ON MAIN POWER DIST. (Mill) SPARE 115 VAC (Lathe)
910B	115VAC TO SERVO FAN
910C	115VAC TO DELTA/WYE COIL (Vert & Lathe) 115VAC TO PURGE SOLENOID (Horiz)
910D	115VAC TO WORK LIGHT (Vert) 115 VAC TO PALLET ALARM (Horiz) 115 VAC TO PART CATCHER (Lathe)
920	REGENERATIVE LOAD RESISTOR FOR SERVO (Vert)
921	LEG 1
922	LEG 2
923	SHIELD DRAIN
930	FUSED 230 VAC FOR COOLANT PUMP
931	LEG 1
932	LEG 2
933	SHIELD DRAIN
940	230 VAC TO COOLANT PUMP
941	LEG 1 (P7-A)
942	LEG 2 (P7-F)
943	SHIELD DRAIN
940A	230 VAC SINGLE PHASE POWER TO THROUGH SPINDLE COOLANT PUMP (Horiz)
941A	LEG 1
942A	LEG 2
943A	SHIELD DRAIN
950	LOW AIR PRESSURE/OIL LUBE SENSOR
951	LOW AIR SIGNAL (INPUT 12)
952	LOW AIR/OIL RETURN (D GROUND) (65) (Vert) LOW OIL LUBE SIGNAL (Horiz & Lathe)
953	LOW OIL PRESSURE SWITCH FOR VERTICAL TRANSMISSION (Vert) COMMON (Horiz & Lathe)
954	SHIELD DRAIN
950A	LOW HYDRAULIC PRESSURE SWITCH FOR LATHE
952	LOW HYDRAULIC RETURN (D GROUND)
953	LOW HYD PRESSURE SWITCH FOR VERTICAL TRANSMISSION
954	SHIELD DRAIN
960	LOW LUB/DOOR OPEN SENSORS (Vert) LOW TRANSMISSION OIL LUBE (Horiz)
	LOW HYD PRESSURE (Lathe)
961	LOW LUB SIGNAL (Vert) LOW TRANSMISSION OIL LUBE SIGNAL (Horiz) LOW HYD PRESSURE (Lathe)
962	LOW LUB RETURN (D GROUND) (65)
963	SHIELD DRAIN
970	LOW VOLTAGE SENSOR (Vert) VECTOR DRIVE OVER-VOLT SENSOR (Horiz & Lathe)
971	LOW VOL SIGNAL (Vert) OVERVOLTAGE SIGNAL (Horiz & Lathe)
972	LOW VOL RETURN (D GROUND) (Vert) OVERVOLTAGE RETURN (Horiz & Lathe)
973	SHIELD DRAIN
980	VOLTAGE MONITOR
981	VOLTAGE MONITOR 0 TO
982	VOLTAGE MON RET
983	SHIELD DRAIN



990	HOME SENSORS
991	X HOME SWITCH (Vert) COMMON (DATA GROUND) Horiz & Lathe)
992	Y HOME SWITCH (LATHE TAIL STOCK) (Vert) X-AXIS HOME SWITCH (Horiz & Lathe)
993	Z HOME SWITCH (Vert) Y-AXIS HOME SWITCH (Horiz & Lathe)
994	HOME SWITCH RETURN (Vert) Z-AXIS HOME SWITCH (Horiz & Lathe)
995	SHIELD DRAIN
1000	SPINDLE ENCODER CABLE (LATHE TAIL STOCK)(BRUSH SYSTEMS) (Vert)
1001	LOGIC RETURN (D GROUND)
1002	ENCODER A CHANNEL
1003	ENCODER B CHANNEL
1004	+5 VDC
1005	ENCODER Z CHANNEL
1006	SHIELD DRAIN
1000	SPINDLE ENCODER CABLE (MOCON SIDE CONNECTION) (Horiz & Lathe)
1000-1	LOGIC RETURN (D GROUND)
1000-2	ENCODER A CHANNEL
1000-3	ENCODER B CHANNEL
1000-4	+5 VDC
1000-5	ENCODER Z CHANNEL
1000-6	NOT USED
1000-7	NOT USED
1000-8	ENCODER A* CHANNEL
1000-9	ENCODER B* CHANNEL
1000-10	ENCODER Z* CHANNEL
1000-11	NOT USED
1000-12	NOT USED
1000-13	NOT USED
1000-14	NOT USED
1000-15	SHIELD DRAIN
1000-16	NOT USED
1010	AUX FRONT PANEL CABLE (HS-1R/RP)
1011	COMMON FOR CYCLE START AND FEED HOLD RETURN
1012	CYCLE START
1013	PART READY
1014	COMMON FOR PALLET ROTATE AND PART READY
1015	PALLET ROTATE
1016	FEED HOLD
1017	SHIELD DRAIN
1020	SPINDLE TEMPERATURE SENSOR CABLE
1021	SIGNAL
1022	ANALOG RETURN
1023	+5 VOLTS TO SENSOR
1024	SHIELD GROUND
1030	SPINDLE LOAD RESISTOR
1031	REGEN LOAD RESISTOR FOR SPINDLE DRIVE (B1)
1032	REGEN LOAD RESISTOR FOR SPINDLE DRIVE (B2)
1033	SHIELD DRAIN
1040	115 VAC TO MIKRON DOOR INTERLOCK SWITCH (OR HORIZONTAL PART READY LAMP (Vert))
1041	LEG 1
1042	LEG 2
1043	SHIELD DRAIN
1050	DOOR SWITCH WIRING THRU SUPPORT ARM
1051	DOOR OPEN SIGNAL (INPUT 9)
1052	DOOR OPEN RETURN (D GROUND) (65)
1053	SHIELD DRAIN

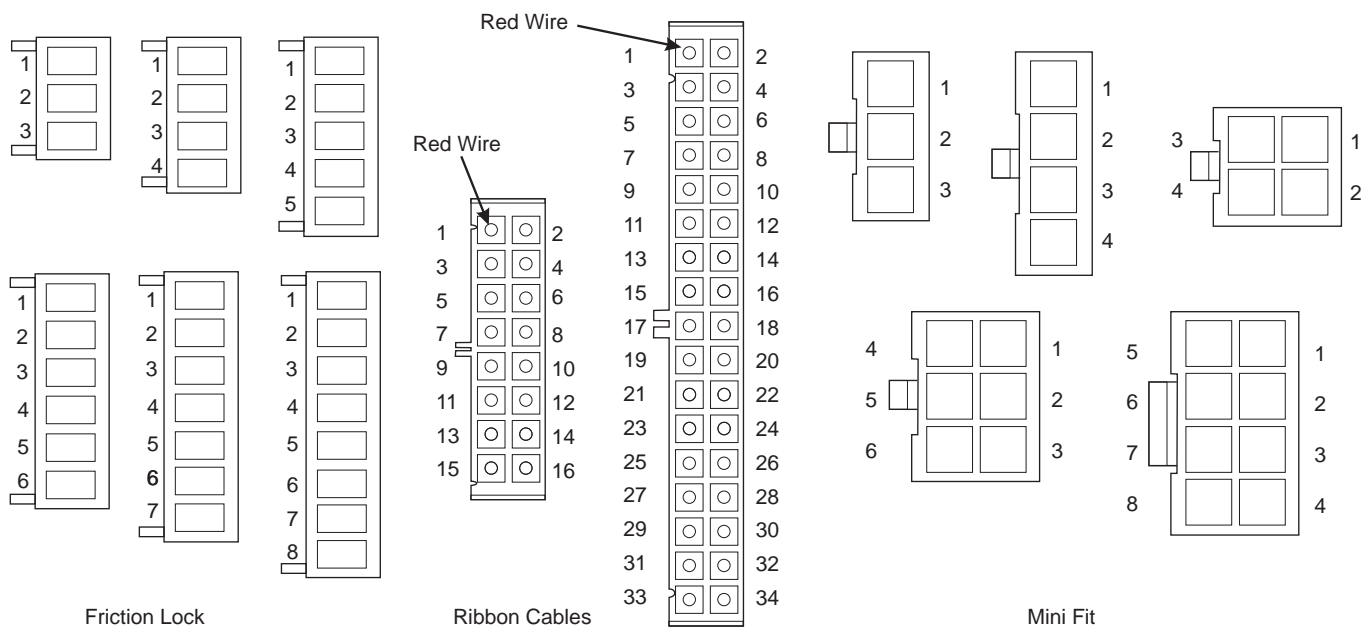


1060	GROUND FAULT DETECTION SENSE INPUT
1061	+ INPUT FROM SENSE RESISTOR
1062	- INPUT FROM SENSE RESISTOR
1063	SHIELD DRAIN
1070	SKIP INPUT FROM SENSOR (Vert & Lathe) PROBE INPUT OPTION (Horiz)
1071	LOGIC COMMON (Vert & Lathe) PROBE SIGNAL (Horiz)
1072	SKIP SIGNAL (Vert & Lathe) LOGIC COMMON (Horiz)
1073	SHIELD DRAIN
1070A	PROBE OUTPUT (MCD RELAY BOARD M22) (OPTION) (Horiz)
1071A	UNSWITCHED LEG 1
1072A	SWITCHED LEG 2
1073A	SHIELD DRAIN

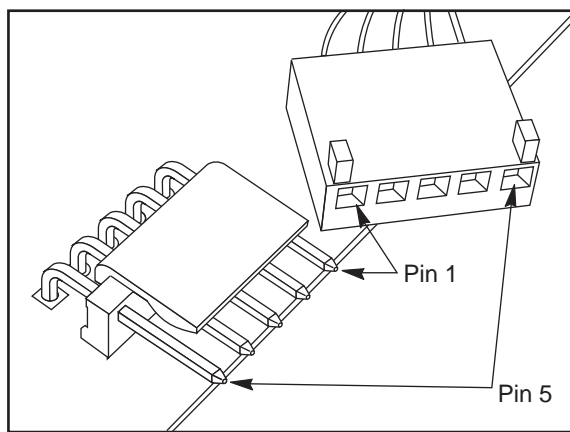


PCBs, CABLE LOCATIONS, AND DIAGRAMS

Shown below are three types of commonly used cable connectors. **They are shown as seen when plugged into the pc board.** These diagrams are to aid in locating the pins for troubleshooting.



NOTE: The numbering sequence is the same regardless of the number of pins.



Connection Example

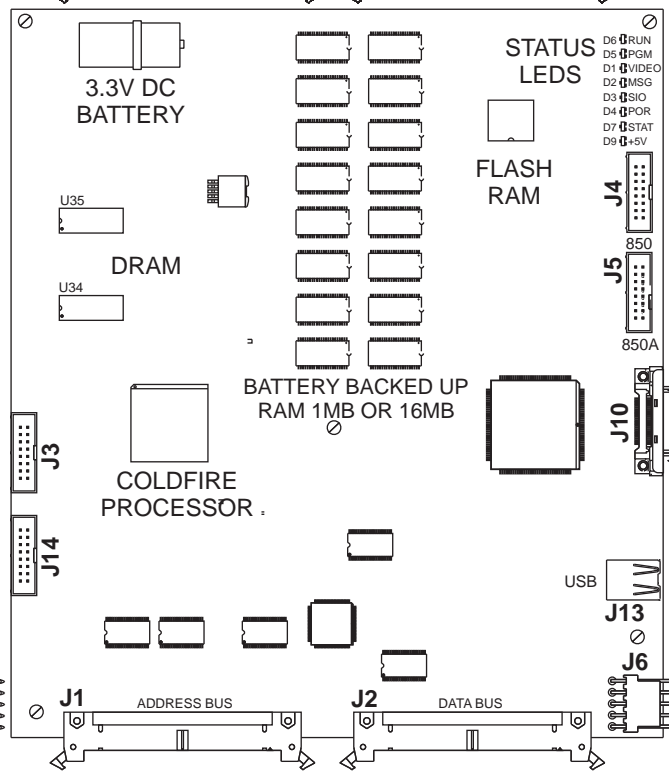
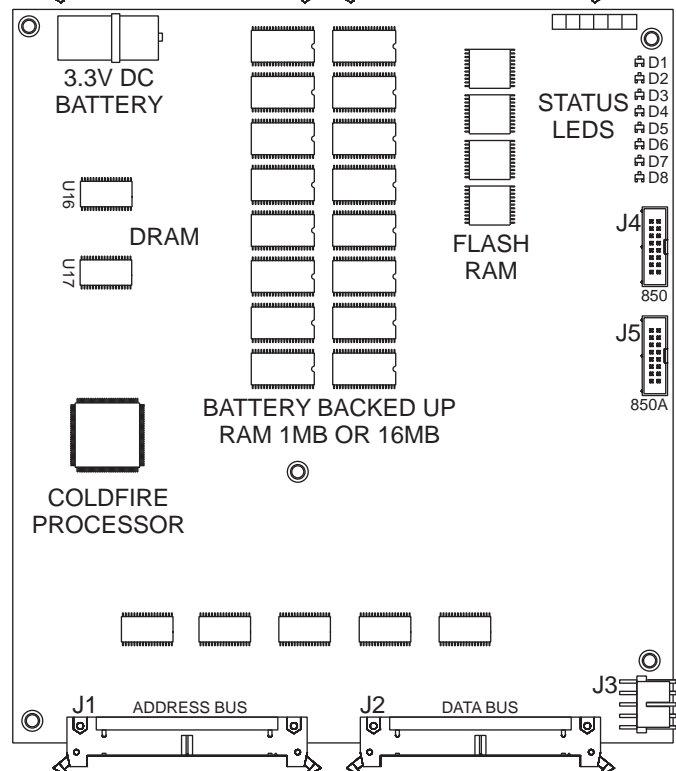
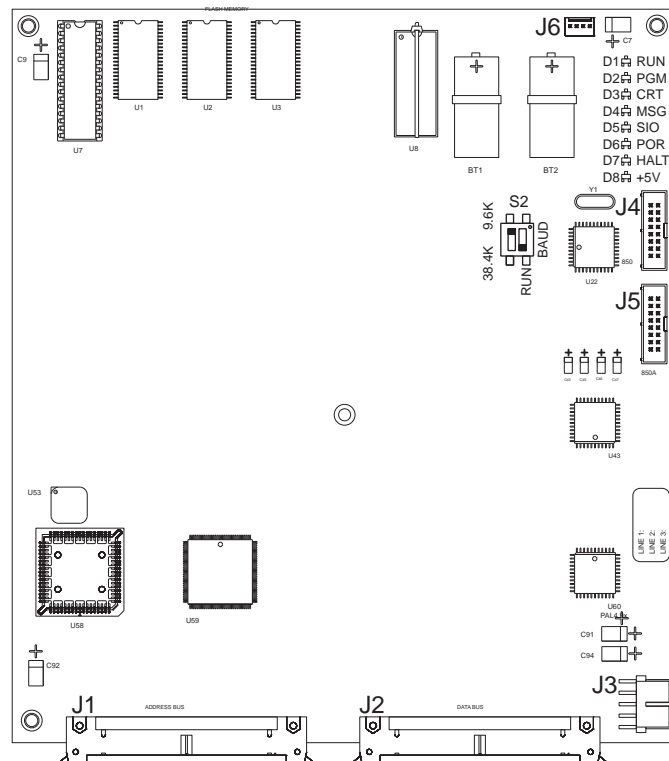
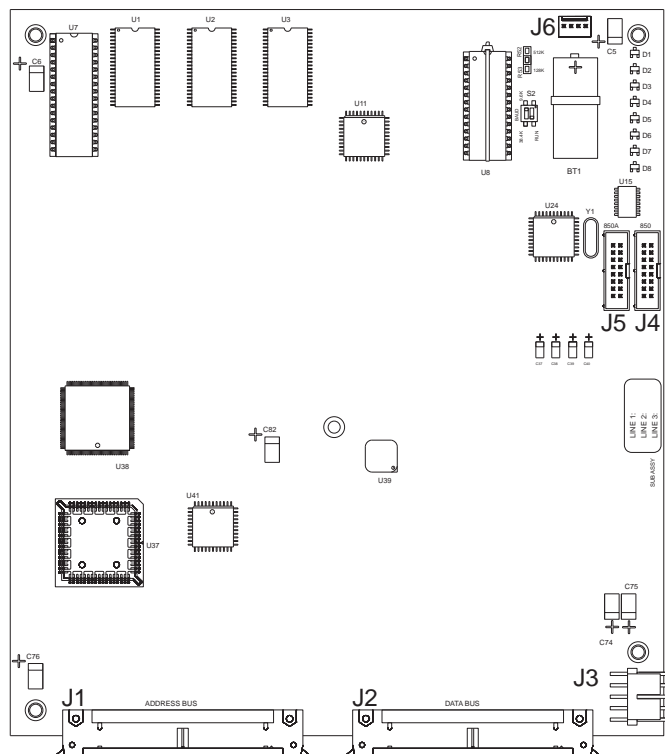


MICROPROCESSOR PCB

Plug numbers and descriptions are on the next page

1MB

16MB



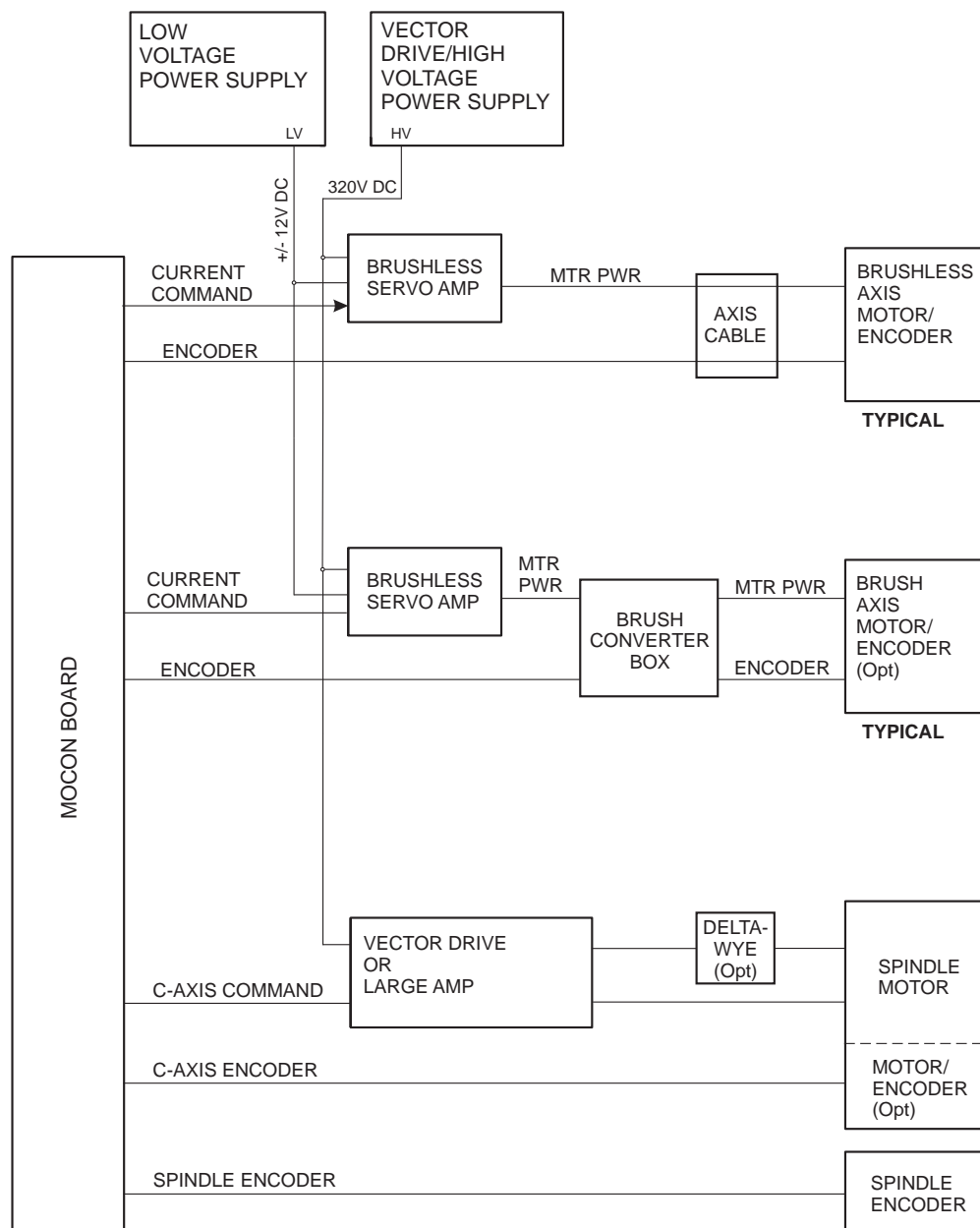
Coldfire

Coldfire 2 (CF2)



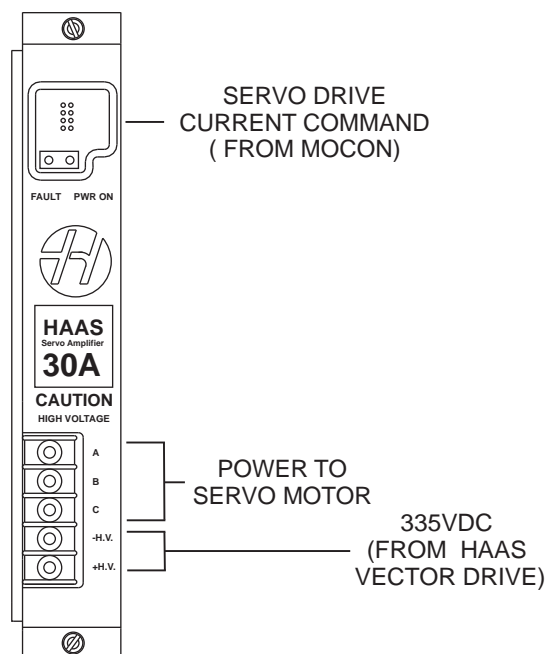
PLUG #	CABLE #	SIGNAL NAME	⇒ TO ⇒	LOCATION	PLUG #
J1 ADDRESS		ADDRESS BUSS		MOCON-MOTIF	—
J2 DATA		DATA BUSS		MOCON-MOTIF	—
J3 (CF2)		SERIAL DATA			
J3, J6 (CF2)	860	LOW VOLTAGE		<FROM>PSUP PCB	—
J4	850	KEYBOARD DATA		KEYBOARD INT.	—
J5 PORT 2	850A	SERIAL PORT #2 AUX PORT		AUX SERIAL PORT	—
J6		AUX BATTERY INPUT			
J10		VIDEO SIGNAL		LCD	
J13		USB DATA			
J14		NOT USED			

SERVO SYSTEM BLOCK DIAGRAM





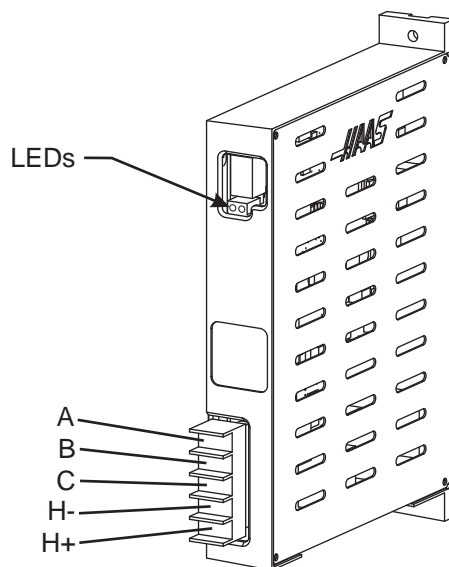
BRUSHLESS SERVO AMPLIFIER (P/N 32-5550F)



PLUG #	CABLE #	SIGNAL NAME	⇒ TO ⇒	LOCATION	PLUG #
X AXIS AMP					
TB A, B, C	—	MOTOR DRIVE		X SERVO MOTOR	—
SERVO PLUG	610	X DRIVE SIGNAL		MOCON PCB	P2
TB -HV +HV	—	335VDC		SPINDLE DRIVE	—
Y AXIS AMP					
TB A, B, C	—	MOTOR DRIVE		Y SERVO MOTOR	—
SERVO PLUG	620	Y DRIVE SIGNAL		MOCON PCB	P3
TB -HV +HV	—	335VDC		SPINDLE DRIVE	—
Z AXIS AMP					
TB A, B, C	—	MOTOR DRIVE		Z SERVO MOTOR	—
SERVO PLUG	630	Z DRIVE SIGNAL		MOCON PCB	P4
TB -HV +HV	—	335VDC		SPINDLE DRIVE	—
A AXIS AMP					
TB A, B, C	—	MOTOR DRIVE		A SERVO MOTOR	—
SERVO PLUG	640	A DRIVE SIGNAL		MOCON PCB	P5
TB -HV +HV	—	335VDC		SPINDLE DRIVE	—



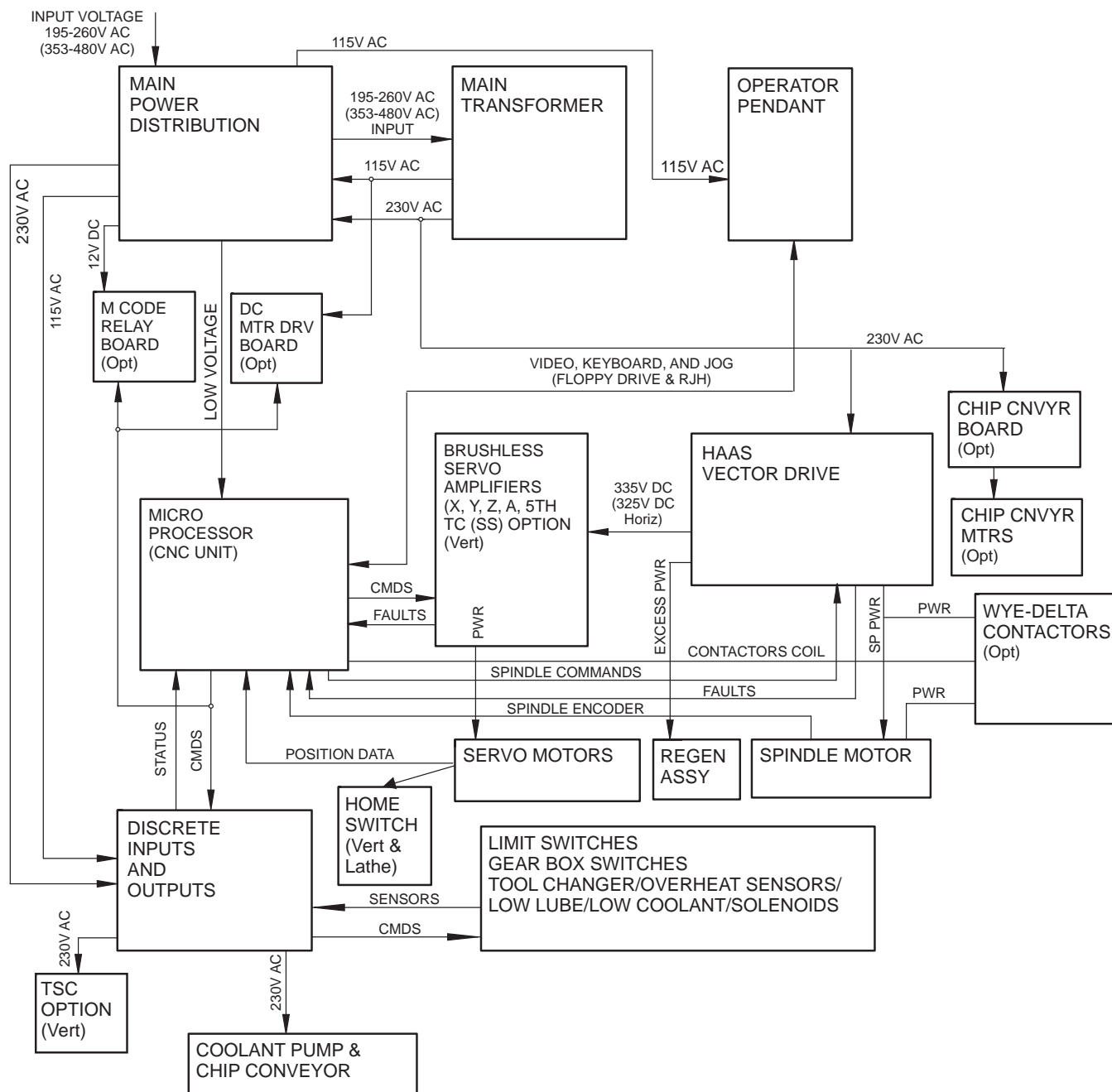
SMART AMPLIFIER (P/N 93-5550J (30A) 93-3551J (45A))



PLUG #	CABLE #	SIGNAL NAME	⇒ TO ⇒	LOCATION	PLUG #
X AXIS AMP					
TB A, B, C	—	MOTOR DRIVE		X SERVO MOTOR	—
SERVO PLUG	610	X DRIVE SIGNAL		MOCON PCB	P2
TB -HV +HV	—	335VDC		SPINDLE DRIVE	—
Y AXIS AMP					
TB A, B, C	—	MOTOR DRIVE		Y SERVO MOTOR	—
SERVO PLUG	620	Y DRIVE SIGNAL		MOCON PCB	P3
TB -HV +HV	—	335VDC		SPINDLE DRIVE	—
Z AXIS AMP					
TB A, B, C	—	MOTOR DRIVE		Z SERVO MOTOR	—
SERVO PLUG	630	Z DRIVE SIGNAL		MOCON PCB	P4
TB -HV +HV	—	335VDC		SPINDLE DRIVE	—
A AXIS AMP					
TB A, B, C	—	MOTOR DRIVE		A SERVO MOTOR	—
SERVO PLUG	640	A DRIVE SIGNAL		MOCON PCB	P5
TB -HV +HV	—	335VDC		SPINDLE DRIVE	—

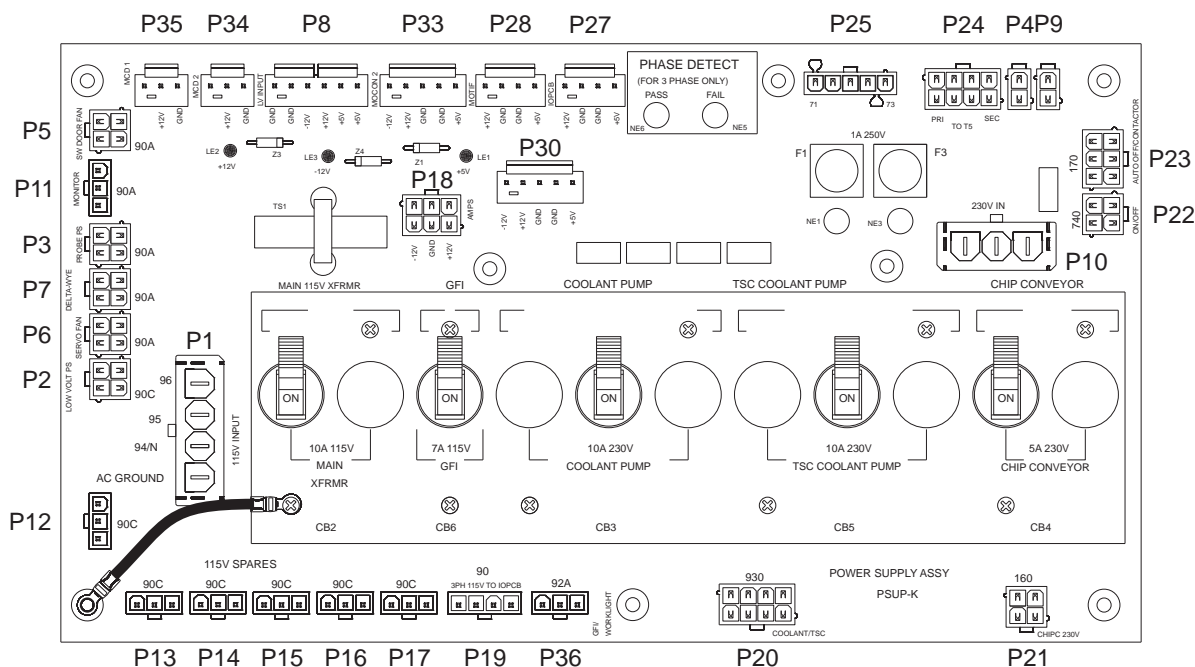


SYSTEM BLOCK DIAGRAM - HIGH/LOW VOLTAGE





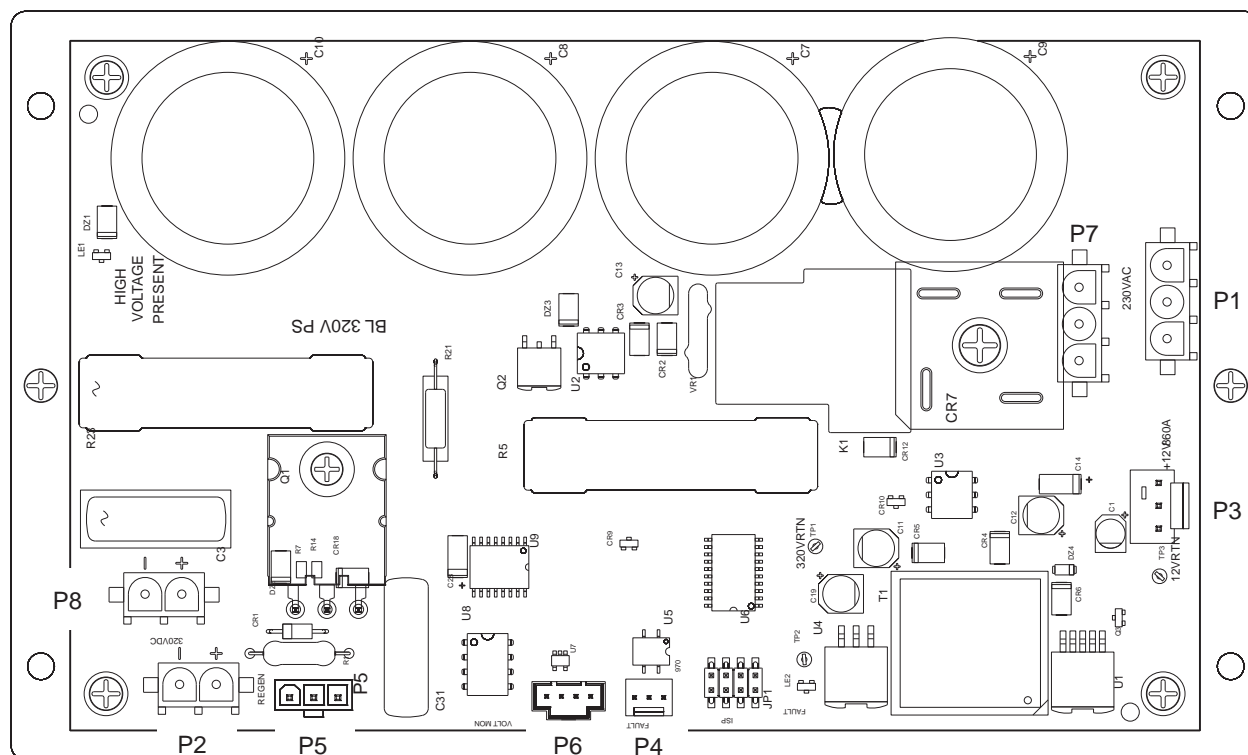
POWER PCB VERSION K/L



PLUG #	CABLE #	SIGNAL NAME	⇒ TO ⇒	LOCATION	PLUG#
P1	94-96	3-PHASE		Transformer	
P2	90C	115VAC		LVPS	
P3	90A	115VAC		Spare	
P4	Jumper			Jumper	
P5	90B	115VAC		Switch Door Fan	
P6	90A	115VAC		Servo Fan	
P7	90A	115VAC		Delta-Wye	
P8	Jumper	+12/-12/+5 VDC In		From LVPS	
P9	Jumper			Jumper	
P10	77/79	230VAC 3/PHASE		Transformer	
P11	90A	115VAC		Front Pnl P.S. (spare)	
P12	90C	115VAC		spare	
P13	90C	115VAC		spare	
P14	90C	115VAC		spare	
P15	90C	115VAC		spare	
P16	90C	115VAC		spare	
P17	90C	115VAC		spare	
P18	860	115VAC		Amplifiers	
P19	90	3PH 115VAC		I/O PCB	P56
P20	930	230V CLNT PUMP/TSC		I/O PCB	P44
P21	160	Chip Conv. 230V 3PH		I/O PCB	P39
P23	170	Auto Off/Contactor		Contactor K1/ I/O PCB	P42
P22	740	On/Off		Front Panel (SKBIF)	J20
P24	T5	Main Cont Frmr		To T5	
P25	71, 72, 73	230VAC IN		From Contactor K1	
P27	860	+12/+5 VDC		I/O PCB	P60
P28	860	+12/+5 VDC		Motif PCB	P15
P30	860	+12/-12/+5 VDC		spare	
P33	860	+12/-12/+5 VDC		Mocon 2 PCB	P15
P34	860A	+12 VDC		SMTc PCB	P2
P35	860	+12 VDC		MCD Relay PCB	P2
P36	92A			Worklight	



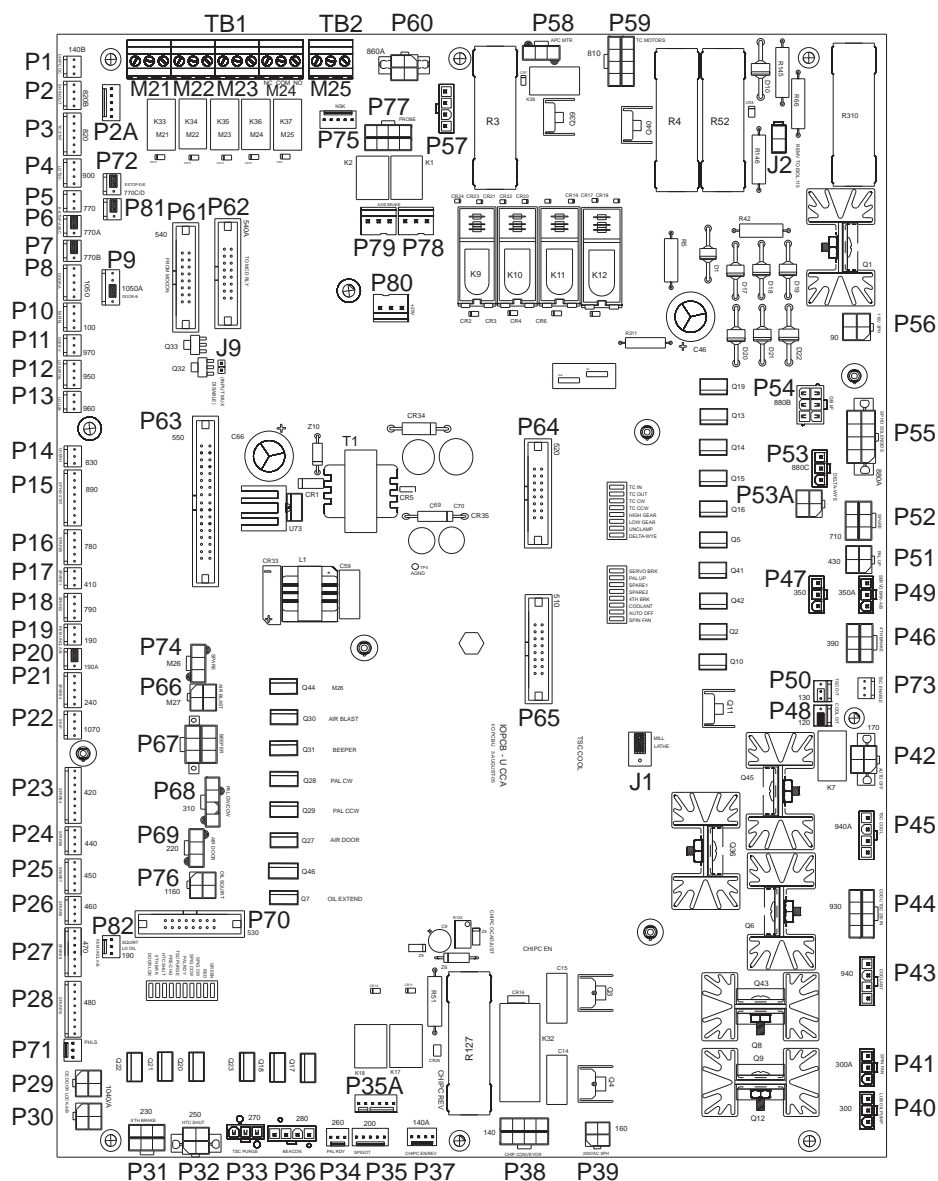
OFFICE MILL POWER SUPPLY



PLUG #	CABLE #	LOCATION	PLUG#
P1	32-5827A	Office machine main transformer LV 1PH	Main transformer
P2		N/A	
P3	33-0982	Cable 860A +5/+12 GND I/O PCB	I/O PCB P60
P4	33-4150	Cable 970 Vector Drive Over Volt	I/O PCB P11
P5	32-7044	40 Ohm Regen Resister	
P6	33-9861	Cable Volt Monitor	MOCON P17
P7	33-0167A	Cable 230V in to BL320VP	PSUP (34-4075K) P10
P8	33-0492	Cable 320VDC to amp	320VDC AMP TB



I/O PCB VERSION W, Z, AA



PLUG #	CABLE #	TO	LOCATION	PLUG #
P1	140B		Chip Conveyor Ckt Bd (32-3072)	P3
P2	820B		TC in/SMTC Pkt down	
P2 (Lathe)	820		TT Unlock/Lock	
P2A	820B		Shuttle In/Out	
P3	820		TC out/SMTC pkt up/Tool #1/TC mark	
P3 (Lathe)	820		C-axis Engage/Disengage	
P4	900		Low TSC press	
P4 (Lathe)	900		Spare	
P5	770		E-Stop Sw A	
P6	770A		E-Stop Sw B	
P7	770B		E-Stop Sw C	
P8	1050		Door Open A	
P9	1050A		Door Open B	



PLUG #	CABLE #	⇒ TO ⇒	LOCATION	PLUG #
P10	100		M-Fin	
P11	970		VD Over Volt	VD J1
P12	950		Low Air/Low Oil/VB low chill pressure	
P12 (Lathe)	950		Low Air/Hyd. pressure	
P13	960		Low Lube	
P14	830		Regen Overheat	
P15	890		SPDB Open/Closed	
P15 (Lathe)	890		Spare/Gearbox	
P16	780		2nd VD OV/contactor On/counterbalance	
P16 (Lathe)	780		Spare	
P17	410		APC Door Open , VB Clamshell	
P17 (Lathe)	410		TS Foot Sw/Sub Spndl Chuck Foot Switch	
P18	790		APC Pin Clear - door open/closed	
P18 (Lathe)	790		Probe Home	
P19	190		Remote Unclamp Sw	
P19 (Lathe)	190		Chuck Unclamp Foot Sw	
P20	190A		Remote Unclamp B	
P20 (Lathe)	190A		Not Used	
P21	240		Spare 3, APC Pallet Home / Grnd fault/ pal up,dwn	
P21 (Lathe)	240		BF Load Bar/Q/RPL	
P22	1070		Skip	M22
P23	420		Spare 4, APC #2 pin clr / pal home	
P23 (Lathe)	420		Spare (VTC: Pocket up/down/tool one/TC Mark)	
P24	440		Spare 6, Auto Door Open / Spare	
P24 (Lathe)	440		Auto Door Open	
P25	450		Spare 7, APC #2 door open	
P25 (Lathe)	450		Steady Rest Foot Switch	
P26	460		Spare 8, APC #2 door closed	
P26 (Lathe)	460		Apl Rotator Mark, Home (VTC: Low Way/SS Lube)	
P27	470		Spare 9, SMTC mtr stop / SMTC origin/ /smtc cl uncl	
P27 (Lathe)	470		Spare (VTC: Motor Stop/Origin/Cl/Uncl)	
P28	480		Spare 10, APC door closed/Open / APC pal clamped	
P28 (Lathe)	480		Spare 10 (VTC: Rem Uncl/SS DB Open/Closed)	
P29	1040A		CE Door LK	
P29 (Lathe)	1040A		Not Used	
P30	1040		CE Door LK	
P31	230		5th Axis Brake	
P31 (Lathe)	230		T/S Fwd	
P32	250		HTC shut, APC Door open, VR Shut In	
P32 (Lathe)	250		T/S Rev	
P33	260		TSC Purge	
P33 (Lathe)	260		T/S Rapid (VTC: Purge)	
P34	270		APC Pal Ready Lt	
P34 (Lathe)	270		Spare (12V Output)	
P35 (35A)	200		Spigot CW/CCW	
P35 (Lathe)	200		Spare (VTC: Spigot CW/CCW)	
P36	280		Spindle Lube	
P36A	280		Worklight	

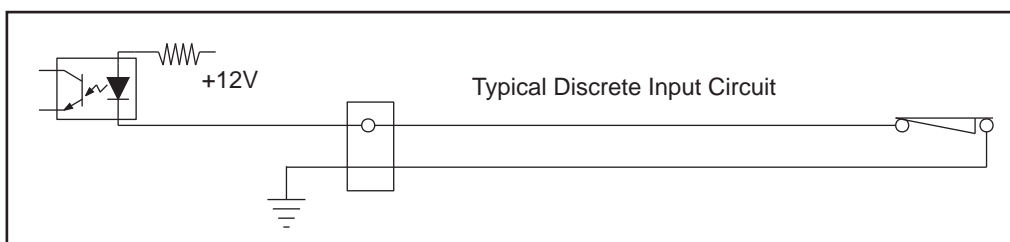


PLUG #	CABLE #	⇒ TO ⇒	LOCATION	PLUG #
P37	140A		Chip Conv Enable	
P37 (Lathe)	140A		Not Used	
P38	140		Chip Conveyor	
P39	160		230V Coolant, Chip Conv Power	PSUP P21
P39 (Lathe)	160		250V for Chip Conv.	
P40	300		250V Oil Pump/Luber	
P40 (Lathe)	300		SP Fan/Oil Pump/Luber	
P41	300A		SP Fan/Oil Pump	
P41 (Lathe)	300A		Gear Box Oil Pump	
P42	170		Auto Off	PSUP P23
P43	940		Coolant Output	
P44	930		250V TSC/Cool Input Power	PSUP P20
P44 (Lathe)	930		230V for Coolant	
P45	940A		TSC Coolant	TSC Cool. Out.
P45 (Lathe)	940A		hp Coolant	PSUP P20
P46	390		4th Axis Brake	
P46 (Lathe)	390		Spin Brake (Live Tooling Hyd Brake)	
P47	350		Servo Brake	Trans P6
P47 (Lathe)	350		Hyd Pump En	
P48	120		Coolant Over Temp	
P48 (Lathe)	120		Not Used (Jumper)	
P49	350A		Servo Brake, Hyd En	Trans P4
P49 (Lathe)	350A		Brake Release	
P50	130		TSC Over Temp	
P50 (Lathe)	130		Not Used (Jumper)	
P51	430		Pallet up	
P51 (Lathe)	430		APL Light/BF Extend Push	
P52	710		Spare, APC #1 pal ready #1,2	
P52 (Lathe)	710		APL Gripper Grip 1, Grip 2	
P53 (P53A)	880C (880D)		Wye-Delta Switch	
P54	880B		Gearbox, High/Low Gear	
P55	880A		Tool unclamp precharge (spindle head solenoids)	
P55 (Lathe)	880A		Chuck Unclamp/TT Out/MLB Fast Push	
P56	90		115V 3ph power	PSUP P19
P57	Haas P/N 33-0815B		TC Jumper or SMTc brake resistor	
P57 (Lathe)			External TC Motor Resistor (Jumper)	
P58	810A		T.C. in/smtc ATC fwd / APC chn drv en/rev	
P58 (Lathe)	810A		Spare	
P59	810		T.C. CW/ SMTc CRSL CW	
P59 (Lathe)	810		Auto Dr, BF Id Bar/Q, APL Rtr (VTC: Car CW/CCW)	
P60	860A		+5/+12V Logic Pwr (LVPS) (I/O PCB)	PSUP P27
P61	540		Outputs Cable 24-55 (I/O PCB)	MOCON P14
P62	540A		To 2nd M-code PCB	MCD Relay P1
P63	550		Inputs Cable	MOCON P10
P64	520		Outputs Cable 8-15	MOCON P12
P65	510		Outputs Cable 0-7	MOCON P11
P66	1100 (M27)		Air Blast	
P67	1110 (M28)		Beeper	
P67 (Lathe)	M28		Sub Spin Chuck Sol	



PLUG #	CABLE #	⇒ TO ⇒	LOCATION	PLUG #
P68	310		Pallet CW/CCW, Auto Door open	
P68 (Lathe)	310		APC Door open	
P69	220		Air Door, Pckt Up/Down, VR Shtle Out, VB Clamshell	
P69 (Lathe)	220		C-axis Engage	
P70	530		Outputs Cable 16-23	MOCON P13
P71	500		N/A	
P72	770C		E Stop D/E	
P73	Haas P/N 33-1966		TSC Enable	
P74	M26		Spare	
P75	710A		NSK Spindle	
P76	1160		Oil Squirt (MOM)	
P77	1070		Probe	
P78	350A		Axis Brake	
P79	350A		Axis Brake	
P80			N/A	
P81	770C		E-Stop	
P82	1130		Oil Squirt (MOM) Low Oil	
P83			From GFI for Worklight	
TB1	TB 12 x 200 (M21-24)		M-Code Outputs (Probe, M-Fin, User Spare)	
TB2	TB 3 x 200 (M25)		M-Code Outputs	
TB2 (Lathe)	TB 3 x 200 (M25)		User Spare	

DISCRETE OUTPUTS



(C) = Switch Normally Closed; (O) = Switch Normally Open

MACRO	CABLE	HORIZONTAL	VERTICAL	LATHE
1000	820 P2/3	TC In SMTc Arm Mark EC-400 (O) SMTc Pkt Dwn	(C) TC In (O) SMTc Pkt Dwn	(C) TT Unlock TL TC Home
1001	820 P2/3	TC Out SMTc Shuttle Out EC-400 (O) SMTc Pkt Up	(C) TC Out (O) SMTc Pkt Up	(C) TT Lock TL TC Mark
1002	820 P3	PC DB Down EC-400 (O) SMTc Tool #1	(C) Tool #1 (O) SMTc Tool #1	*C-axis Disengage
1003	900 P4	Lo TSC Press EC-400 Lo TSC Press	Lo TSC Press	Spare
1004	820 P3	PC Collet Down EC-400 SMTc TC Mark	(C) TC Mark (C) SMTc TC Mark	*C-axis Engage
1005	890 P15	(O) High Gear	(O) High Gear	High Gear
1006	890 P15	(C) Low Gear	(C) Low Gear	Low Gear



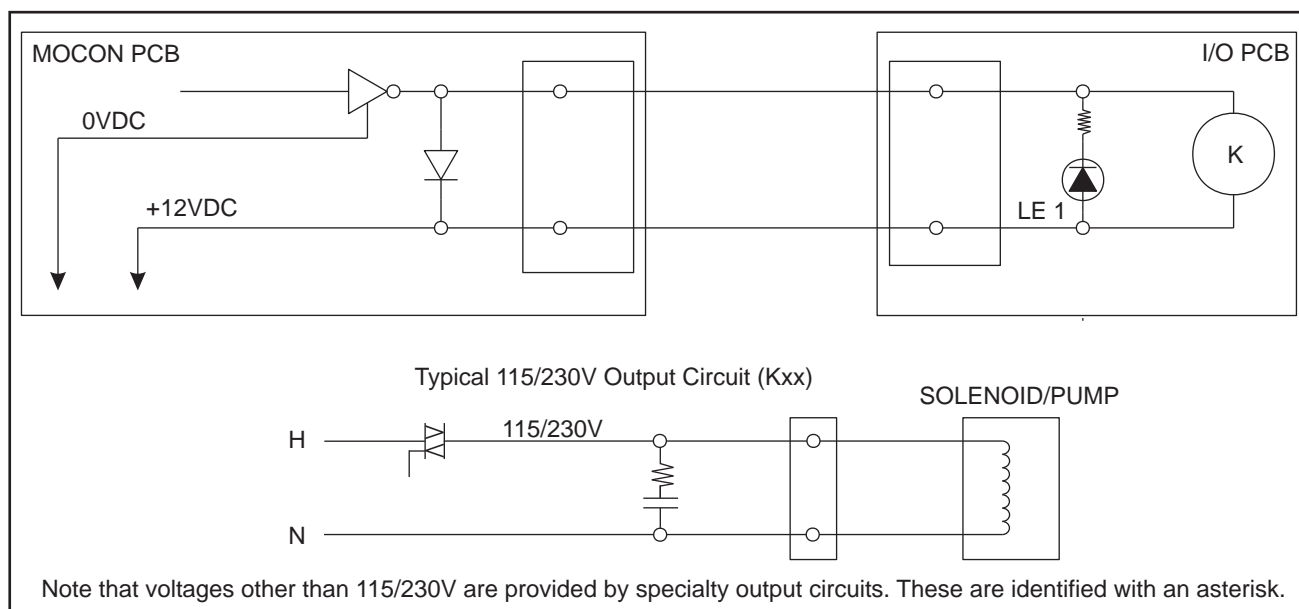
MACRO	CABLE	HORIZONTAL	VERTICAL	LATHE
1007	770 P5/6/7	E-Stop	E-Stop	E-Stop
1008	1050 P8/9	(O) Door Open	(O) Door Open	Door Open
1009	100 P10	M-FIN	M-FIN GR Plasma Confirm	M-FIN
1010	970 P11	Over Volt	Over Volt	Over Volt (not used)
1011	950 P12	Low Air	Low Air	Low Air
1012	960 P13	Low Way Lube	Low Way Lube	Low Way Lube
1013	830 P14	Overheat	Overheat	Overheat
1014	890 P15	(C) SP DB Open	(C) SP DB Open	Gearbox Low Oil
1015	890 P15	(C) SP DB Closed	(C) SP DB Closed	Spare
1016	890 P15	Spare EC-400 3rd DB Pos Sw	3rd DB Pos Sw	Spare
1017	780 P16	2nd VD OV	2nd VD OV	Spare
1018	780 P16	Contactor On	Contactor On	Spare
1019	780 P16	Cntr Balance	Cntr Balance	Spare
1020	950 P12	Gearbox Low Oil	Gearbox Low Oil	Low Hydraulic
1021	410 P17	Air Door Sw EC-400 TC Door Open Old EC-300 Tool Door Open	GR Air Curtain APC CE Door Open	(O) *TS Foot Sw (O) *Sub Spin Chck Ftsw
1022	790 P18	PC Pallet CW EC-400 PP Pallet Lift	(C) APC Pin Clr #1 (O) MD Op Door Open	(O) *Probe Home
1023	790 P18	PC Pallet CCW EC-400 PP Pallet Lower	(C) APC Pin Clr #2 (O) MD Op Door Closed	
1024	190 P19/20	PC Op Station Locked/ Frnt Door BF End of Bar	Rem Uncl	(O) Chuck Uncl Foot Sw
1025	500 P71	LO Phase/Low Grease	LO Phase/Low Grease	LO Phase/Low Grease
1026	240 P21	PC Pallet Up BF Load Bar	(C) APC Pal #2 Home (C) Old MD Pal Up (C) New MD Pal Unclamp	(C) BF Load Bar
1027	240 P21	PC Pallet Down BF Load Q EC-1600 Clamp Press	(C) APC Pal #1 Home (C) Old MD Pal Down	BF Load Q
1028		Grnd Fault	Grnd Fault	Grnd Fault
1029	1070 P22/77	Skip	Skip	Skip
1030	200 P35	Possible P-Cool EC-400 Spigot	Spigot	(C) BF End of Bar
1031	140B P1	Chip Conveyor	Chip Conveyor	Chip Conveyor
1032	420 P23	Mori Notch Pin In/ SMTC Arm In EC-400 Pallet Clamped	(C) APC #2 Pin Clr #1	Pocket Down



MACRO	CABLE	HORIZONTAL	VERTICAL	LATHE
1033	420 P23	Mori Man Tool Rls In/ SMTC Arm Out EC-400 Pallet Unclamped	(C) APC #2 Pin Clr #2	Pocket Up
1034	420 P23	Mori Tool 1/SMTC Arm CCW EC-400 Pallet Clamp Error	(C) APC #2 Pal #2 Home	Tool One
1035	420 P23	Mori TC Mark/SMTC Arm CW	(C) APC #2 Pal #1 Home	TC Mark
1036	440 P24	Mori Arm In/SMTC Cage Door Open EC-400 SMTC Cage Door Open	(O) Auto Door Open	(O) Auto Door Open
1037	440 P24	Mori Arm Out		APL Load Station Door Open
1038	450 P25	Mori Arm CCW	APC #2 CE Door Open	*Steady Rest Ftsw
1039	450 P25	Mori Arm CW		Spare for Foot Sw
1040	460 P26	Mori Slide 1/2 Way	APC #2 Door Closed	(O) APL Rotator Mark
1041	460 P26	Mori Slide Left	APC #2 Door Open	(O) APL Rotator Home
1042	470 P27	Mori Swing Spin/SMTC Shuttle Mark EC-400 SMTC Motor Stop	SMTC Motor Stop	Motor Stop
1043	470 P27	Mori Swing Mag/SMTC Slide at Chain EC-400 SMTC Origin	SMTC Origin	Origin
1044	470 P27	Mori Cage Door Open/ SMTC Slide at Standby EC-400 SMTC Cl/Uncl	SMTC Cl/Uncl	Cl/Uncl
1045	470 P27	Mori Slide Right/SMTC Slide at Spindle EC-400 Tool Transer		
1046	480 P28	EC-400 8-pos TC Unlock	APC Door Closed	APL Door Closed
1047	480 P28	EC-400 8-pos TC Lock	APC Door Open	APL Door Open
1048	480 P28	EC-400 8-pos TC Mark	APC Pal Clamped	SS DB Open
1049	480 P28	EC-400 8-pos TC Home	APC Pal In Position	SS DB Closed
1050	1130 P82	EC-400 Oil Squirt Low Oil	Oil Squirt Low Oil	Oil Squirt Low Oil



DISCRETE OUTPUTS



MACRO RELAY	CABLE	HORIZONTAL	VERTICAL	LATHE (SL)	VOLTAGE	
1100	K1	350 P47/49	Servo Pwr/Brk (EC) Servo Brake (HS)	Servo Pwr/Brk	Hyd Pump En	115V
1101	K2	430 P51/75	TC Door Open (EC) PC Pallet Up (HS)	APC Pal Clamp Old MD Pal Up New MD Pal Unclamp GR Air Curtain NSK Spin Fwd	APL Light BF Extd Push	115V
1102	K3	710 P52/75	PC Pallet Up (EC) P-Cool (HS) BF Collet Open (HS)	APC#1 Pallet Ready 1 NSK Spin Rev	APL Grip 1	115V
1103	K4	710 P52	PC Pallet Down (EC) BF Collet Close (HS)	APC#1 Pallet Ready 2 Robot Fix Uncl	APL Grip 2	115V
1104	K5	390 P46	4th Axis Platter Up (EC) 4th Axis Brake (HS)	4th Axis Brake	Spin Brk	115V
1105	K6	940 P43	Coolant	Coolant	Coolant	230V
1106	K7	170 P42	Auto Off	Auto Off	Auto Off	24VAC*
1107	K8	300 P40/41	Sp Fan Oil pump Luber	Sp Fan Oil pump Luber	Sp Fan Oil pump Luber	115V
1108	K9	810 P58/59	SMTC ATC Fwd (EC) Tool Xfer Fwd (EC) PC Main DB Fwd (HS) BF Load Q (HS)	TC In SMTC ATC Fwd APC Chn Drv Fwd	APL Rotator CW BF load Q 8-pos TC Rotate	170VDC* paired w/ K10
1109	K10	810 P58/59	SMTC ATC Rev (EC) Tool Xfer Rev (EC) PC Main DB Rev (HS) BF Load Bar (HS)	TC Out SMTC ATC Rev APC Chn Drv Rev	APL Rotator CCW BF Load Bar 8-pos TC Rotate	170VDC* paired w/ K9

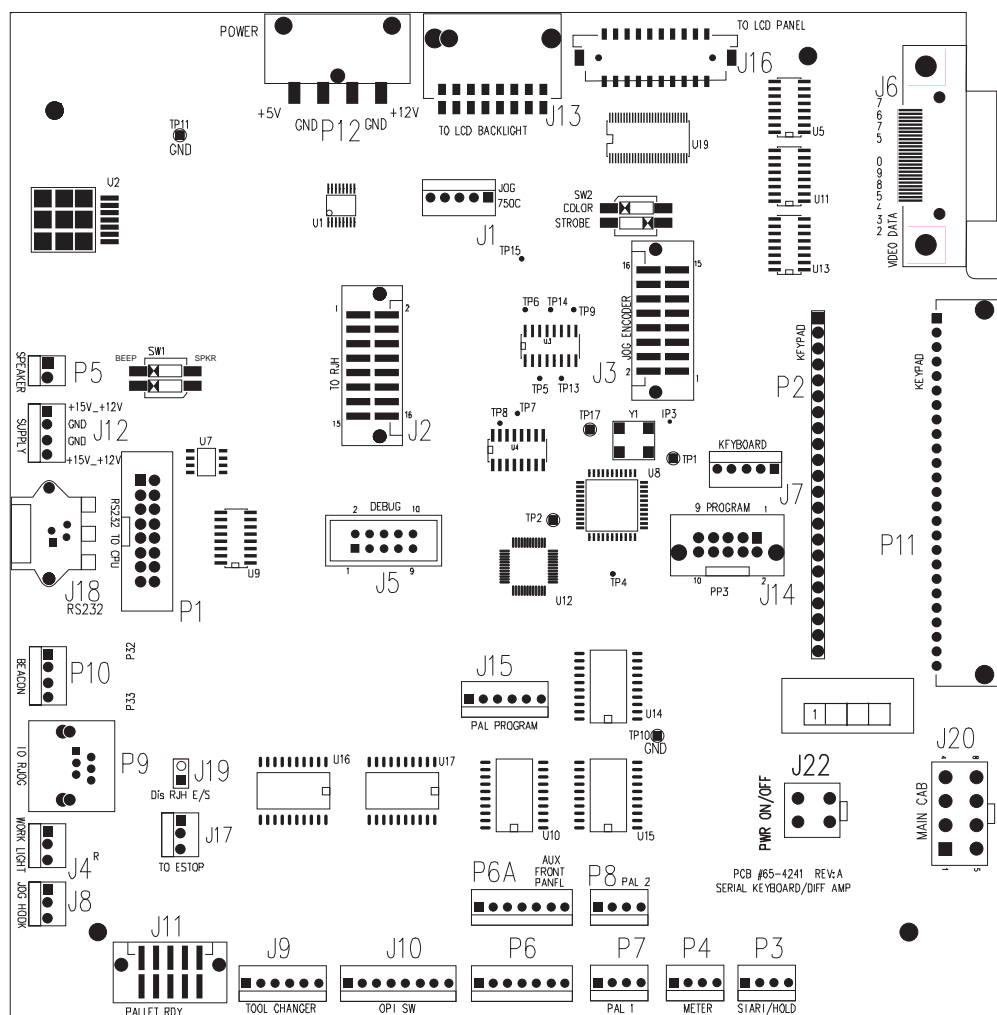


MACRO	RELAY	CABLE	HORIZONTAL	VERTICAL	LATHE (SL)	VOLTAGE
1110	K11	810 P59	SMTC Crsl CW (EC) TC In (HS)	TC CW SMTC Crsl CW	Auto Door Mtr Open	170VDC* paired w/ K12
1111	K12	810 P59	SMTC Crsl CCW (EC) TC Out (HS)	TC CCW SMTC Crsl CCW	Auto Door Mtr Close	170VDC* paired w/ K11
1112	K13	880A P54/55	High Gear (EC) 4 High Gear (HS)	High Gear	High Gear	115V
1113	K14	880A P54/55	Low Gear (EC) 4 Low Gear (HS)	Low Gear	Low Gear	115V
1114	K15	880A P55	Tool Unclamp	Tool Unclamp	Chuck Unclamp	115V
1115	K16	880A P53 P53A/P55	Delta-Wye Switch	Delta-Wye Switch Laser Hi Press Assist	Delta-Wye Switch	115V
1116	K17	200 P35	Spigot CW (EC) P-Cool (HS)	Spigot CW	TL TC CW	+12VDC*
1117	K18	200 P35	Spigot CCW (EC) P-Cool (HS)	Spigot CCW	TL TC CCW	+12VDC*
1118	K19	260 P34	Pallet Ready Light	APC Pal Ready		+12VDC*
1119	K20	270 P33	TSC Purge	TSC Purge	T/S rapid OM live tool #2	115V
1120	K21	880A P55	Precharge	Precharge Laser Low Press Assist	TT Out TL TC up	115V
1121	K22	250 P32	PP Pallet Lift (EC) HTC Shuttle (HS) Mori Manual Tool Rls (HS)	VR Shut In APC Door Open Old MD Niagra Clnt On	T/S Rev OM live tool #3	115V
1122	K23	230 P31	5th Axis Brake	5th Axis Brake	T/S Fwd OM live tool #1	115V
1123	K24	1040 P29/30	Door Interlock	CE Door Lock	CE Door Lock	115V
1124	K25	310 P68	PC Pallet Clamp (EC) PC Pallet CW (HS)	APC#2 Door Open	Auto Door Clutch	115V
1125	K26	310 P68	PC Air Blast Proto Flood Coolant PC Pallet CCW (HS)	DES Vac Enable GR Plasma Head Down	Parts Catcher	115V
1126	K27	220 P69	SMTC Pkt U/D Sol (EC) Air Door (HS)	VR shut out VB clamshell SMTC Pkt U/D Sol Laser Vac Enable	C-Axis Engage	115V
1127	K28	940A P45	TSC Clnt	TSC Clnt	P73 HP coolant	230V
1128	K29	280 P36	Spindle Lube	Spindle Lube	Spindle Lube	115V
1129	K30	280 P36	Worklight	Worklight	Worklight	115V
1130	K31	140 P37/38	ChipC En	ChipC En	ChipC En	230V* paired w/ K32



MACRO	RELAY	CABLE	HORIZONTAL	VERTICAL	LATHE (SL)	VOLTAGE
1131	K32	140 P37/38	ChipC Rev	ChipC Rev	ChipC Rev	230V* paired w/ K31
1132	K33	M21 TB1	M-Fin Shower Coolant (EC) Mori Notch Pin Out (HS)	M-Fin GR Plasma Start HIT Index	M-Fin	Relay Contact*
1133	K34	M22 TB1/P77	Probe	Probe Laser Aim Beam On	Probe	Relay Contact*
1134	K35	M23 TB1/P77	Probe (EC) Mori Mag CW (HS)	Laser Shut Open Spin Probe Enable`	Spin Probe Enable	Relay Contact*
1135	K36	M24 TB1	Flood Coolant (EC) Mori Mag CCW (HS)	HIT Go Home	Probe Arm Up	Relay Contact*
1136	K37	M25 TB2/P76	Oil Squirter (MOM)	Oil Squirter (MOM)	Probe Arm Down Oil Squirter (MOM)	Relay Contact*
1137	K38	810A P58/74	PC Main DB En (HS)	APC Chn Drv Pwr En	8-pos TC Rotate	160VDC*
1138	K39	M27 P66	Air Jet Blast (EC) PC Air Blast (HS)	Gantry Oil Air Blast	Air Blast ML BF push Air Closer Enable Chuck Clamp	115V
1139	K40	M28 P67	PC Beeper	APC Beeper, Airblast Old EC300 Tool Door New MD Airblast	Sub Spin Chuck	115V

SERIAL KEYBOARD INTERFACE PCB WITH HANDLE JOG (34-4241B)



The Serial Keyboard Interface PCB (SKBIF) provides:

- connection between the operator keypad and the main processor
- differential receiver for video data
- power for the backlight of the LCD
- connection between the jog handle (remote jog handle) and the main processor
- various machine-dependent functions.

The SKBIF is backward-compatible for all previous mill, lathe and simulator hardware and software versions.

NOTE: The video data connectors are only used by machines with a 15" monitor. Machines with a 10" monitor have a separate differential card in the LCD panel connected directly to the main processor.

Connector Descriptions

- P1** This connector supports an RS-232 ribbon cable that sends and receives data from the Main Processor.
- P2** This connector is used for the operator keypad interface. It receives keyboard data, which it sends to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.



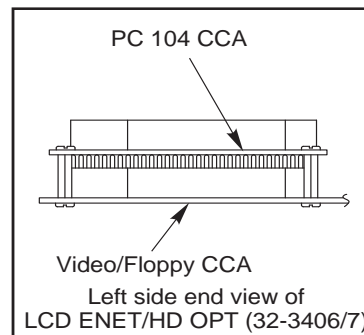
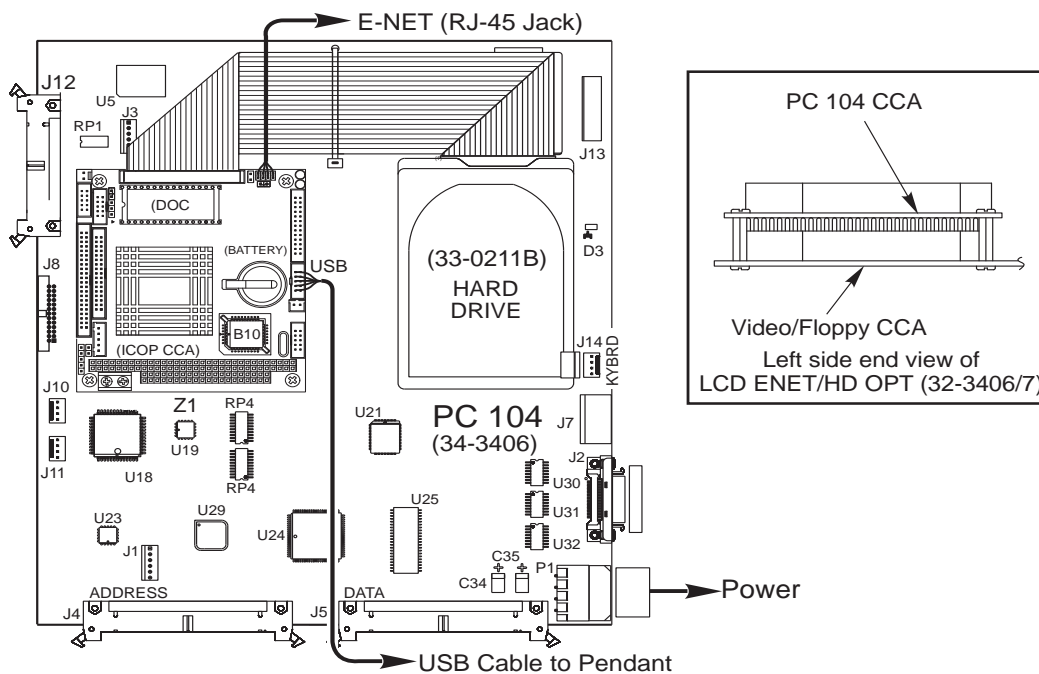
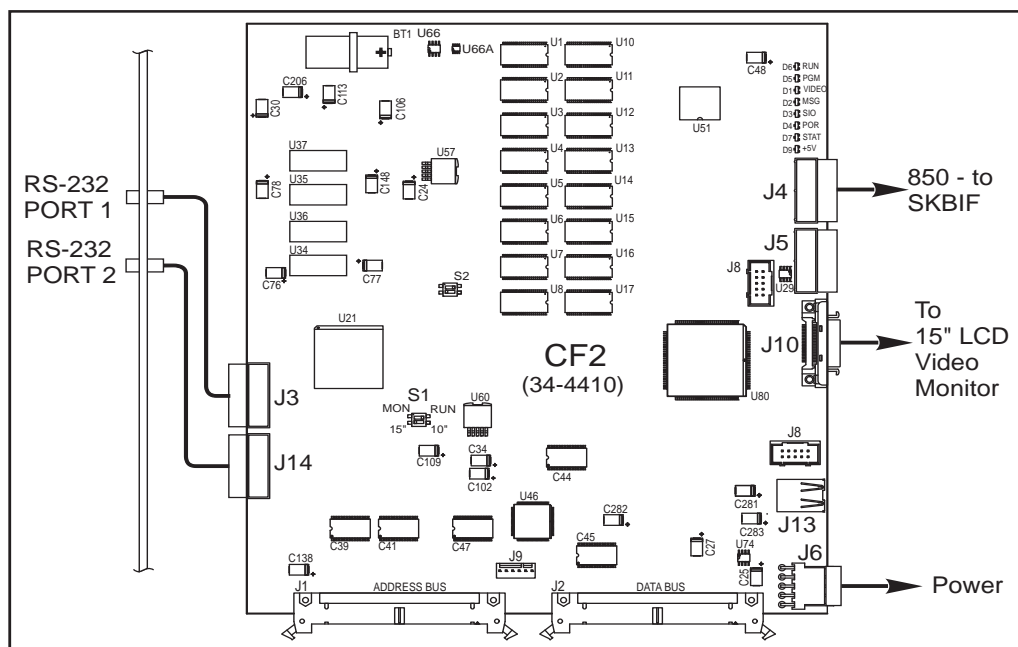
- P3** This connector is wired directly to the Cycle Start and Feed Hold buttons on the operator pendant front panel. The signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- P4** This connector is used on machines with an analog Load Meter and is wired directly to the Load Meter on the operator pendant front panel. The signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- P5** This connector is wired directly to the Beeper on the operator pendant front panel. The Main Processor sends On/Off commands to the Beeper, while the 'beeps' associated with each key stroke are controlled by wiring between P5 and the SKBIF micro-controller (U8).
- P6** This connector is wired directly to the Cycle Start and Feed Hold buttons on a Remote Jog Handle or an auxiliary front panel. It handles Part Ready and Pallet Rotate signals as well as mill Pallet 6 scheduling. The signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- P6A** This connector is wired directly to an auxiliary front panel (such as a Tool Changer panel). It handles Cycle Start, Feed Hold, Part Ready and Pallet Rotate signals as well as mill Pallet 6 scheduling. The signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- P7** This connector is used by mills utilizing a pallet changer. Pallet 1 and 2 scheduling signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- P8** This connector is used by mills utilizing a pallet changer. Pallet 3 and 4 scheduling and vertical mill MD Load Table Rotation signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- P9** This connector is wired to the Enhanced Remote Jog Handle. RJH(E) signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- P10** This connector is wired to the beacon on the operator pendant. Thin pendant signals are sent in over the RS-232 line from the Main Processor to the SKBIF micro-controller (U8), which turns the beacon on and off. A regular operator pendant has the beacon connected directly to the I/O Board, which turns the beacon on and off.
- P11** This connector is not currently used.
- P12** This connector is not currently used.
- J1** This connector is wired to the Jog Handle on the operator pendant front panel. Jog Handle signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor. If a cable is present on J3, jog handle signals are sent to the MOCON from J3.
- J2** This connector is wired to the Remote Jog Handle. RJH signals may be sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor. Alternatively, the RJH signals may be connected to J3, from where the data is sent directly to the MOCON.
- J3** This connector is wired to the Remote Jog Handle connector J2. RJH data is sent from J3 directly to the MOCON.
- J4** This connector is wired to the pendant's Worklight Switch on a vertical mill thin pendant. Worklight Switch signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.



- J5** This connector is not currently used.
- J6** This connector receives video data from the Main Processor. The video data exits the SKBIF from J16 and is sent directly to the LCD panel.
- J7** This connector is not currently used.
- J8** This connector is wired to the Enhanced Remote Jog Handle Switch on vertical mills. When the RJH(E) is placed in its receiver cradle, a HOOK signal is received over J8 and sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- J9** This connector is used by horizontal mills utilizing a tool changer. Tool Changer Magazine CW/CCW, Manual, and Tool Release Pedal signals are sent from the Tool Changer box, received over J9 and sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- J10** This connector is used by machines utilizing CE Push Button, Edit Lock Key Switch, 2nd Home Push Button, and Auto Door Push Button signals. Signals are sent from the Push Button or Switch, received over J9 and sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- J11** This connector is used by machines utilizing a pallet changer. Part Ready, Pallet Rotate, and Autodoor signals are sent by all machines. Pallet scheduling signals are sent by mills. The signals are sent to the SKBIF micro-controller (U8), where the data is processed and sent out over the RS-232 line to the Main Processor.
- J12** This connector provides +12V DC power to the SKBIF from a power supply built into the LCD assemblies. This connector is not used for thin pendants, or if cabling is present on J20 and J22.
- J13** This connector provides power to a high voltage power supply in the LCD panel to supply backlighting to the LCD.
- J14** This connector is used to program the SKBIF micro-controller.
- J15** This connector is used to program PAL chip U12.
- J16** This connector receives video data from the Main Processor by way of J6. The video data exits the SKBIF from J16 and is sent directly to the LCD panel.
- J17** This connector is wired to the E-Stop button on the operator pendant front panel and to J20. The E-STOP signal enters at J17 and exits at J20, where it is sent to the I/O Board and Power Supply card.
- J18** This connector supports an RS-232 RJ-11 style phone cable that sends and receives data from the Main Processor.
- J19** This connector is not used at this time. A jumper is in place across the two pins.
- J20** This connector receives +12V DC to power the SKBIF, Power On, Power Off and E-Stop signals.
- J22** This connector is wired to the Power On and Power Off buttons on the operator pendant front panel and to J20. The Power On and Off signals are received by J22 and sent to J20.
- SW1** This switch determines how the beeper is being driven. The switch is set to 'BEEP' for a front panel that contains a buzzer. The switch is set to 'SPKR' for a front panel that contains a speaker.
- SW2** The COLOR switch is set based upon what LCD assembly is used. SHARP LCD assemblies require the switch to be placed to the left (toward COLOR). LG LCD assemblies require the switch to be placed to the right (away from COLOR). The STROBE switch should always be placed to the left (toward STROBE).



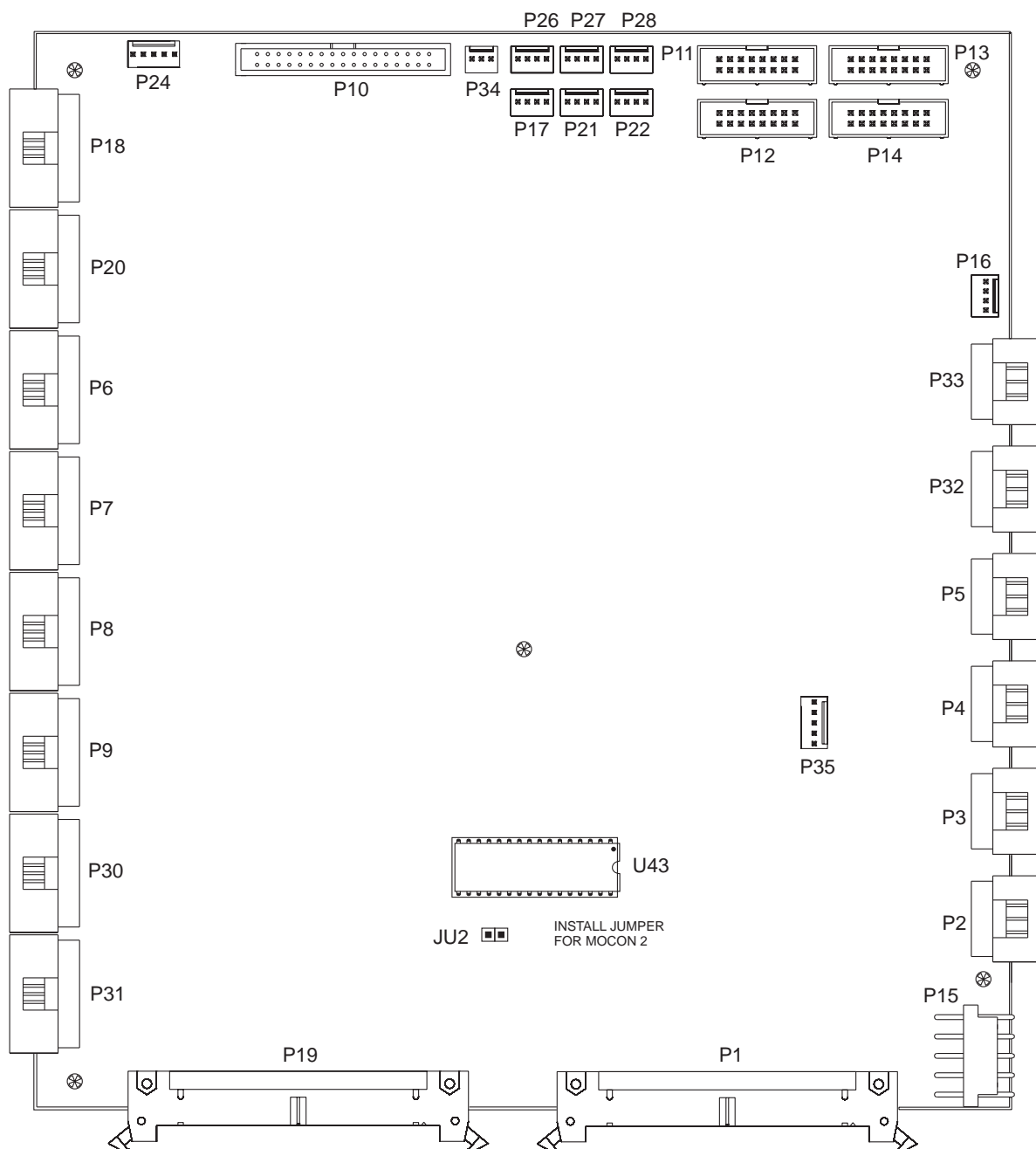
VIDEO & KEYBOARD PCB w/ETHERNET & USB DRIVE



PLUG #	CABLE #	SIGNAL NAME	⇒ TO ⇒	LOCATION	PLUG #
P1	860	LOW VOLTAGE		POWER SUPPLY PCB	—
J2	—	VIDEO SIGNAL		N/A	—
J4	—	ADDRESS BUSS		MICRO PROC.PCB	—
J5	—	DATA BUSS		MOTIF PCB	—
J13	850	SERIAL DATA		N/A	J1
J14	—	SERIAL DATA		KYBD	—



MOCON PCB

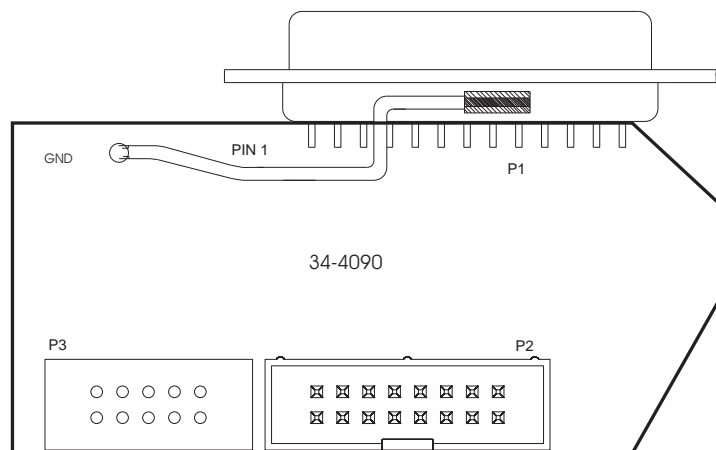


PLUG #	CABLE #	SIGNAL NAME	⇒ TO ⇒	LOCATION	PLUG #
P1	—	DATA BUSS		VIDEO PCB MICRO PROC. PCB	—
P2	610	X DRIVE SIGNAL		X SERVO DRIVE AMP. P	
P3	620	Y DRIVE SIGNAL		Y SERVO DRIVE AMP. P	
P4	630	Z DRIVE SIGNAL		Z SERVO DRIVE AMP. P	
P5	640	A DRIVE SIGNAL		A SERVO DRIVE AMP. P	
P32	640B	B DRIVE SIGNAL		B SERVO DRIVE AMP. P	
P6	660	X ENCODER INPUT		X ENCODER	—



PLUG #	CABLE #	SIGNAL NAME	⇒ TO ⇒	LOCATION	PLUG #
P7	670	Y ENCODER INPUT		Y ENCODER	—
P8	680	Z ENCODER INPUT		Z ENCODER	—
P9	690	A ENCODER INPUT		A ENCODER	—
P30	690B	B ENCODER INPUT		B ENCODER	—
P10	550	MOTIF INPUTS/I/O OUTPUTS		I/O PCB	P4
P11	510	I/O RELAYS 1-8	I/O	I/O PCB	P1
P12	520	I/O RELAYS 9-16		I/O PCB	P2
P13	530	I/O RELAYS 17-24		I/O PCB	P51
P14	540	I/O RELAYS 25-32		I/O PCB	P3
P15	860	LOW VOLTAGE		POWER SUPPLY PCB	—
P16	720	SP. LOAD METER		LOAD METER	—
P17	640C	VOLTAGE MONITOR		VECTOR DRIVE	J3
P18	750	JOG ENCODER INPUT		JOG HANDLE	—
P19		ADDRESS BUSS		VIDEO PCB	—
				MICRO PROC. PCB	—
				SPINDLE ENCODER	—
P20	1000	SP. ENCODER INPUT			
P21		X-AXIS TEMP SENSOR			
P22	730B	SP. DRIVE LOAD		SPINDLE DRIVE	—
P24	990	HOME SENSORS		X, Y & Z LIMIT	—
P26		Y-AXIS TEMP SENSOR			
P27		Z-AXIS TEMP SENSOR			
P28		SPARE			
P31	690C	C ENCODER INPUT		SPINDLE MOTOR	
			Plug numbers and descriptions are on the next page (lathe- 2nd spindle encoder)		
P33	640C	VCTR DR CUR. CMD.		VECTOR DRIVE	J3
P34		SPARE			
P35		PWM OUTPUT (LASER)			

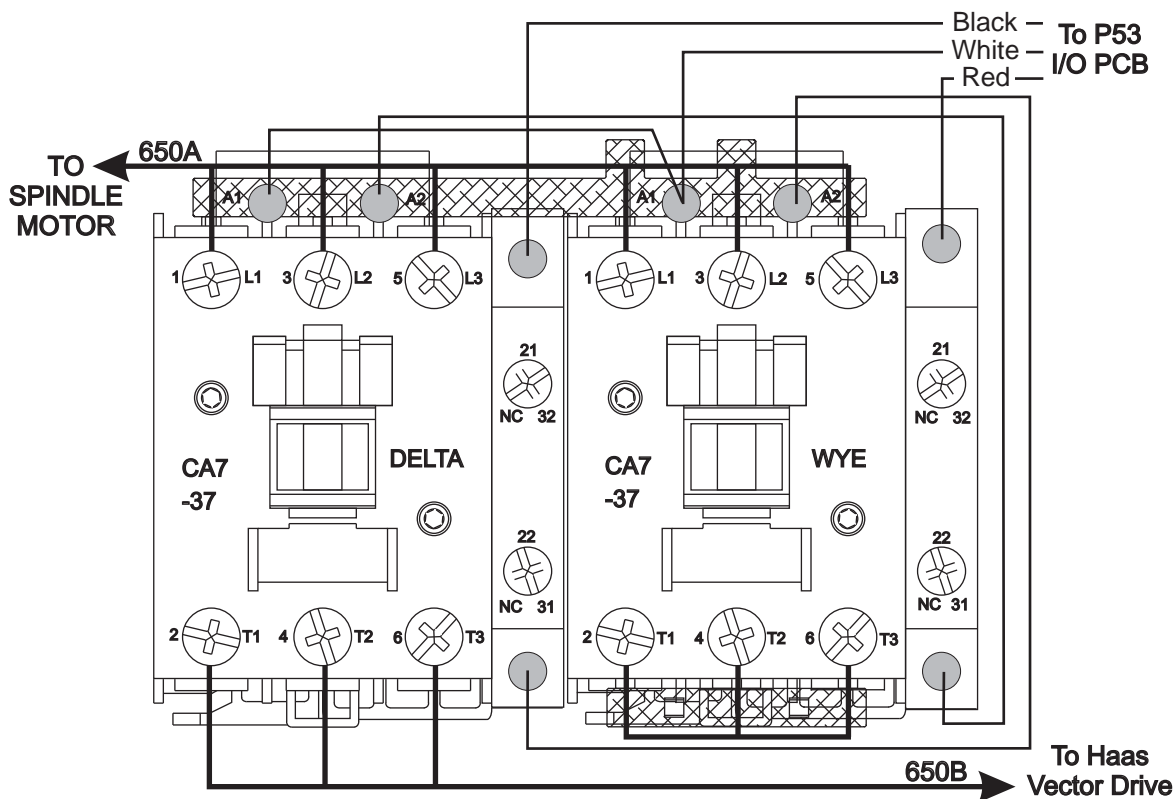
RS-232 PORT #1 PCB



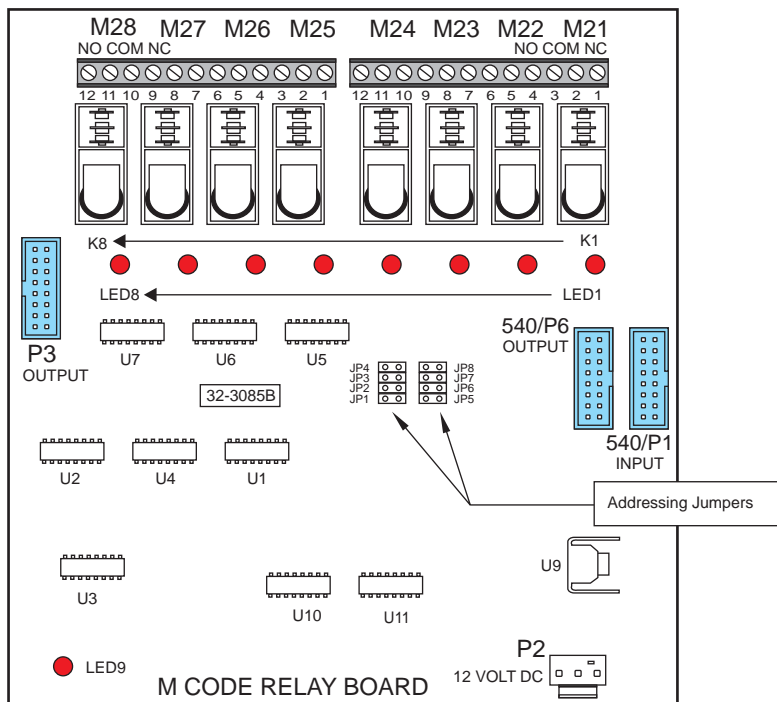
PLUG #	CABLE #	⇒ TO ⇒	LOCATION	PLUG #
P1	850		CABINET CONNECTION	
P2	850A		VIDEO & KEYBOARD	J13
P3	850A		PC104 OPTION	J9



WYE-DELTA SWITCH ASSEMBLIES

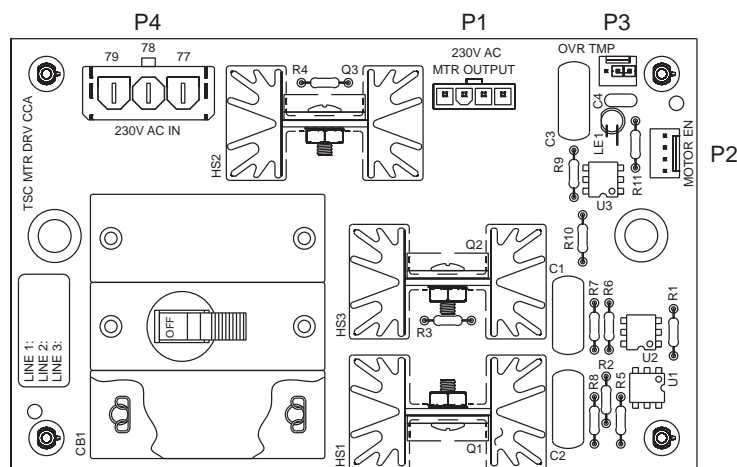


M CODE RELAY BOARD



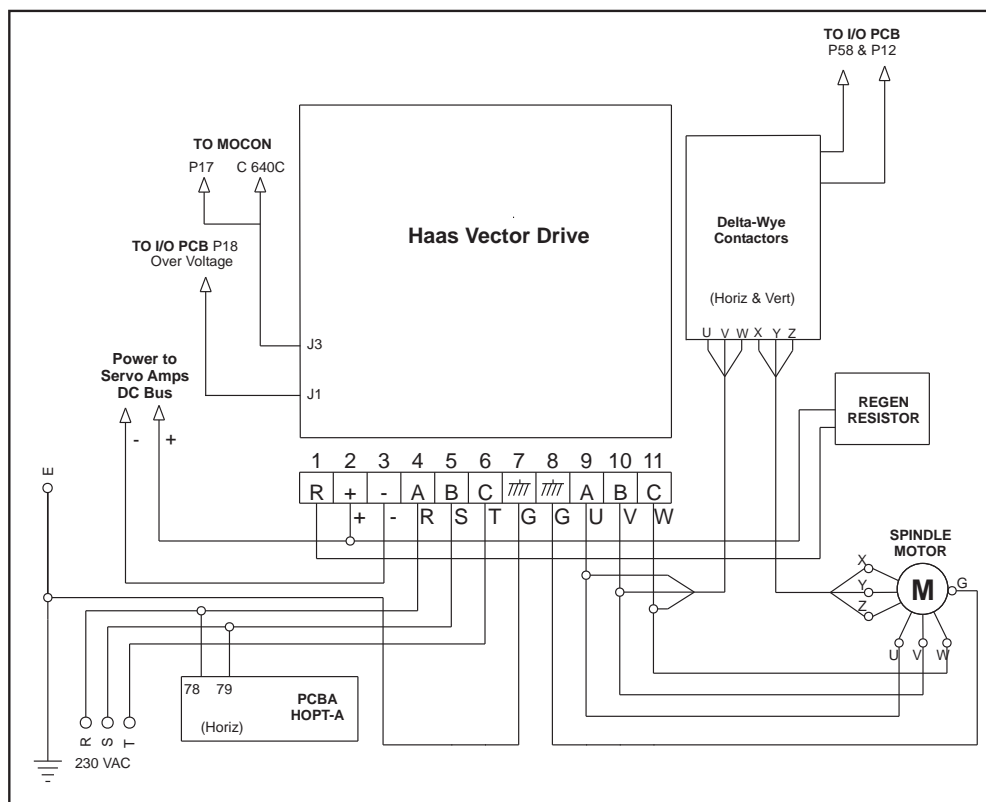


TSC MOTOR DRIVE/HIGH PRESSURE COOLANT PCB



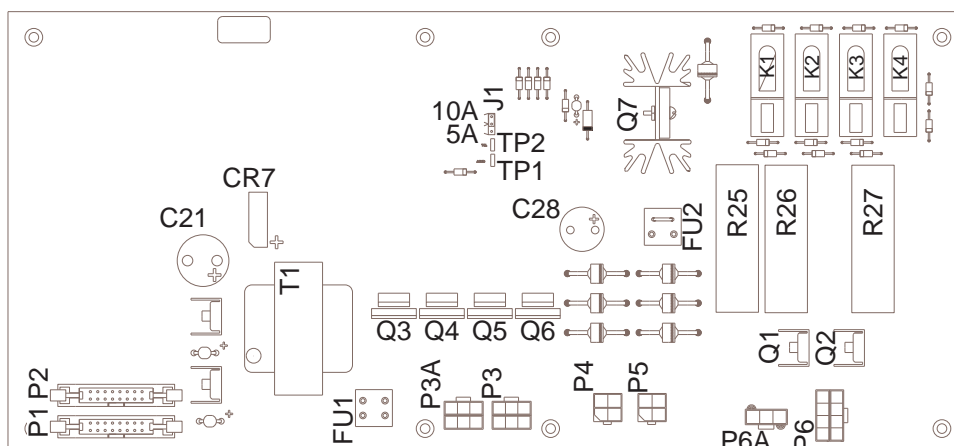
PLUG #	CABLE #	LOCATION	PLUG #
P1	33-0941E	3ph coolant pump socket	Pump Socket
P2	33-1944	Coolant Enable	I/O PCB P73
P3	33-0941E	OVR TMD	Pump Socket
P4	33-0987	230V IN	Out transformer TB2

HAAS VECTOR DRIVE UNIT



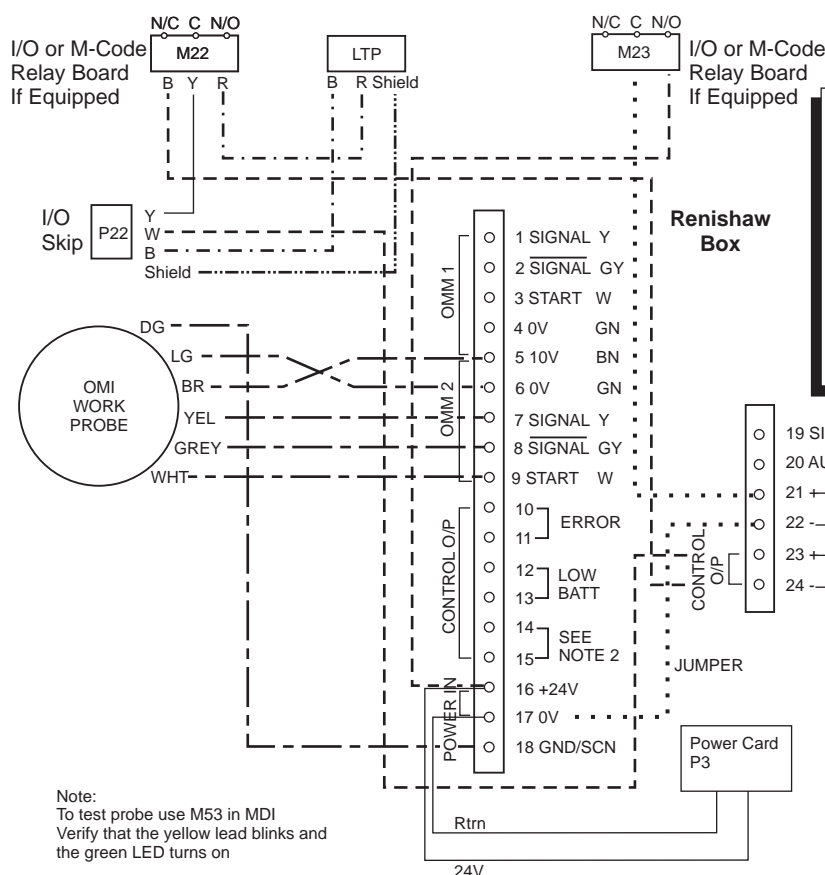


QUAD APC (32-3078A) PCB



PLUG #	CABLE #	LOCATION	PLUG #
P1	33-1516	I/O PCB	P62
P3	33-6038A	Air Door	
P4	33-0191	From Power Card	
6A	33-6038A	Pallet Chain Motor	

RENISHAW TOOL PRESETTER (LATHE)



Dual Probe LTP and Work Probe - Lathe

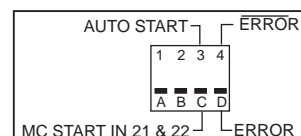
M52 LTP ON
M62 LTP OFF
M53 PROBE ON
M63 PROBE OFF

Note:
To test probe use M53 in MDI
Verify that the yellow lead blinks and
the green LED turns on

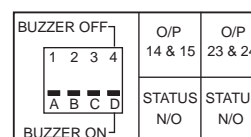
This toggles the skip bit shown on the
Diagnostics page, when the probe is deflected

Notes:

1. Set SW2 as shown



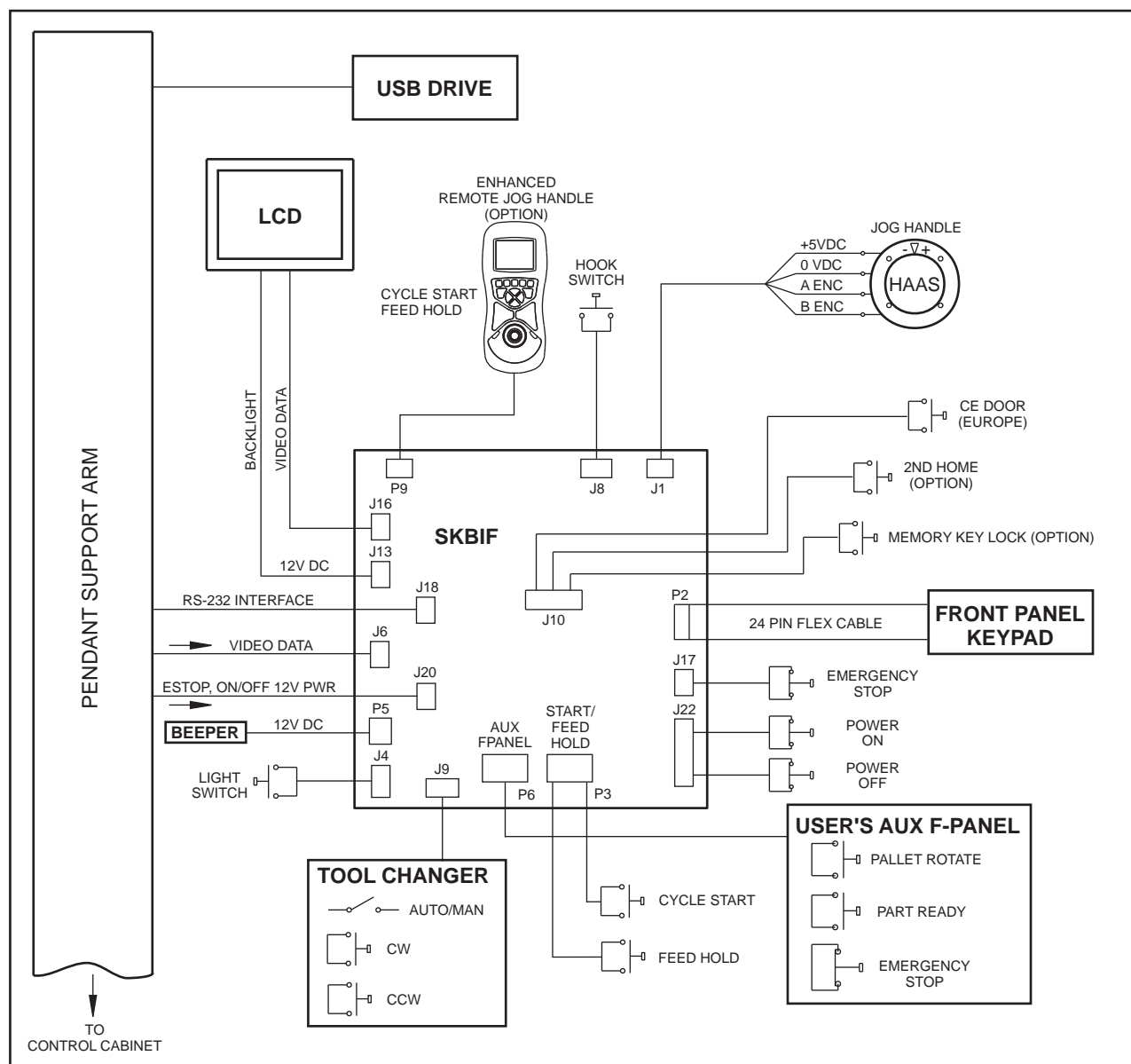
2. Set SW3 as shown



3. Other switch configurations
as defined in user handbook

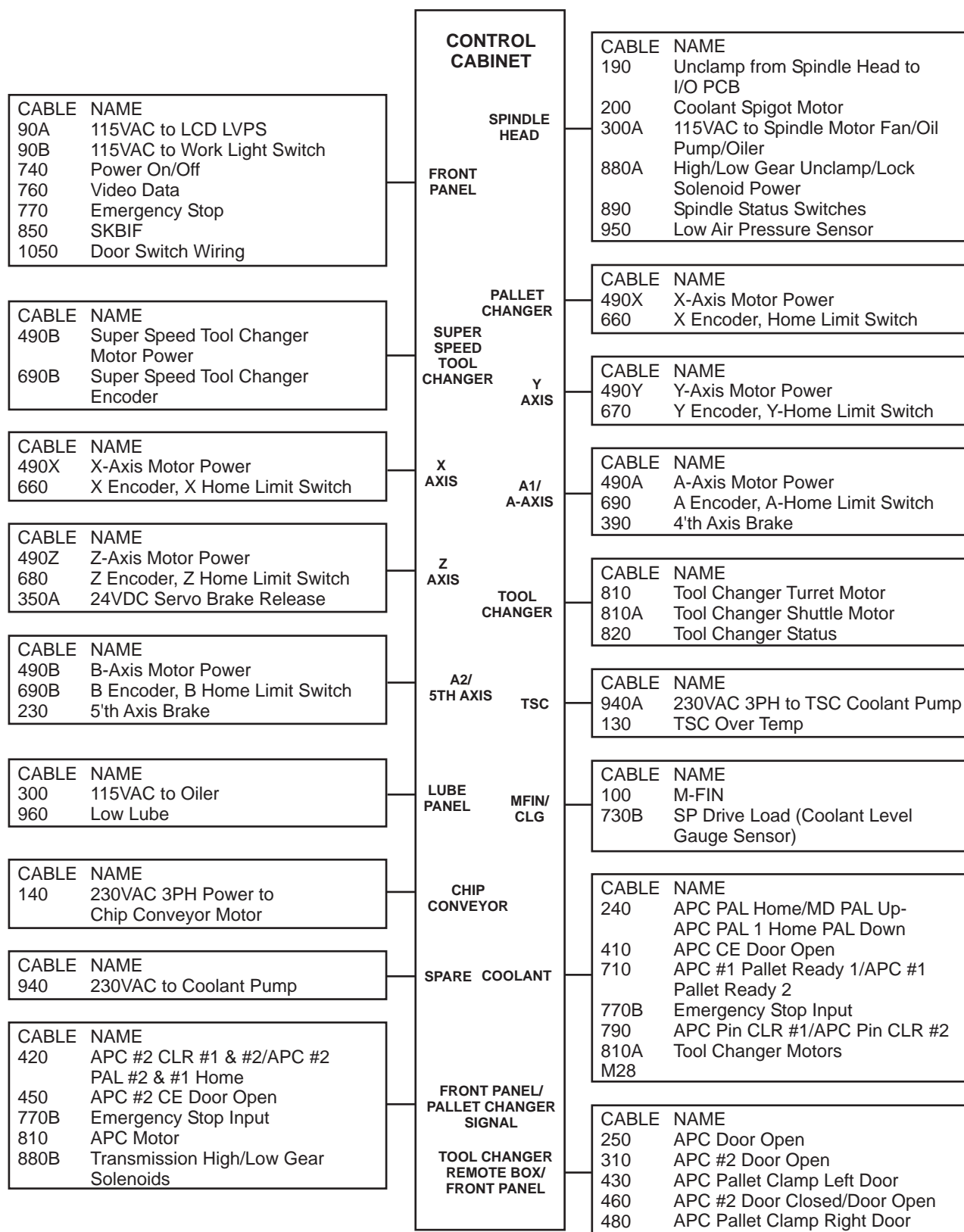


OPERATOR PENDANT



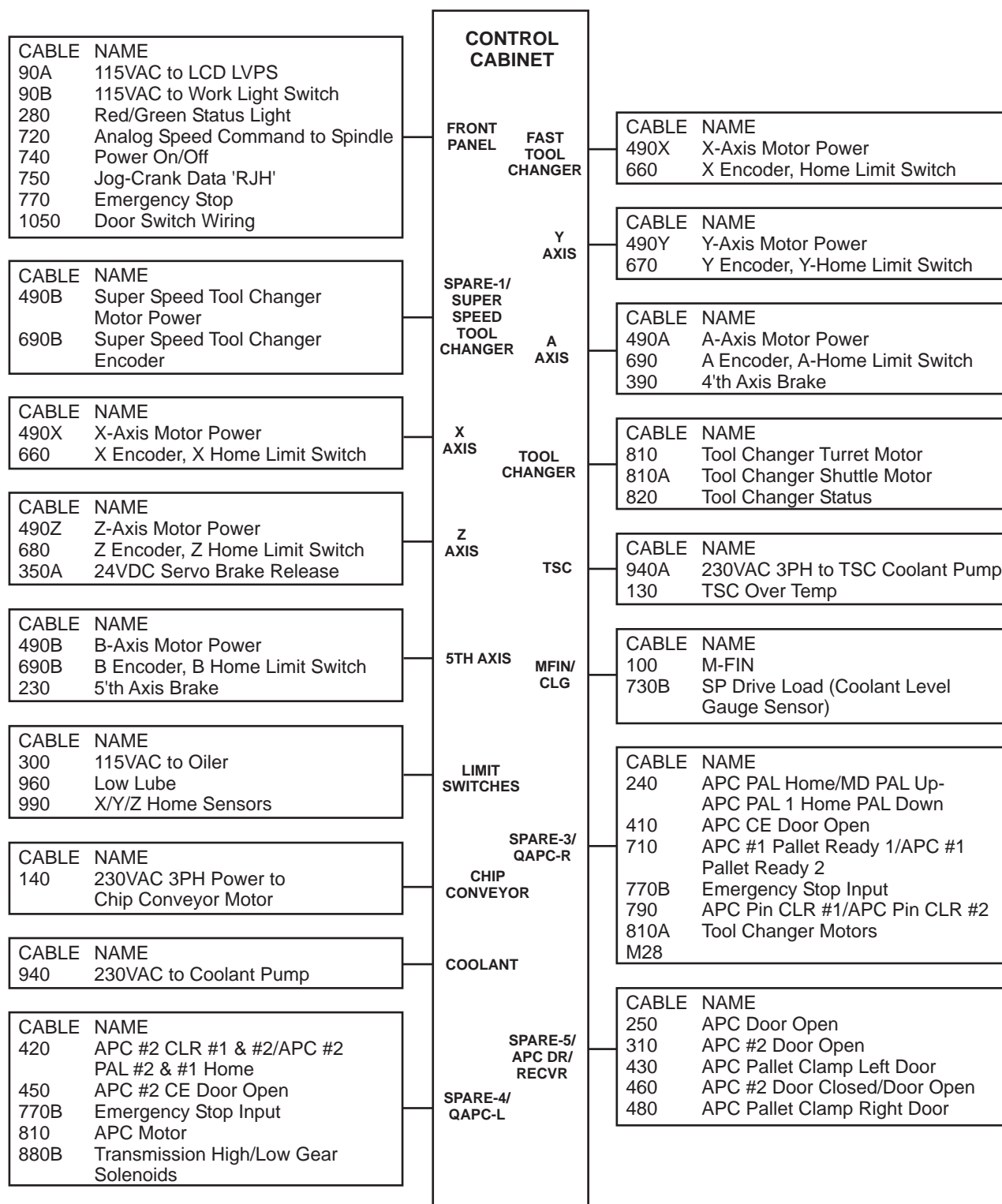


HORIZONTAL MACHINE CONTROL CABINET WIRING DIAGRAM



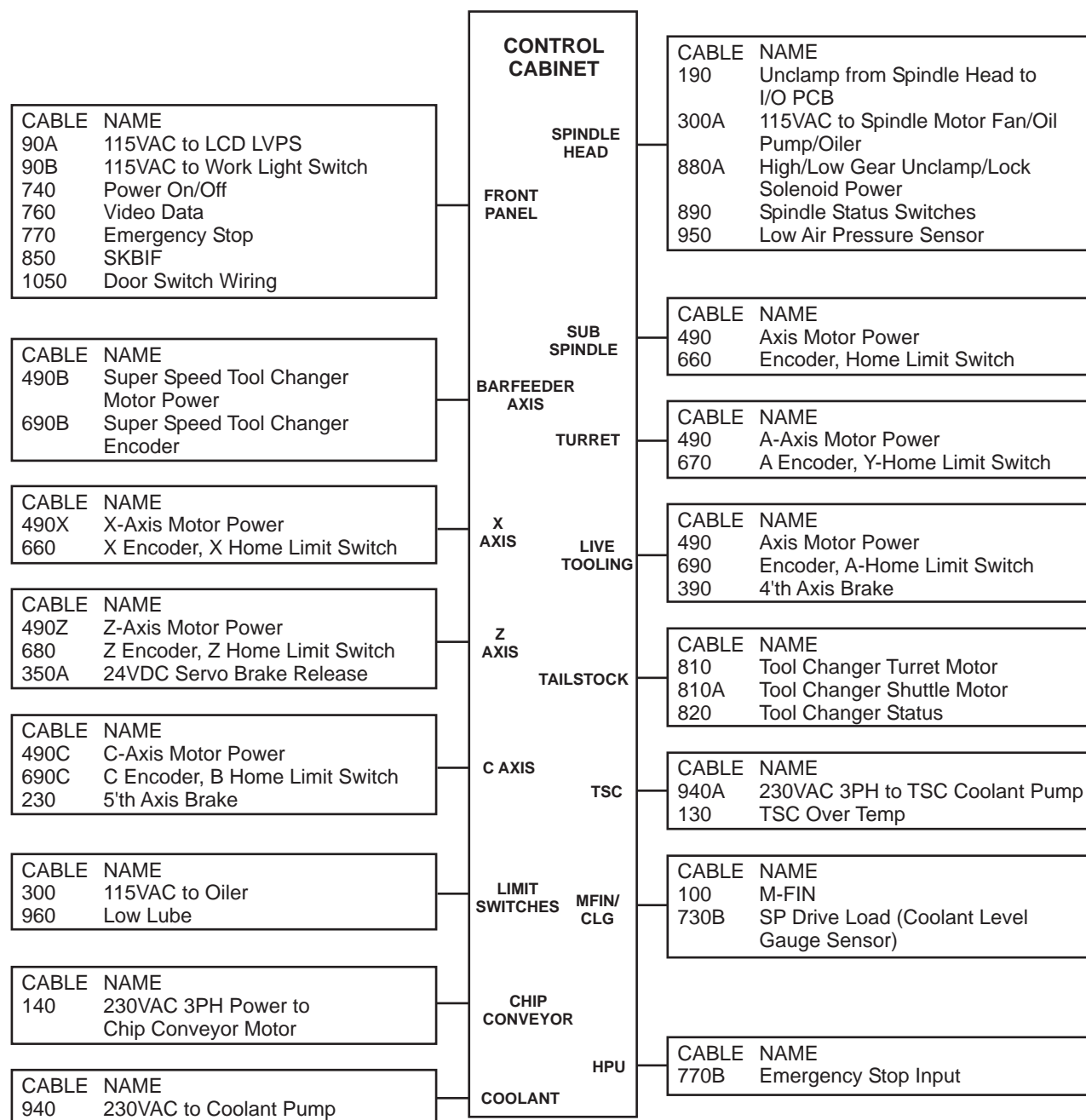


VERTICAL MACHINE CONTROL CABINET WIRING DIAGRAM





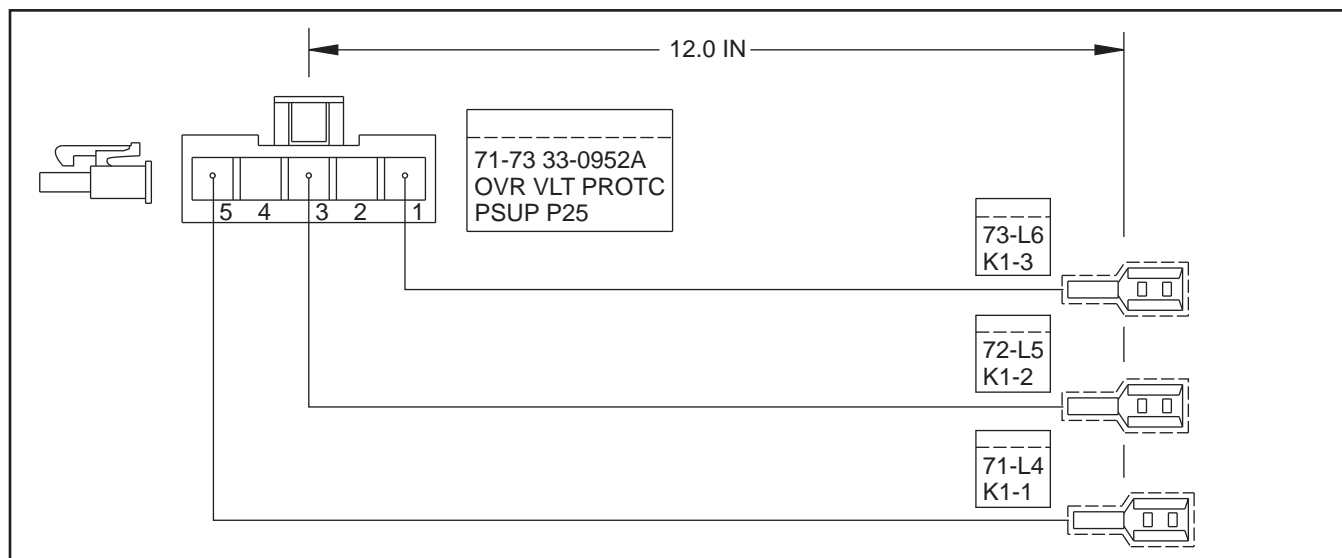
LATHE CONTROL CABINET WIRING DIAGRAM



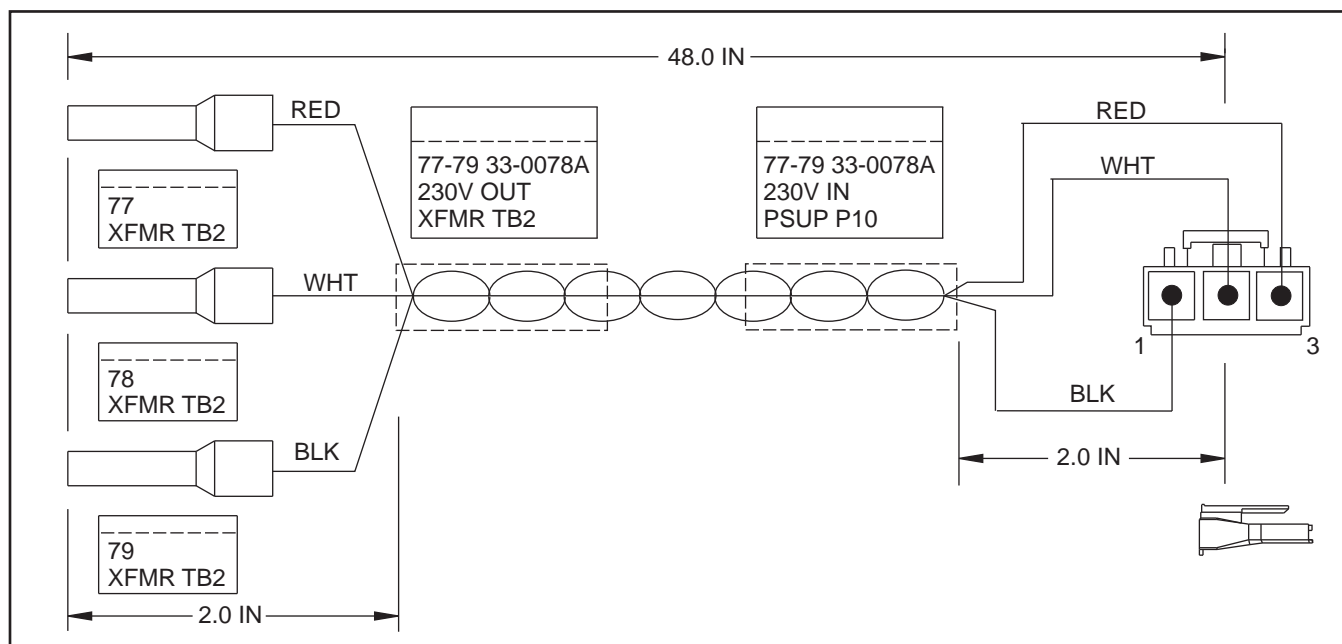


CABLES

CABLE 71/72/73, POWER - K1 TO POWER SUPPLY (33-0952A)

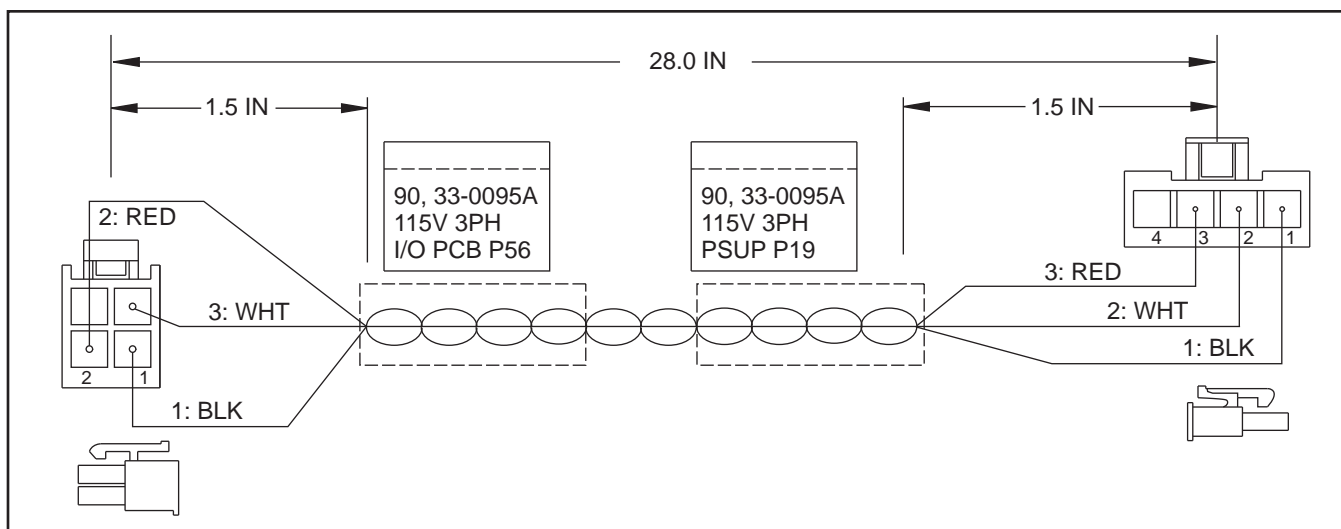


CABLE 77/78/79, 230V TRANSFORMER - POWER SUPPLY (33-0078B)

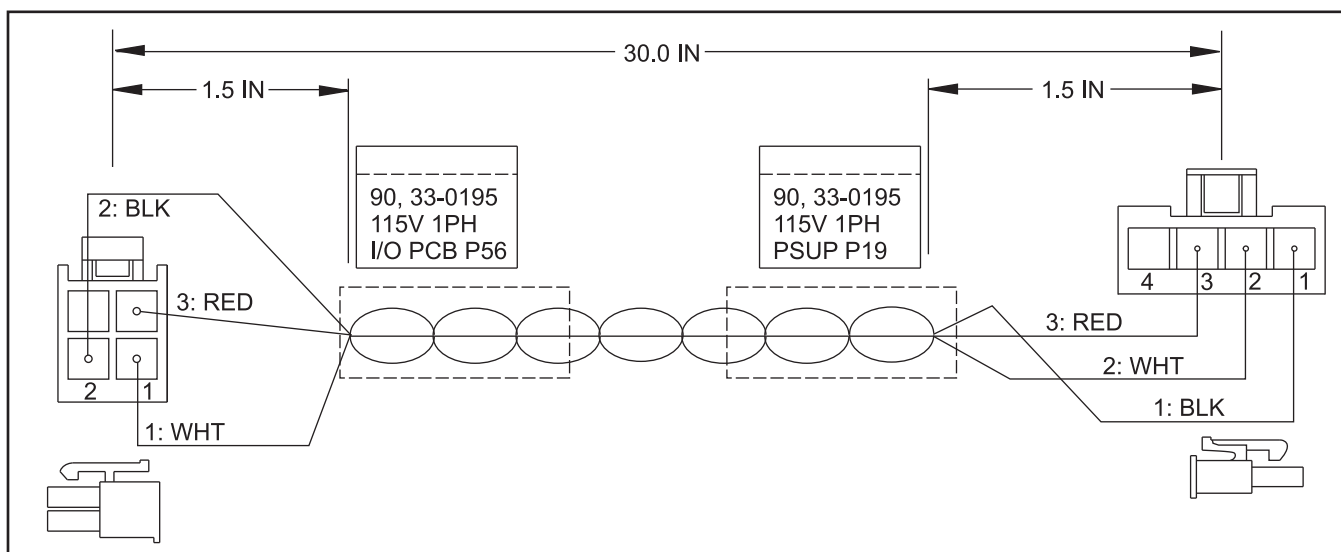




CABLE 90, 115V 3PH POWER SUPPLY - I/O PCB (33-0095A)

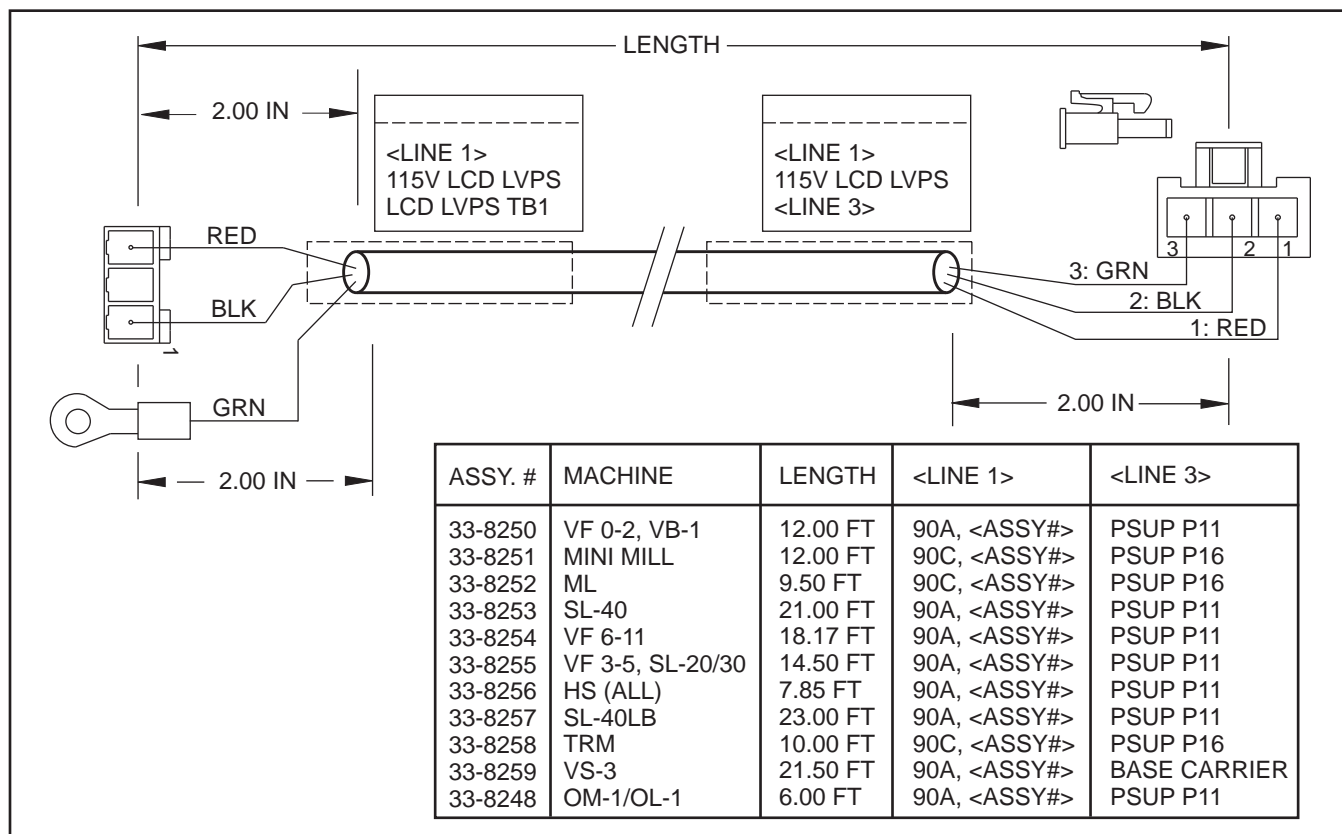


CABLE 90, 115V 1PH POWER SUPPLY - I/O PCB (33-0195A)

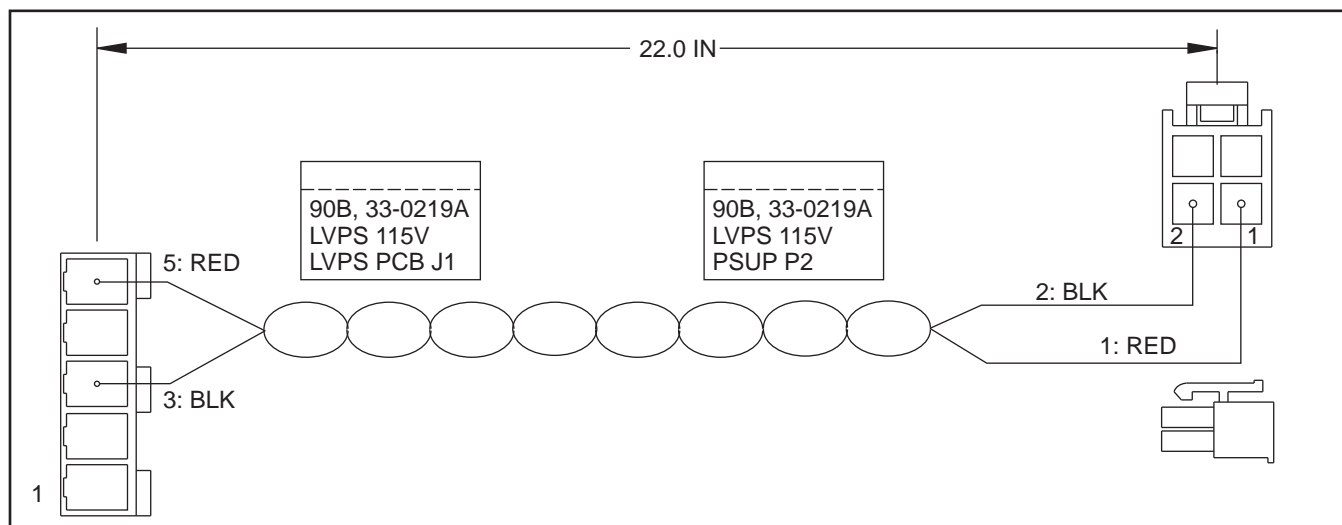




CABLE 90A, 115V LCD Low Voltage Power Supply (33-8250)

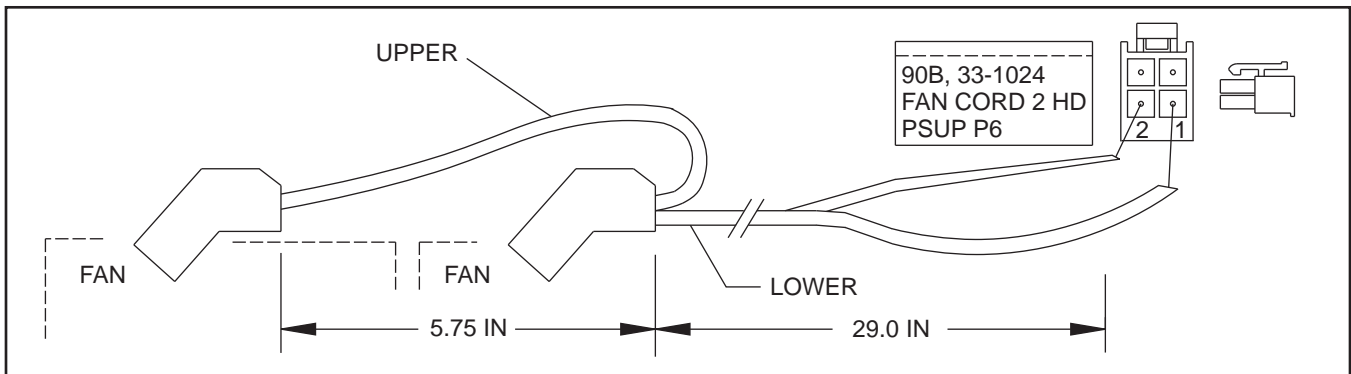


CABLE 90B, POWER TO Low Voltage Power Supply 5-PIN (33-0219A)

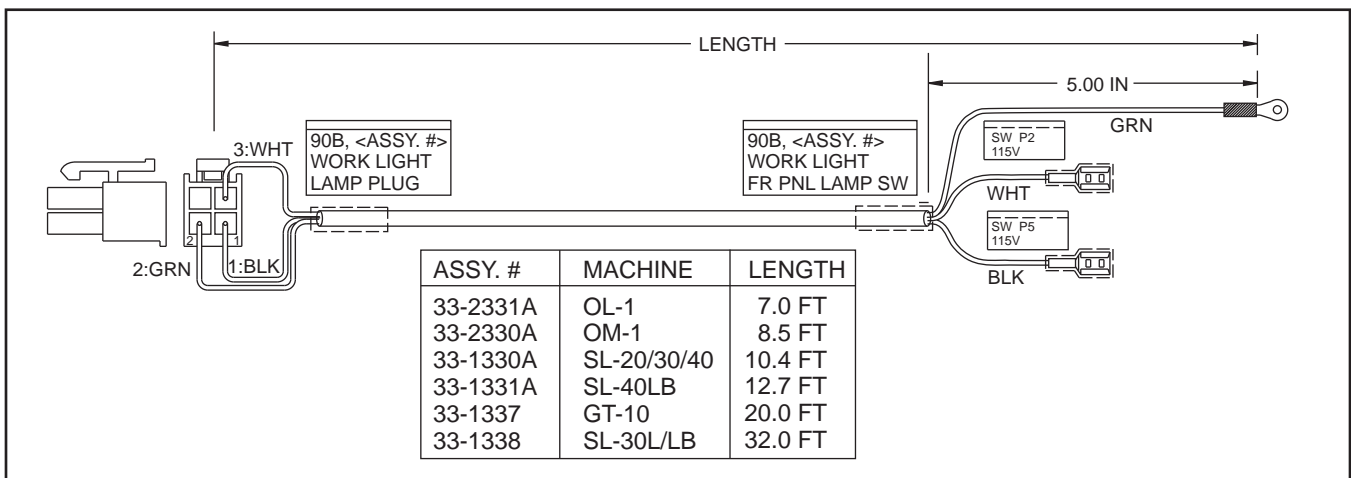




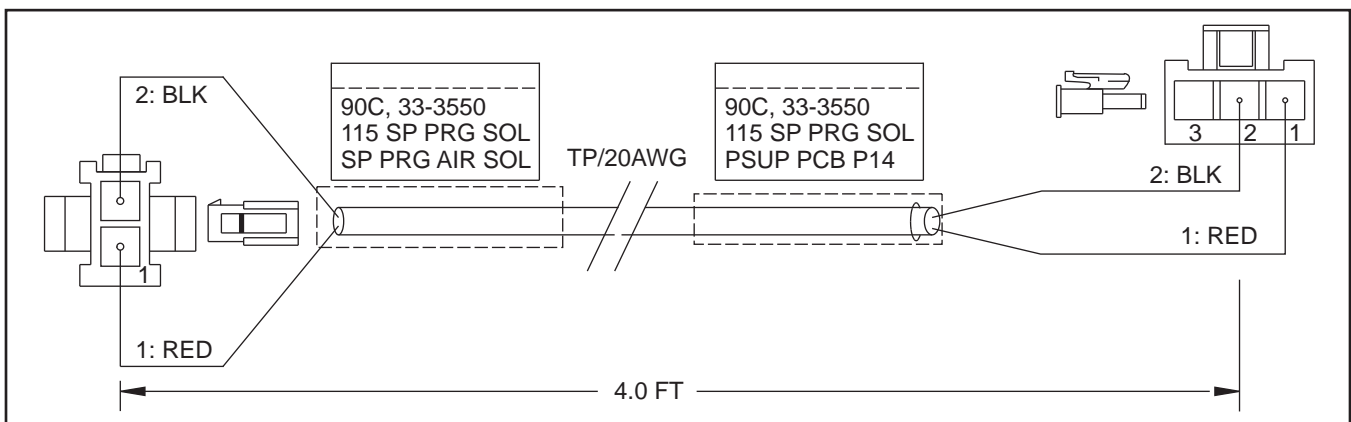
CABLE 90B FAN CORD - VECTOR DRIVE 2HD (33-1024A)



CABLE 90B Work Light (33-2330)

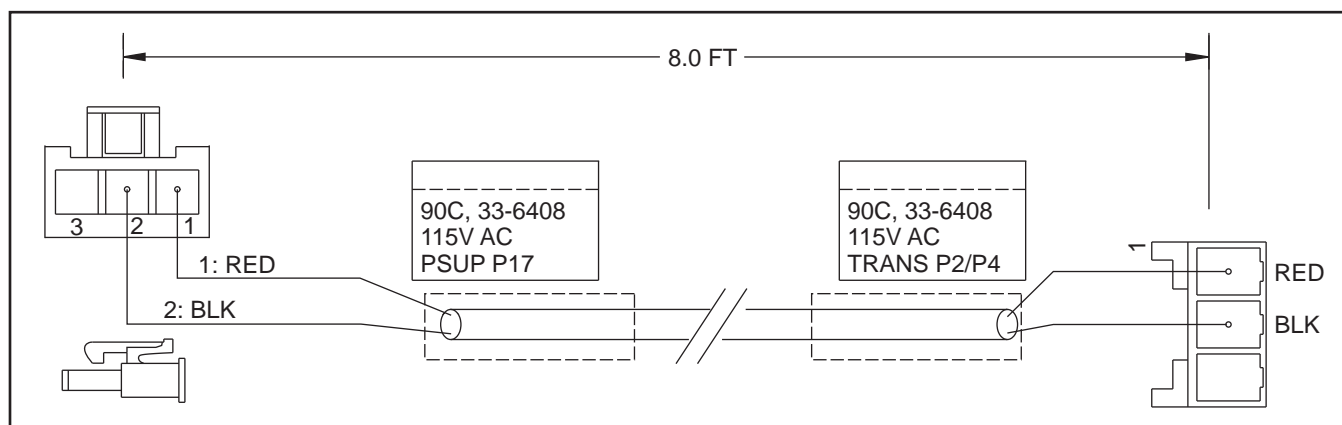


CABLE 90C, SPINDLE PURGE AIR SOLENOID (33-3550)

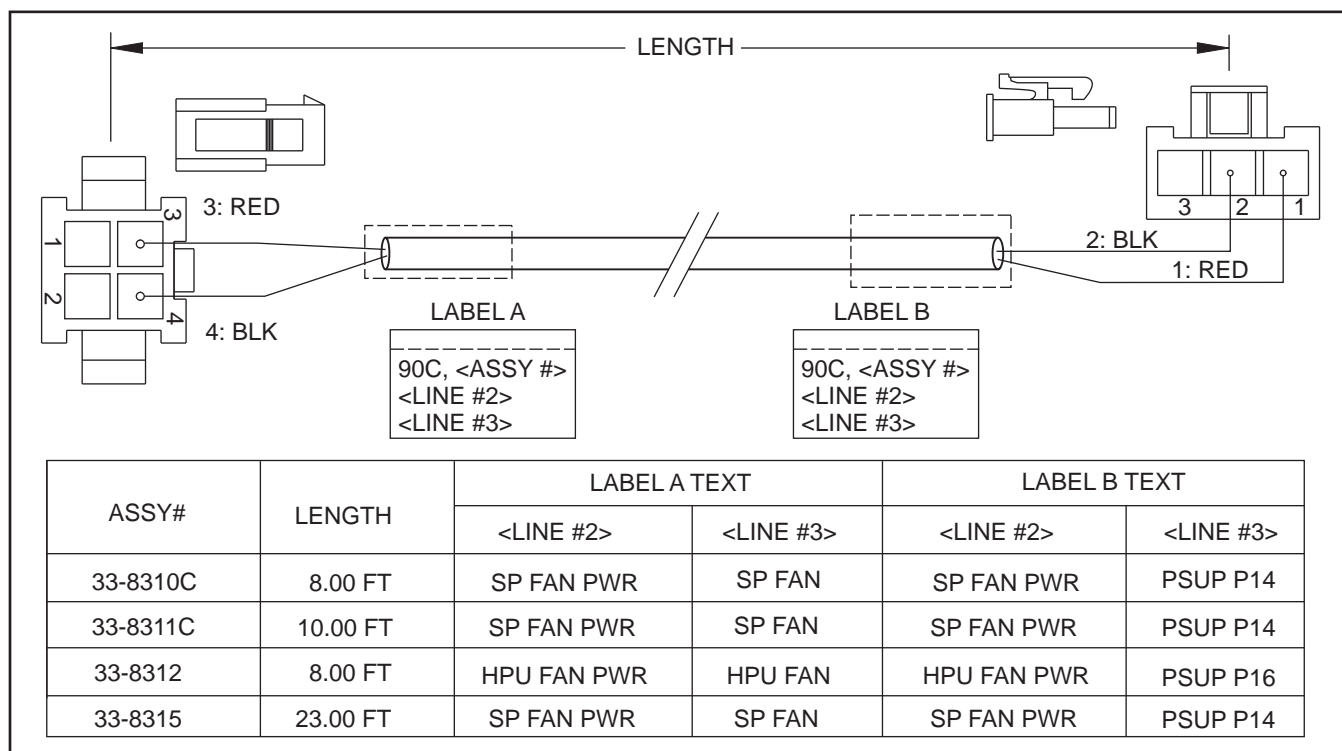




CABLE 90C, 115V TRANSFORMER POWER SUPPLY - 8' (33-6408)

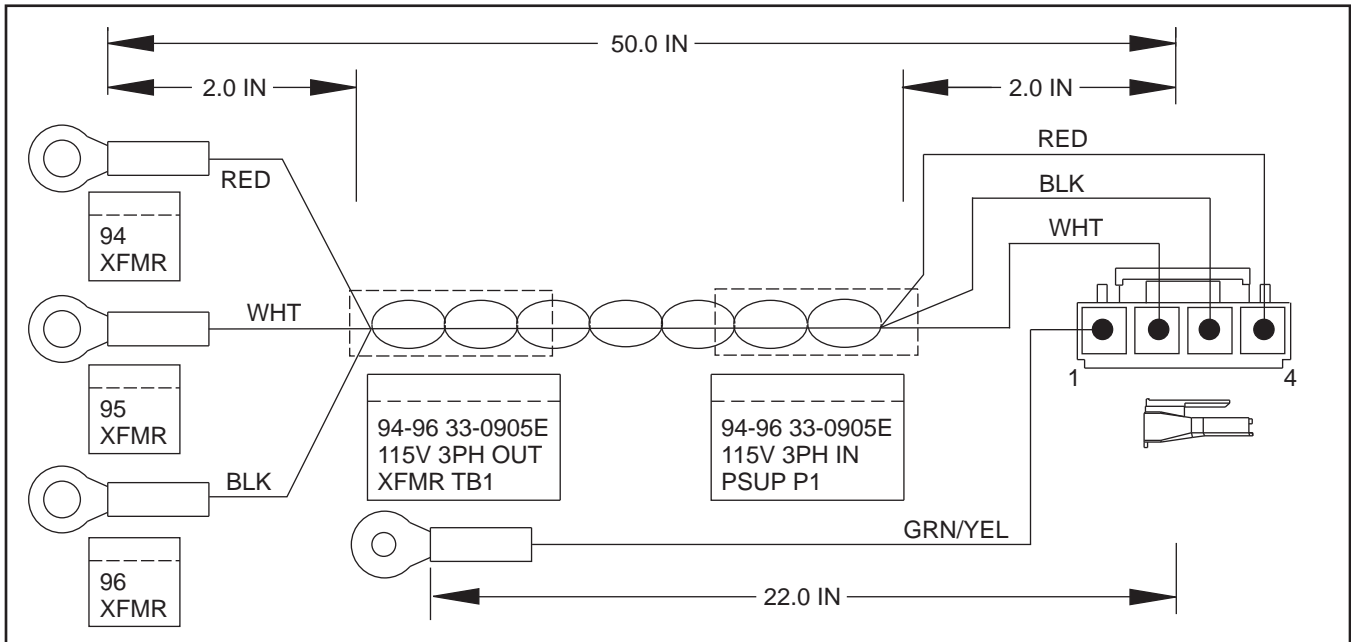


CABLE 90C, SPINDLE FAN - TL-15/SL-20 (33-8310C)

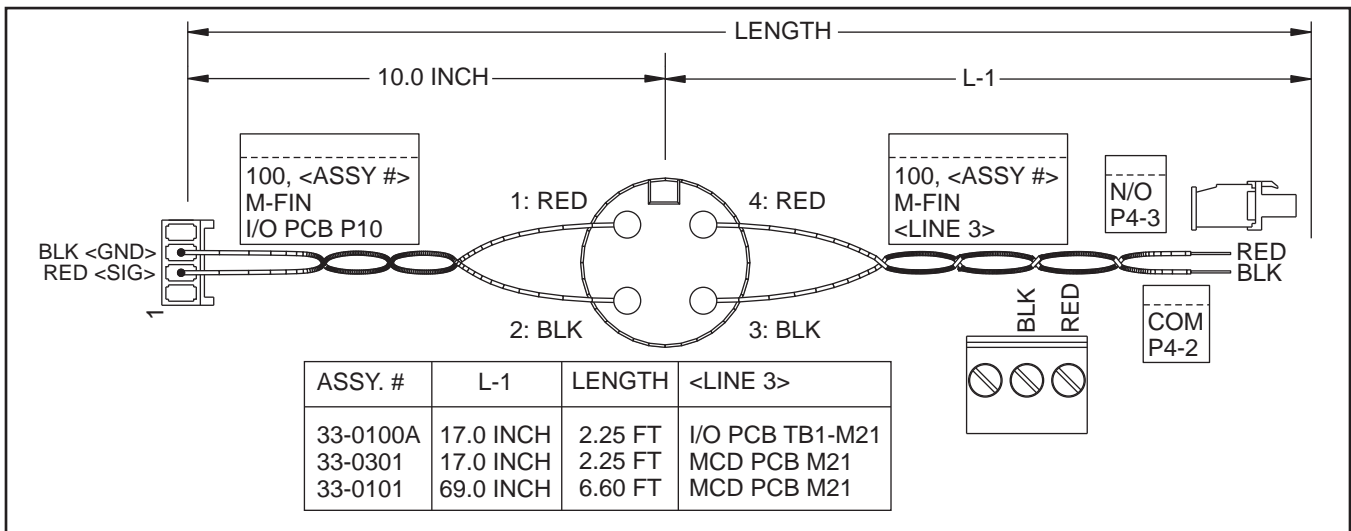




CABLE 94/95/96, 115V 3PH TO POWER SUPPLY (33-0905E)

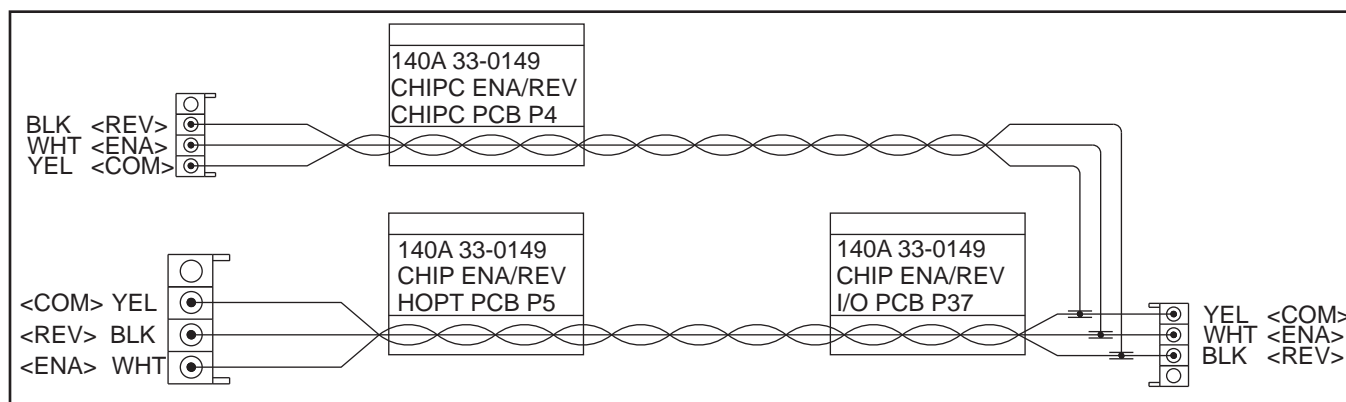


CABLE 100, M-FIN FUNCTION W/MCD (33-0101)

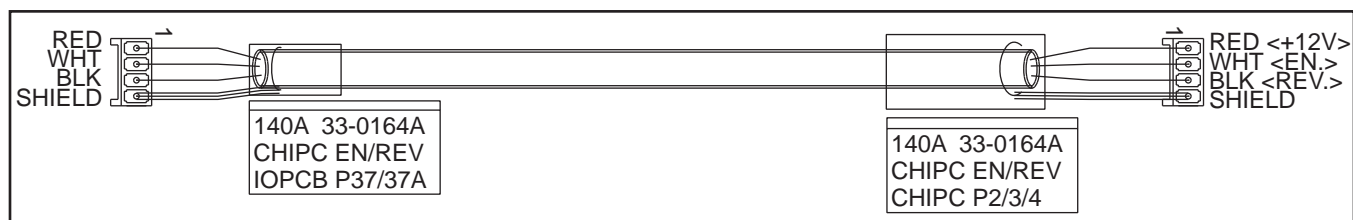




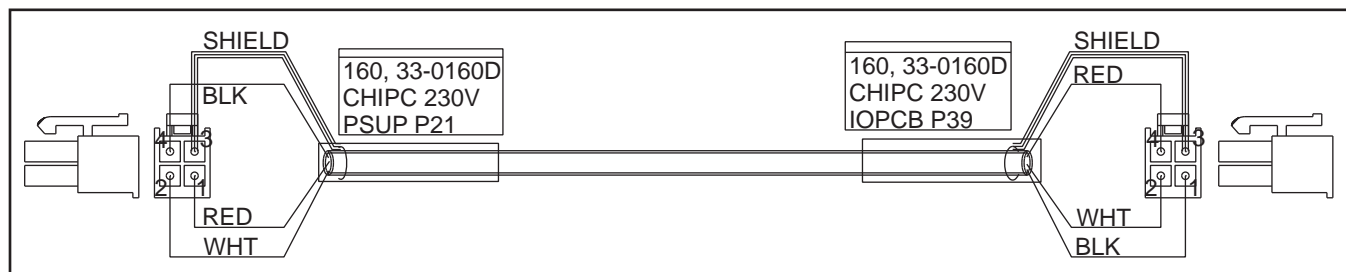
CABLE 140A, CHIP CONVEYOR ENABLE/REVERSE (33-0149)



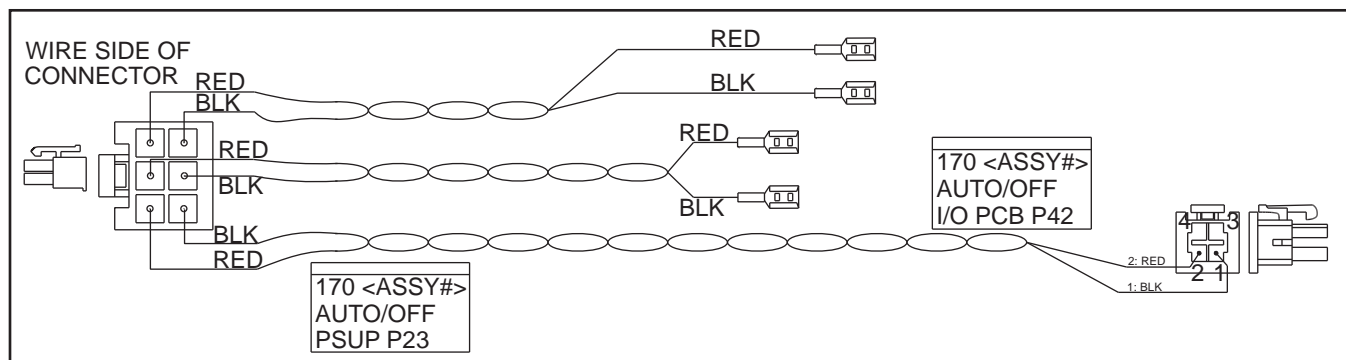
CABLE 140A, LEFT CHIP CONVEYOR ENABLE/REVERSE (33-0164A)



CABLE 160, CHIP CONVEYOR 230V (33-0160D)

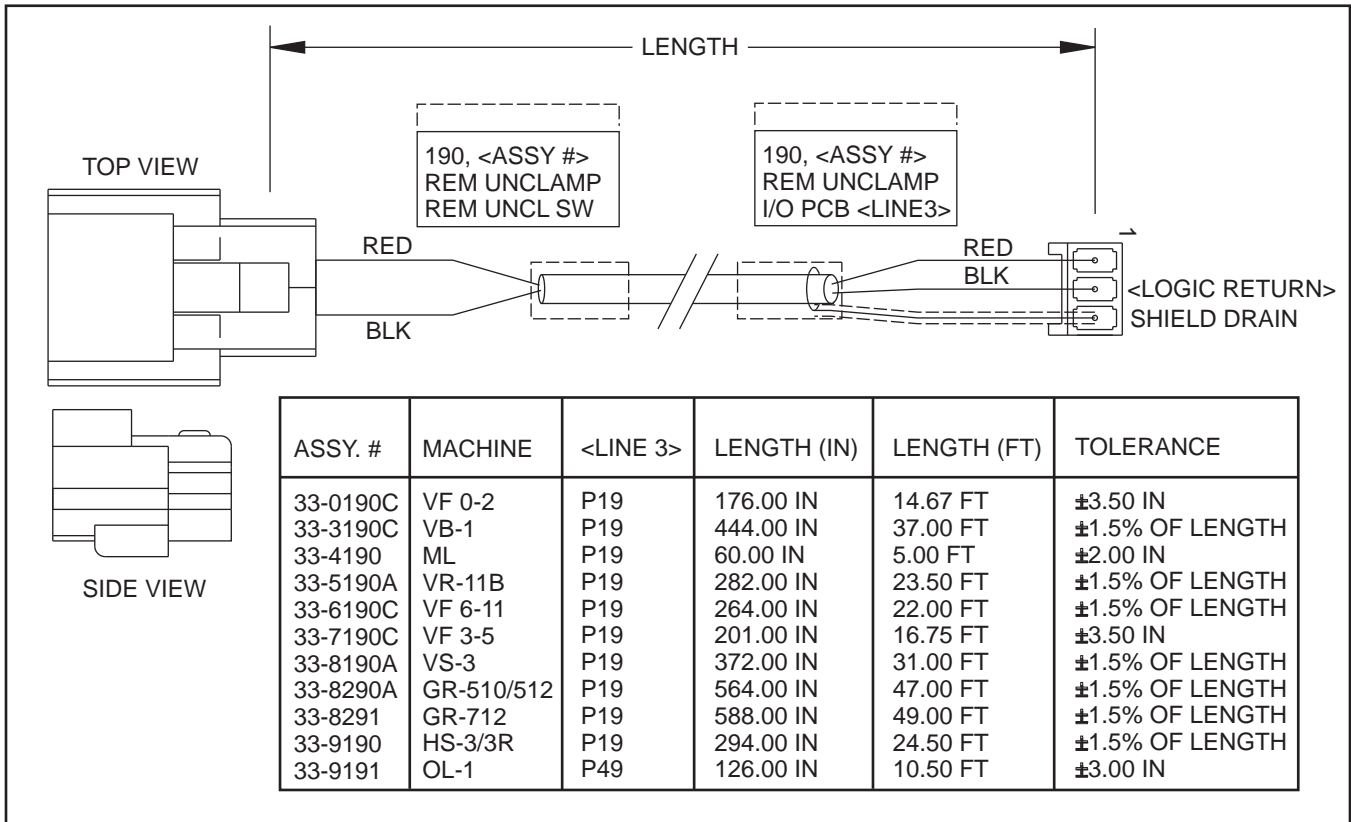


CABLE 170, Aux/COIL 30HP CONTACTOR (33-0179A)

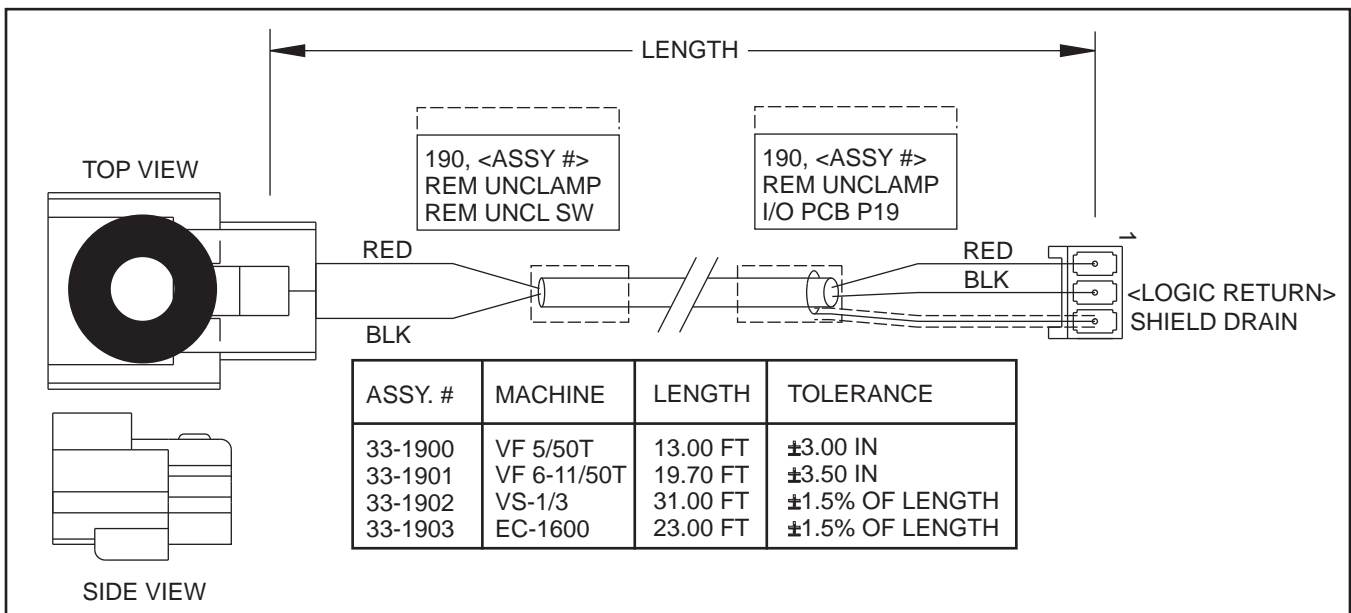




CABLE 190, TOOL RELEASE (33-0190C)

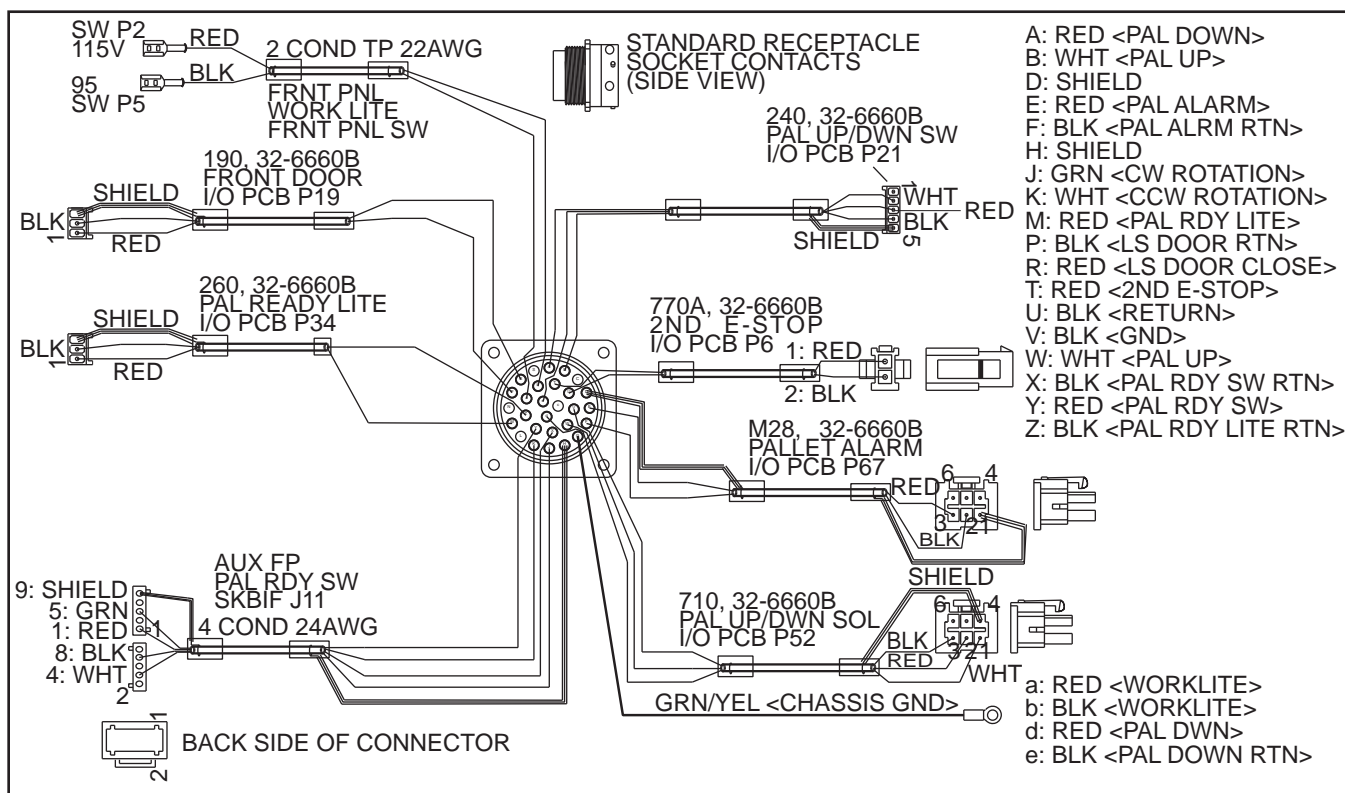


CABLE 190, TOOL RELEASE (33-1900)

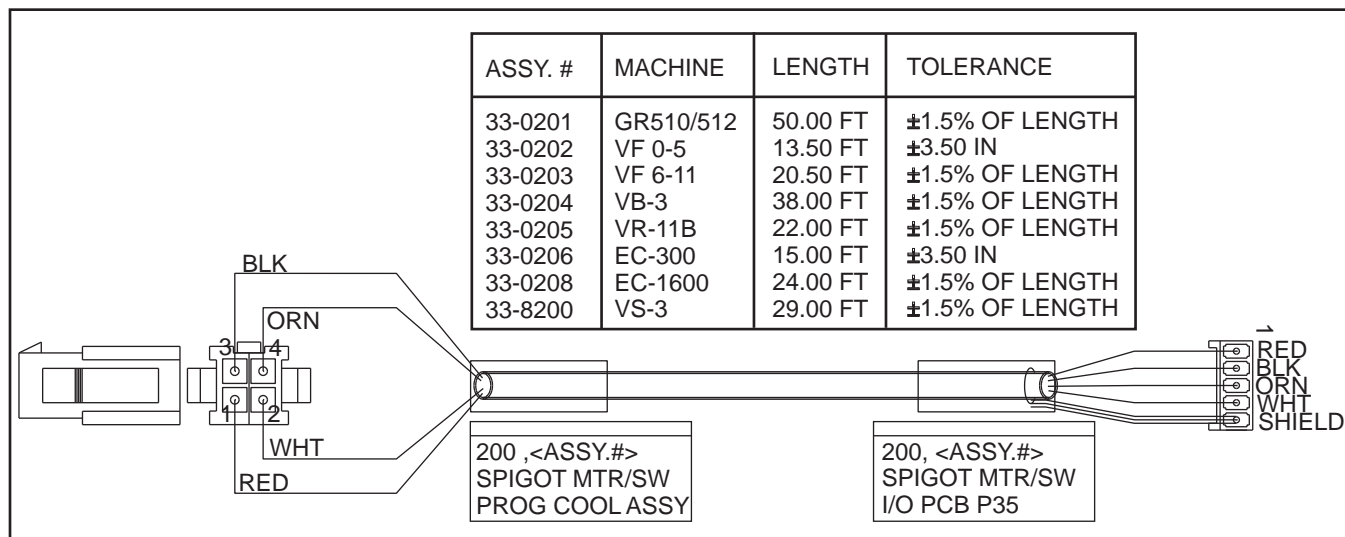




190/240/260/710/770A FRONT ENCLOSURE SIGNAL RECEPTACLE (32-6660B)

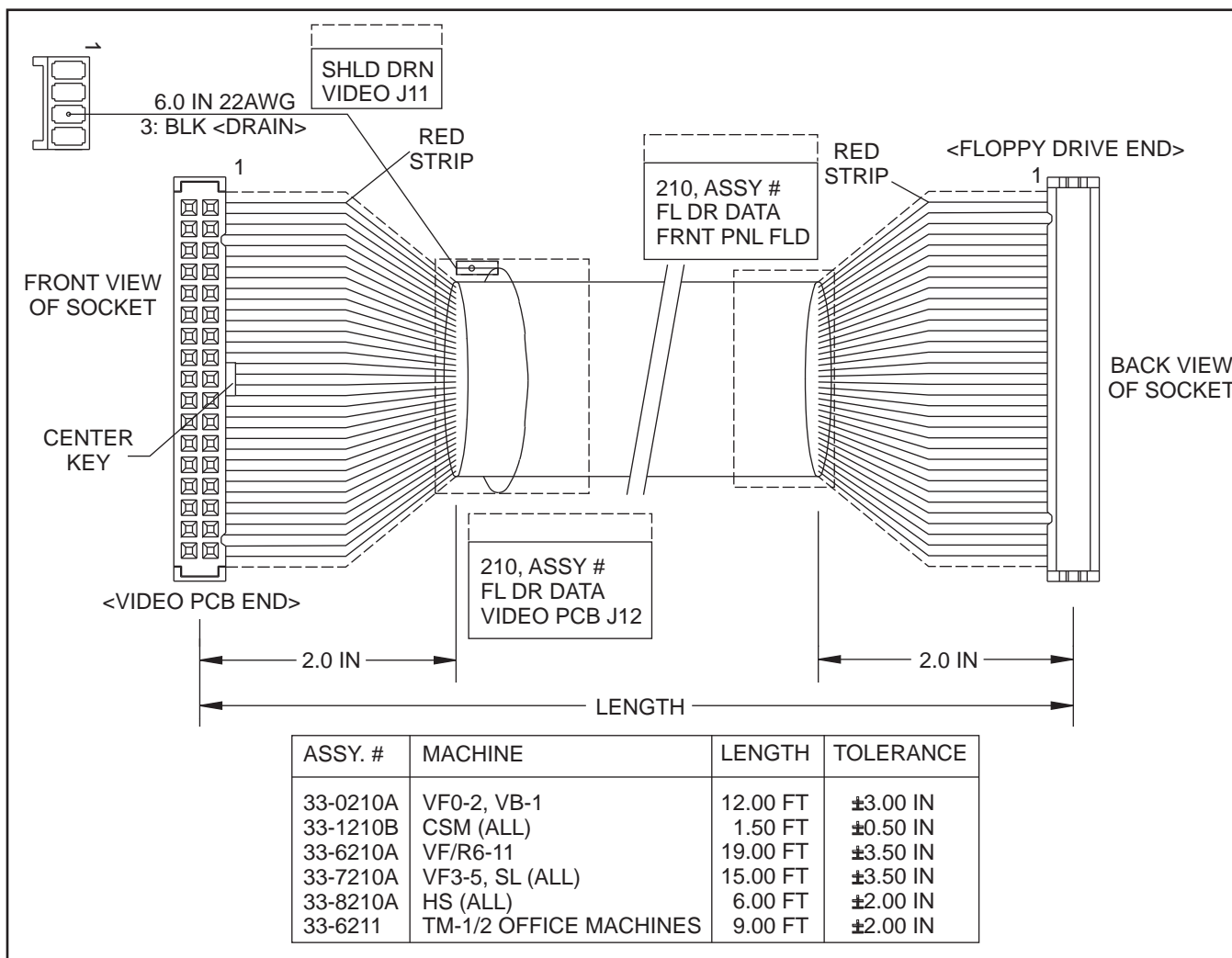


CABLE 200, PROGRAMMABLE COOLANT (33-0202)

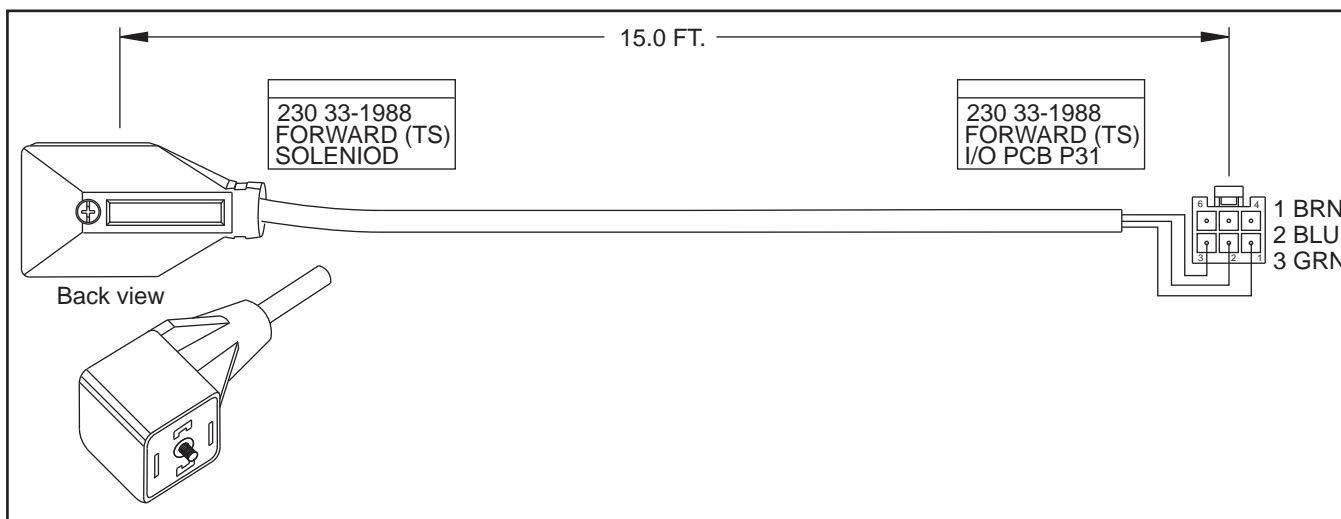




CABLE 210, FLOPPY DRIVE DTA VF0-2/VB-1 (33-0210A)

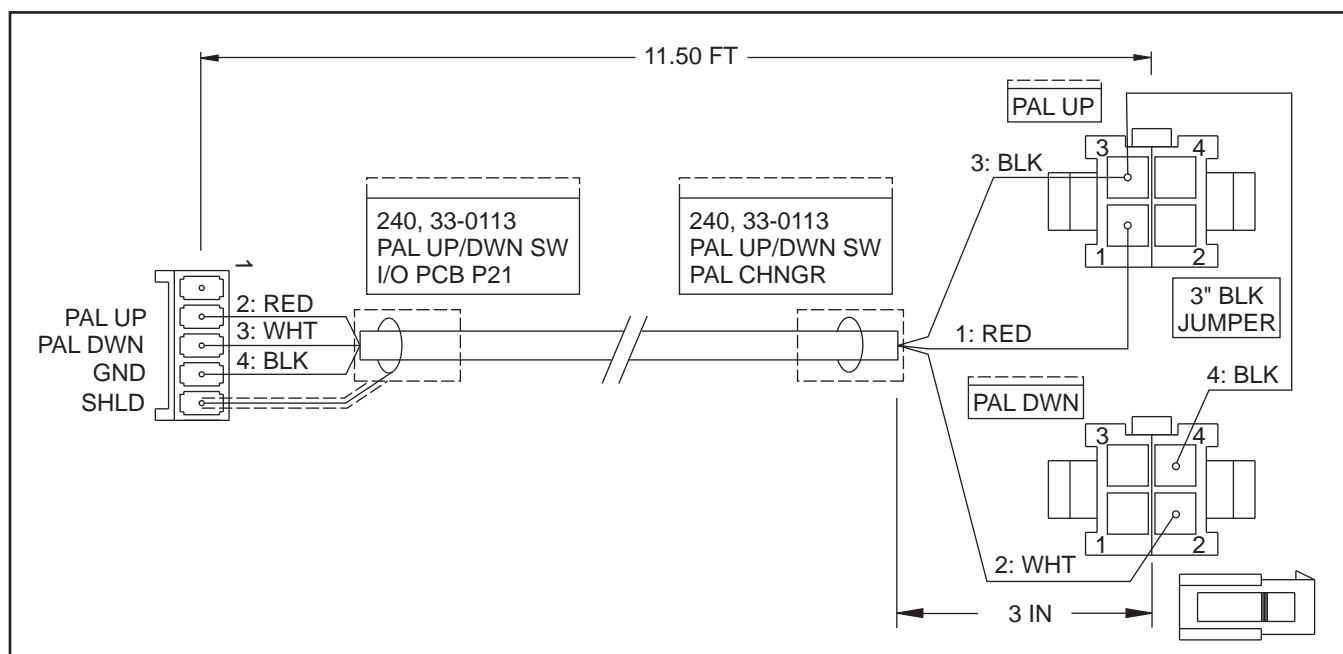


CABLE 230, TAILSTOCK CONTROL - FORWARD (33-1988)

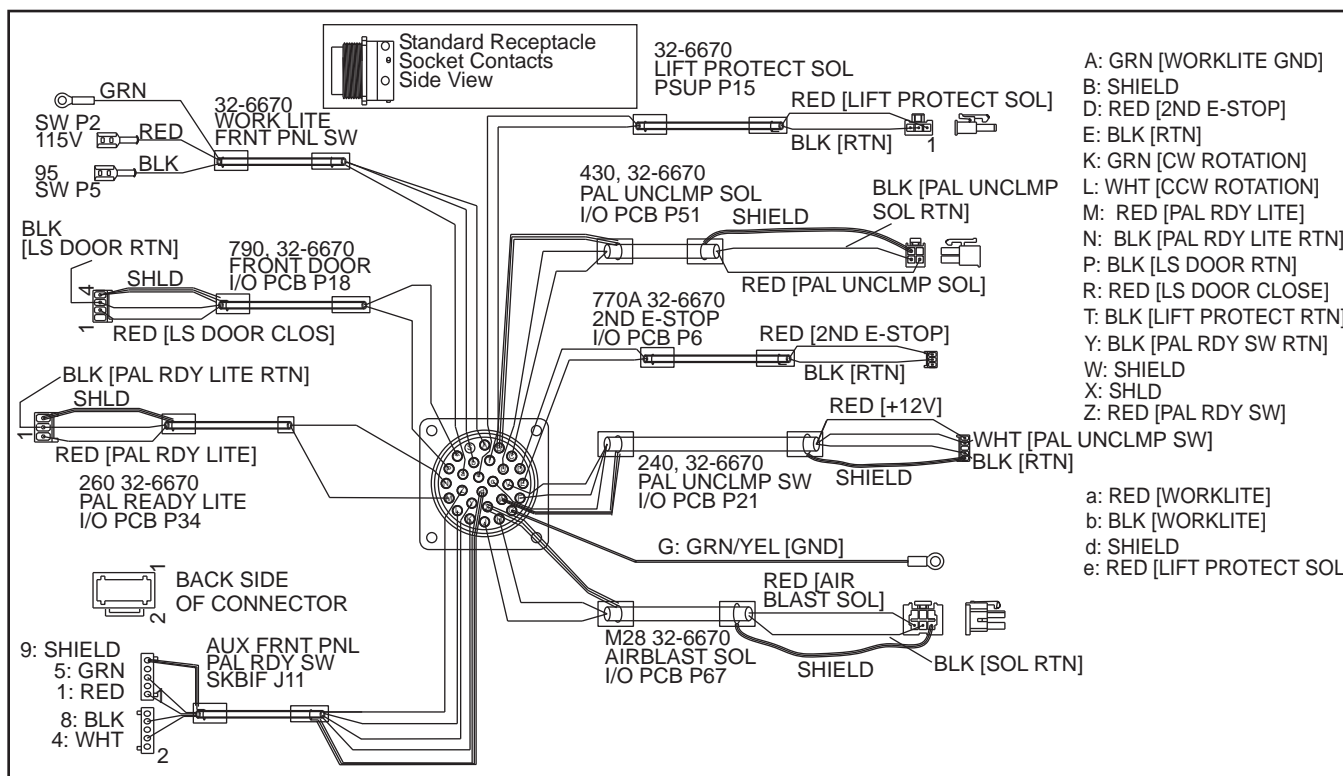




CABLE 240, PALLET UP/DOWN SWITCH (33-0113)

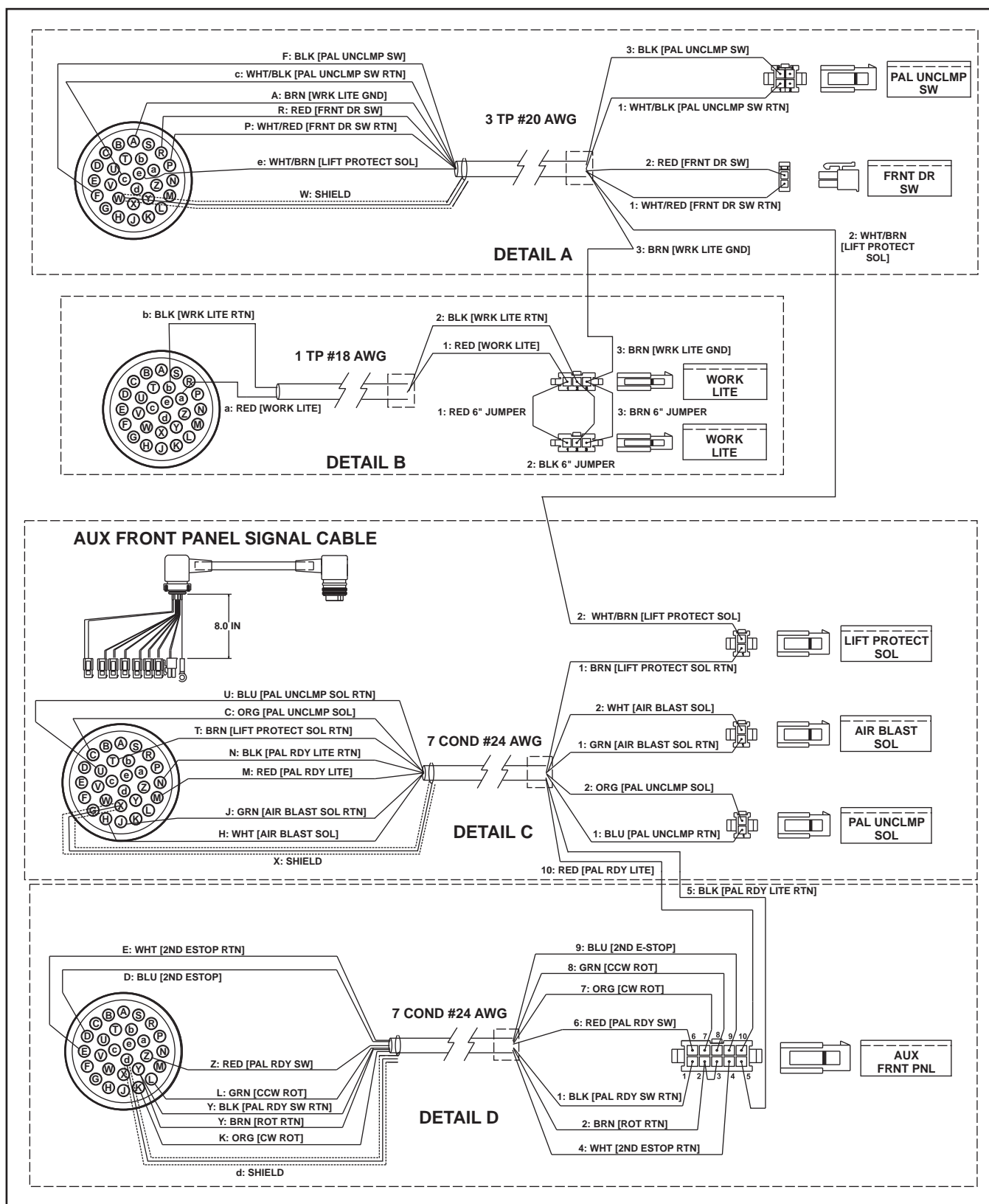


CABLE 240/260/430/770A/790 AUX. FRONT PANEL SIGNAL RECEPTACLE (32-6670)



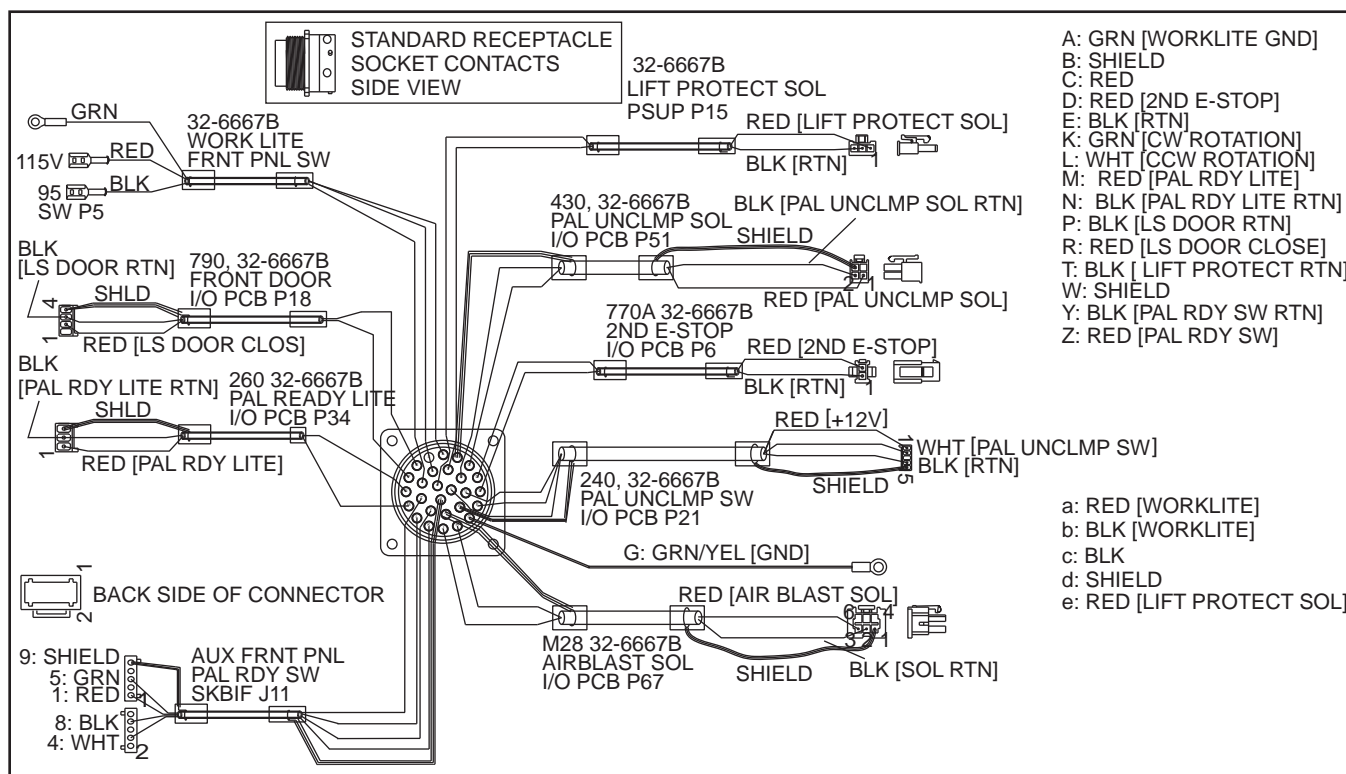


CABLE 240/260/430/770A/790 AUX. FRONT PANEL SIGNAL CABLE (32-6665A)

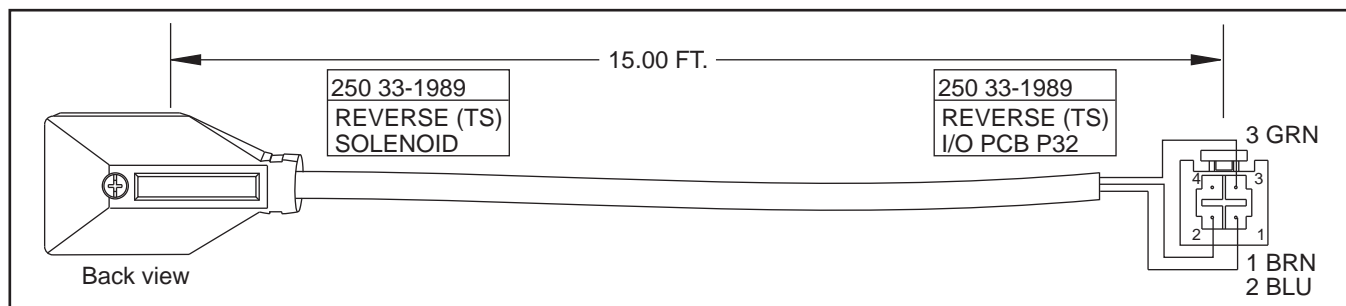




CABLE 240/260/430/770A/790 AUX. FRONT PANEL SIGNAL RECEPTACLE (32-6667B)

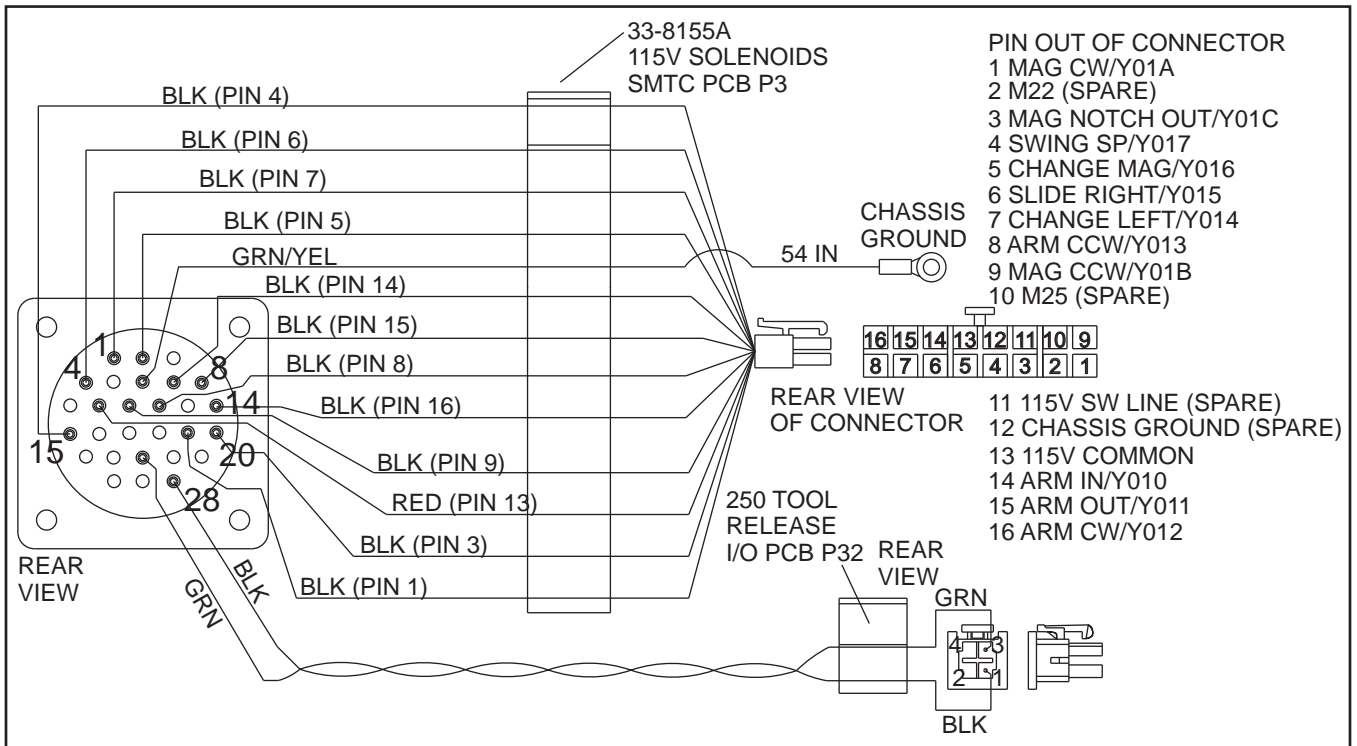


CABLE 250, TAILSTOCK CONTROL - REVERSE (33-1989)

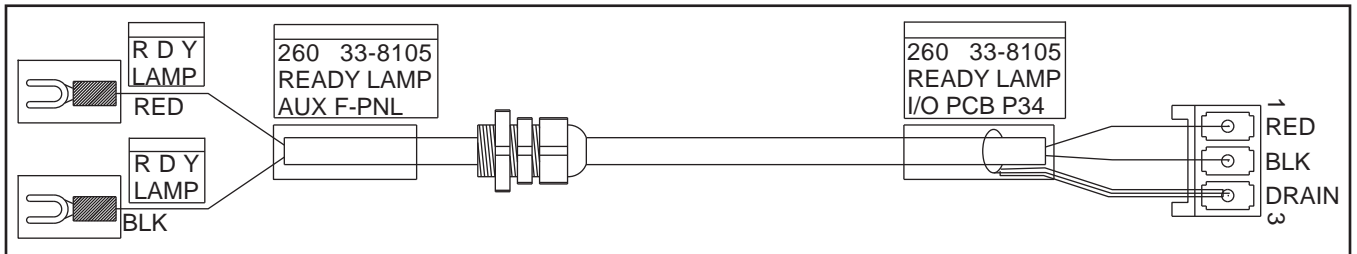




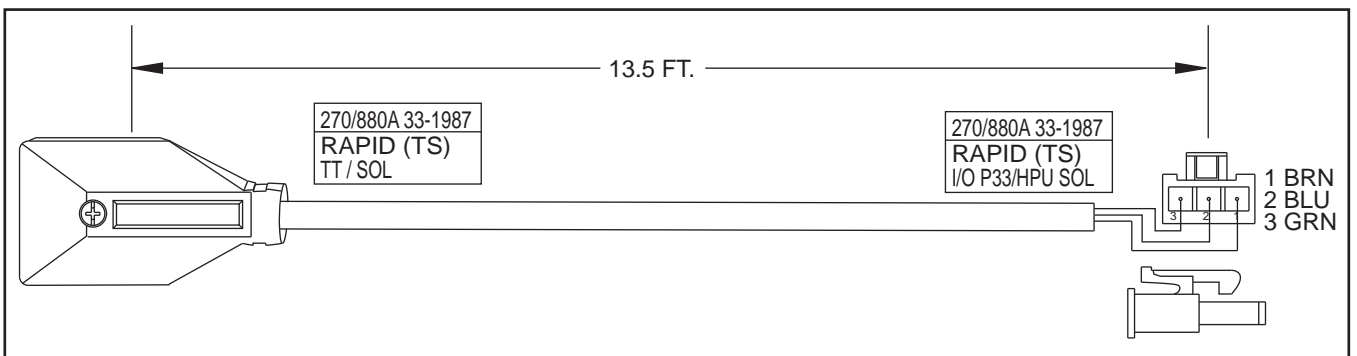
CABLE 250 MORI T/C RECEPTACLE OUTPUTS (33-8155A)



CABLE 260, READY LAMP - EC-300 (33-8105)

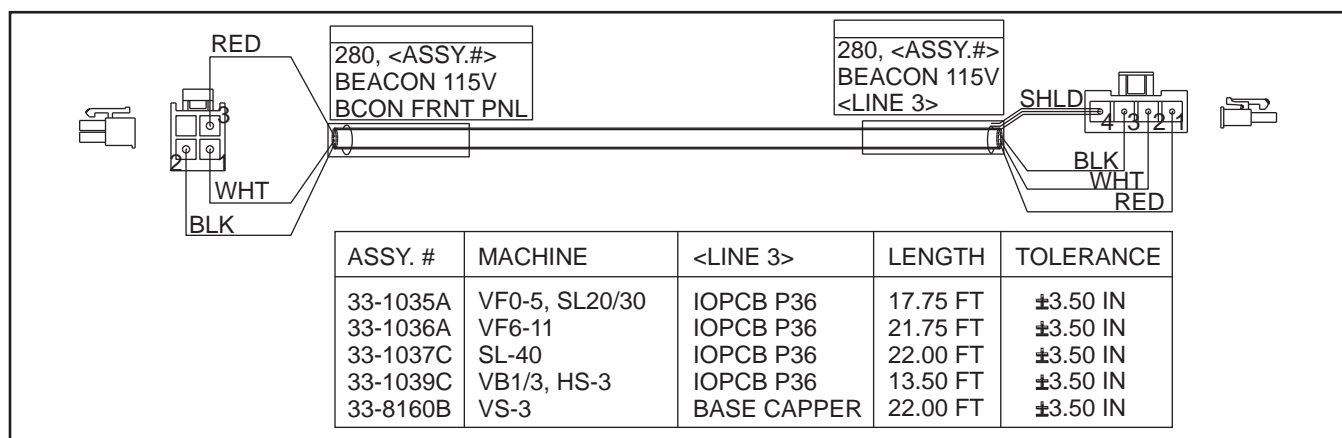


CABLE 270, TAILSTOCK CONTROL - RAPID (33-1987)

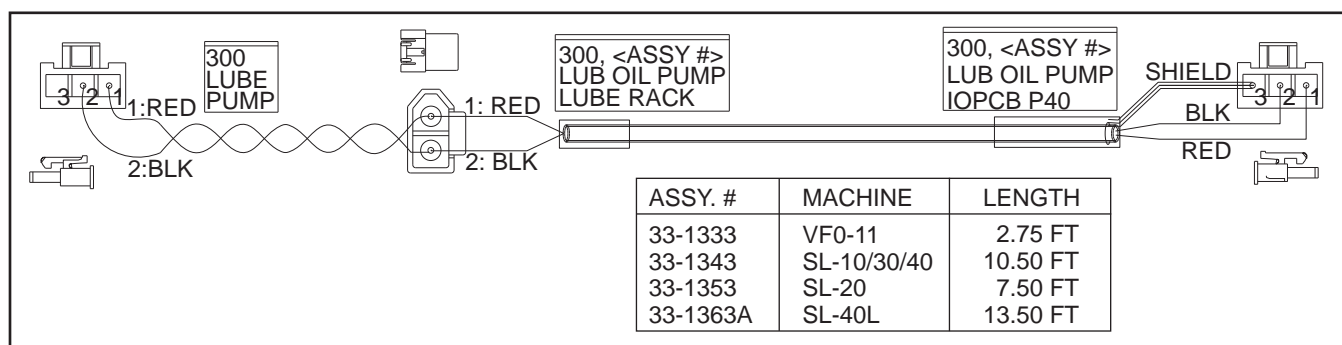




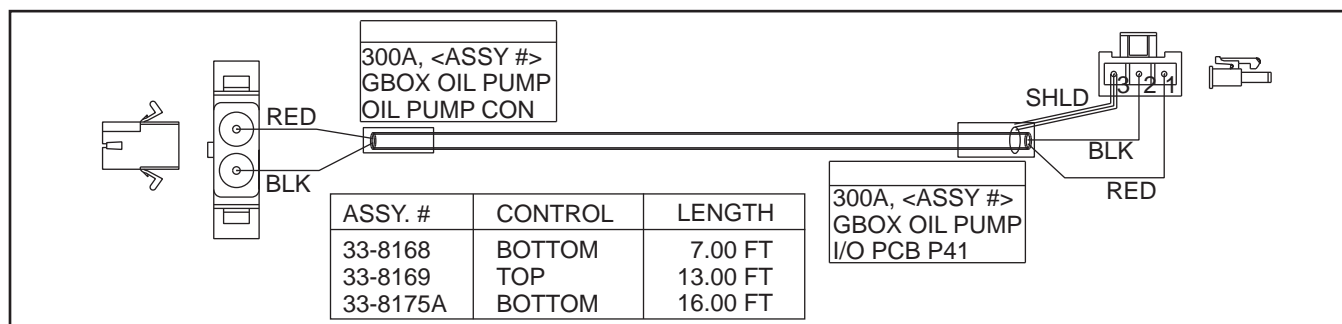
CABLE 280, HAAS BEACON (33-1035A)



CABLE 300, SPINDLE FAN/LUBE PUMP (33-1333)

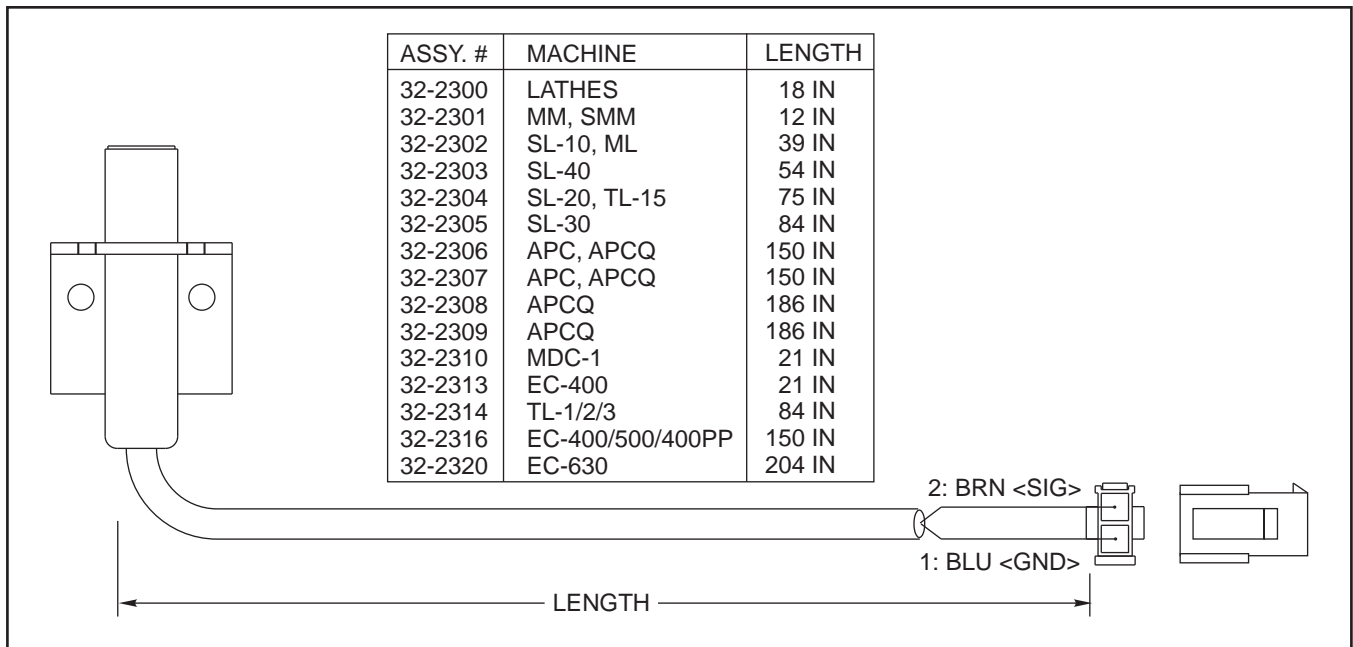


CABLE 300A, GEARBOX OIL PUMP - SL-30/40 (33-8168)

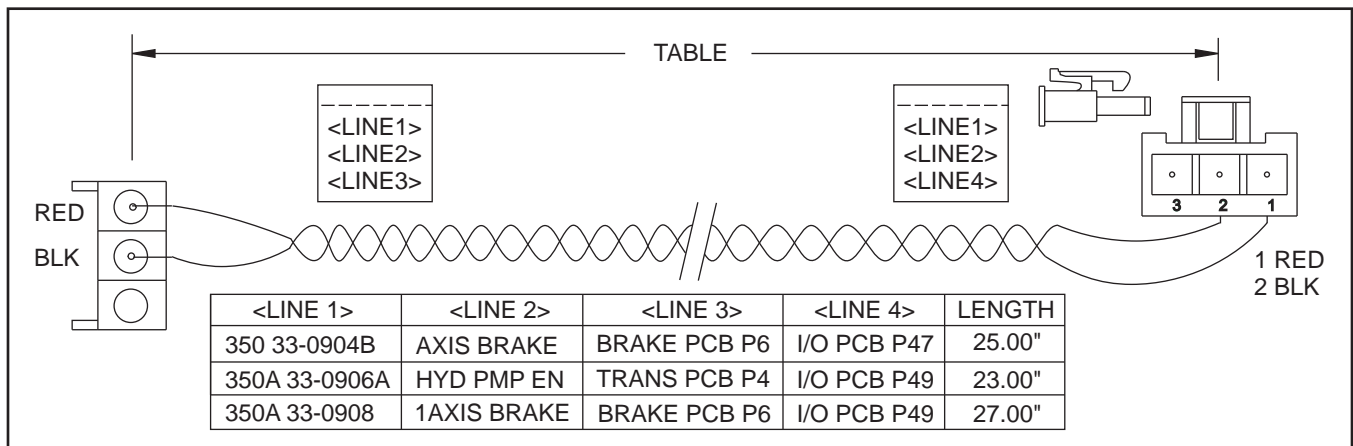




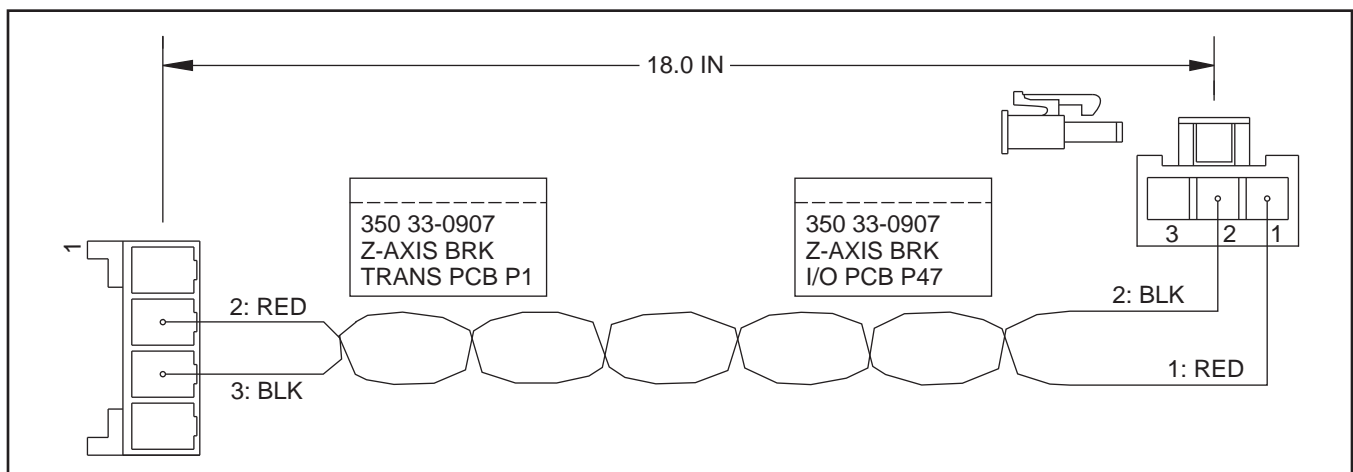
CABLE 310, DOOR OPEN (33-2300)



CABLE 350/350A, AXIS BRAKE (33-0904B)

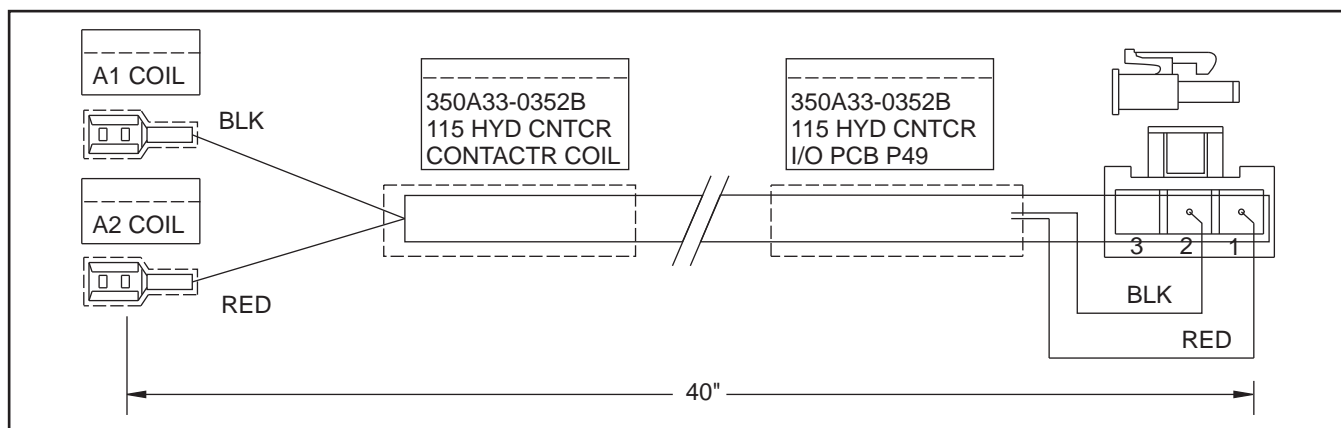


CABLE 350, Z-AXIS BRAKE (33-0907)

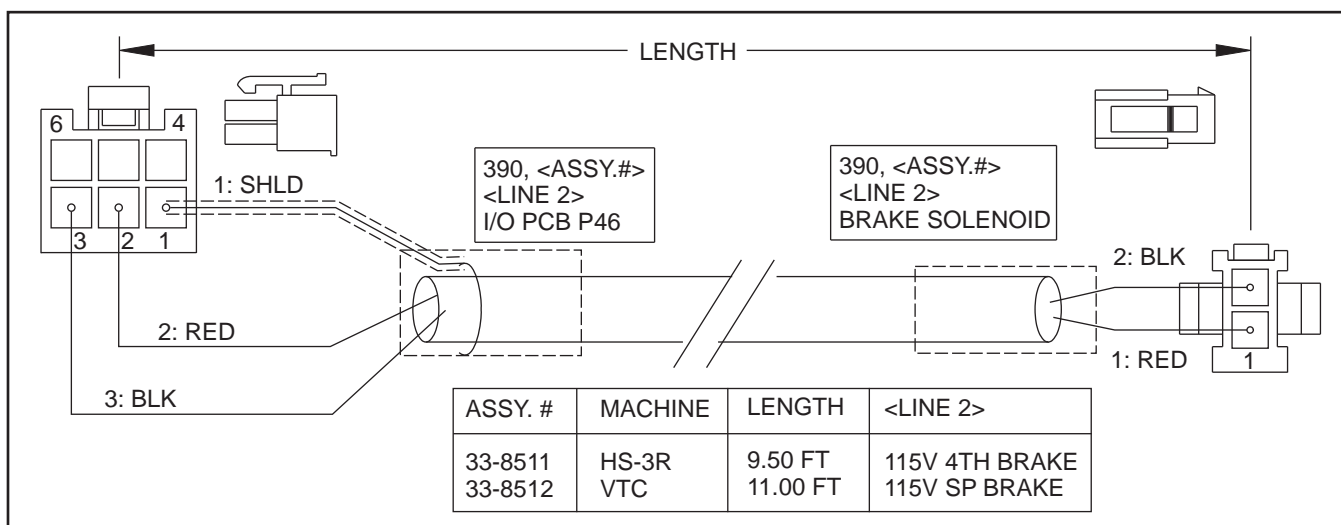




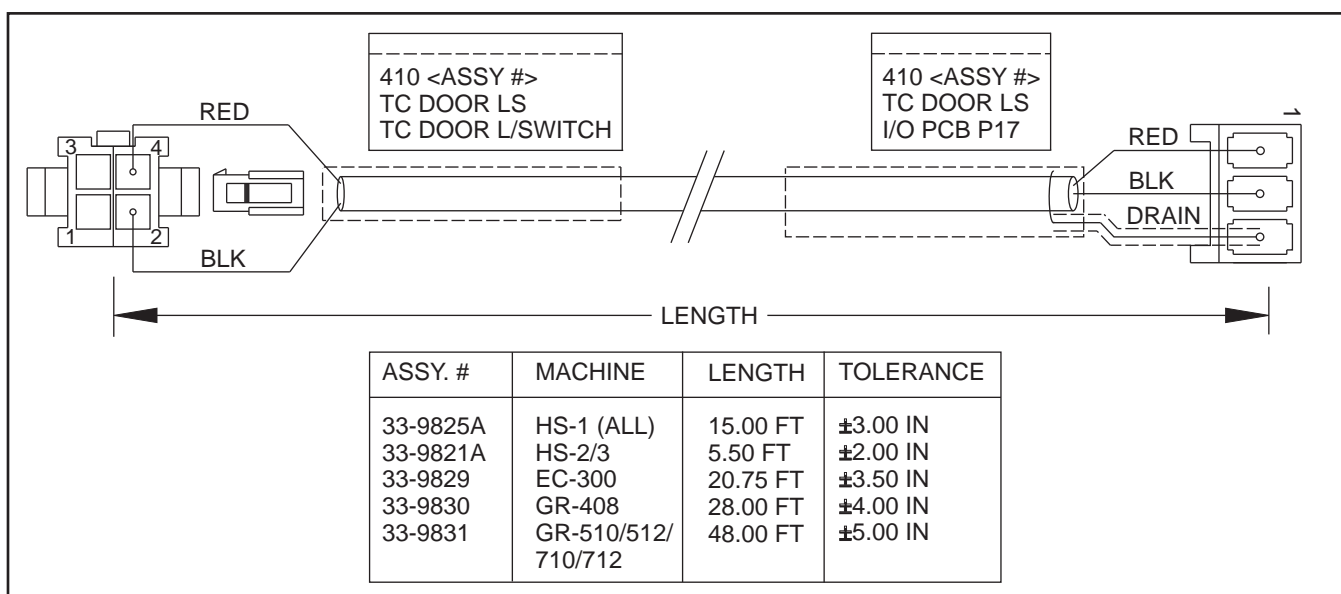
CABLE 350A, HYDRAULIC PUMP CONTACTOR (33-0352B)



CABLE 390, 115V 4TH AXIS BRAKE (33-8511)

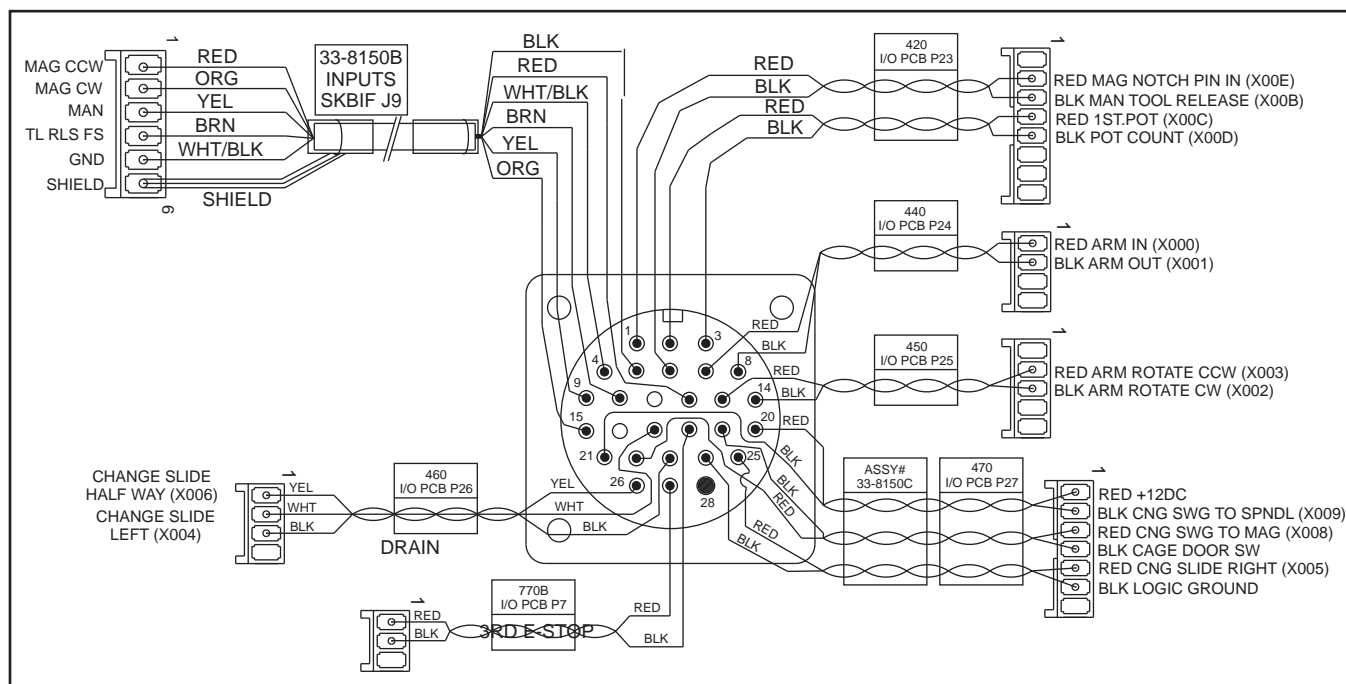


CABLE 410, TOOL CHANGER DOOR SWITCH (33-9825A)

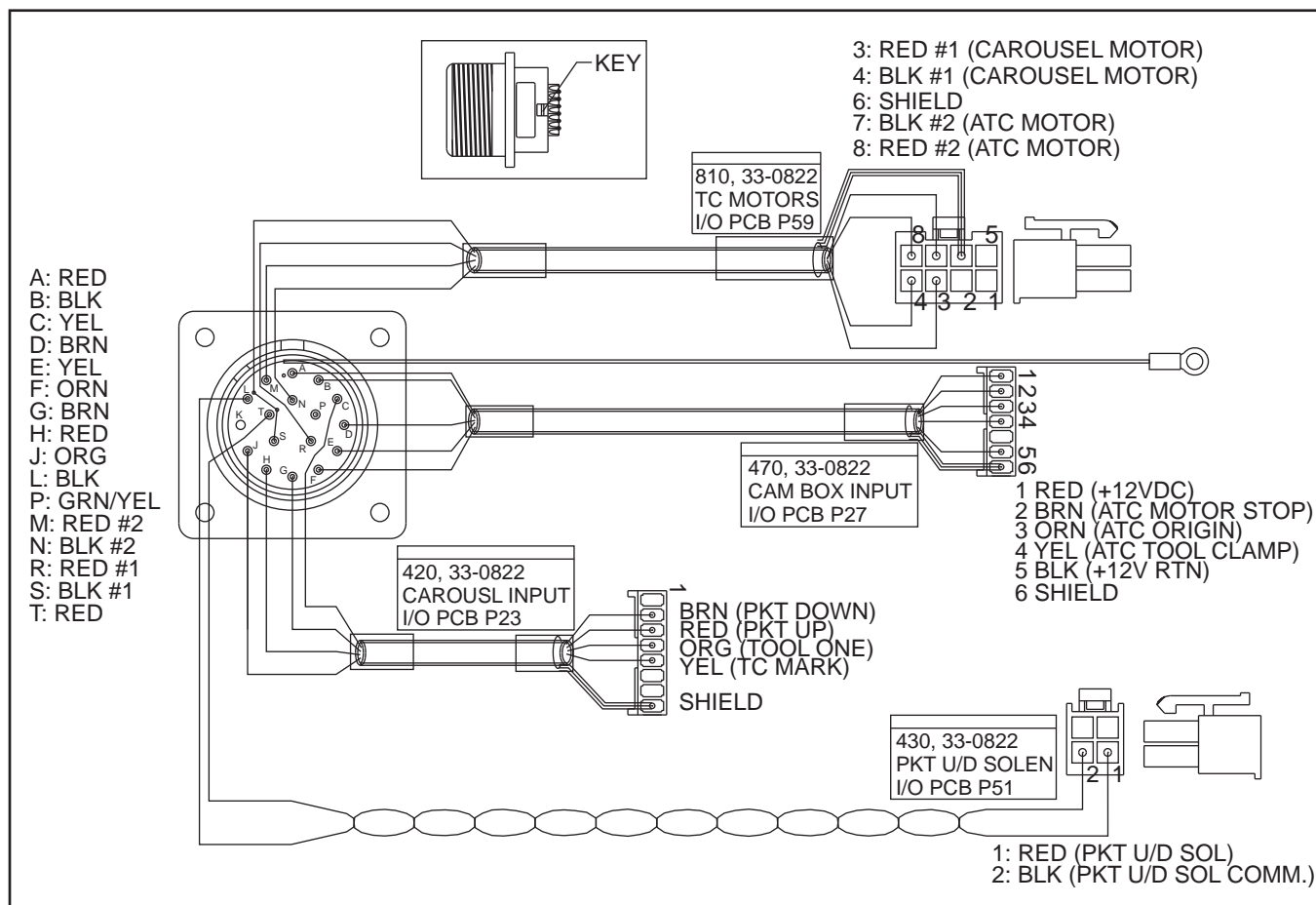




CABLE 420/440/450/460/470/770B MORI T/C RECEPTACLE INPUTS (33-8150C)

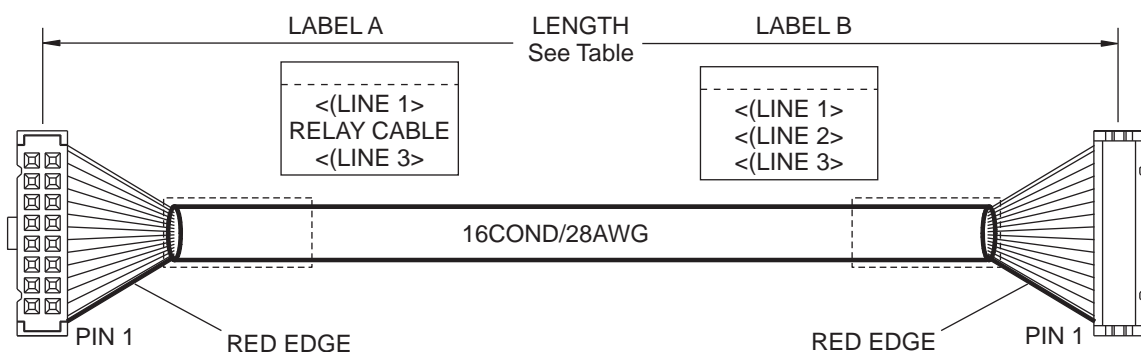


CABLE 420/430/470/810 SIDE-MOUNT TOOL CHANGER AMPHENOL CABLE ASSEMBLY (33-0822)





CABLE 510, I/O PCB TO MOCON - No SHIELD (33-0515A)



ASSY. #	LABEL A & B <LINE 1>	LABEL B <LINE 2>	LABEL A <LINE 3>	LABEL B <LINE 3>	LENGTH
33-0515	510, 33-0515A	RELAY CABLE	MOCON P11	I/O PCB P65	46.0 IN
33-0525	520, 33-0525A	RELAY CABLE	MOCON P12	I/O PCB P64	46.0 IN
33-0535	530, 33-0535A	RELAY CABLE	MOCON P13	I/O PCB P70	46.0 IN
33-0545	540, 33-0545A	PRE I/O-S P3	MOCON P14	I/O PCB P61	38.0 IN

CABLE 510

PIN 1/2 SERVO POWER ON/RTN
PIN 3/4 PALLET UP/RTN
PIN 5/6 SPARE A/RTN
PIN 7/8 SPARE B/RTN
PIN 9/10 4TH AXIS BRAKE/RTN
PIN 11/12 COOLANT ON/RTN
PIN 13/14 AUTO POWER OFF/RTN
PIN 15/16 SPINDLE COOLING (VF-0)
SPINDLE LUBE
SPINDLE FAN
GEAR BOX OIL PUMP
WAY LUBE PUMP/RTN

CABLE 520

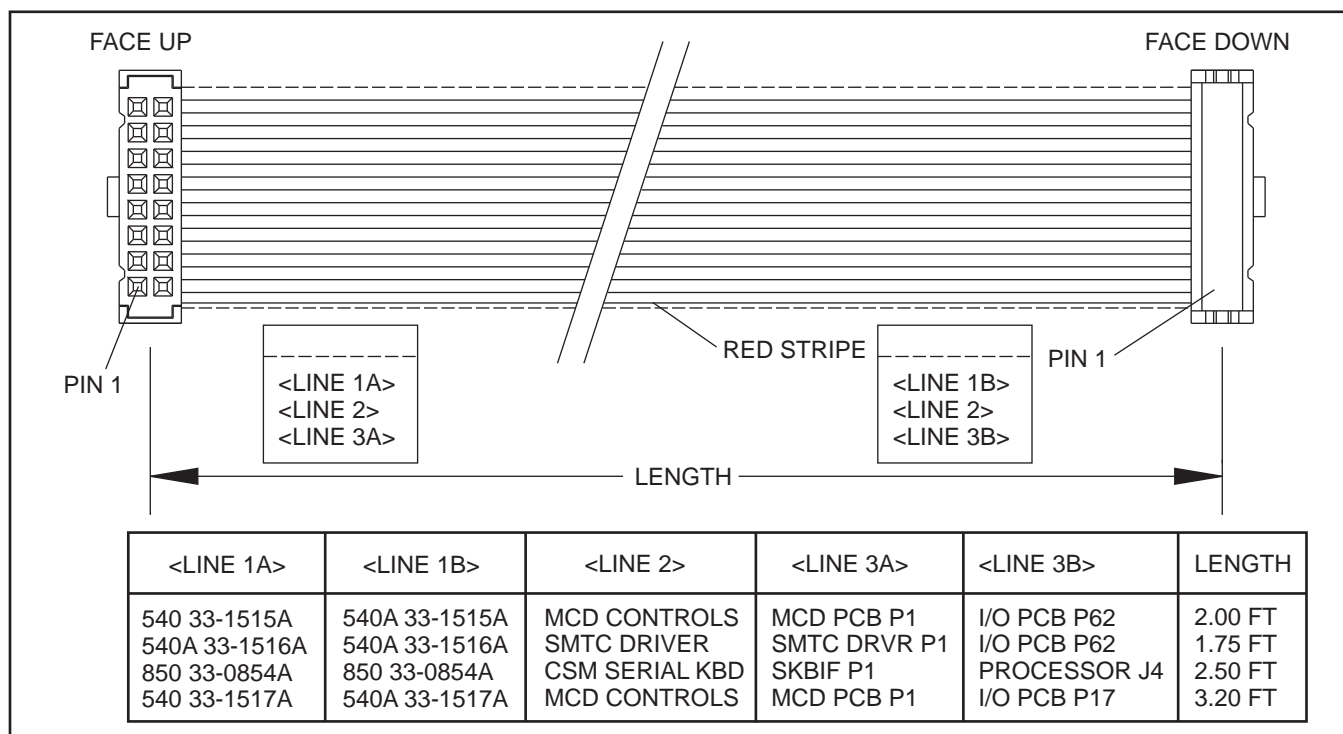
PIN 1/2 TOOL SHUTTLE IN/RTN
PIN 3/4 TOOL SHUTTLE OUT/RTN
PIN 5/6 TOOL TURRET CW/RTN
PIN 7/8 TOOL TURRET CCW/RTN
PIN 9/10 HIGH GEAR SHIFT/RTN
PIN 11/12 LOW GEAR SHIFT/RTN
PIN 13/14 TOOL UNCLAMP/RTN
PIN 15/16 SPINDLE LOCK/RTN

CABLE 530

PIN 1/2 SPIGOT FORWARD/RTN
PIN 3/4 SPIGOT REVERSE/RTN
PIN 5/6 SPARE A/RTN
PIN 7/8 SPARE B/RTN
PIN 9/10 PRECHARGE/RTN
PIN 11/12 SPARE C (HTC SHUTTLE)/RTN
PIN 13/14 5TH AXIS BRAKE/RTN
PIN 15/16 DOOR LOCK (EUROPE)/RTN

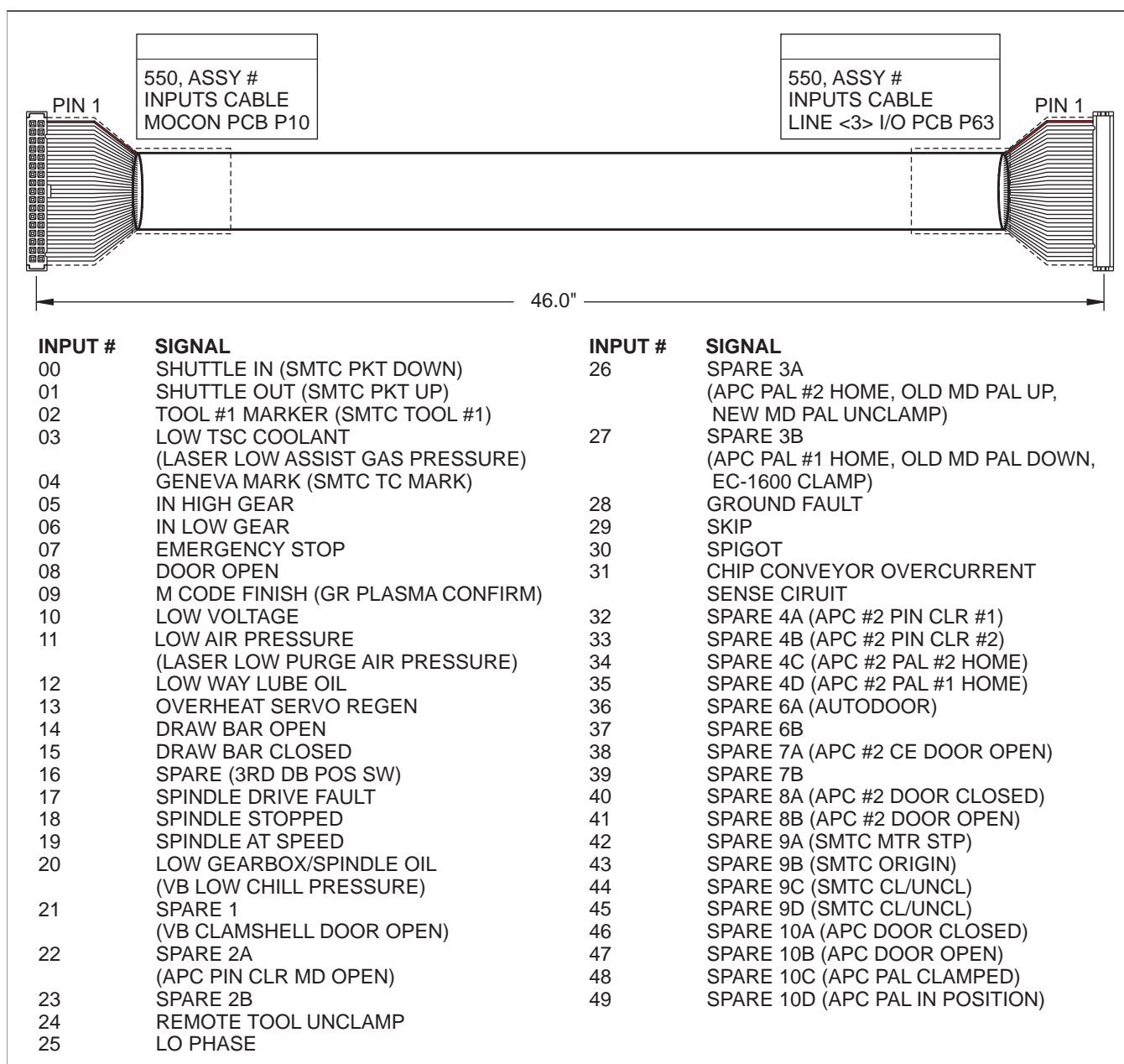


CABLE 540/540A/850 I/O PCB TO MCD CONTROLS (33-1515G)



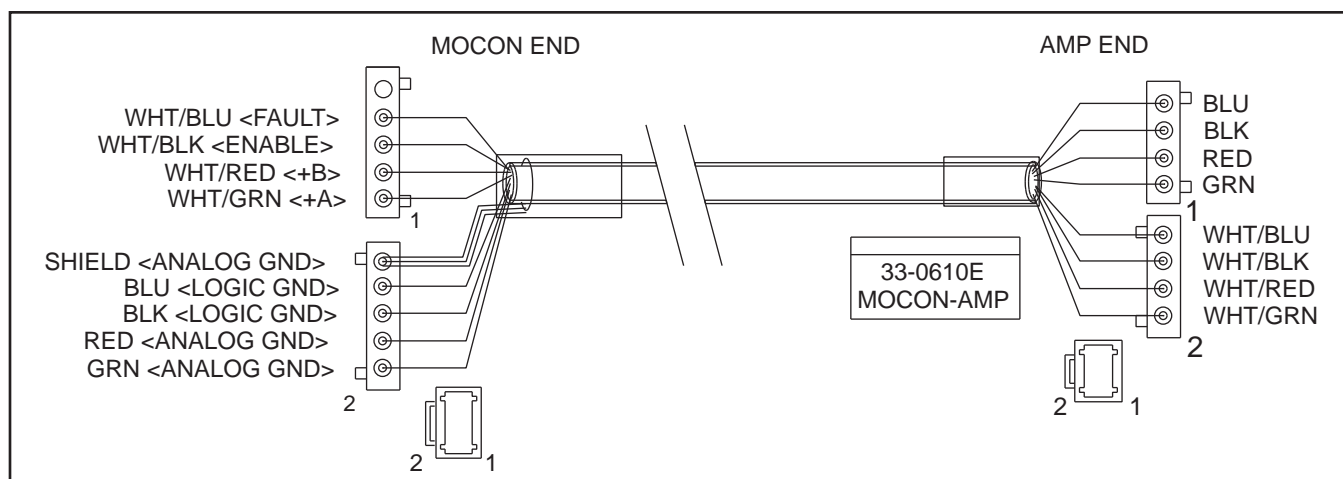


CABLE 550, INPUT I/O TO MOCON - No SHIELD (33-0552)

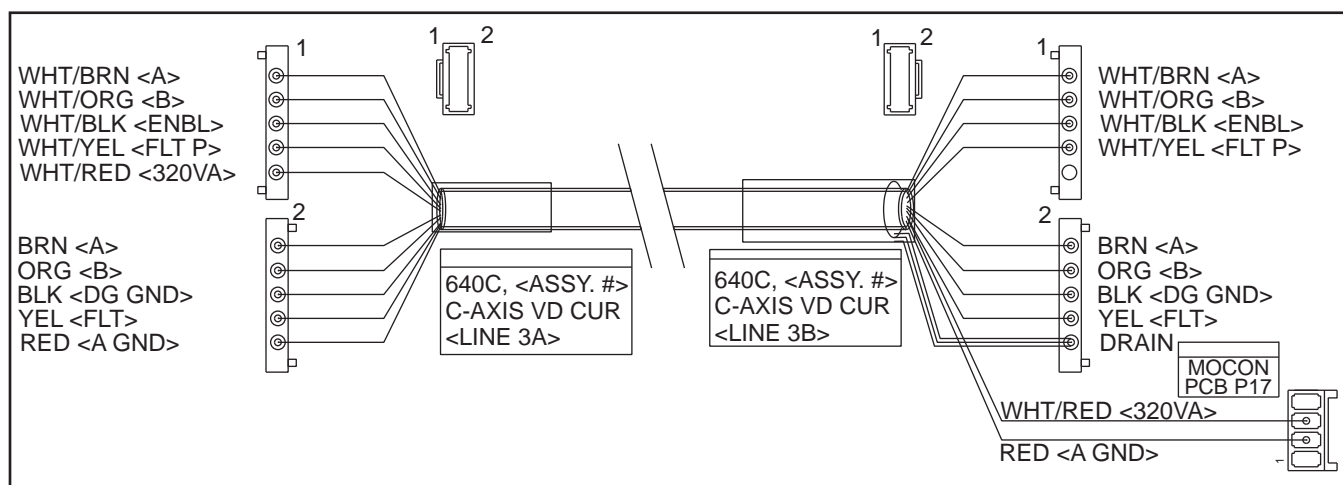




CABLE 610 (620, 630), AXIS CURRENT COMMAND (33-0610E)

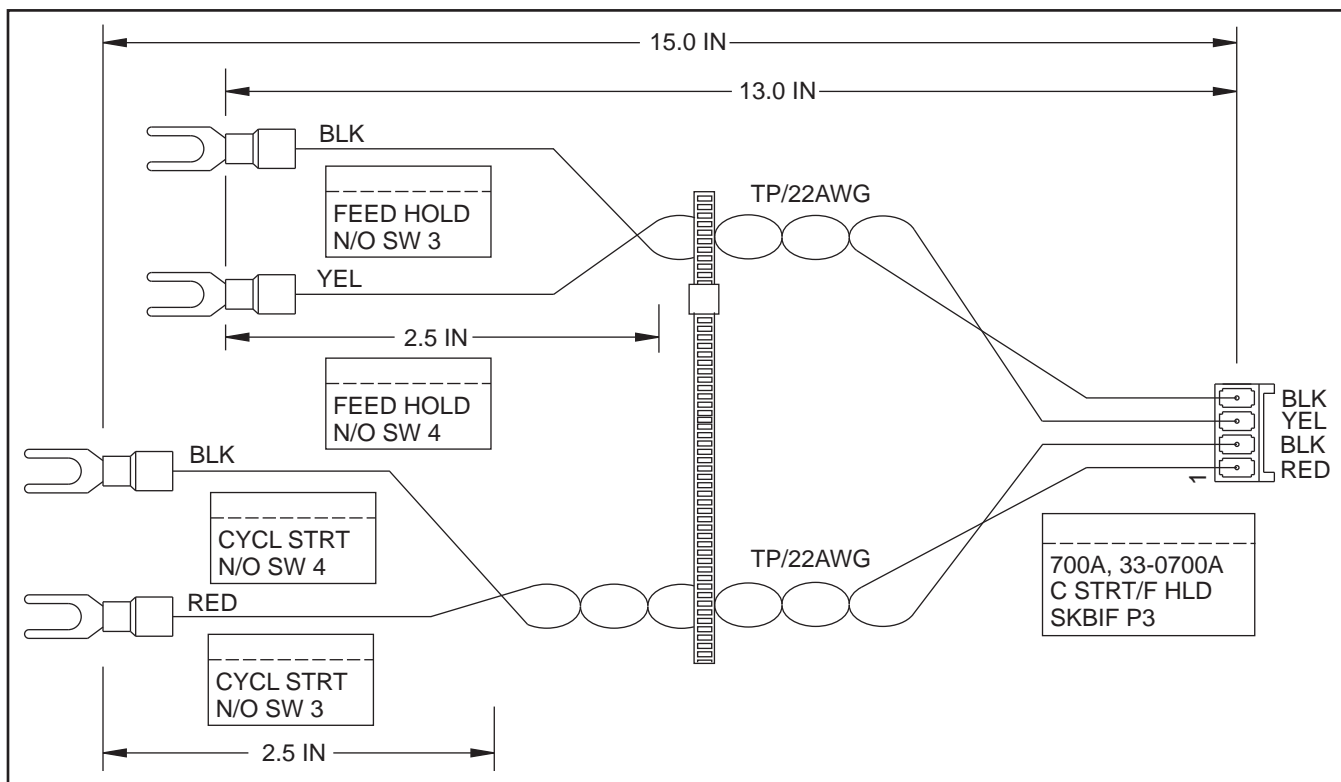


CABLE 640C, VECTOR DRIVE CURRENT COMMAND (33-4048B)

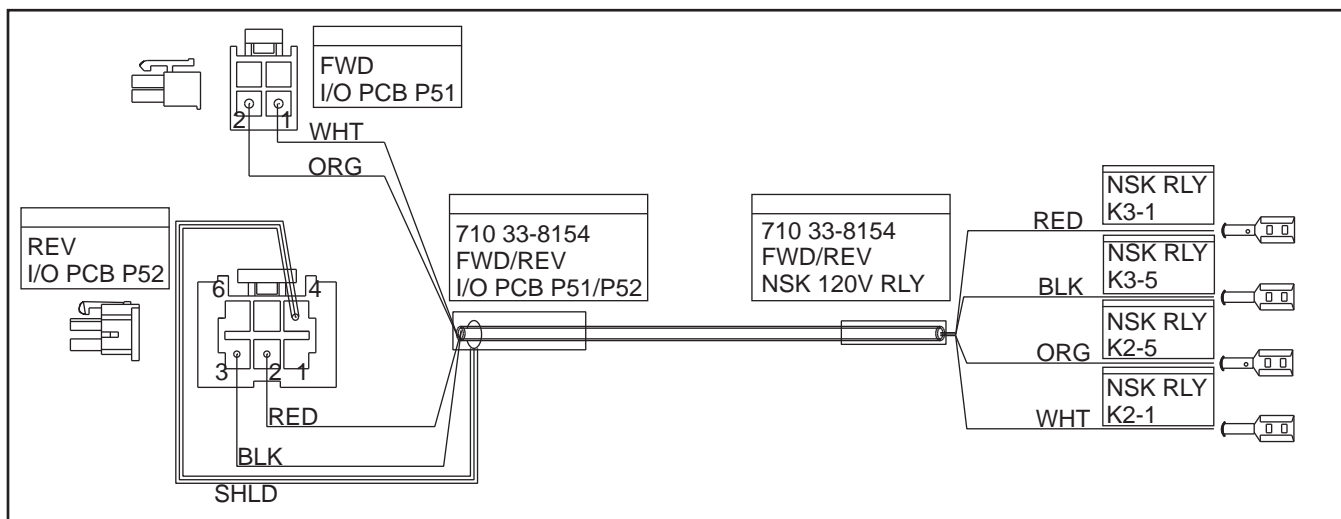




CABLE 700A, FEED HOLD/CYCLE START (33-0700A)

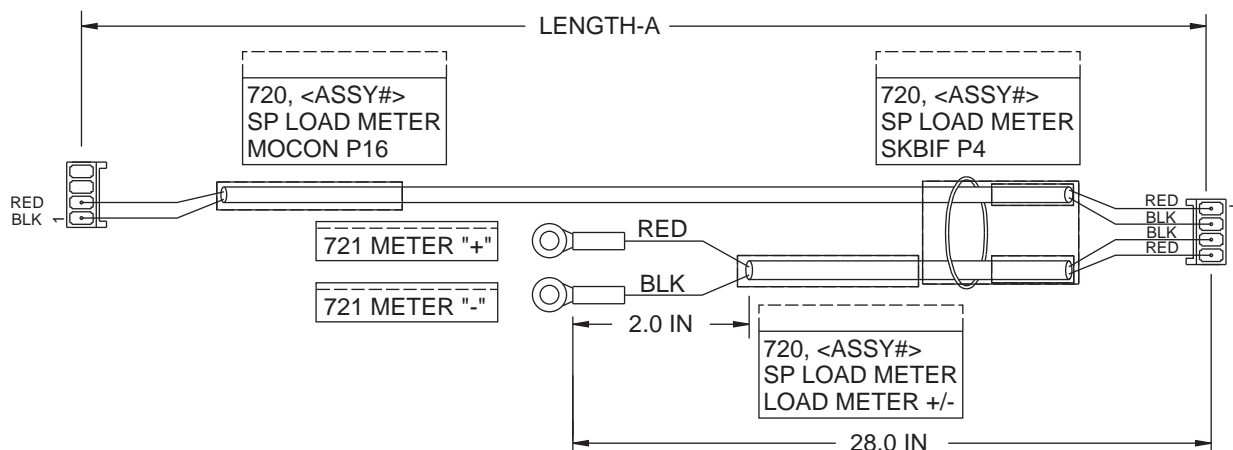


CABLE 710, FORWARD/REVERSE RELAY - OM-1 (33-8154)



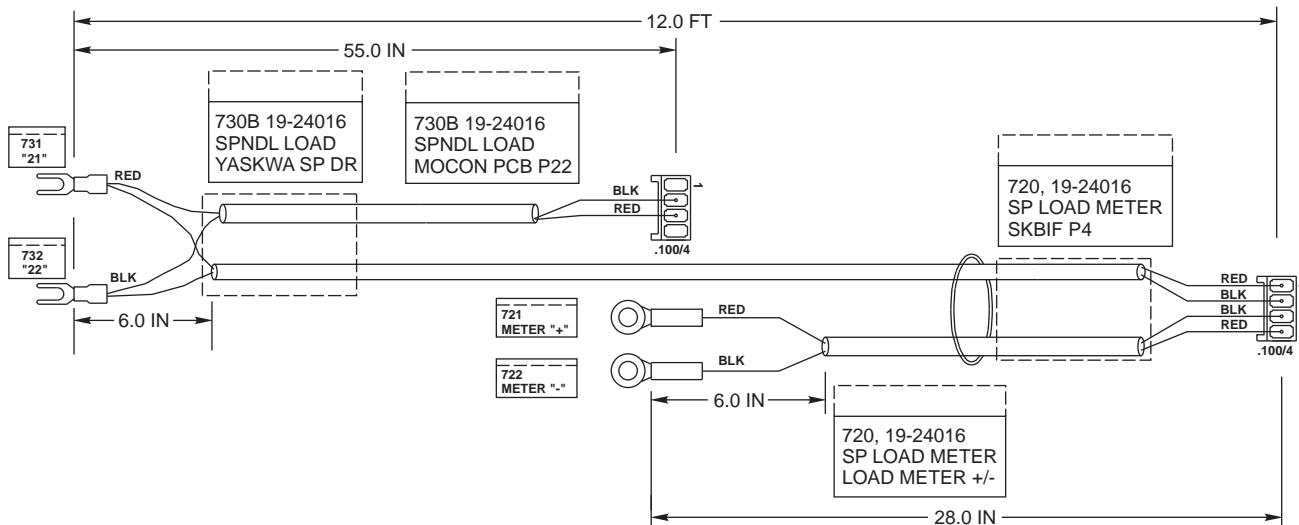


CABLE 720, SPINDLE LOAD METER (33-0733)



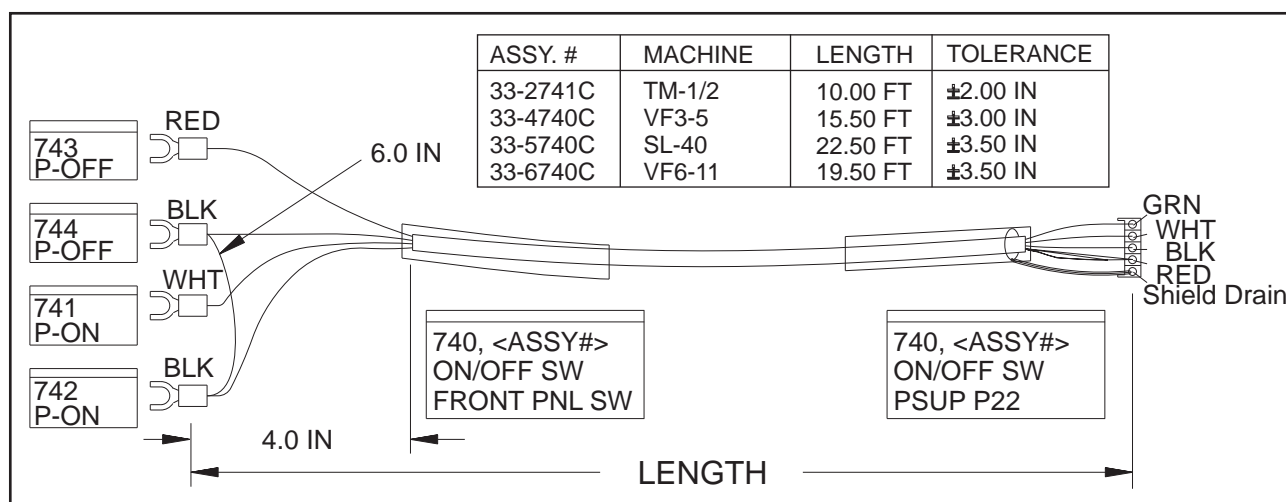
ASSY. #	MACHINE	LENGTH-A	TOTAL LENGTH
33-0733	VF 0-2, VB-1	12.00 FT	14.33 FT
33-4733	VF 3-5	15.00 FT	17.33 FT
33-2733	TM-1/2	8.50 FT	10.83 FT
33-5733	ML	8.00 FT	10.33 FT
33-6733	VF 6-11, SL-40	19.00 FT	21.33 FT
33-6737	SL-40LB	22.50 FT	24.85 FT
33-7733	SL-20/30	14.00 FT	16.33 FT
33-8733A	HS (ALL)	6.00 FT	8.33 FT

CABLE 720/730B, SPINDLE DRIVE LOAD (19-24016)

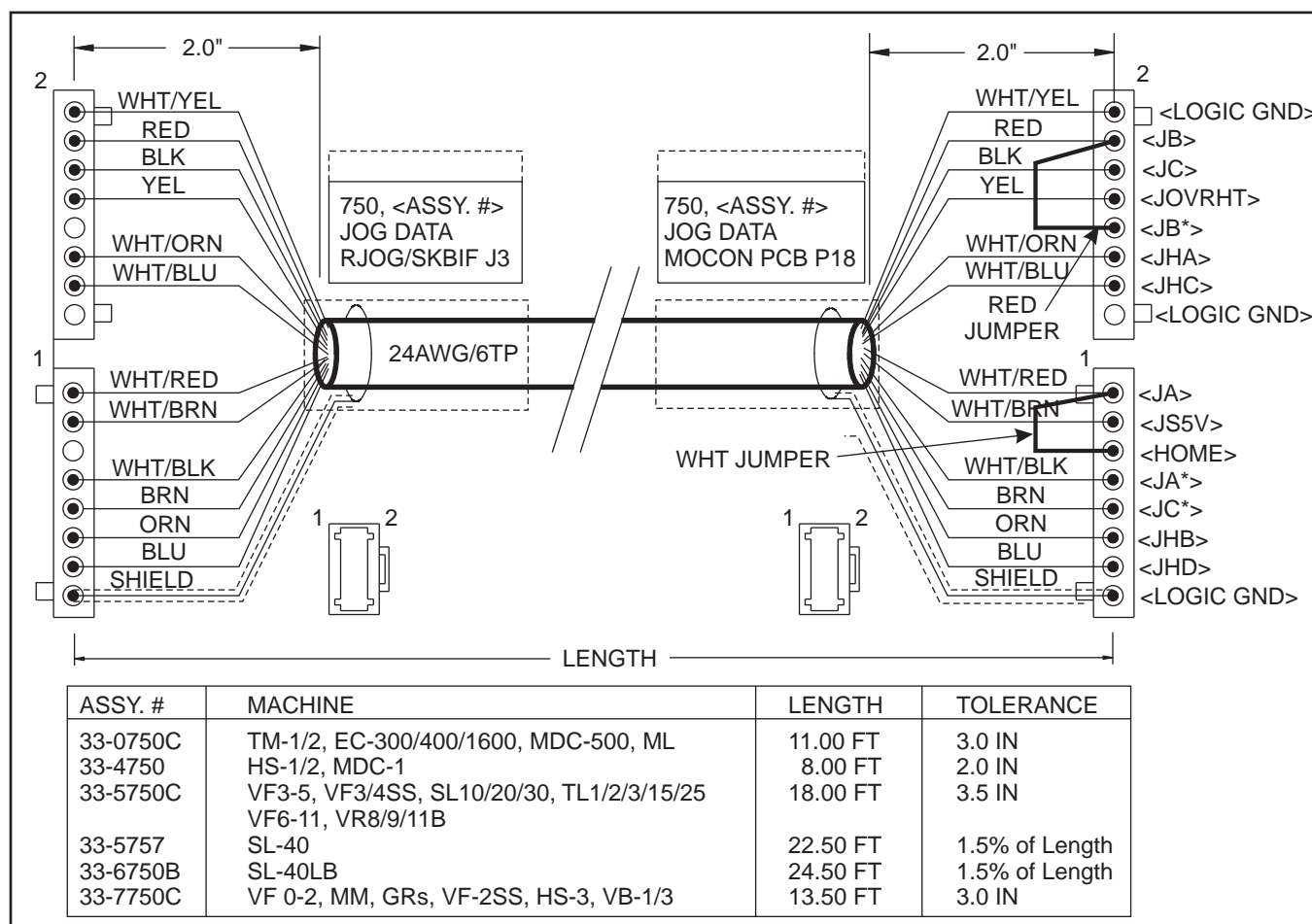




CABLE 740, ON/OFF F P (33-2741C)

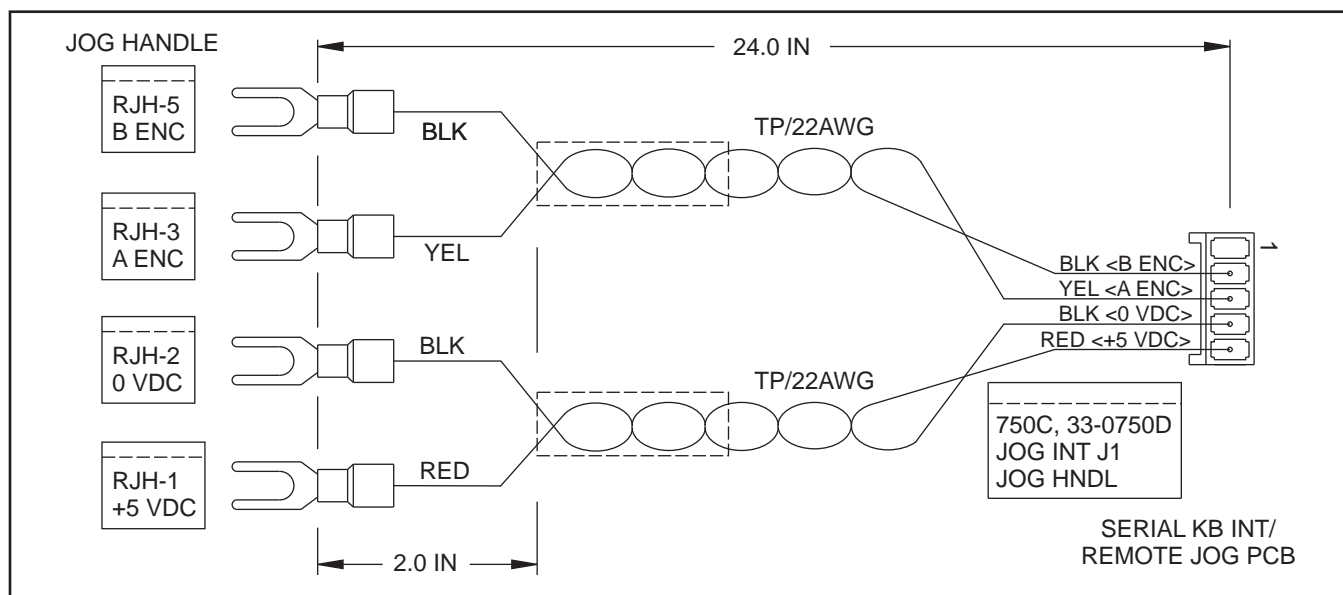


CABLE 750, REMOTE JOG HANDLE DATA - 11 FT (33-0750C)

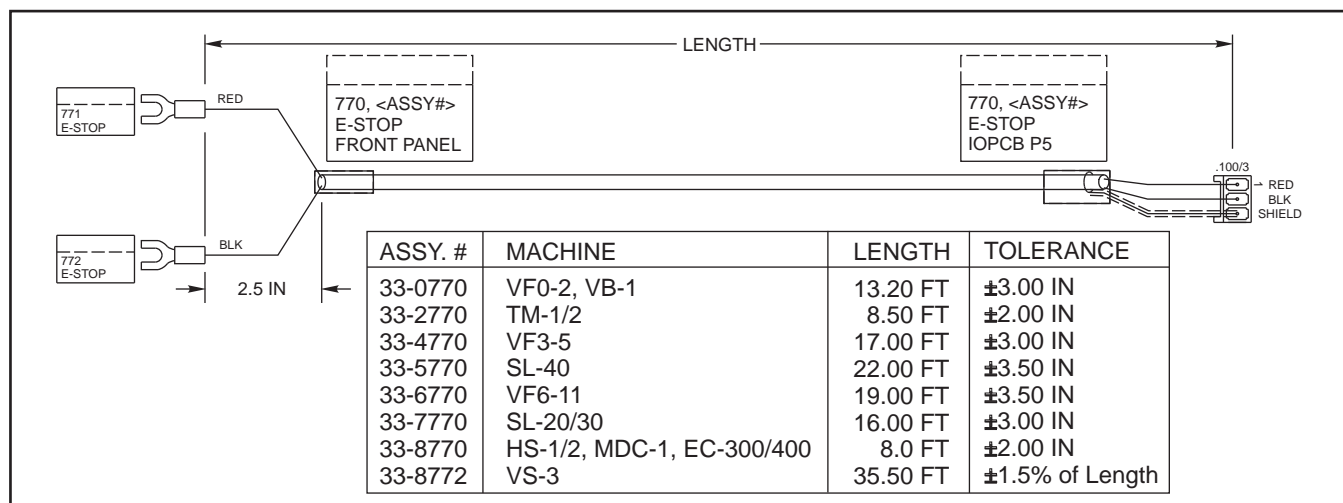




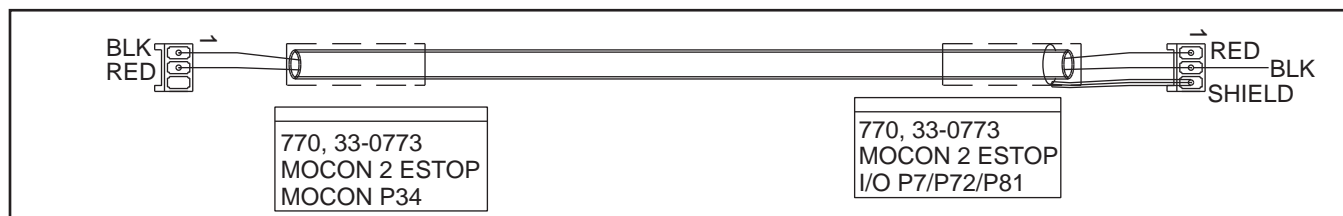
CABLE 750C, JOG HANDLE ASSEMBLY (33-0750D)



CABLE 770, EMERGENCY STOP INPUT (33-0770)

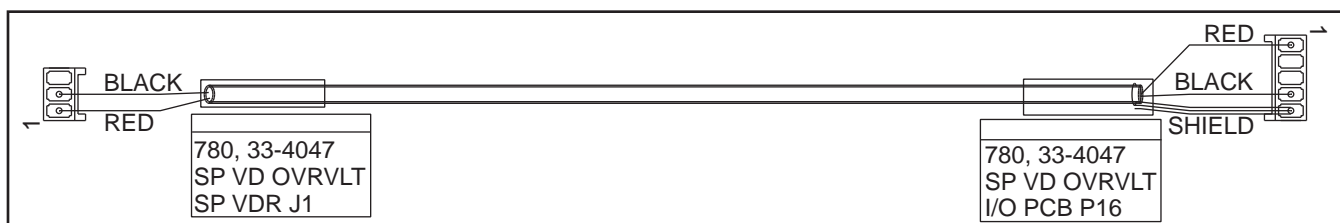


CABLE 770, MOCON 2 AUXILIARY E-STOP (33-0773)

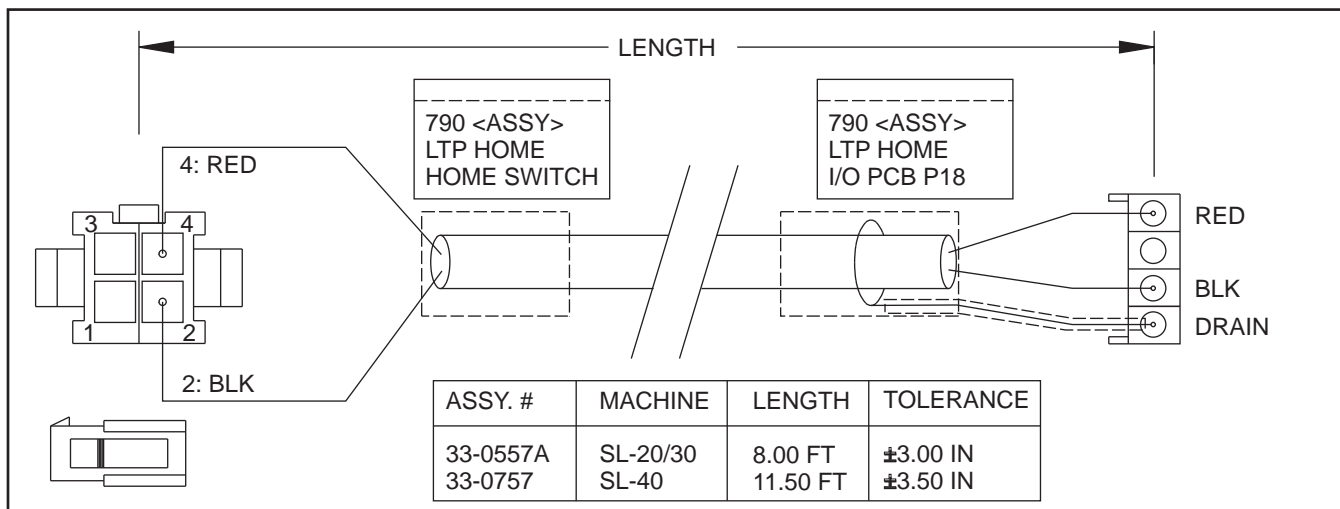




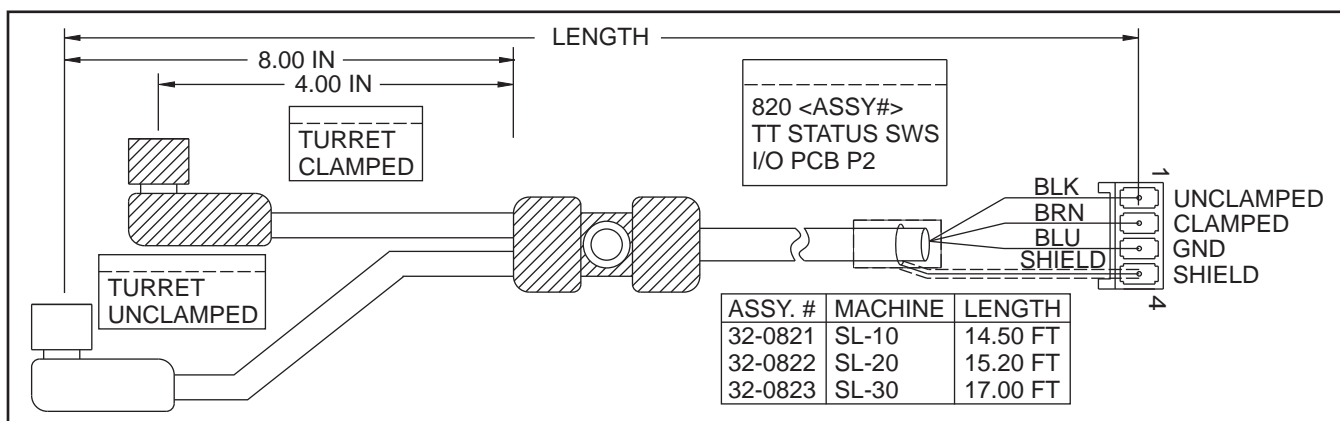
CABLE 780, SPINDLE OVERVOLTAGE (33-4047)



CABLE 790, TOOL PRESETTER HOME SWITCH "I/O S" SL-20/30 (33-0557A)

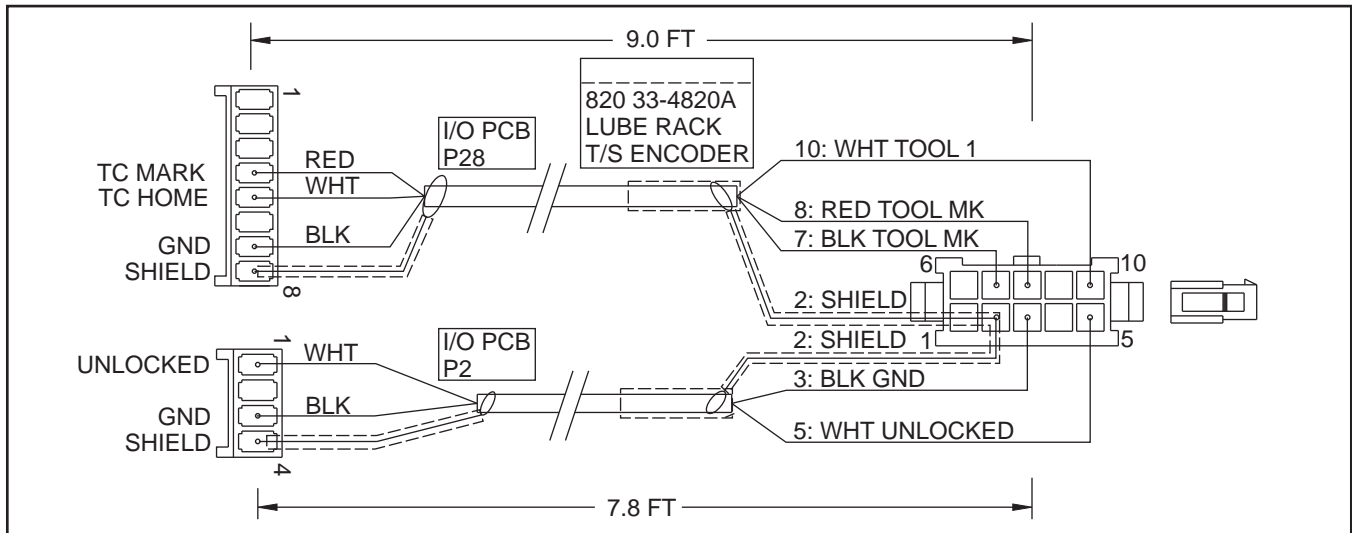


CABLE 820, TOOL TURRET STATUS - 17 FT (32-0823)

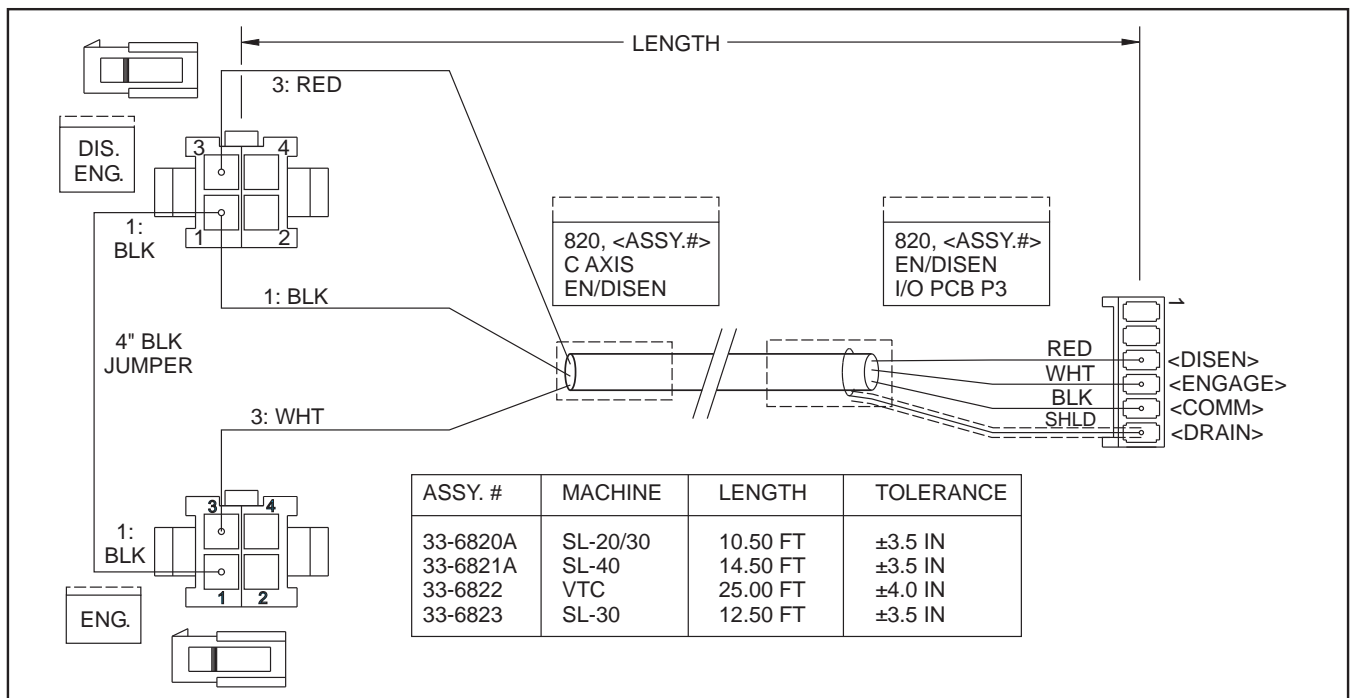




CABLE 820, 8-STATION TOOL TURRET STATUS (33-4820A)

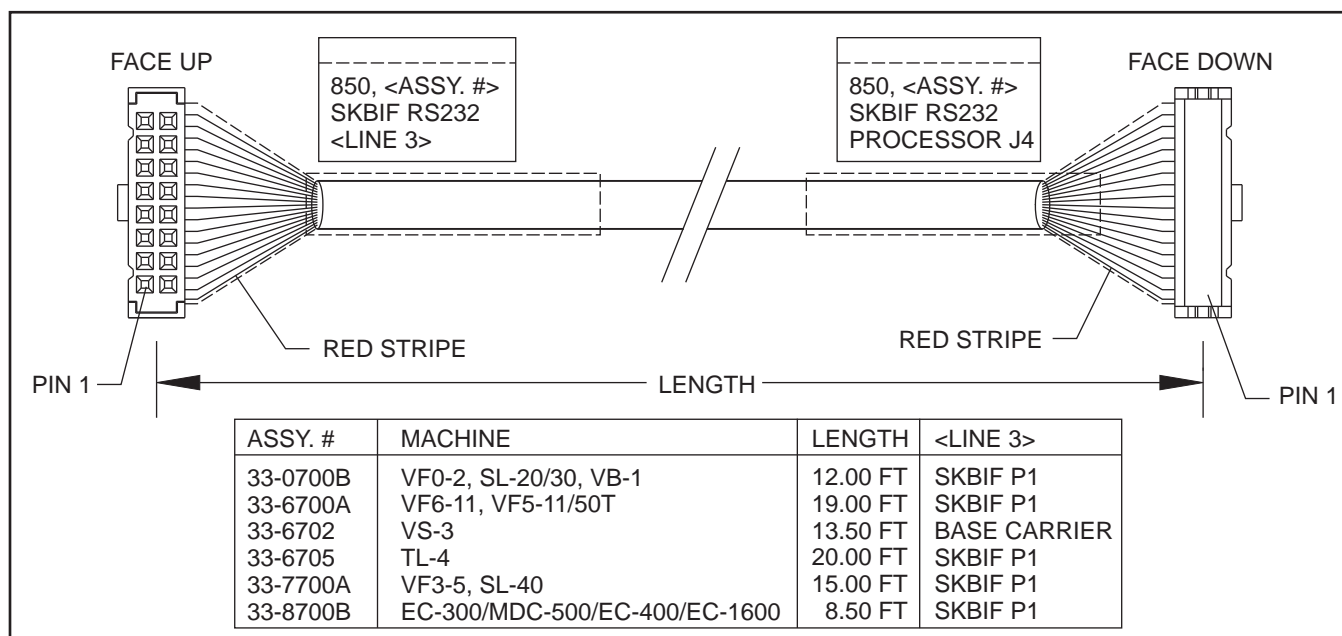


CABLE 820, C-AXIS ENABLE/DISABLE SL-20/30 (33-6820A)

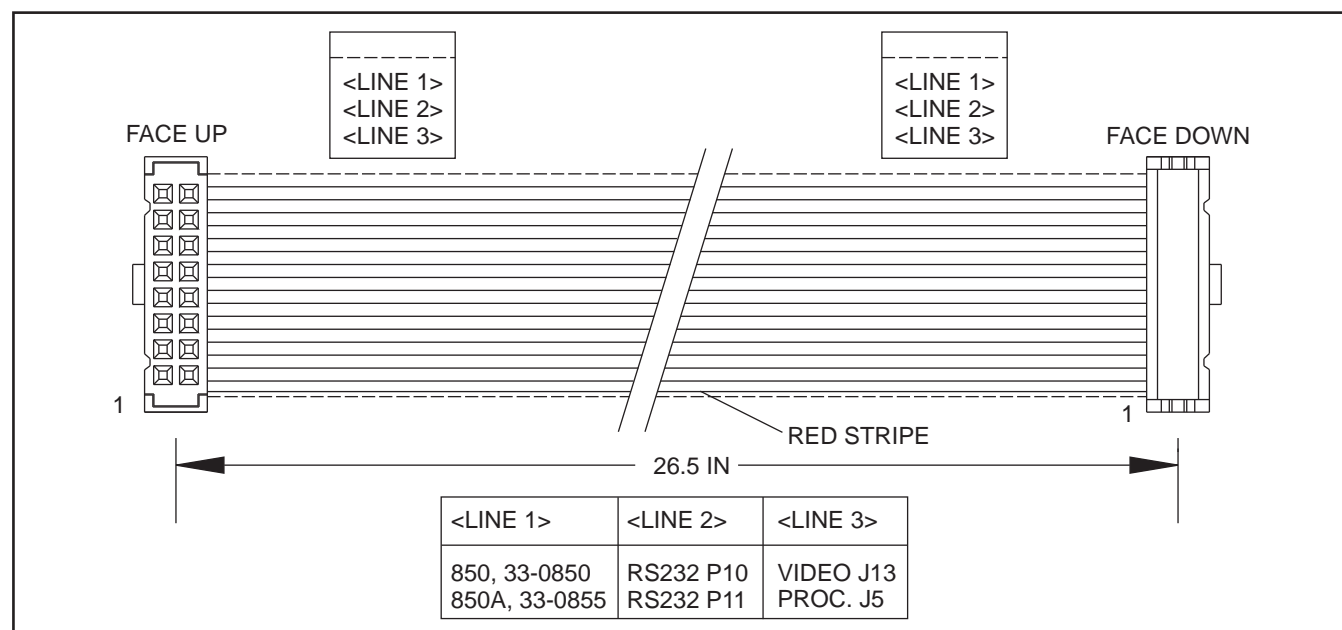




CABLE 850, SKBIF (33-0700B)

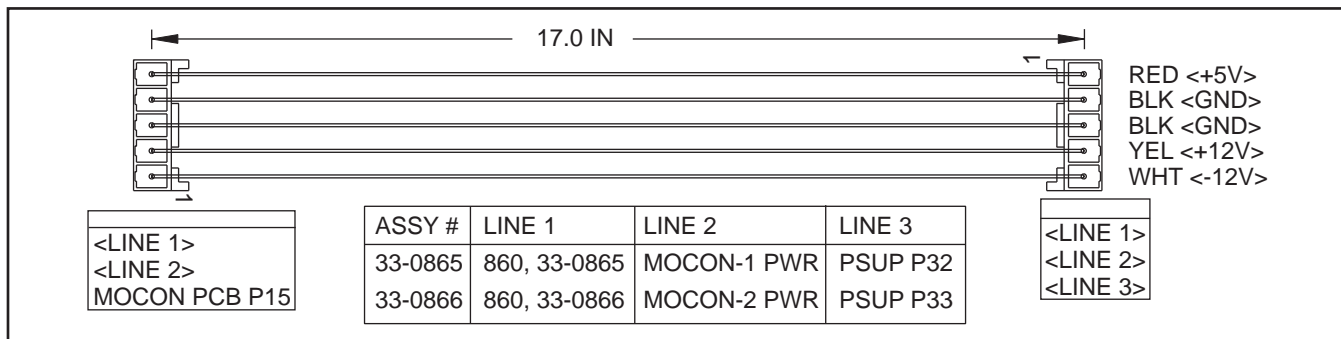


CABLE 850/850A RS-232 16-PIN RIBBON CABLE (33-0850)

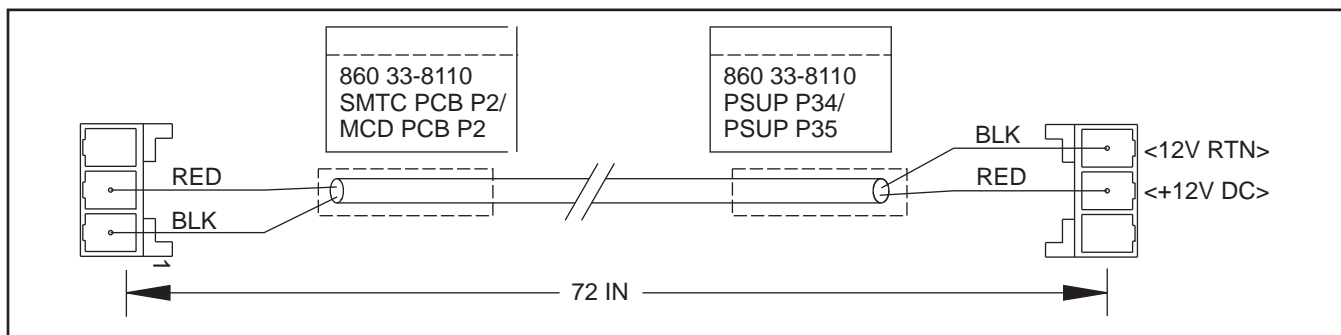




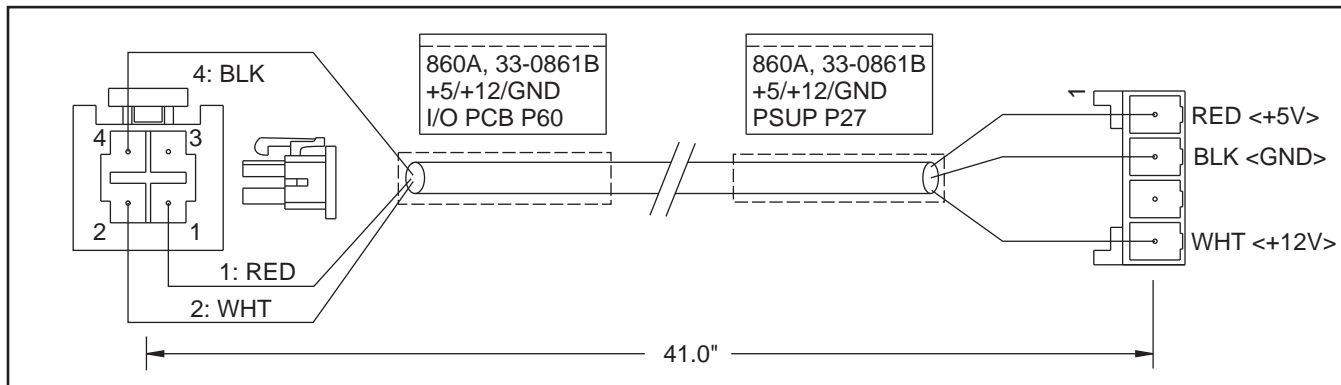
CABLE 860, +5V/+12V/-12V/GND TO MOCON 1 (33-0865)



CABLE 860, 12V DC - MCD RELAY PCB (33-8110)

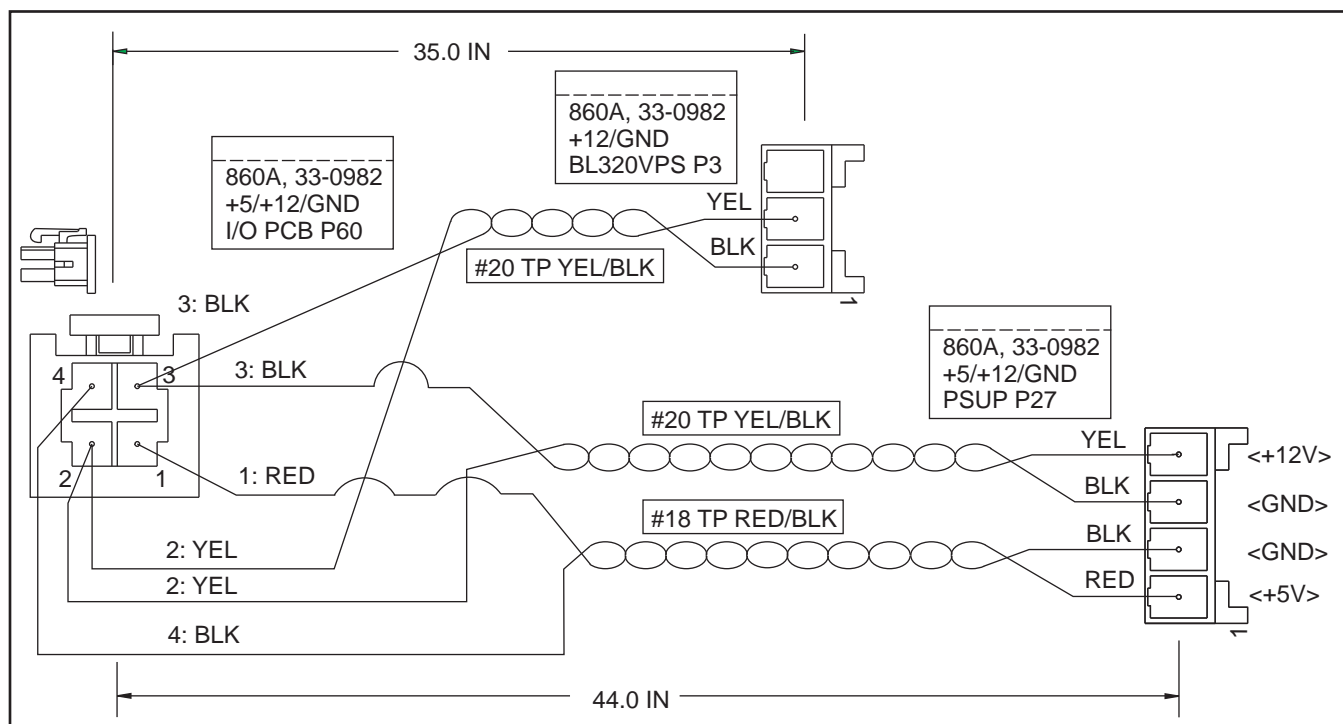


CABLE 860A, +5V/+12V/GND TO I/O PCB (33-0861B)

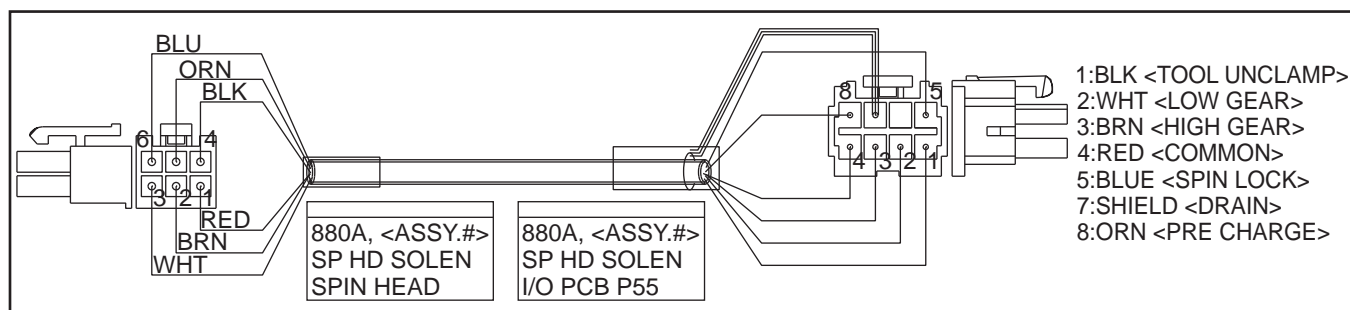




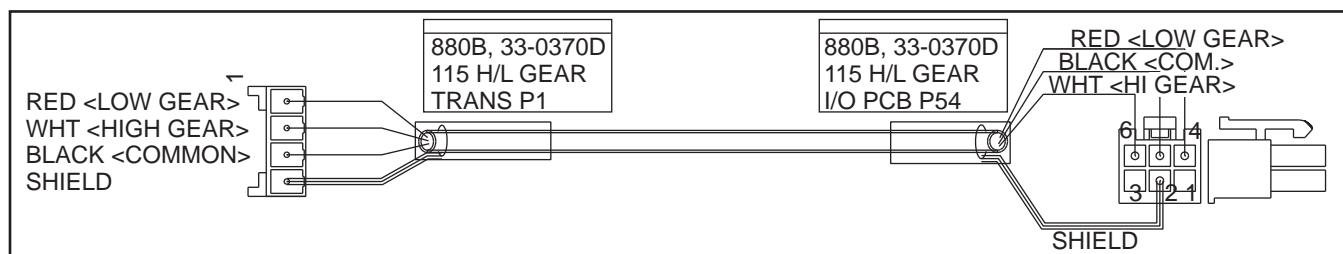
CABLE 860A, +5V/+12V/GND TO I/O PCB (33-0982)



CABLE 880A, SPINDLE HEAD SOLENOID (33-0881)

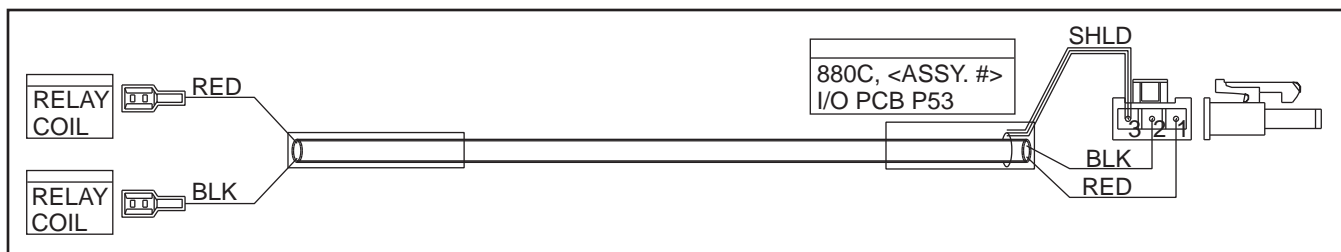


CABLE 880B, 120V AC TO GEAR RELAY (33-0370D)

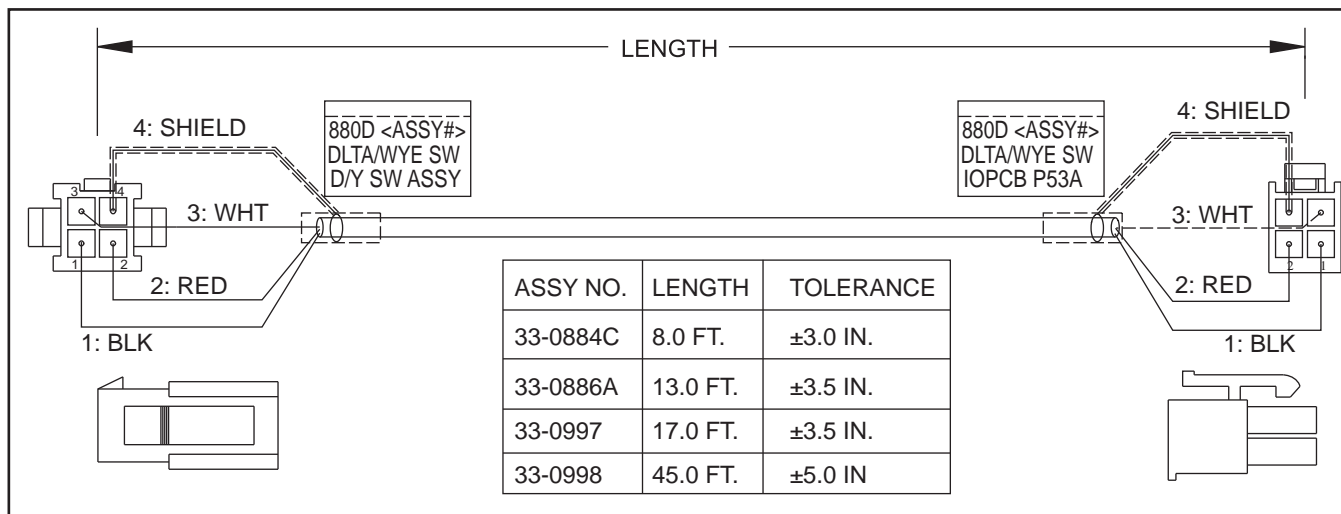




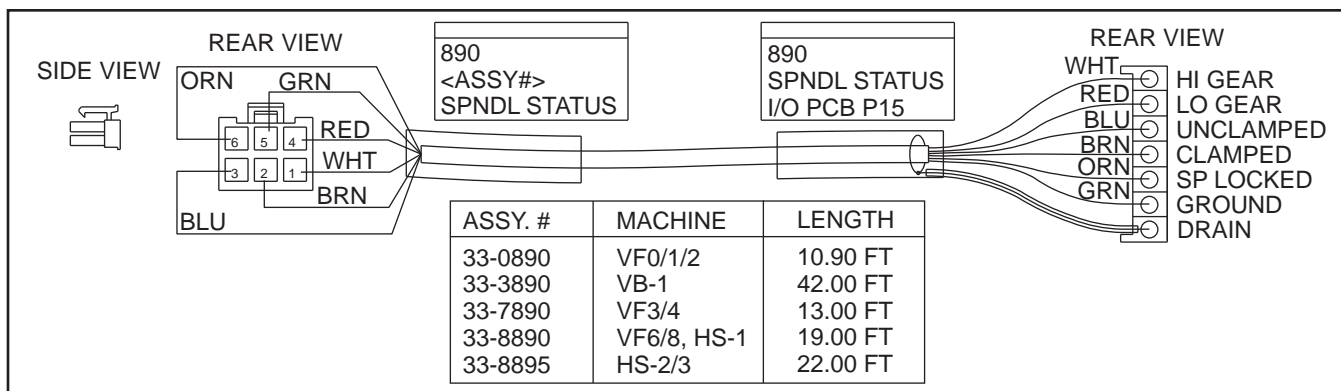
CABLE 880C, DELTA/WYE RELAY - 115V (33-0882A)



CABLE 880D EXTERNAL DELTA/WYE RELAY - 115V (33-0886C)

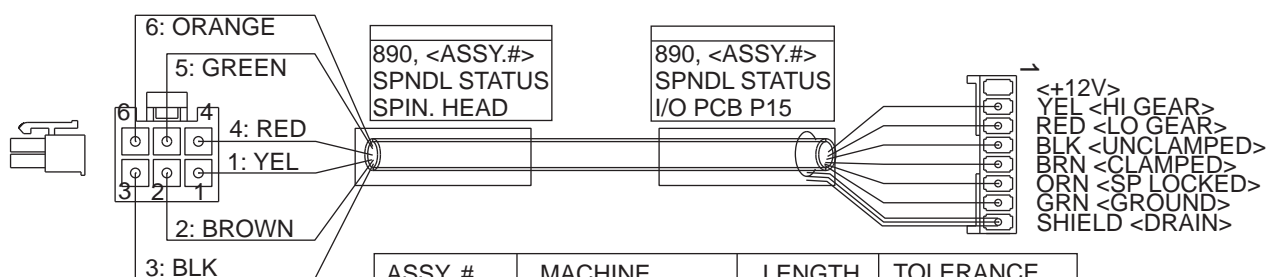


CABLE 890, SPINDLE STATUS (33-0890)



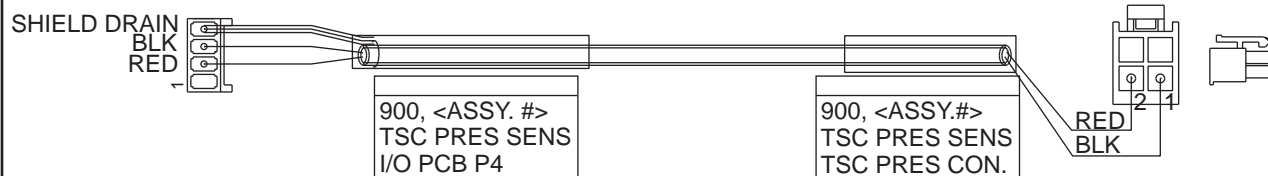


CABLE 890, SPINDLE STATUS SWITCH (33-0891)



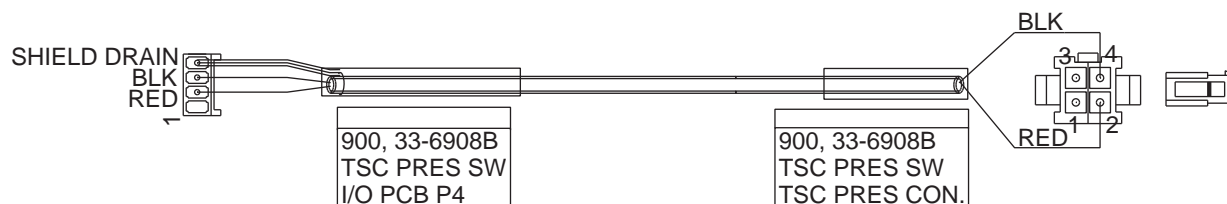
ASSY. #	MACHINE	LENGTH	TOLERANCE
33-0891	VF0-2	10.90 FT	±3.50 IN
33-3891	VB-1/3	38.50 FT	±1.5% of Length
33-6891	HS-2/3	22.00 FT	±1.5% of Length
33-7891	VF3-5	13.00 FT	±3.50 IN
33-7892A	GR-510/512/710	46.00 FT	±1.5% of Length
33-7893	GR-712	48.00 FT	±1.5% of Length
33-8891	VF6-11, HS-1	19.00 FT	±3.50 IN
33-8892	VR-11B	20.50 FT	±1.5% of Length
33-8893	VS-3	28.50 FT	±1.5% of Length
33-7894	GR-408	31.00 FT	±1.5% of Length

CABLE 900, THROUGH THE SPINDLE COOLANT PRESSURE SENSOR - 11.5 FT (33-0900C)



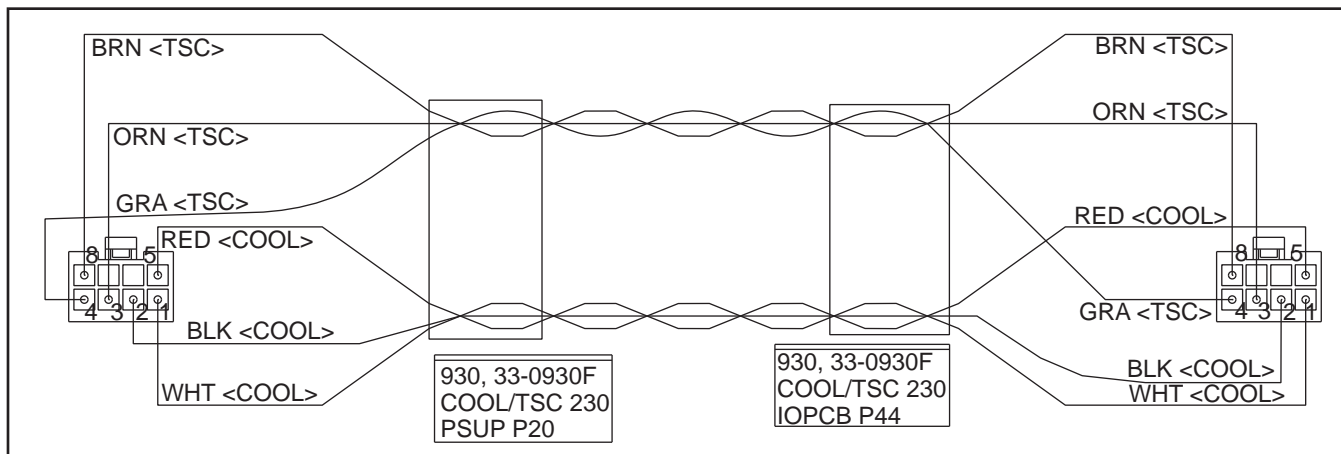
ASSY. #	MACHINE	LENGTH	TOLERANCE
33-0900C	VF0-3	11.50 FT	±3.50 IN
33-6904A	VF6, HS (ALL), VR11B	21.50 FT	±1.5% of Length
33-8904	VS-3	29.50 FT	±1.5% of Length
33-8964	MDC-1	19.50 FT	±1.5% of Length
33-6907	EC-300	14.00 FT	±3.50 IN
33-6912	VB-3/X	50.00 FT	±1.5% of Length

CABLE 900, TSC Low PRESSURE SWITCH (33-6908B)

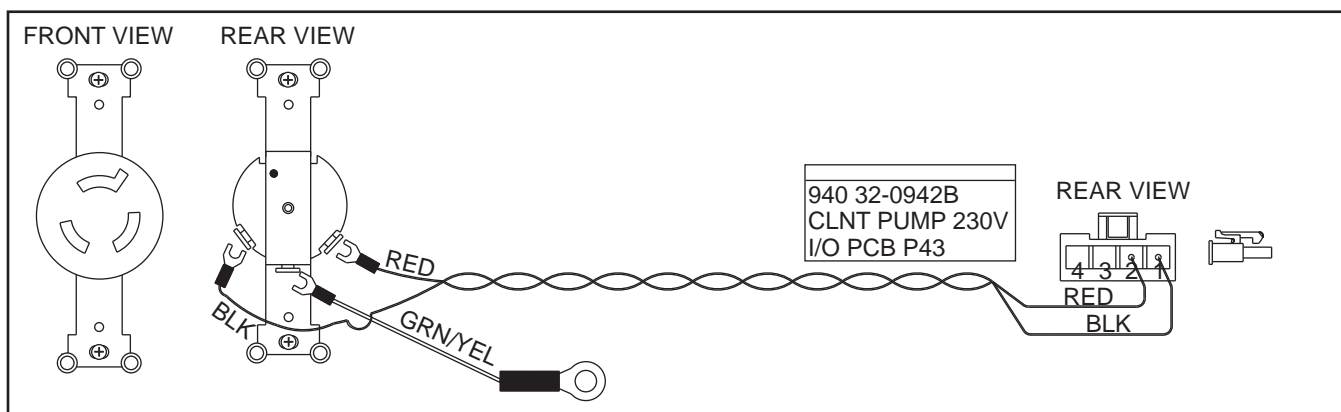




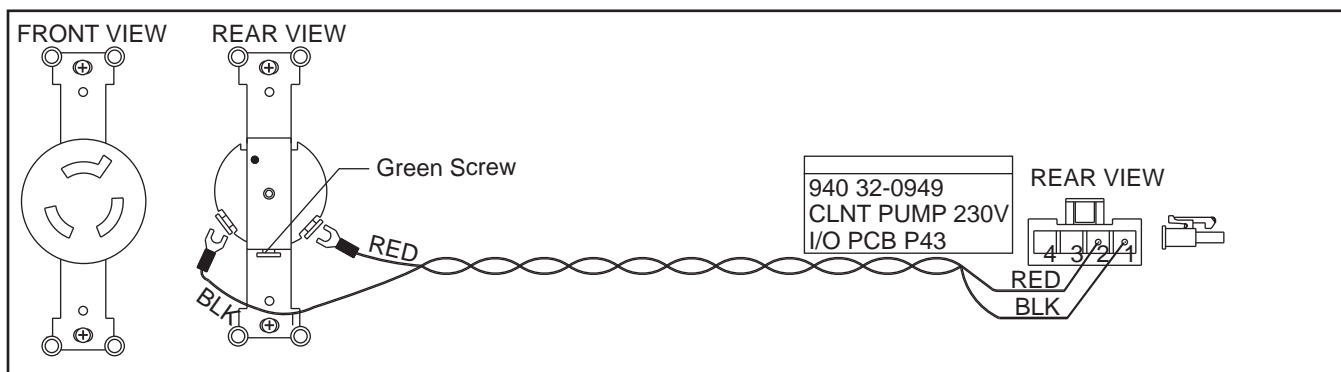
CABLE 930, 230V I/O COOLANT - TSC (33-0930F)



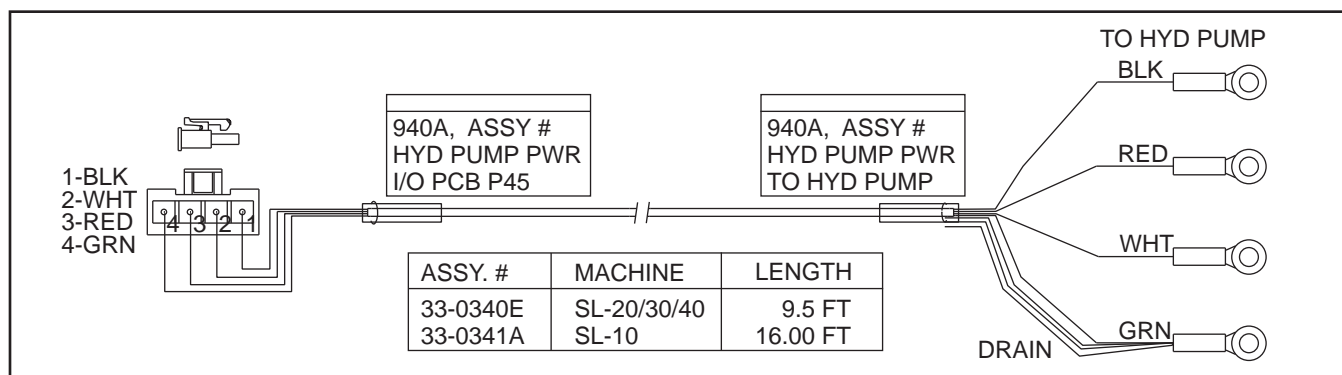
CABLE 940, COOLANT PUMP RECEPTACLE (32-0942B)



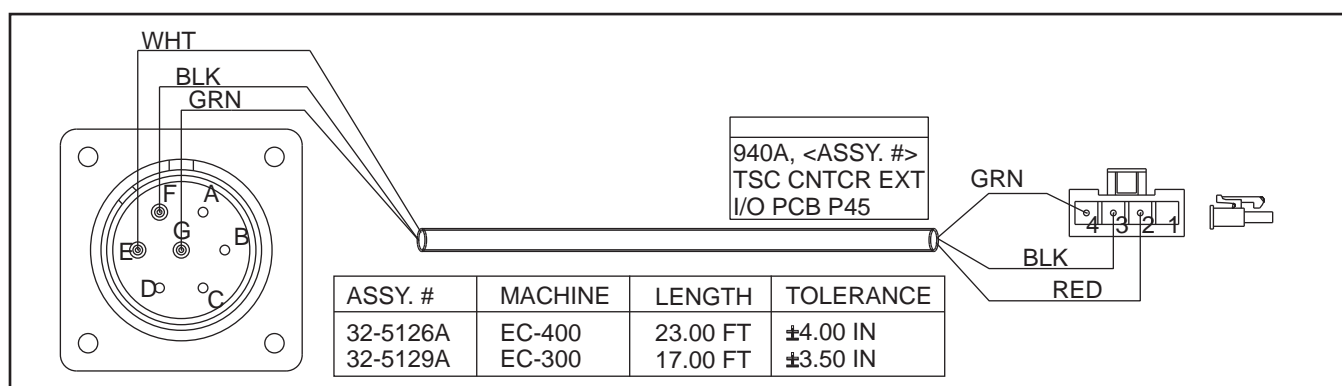
CABLE 940, COOLANT PUMP RECEPTACLE - OM (32-0949)



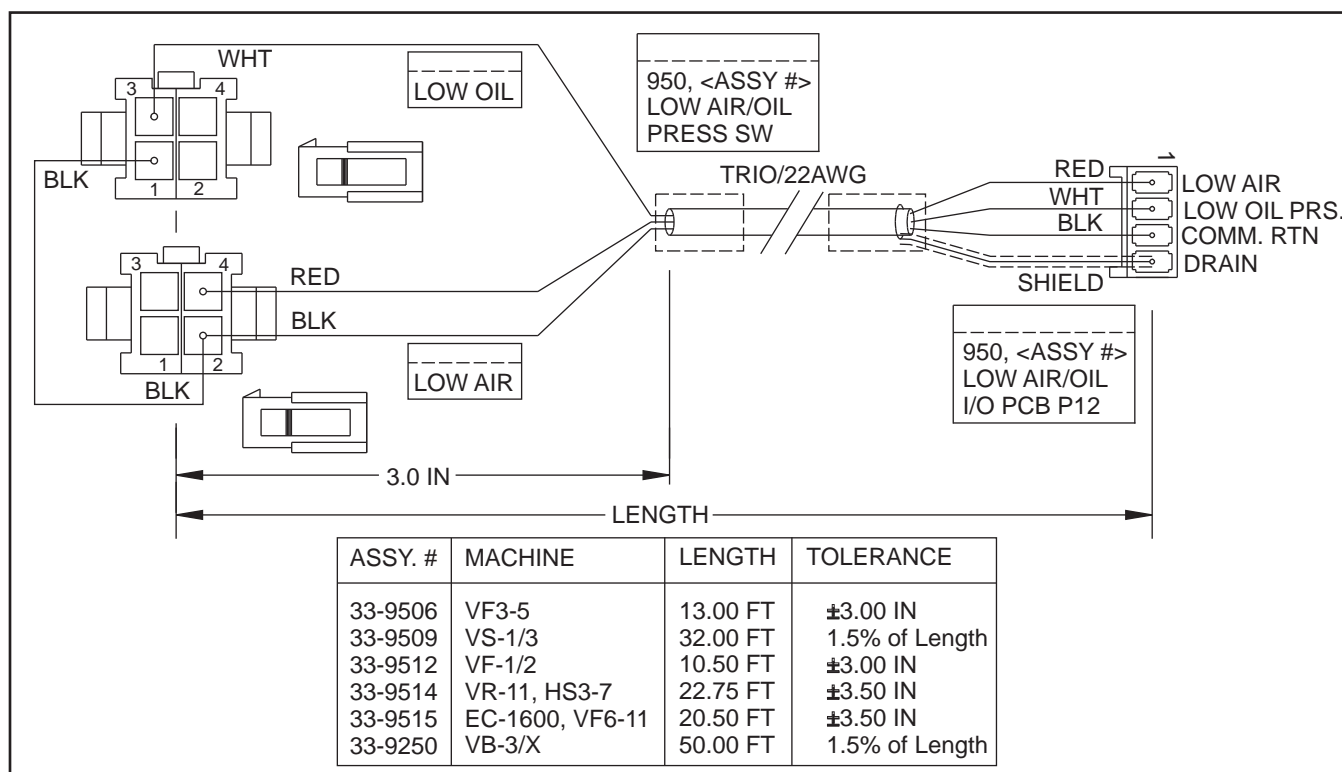
CABLE 940A, HYDRAULIC PUMP POWER (33-0340E)



CABLE 940A, TSC 1000 EXT. 23 FT (32-5126A)

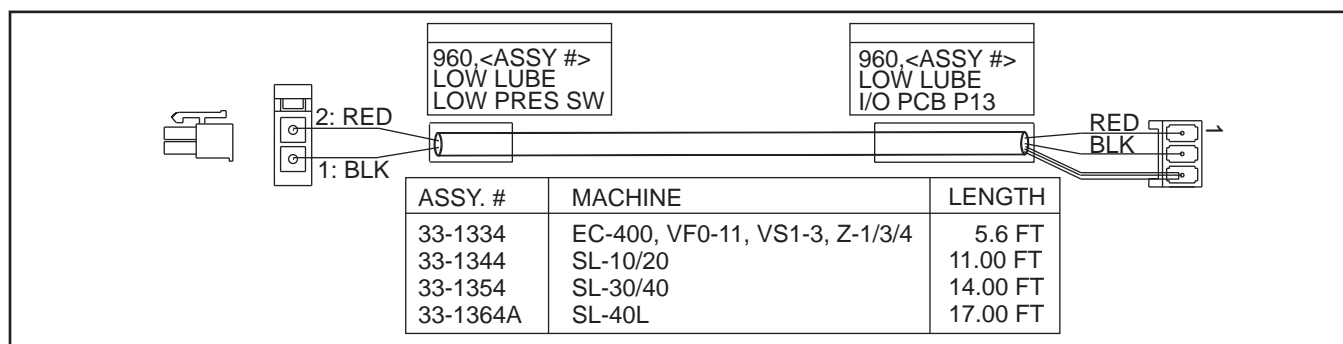


CABLE 950, LOW AIR/OIL - 13 FT (33-9506)

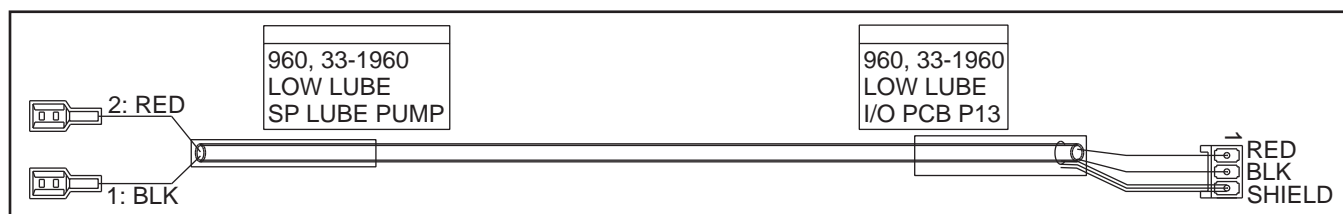




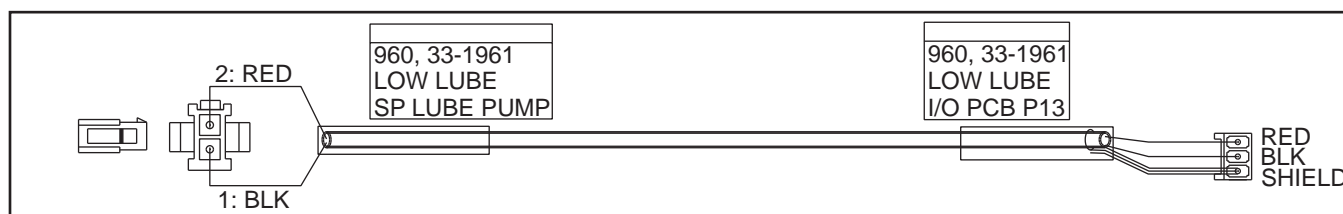
CABLE 960, LOW LUBE (33-1334)



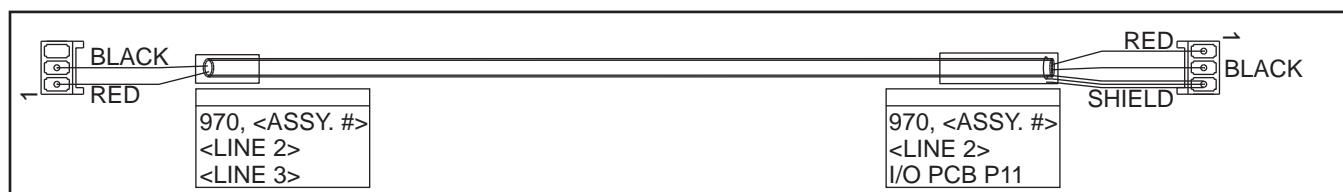
CABLE 960, LOW LUBE SPINDLE PUMP (33-1960)



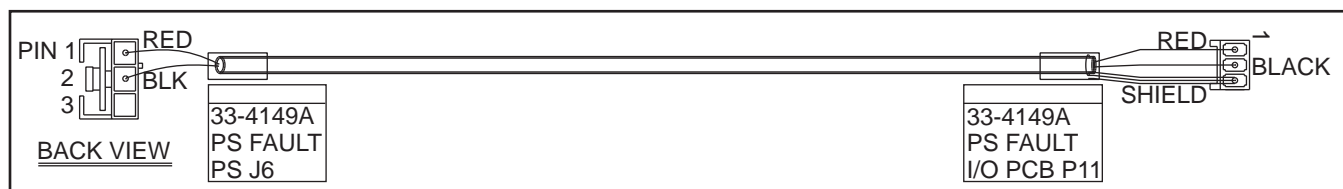
CABLE 960, LOW LUBE SPINDLE PUMP (33-1961)



CABLE 970, VECTOR DRIVE OVERVOLTAGE (33-4049A)

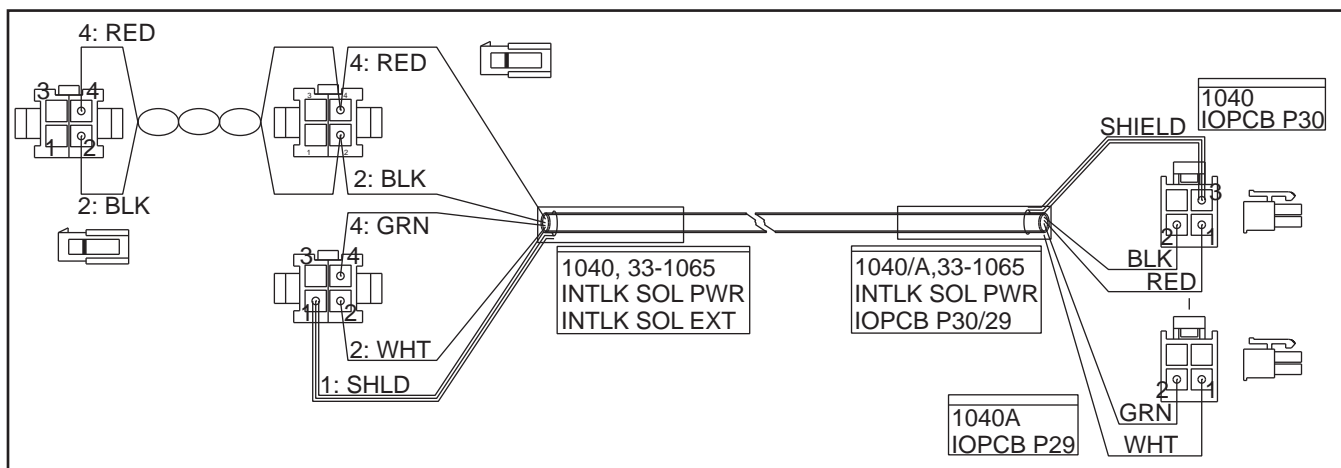


CABLE 970, POWER SUPPLY FAULT - MINIMILL (33-4149A)

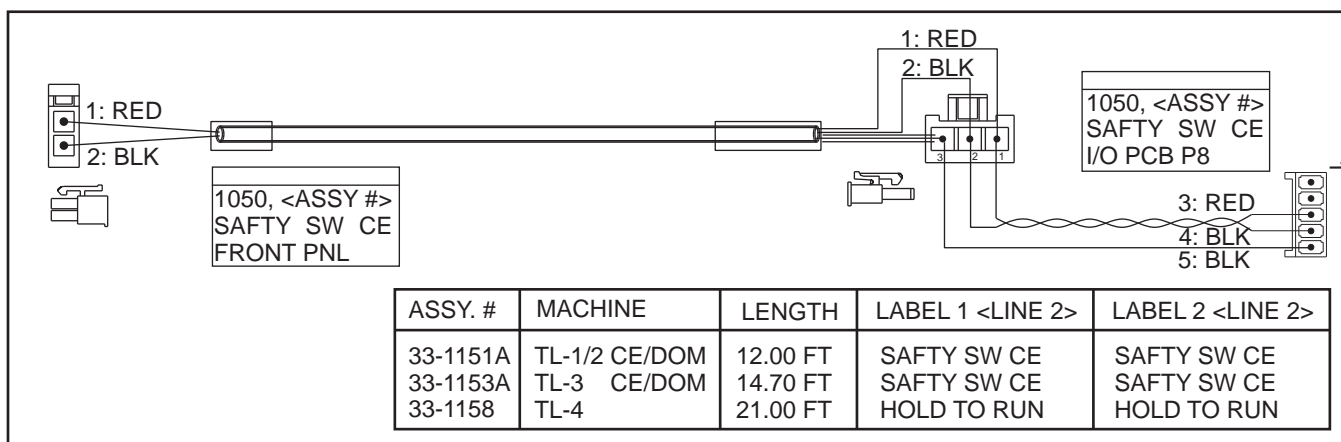




CABLE 1040, TRIPLE INTERLOCK SOLENOID POWER HCE 500 (33-1065)

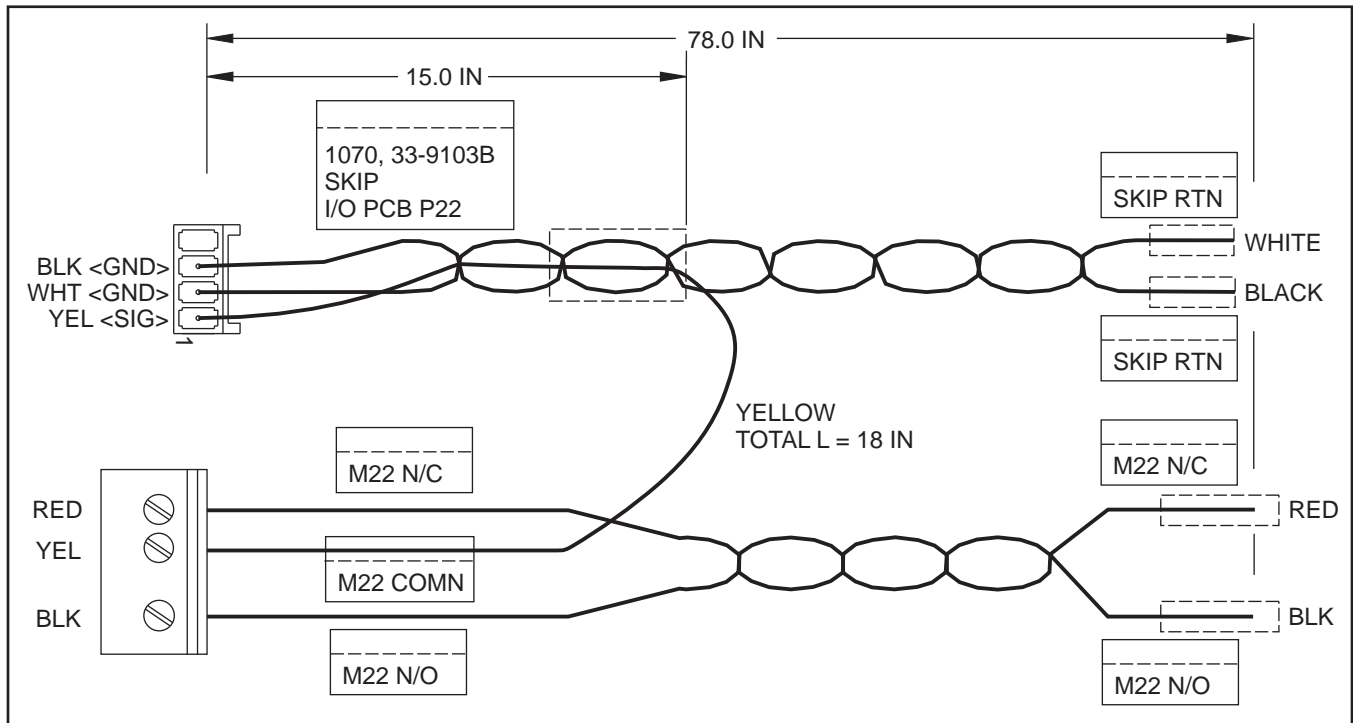


CABLE 1050, CE INTERLOCK SWITCH (33-1151A)

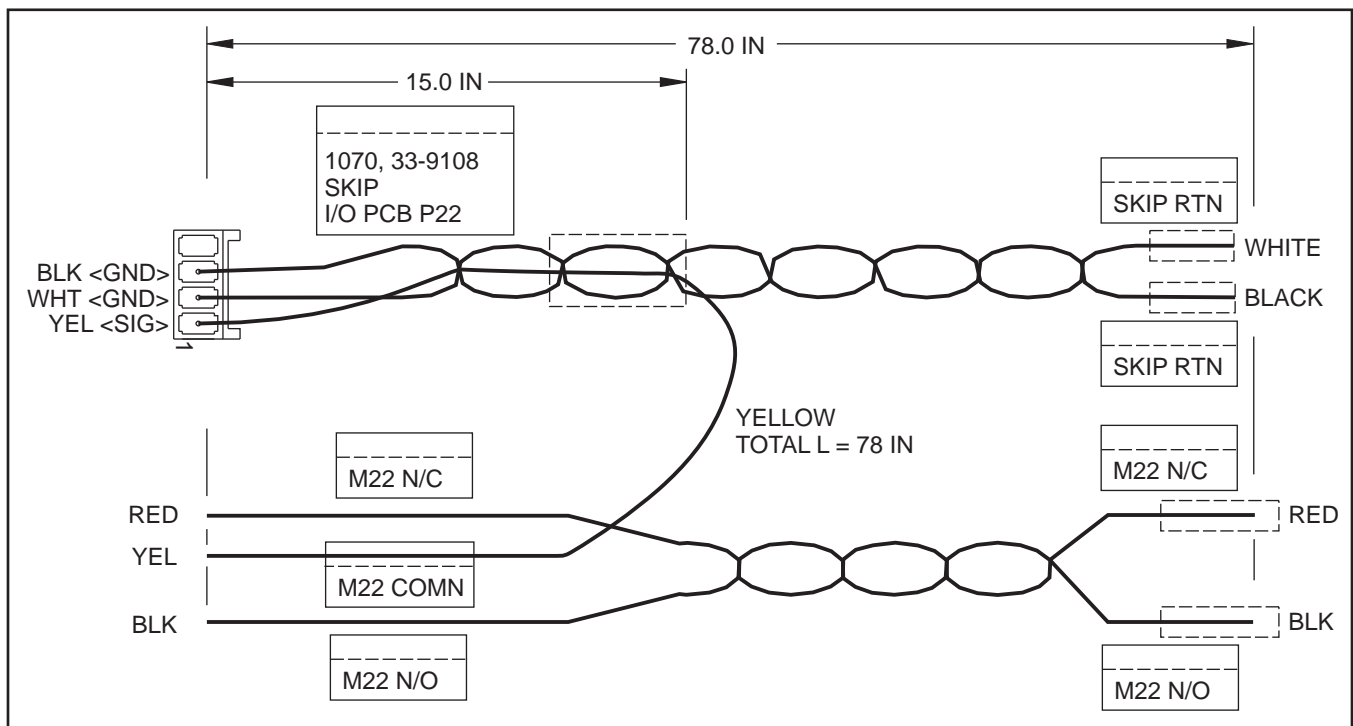




CABLE 1070, SKIP DUAL PROBE (33-9103B)

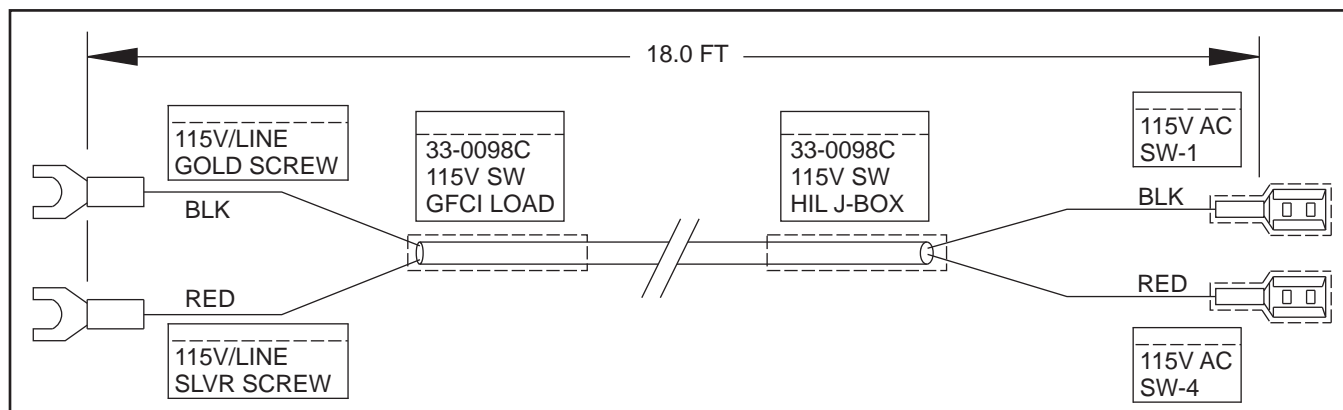


CABLE 1070, SKIP DUAL PROBE w/8M (33-9108)

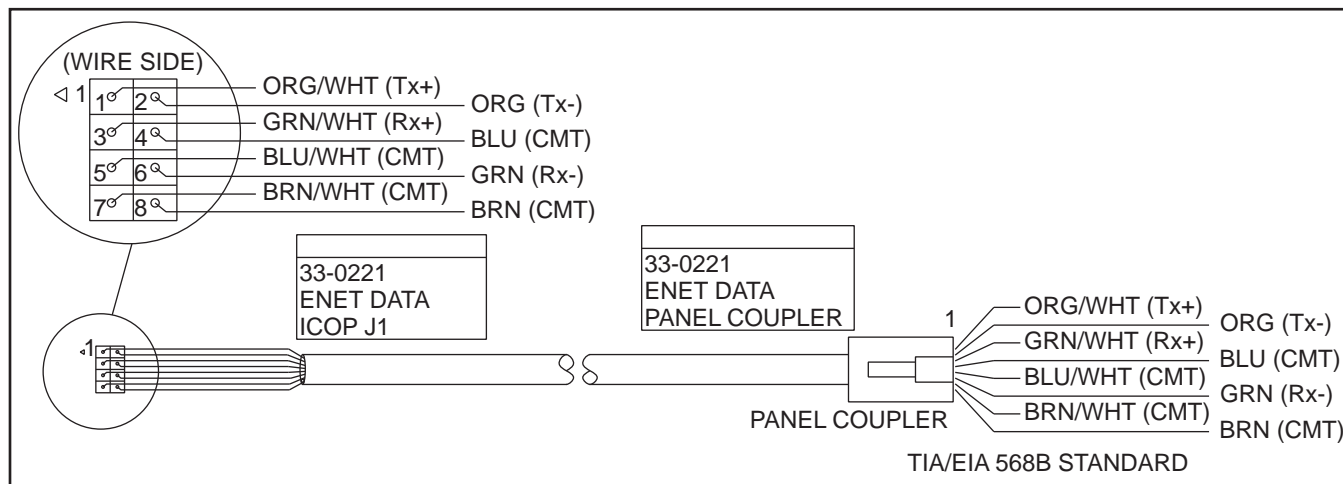




CABLE, 115V GFCI SW (33-0098C)

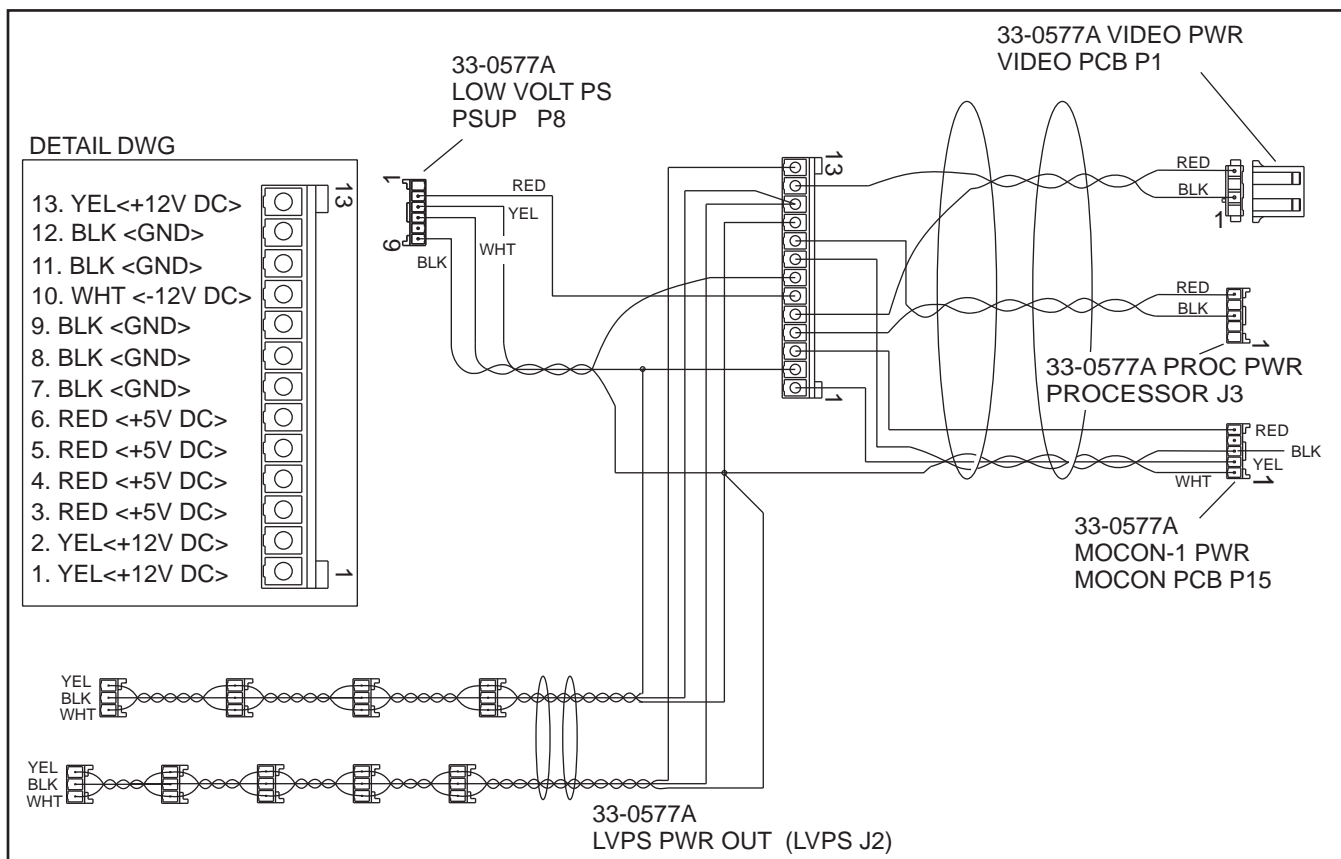


CABLE, ETHERNET DATA OPTION ICOP 3' (33-0221)

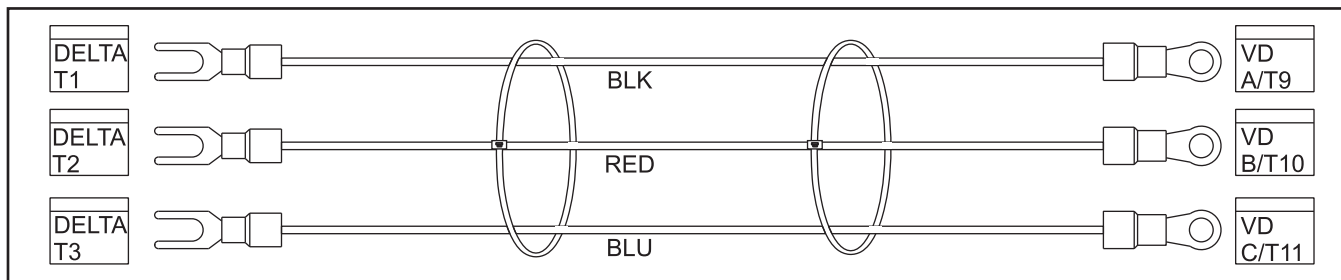




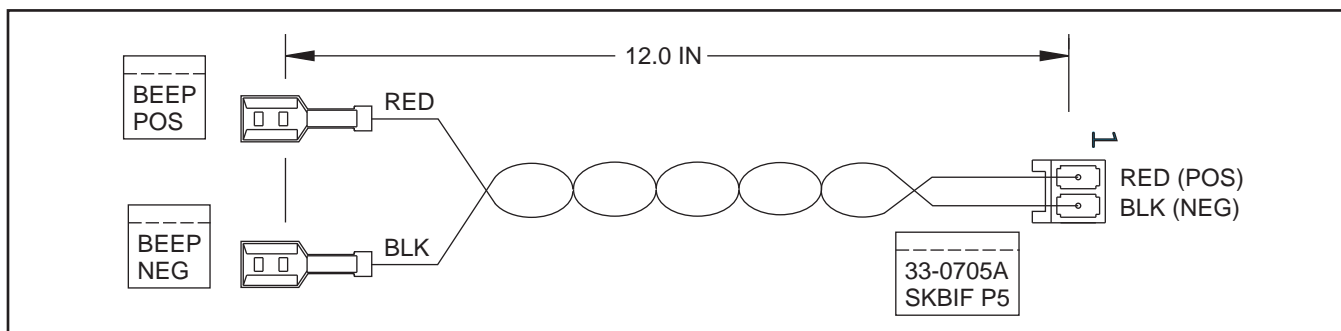
CABLE, LOW VOLTAGE POWER SUPPLY - SinPRO 9 AMP (33-0577A)



DELTA CONTACT - VECTOR DRIVE CABLE 10HP (33-0696A)

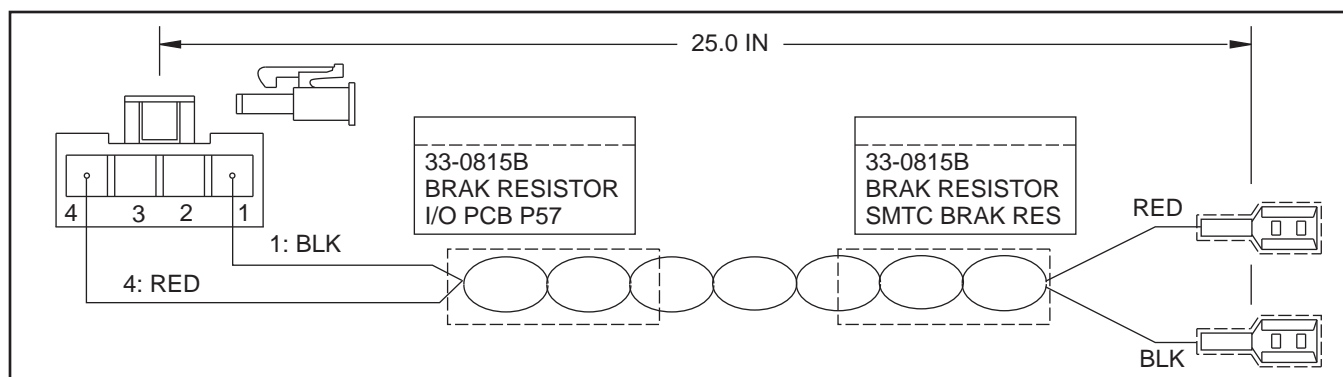


12V BEEPER CABLE (33-0705A)

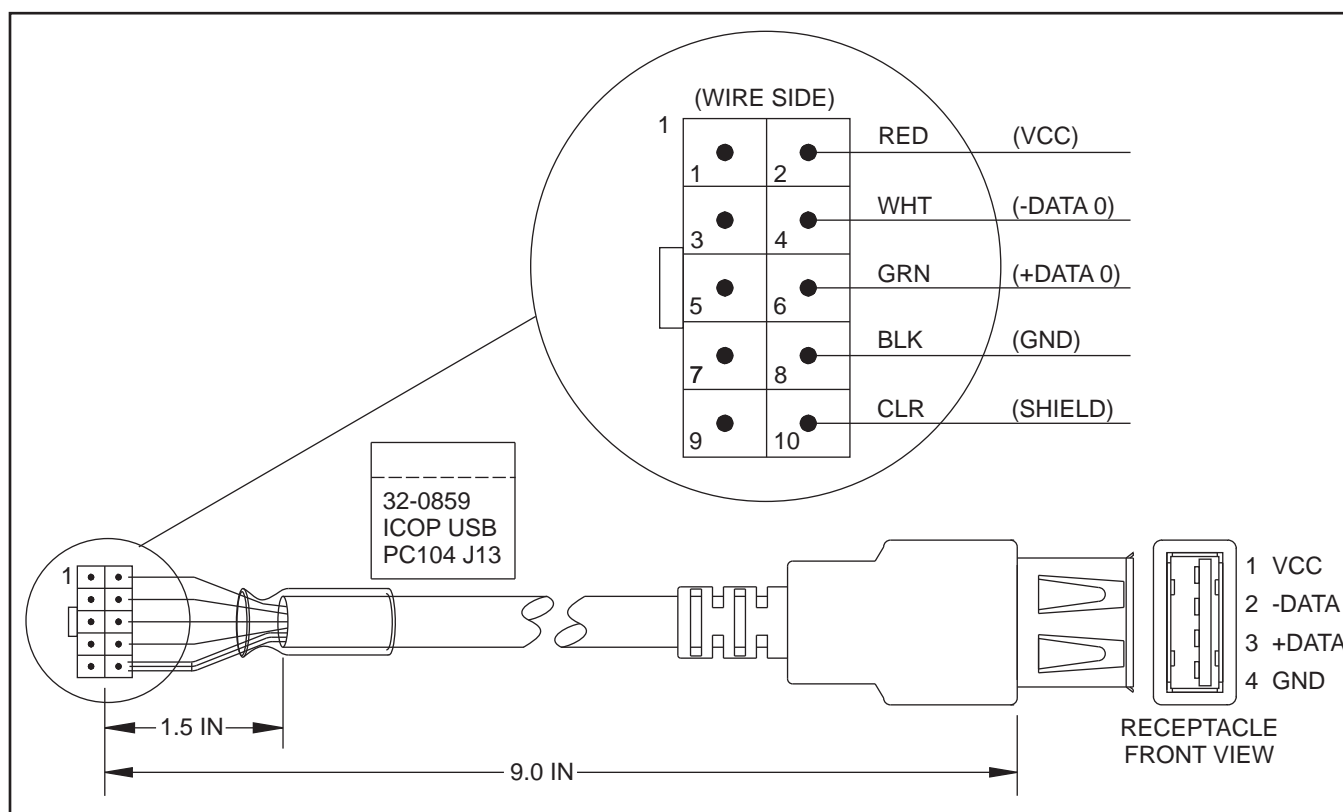




SIDE-MOUNT TOOL CHANGER BRAKE RESISTOR CABLE (33-0815B)

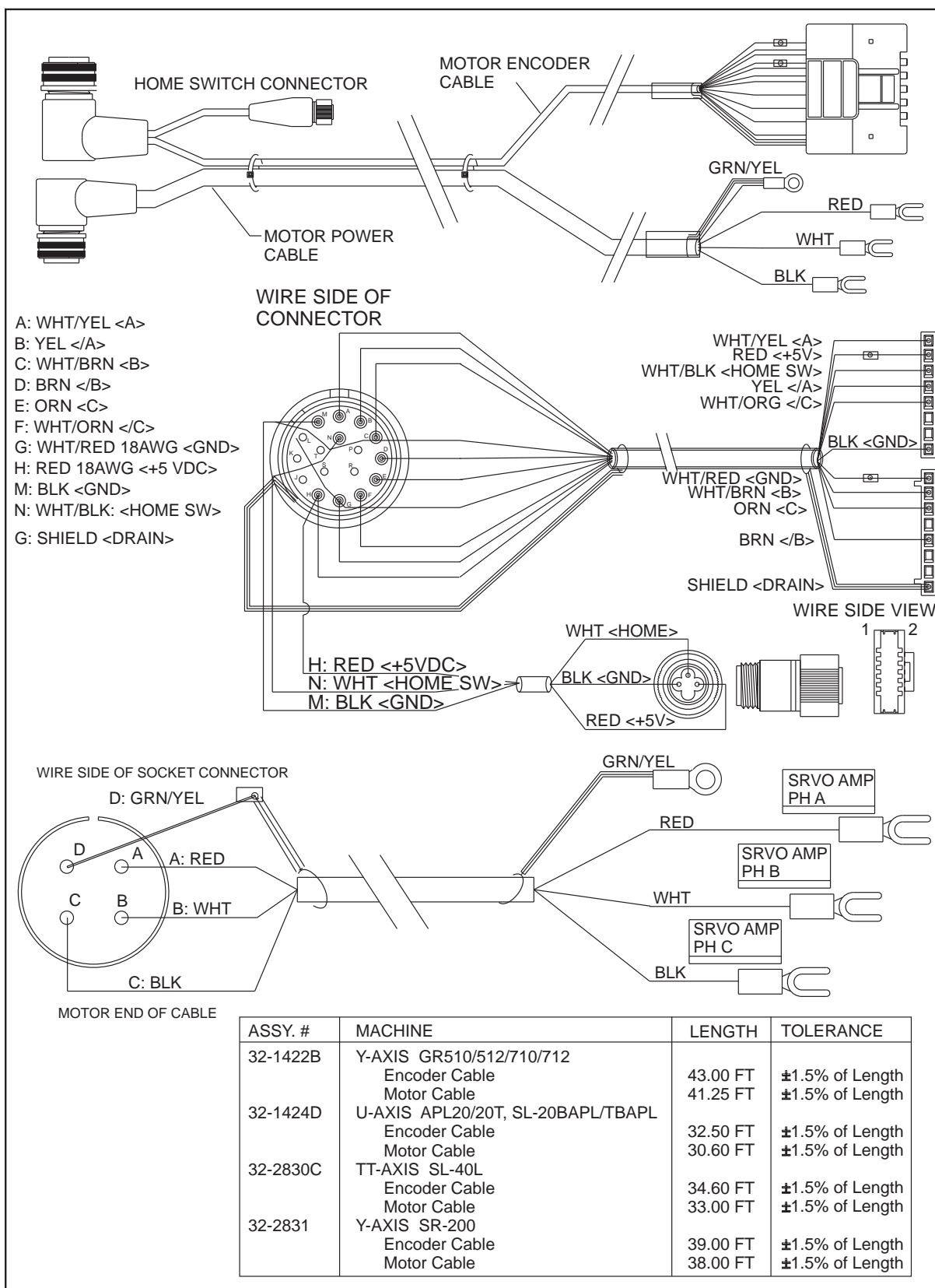


CABLE, USB ASSEMBLY - ICOP (32-0859)



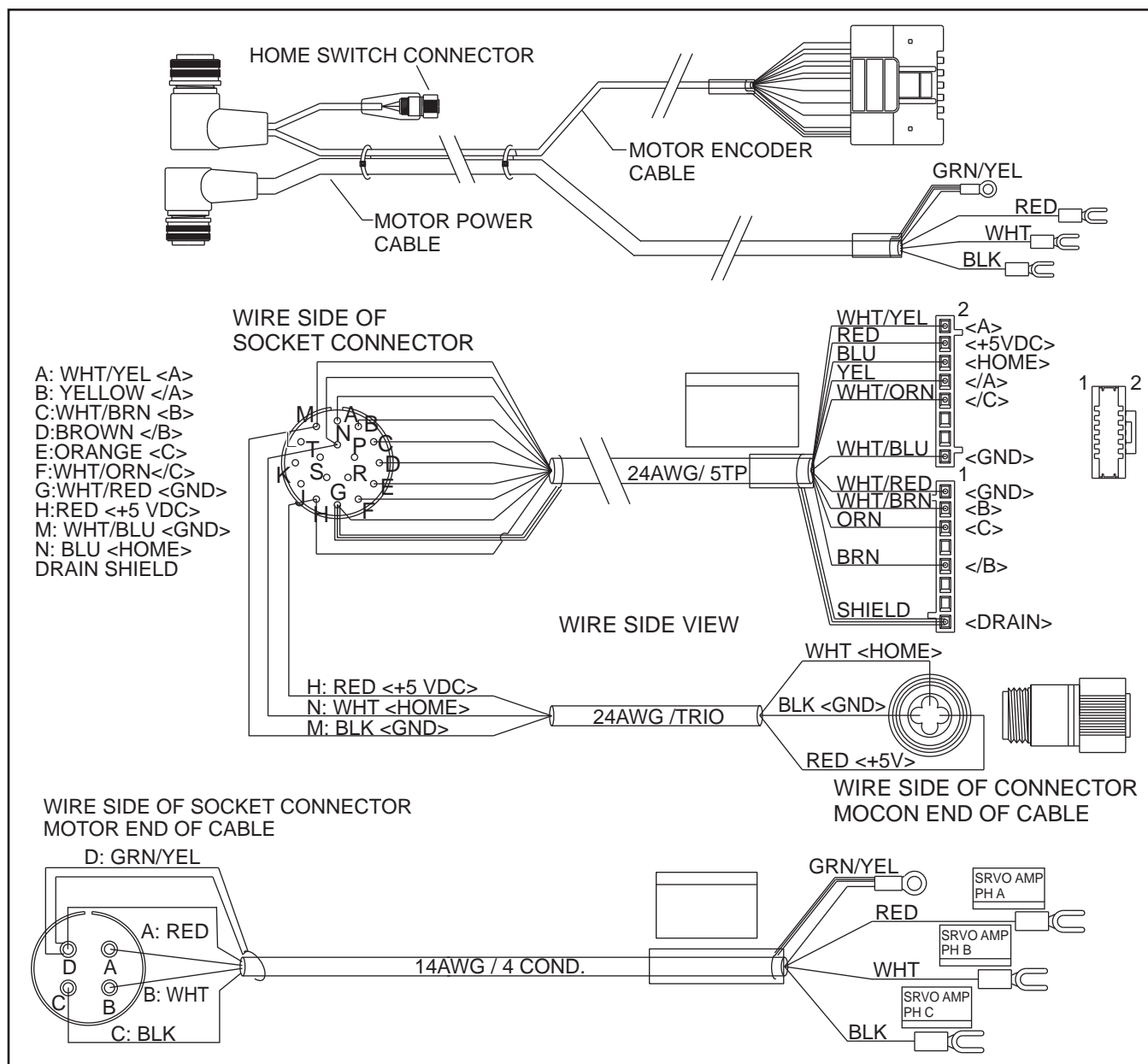


CABLE, AXIS MOTOR/ENCODER - 41.25 FT (32-1422B)





CABLE, AXIS MOTOR/ENCODER - 14.25 FT (32-1425F)



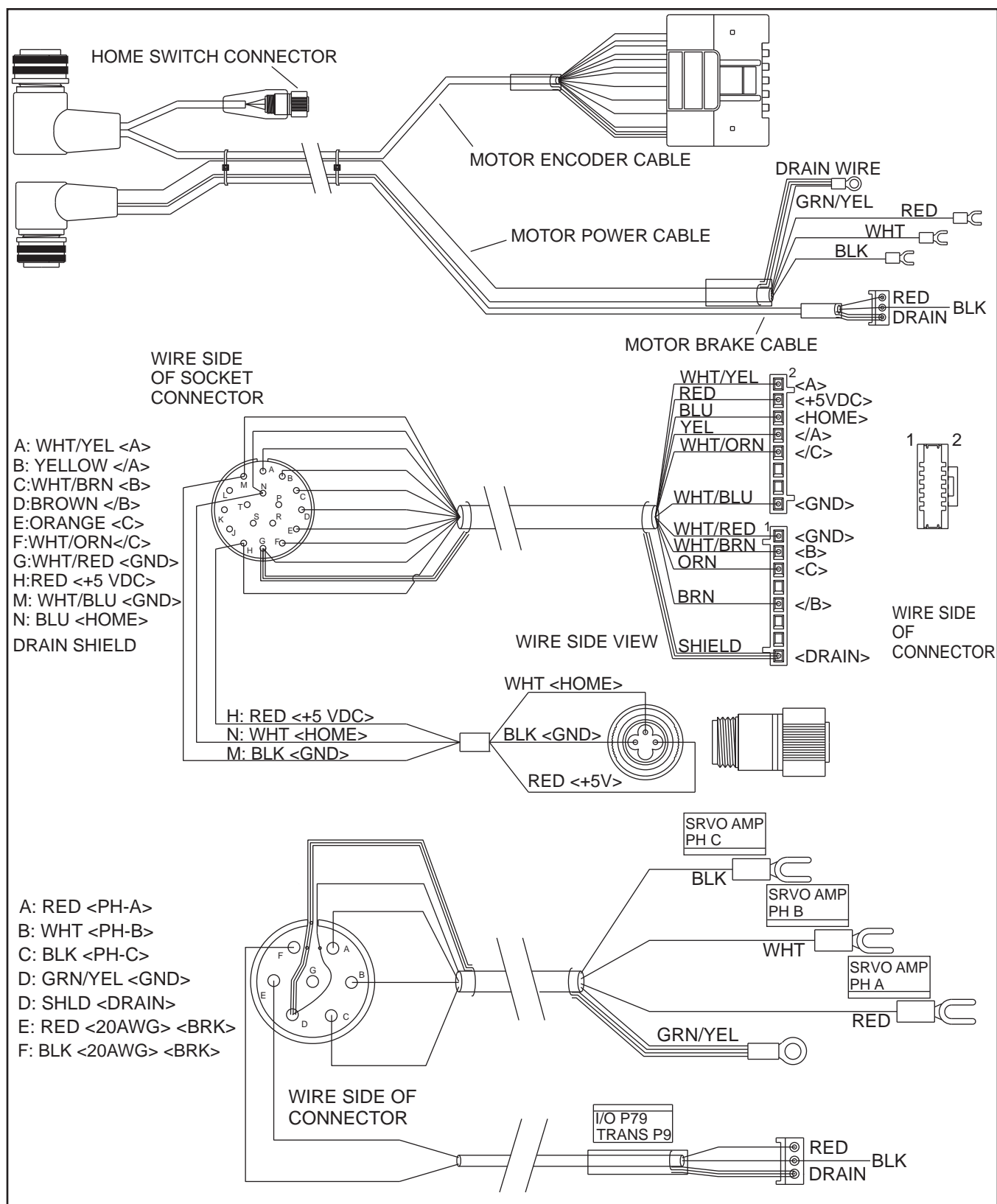


CABLE, AXIS MOTOR/ENCODER - 14.25 FT (32-1425F) TABLE

ASSY. #	MACHINE	LENGTH	TOLERANCE
32-1425F	X-AXIS VF1/2, VM2, VF2SS, GRs, MM, SMM Y-AXIS VF6-11 Encoder Cable Motor Cable	16.00 FT 14.25 FT	±3.00 IN ±3.00 IN
32-1429F	X-AXIS VF6-11, VR-8/9/11, EC-1600 Encoder Cable Motor Cable	28.50 FT 27.00 FT	±4.00 IN ±4.00 IN
32-1437F	X-AXIS VF-3/4/5, VF-3/4SS, VM3 Encoder Cable Motor Cable	20.25 FT 18.50 FT	±3.50 IN ±3.50 IN
32-1557A	X-AXIS TL-3/3W Encoder Cable Motor Cable	14.25 FT 12.50 FT	±3.00 IN ±3.00 IN
32-1609A	X-AXIS GT-20 Encoder Cable Motor Cable	8.20 FT 9.50 FT	±2.00 IN ±2.00 IN
32-1625	PC-AXIS EC-630 Encoder Cable Motor Cable	26.25 FT 23.50 FT	±1.5% of Length ±1.5% of Length
32-1438F	Y-AXIS VF1-5, VM3, VF2-4SS, TM1/2 Encoder Cable Motor Cable	9.75 FT 8.00 FT	±2.00 IN ±2.00 IN
32-1528A	Y-AXIS MM, SMM Encoder Cable Motor Cable	14.00 FT 12.25 FT	±2.50 IN ±2.50 IN
32-1426F	Z-AXIS SL-10 (ALL) Encoder Cable Motor Cable	7.80 FT 11.70 FT	±2.00 IN ±2.00 IN
32-1428F	Z-AXIS VF-5/50 Encoder Cable Motor Cable	7.00 FT 8.00 FT	±2.00 IN ±2.00 IN
32-1508B	Z-AXIS EC-400/500/400PP Encoder Cable Motor Cable	20.00 FT 18.25 FT	±3.00 IN ±3.00 IN
32-1530A	Z-AXIS VF6-11/50, VR8/9/11 Encoder Cable Motor Cable	11.00 FT 12.00 FT	±2.50 IN ±2.50 IN
32-1541B	Z-AXIS TL-1/2/3/3W Encoder Cable Motor Cable	9.50 FT 7.75 FT	±2.00 IN ±2.00 IN
32-1539A	V-AXIS APL20/T, SL-20BAR/TBAPL Encoder Cable Motor Cable	18.00 FT 15.40 FT	±2.50 IN ±2.50 IN
32-1549B	Y-AXIS MDC-500 Encoder Cable Motor Cable	17.00 FT 18.90 FT	±2.50 IN ±2.50 IN
32-2800G	A-AXIS SL-10 (ALL) Encoder Cable Motor Cable	13.50 FT 18.00 FT	±2.50 IN ±2.50 IN
32-2802A	TT-AXIS SL-40B/TB TS-AXIS TL25/B Encoder Cable Motor Cable	22.10 FT 20.00 FT	±1.5% of Length ±1.5% of Length
32-2810H	TS-AXIS TL-15/B Encoder Cable Motor Cable	19.30 FT 17.70 FT	±2.50 IN ±2.50 IN
32-1630	Z-AXIS VF-3&4/50 Encoder Cable Motor Cable	11.00 FT 12.00 FT	±2.00 IN ±2.00 IN



CABLE, AXIS MOTOR/ENCODER BRAKE - 28.9 FT (32-1434D)



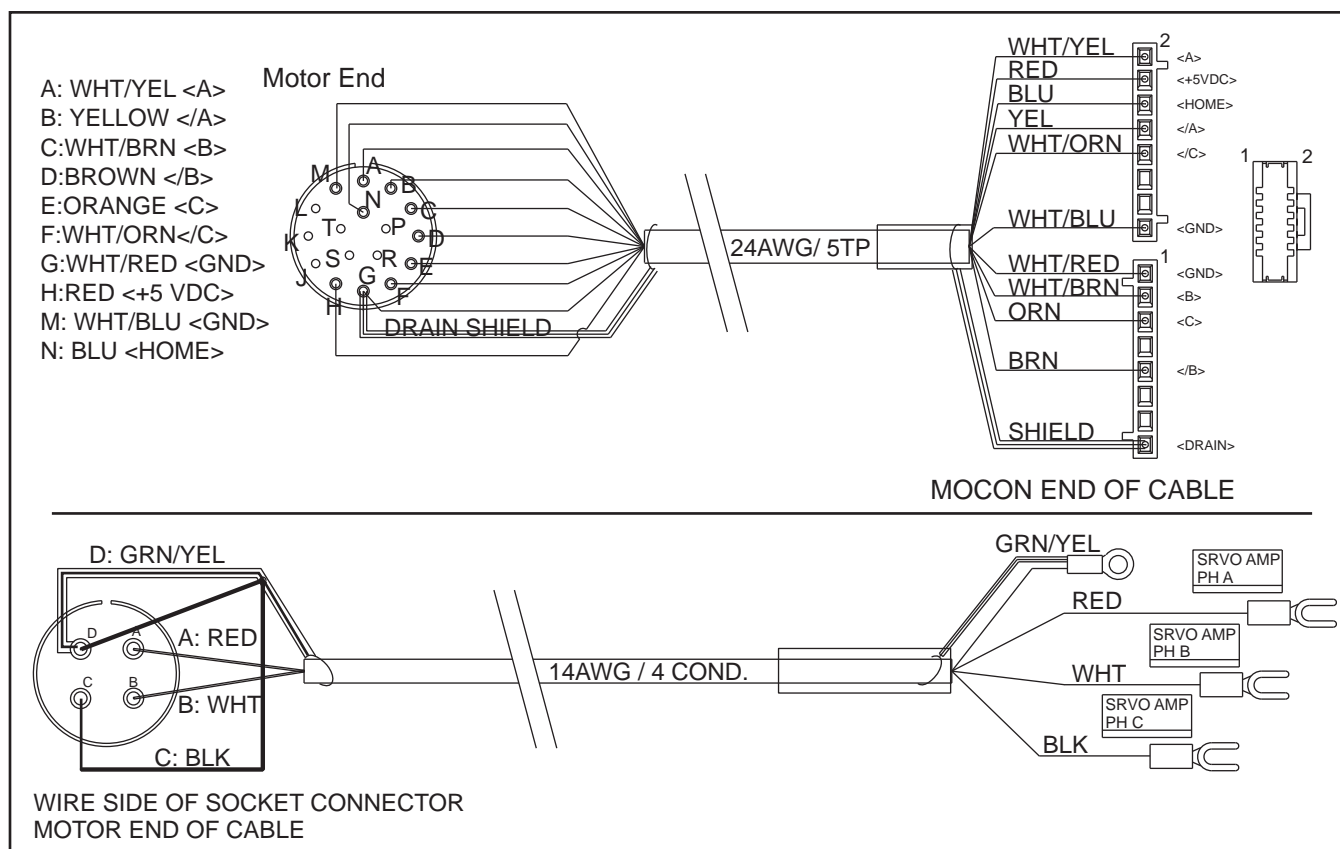


CABLE, AXIS MOTOR/ENCODER BRAKE - 28.9 FT (32-1434D) TABLE

ASSY. #	MACHINE	LENGTH	TOLERANCE
32-1434D	X-AXIS SL-40L		
	Encoder Cable	30.70 FT	±1.5% of Length
	Motor Cable	28.90 FT	±1.5% of Length
32-1448D	Motor Brake Cable	28.90 FT	±1.5% of Length
	W-AXIS APL20T/SL20BAPL/SL20TBAPL		
	Encoder Cable	28.00 FT	±1.5% of Length
32-1449C	Motor Cable	26.00 FT	±1.5% of Length
	Motor Brake Cable	26.00 FT	±1.5% of Length
	X-AXIS SL-20/T/B/BAPL/TBAPL, TL-15/B, SL-30/T/B/TB, TL-25/B		
32-1534C	Encoder Cable	19.60 FT	±3.50 IN
	Motor Cable	17.90 FT	±3.50 IN
	Motor Brake Cable	17.90 FT	±3.50 IN
32-1536B	X-AXIS SL-10 (ALL)		
	Encoder Cable	14.75 FT	±3.00 IN
	Motor Cable	17.00 FT	±3.00 IN
32-1537A	Motor Brake Cable	17.00 FT	±3.00 IN
	Z-AXIS VF1-4, MM, SMM, VF2SS, VM2		
	Encoder Cable	7.00 FT	±2.00 IN
32-1509B	Motor Cable	8.00 FT	±2.00 IN
	Motor Brake Cable	8.00 FT	±2.00 IN
	X-AXIS SL-40B/TB		
32-1537A	Encoder Cable	25.00 FT	±1.5% of Length
	Motor Cable	23.00 FT	±1.5% of Length
	Motor Brake Cable	23.00 FT	±1.5% of Length
32-1509B	Y-AXIS EC-400/500/400PP		
	Encoder Cable	17.10 FT	±1.5% of Length
	Motor Cable	19.00 FT	±1.5% of Length
32-1509B	Motor Brake Cable	19.00 FT	±1.5% of Length



CABLE, AXIS MOTOR/ENCODER - 8.25 FT (32-1491B)



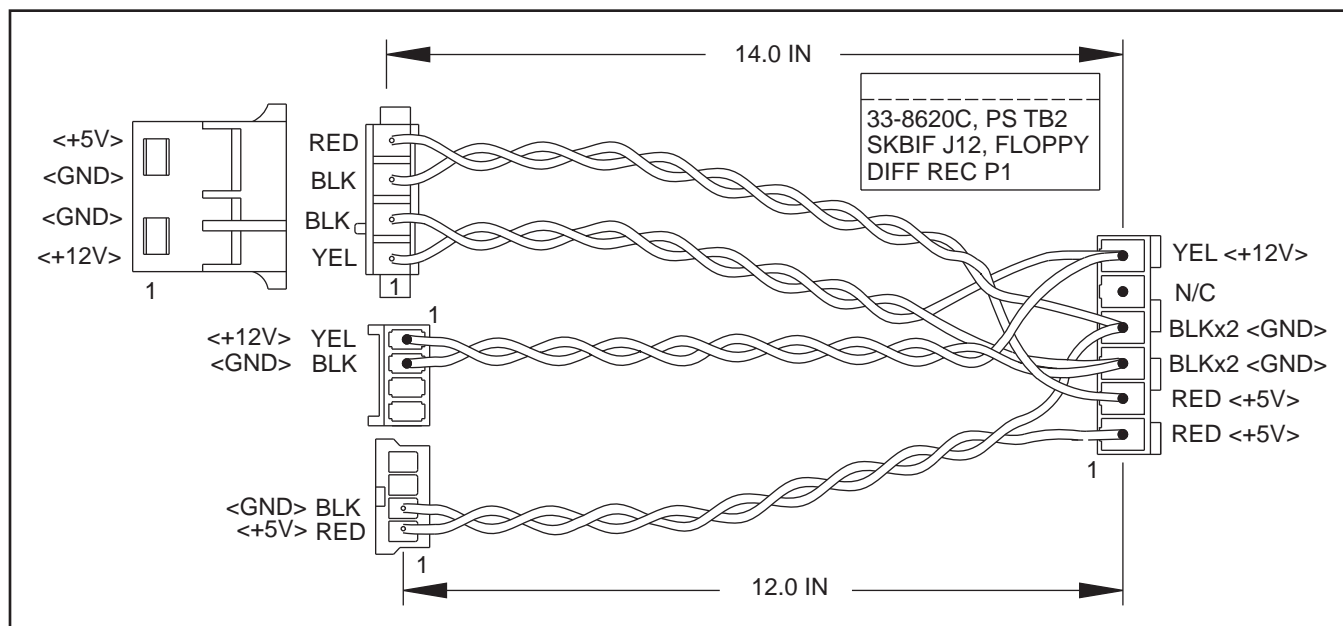
CABLE, AXIS MOTOR/ENCODER - 8.25 FT (32-1491B) TABLE

ASSY. #	MACHINE	LENGTH	TOLERANCE
32-1491B	TC-AXIS VF-2/3/4SS, VF-2/3SSYT	8.25 FT	±2.00 IN
	Encoder Cable	9.25 FT	±2.00 IN
32-1597	TC-AXIS VF-6SS	13.50 FT	±3.00 IN
	Encoder Cable	14.50 FT	±3.00 IN
32-1506A	TC-AXIS EC-300/1600/2000, MDC-500	22.00 FT	±3.00 IN
	LT-AXIS SL-40/B	20.25 FT	±3.00 IN
32-1602A	TC-AXIS EC-400/500	25.00 FT	±3.00 IN
	Encoder Cable	23.25 FT	±3.00 IN
32-1517A	C-AXIS SL20/B/T/TB, TL15/B, APL20/T	17.00 FT	±3.00 IN
	Encoder Cable	14.80 FT	±3.00 IN
32-1518A	C-AXIS SL30/B/T/TB, TL-25/B	19.00 FT	±3.50 IN
	Encoder Cable	16.80 FT	±3.50 IN
32-1519A	C-AXIS SL-40B/TB, SL-40L	21.00 FT	±1.5% of Length
	Encoder Cable	18.80 FT	±1.5% of Length
32-1532A	LT-AXIS SL-30B/TB	19.90 FT	±3.00 IN
	Encoder Cable	17.50 FT	±3.00 IN
32-1533A	LT-AXIS SL-40L	26.10 FT	±1.5% of Length
	Encoder Cable	23.70 FT	±1.5% of Length



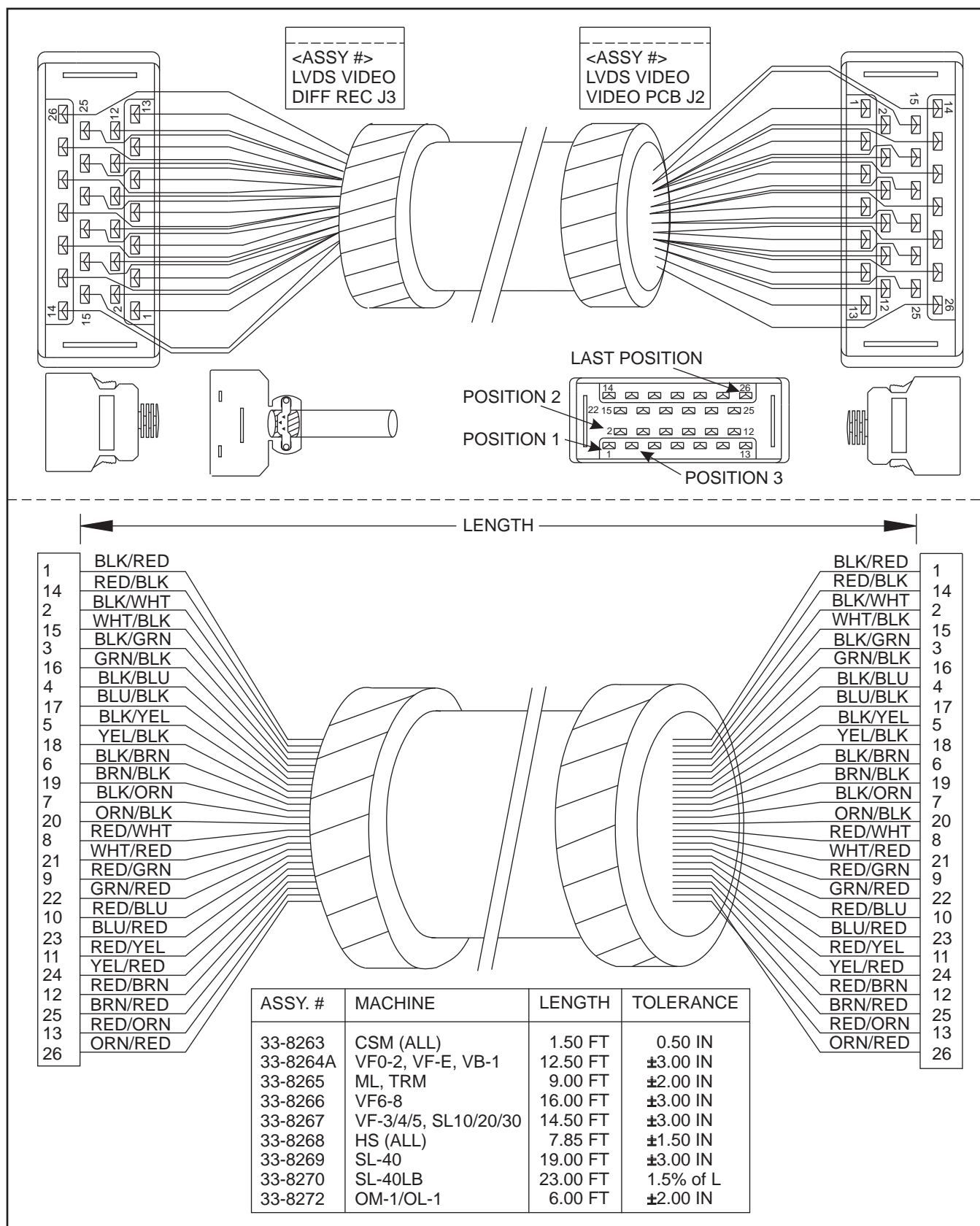


CABLE, +12V/+5V/GND LCD 30W POWER SUPPLY UNIT (33-8260C)



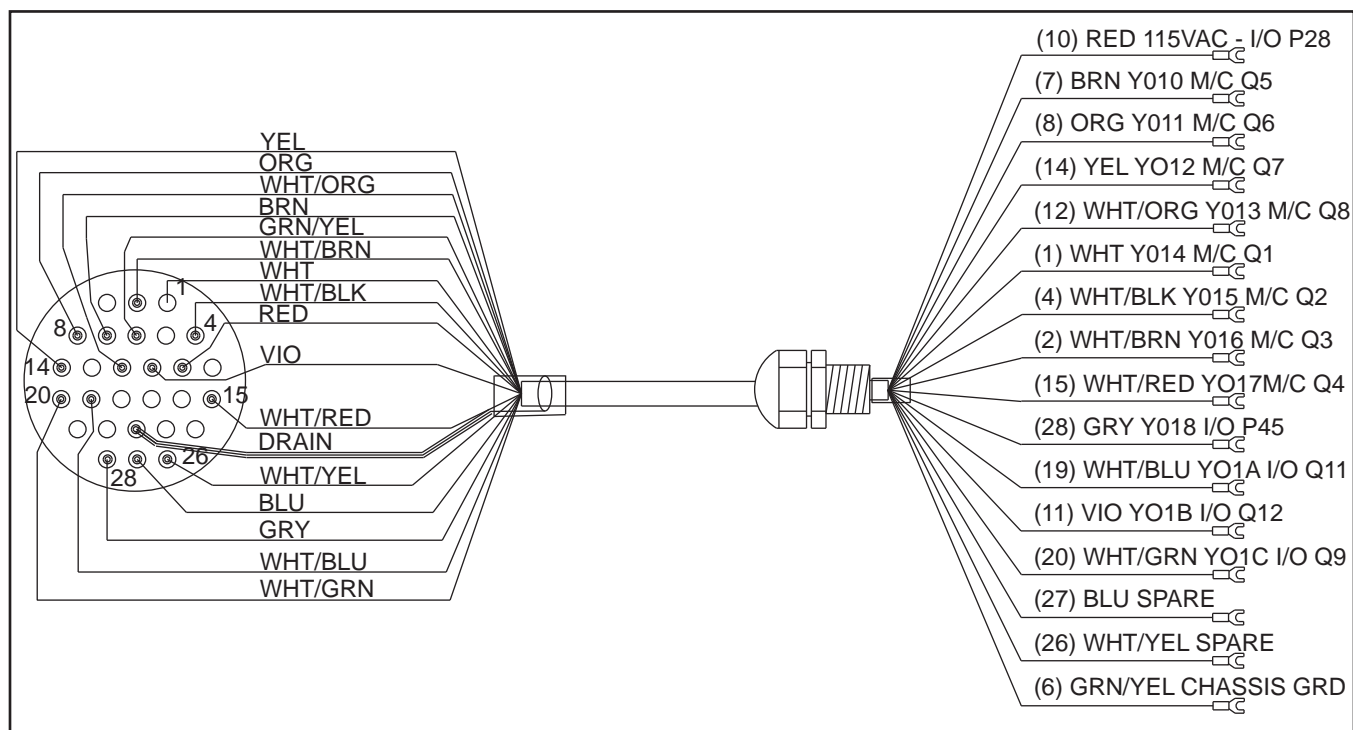


LVDS VIDEO DATA CABLE (33-8264A)





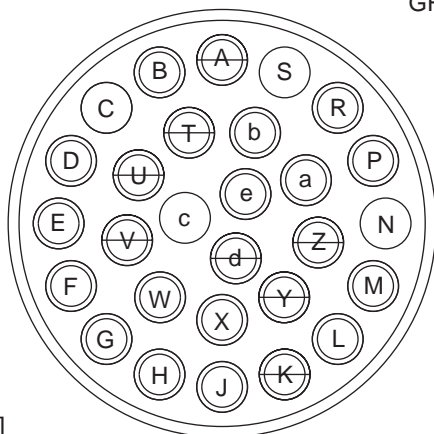
CABLE, MORI 60 TOOL CHANGER RECEPTACLE OUTPUTS (32-8156A)



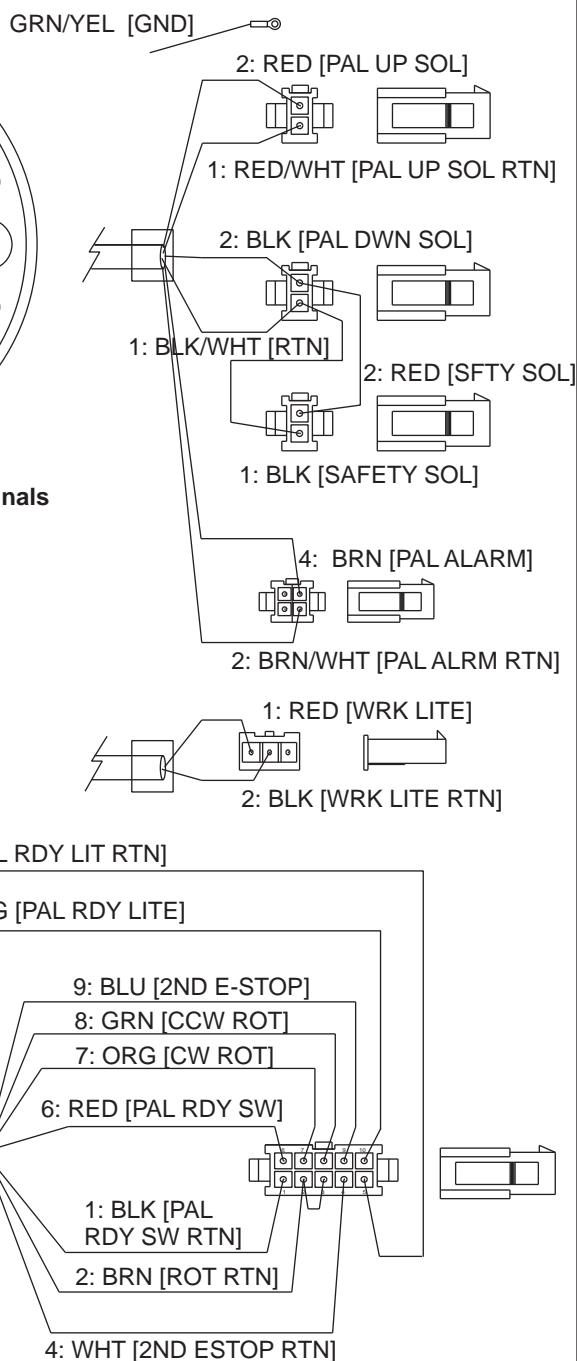


FRONT ENCLOSURE SIGNAL CABLE (32-6662D)

- A: GRN [PAL DWN SW]
- B: WHT [PAL UP SW]
- D: SHIELD
- E: BRN [PAL ALARM]
- F: BRN/WHT [PAL ALRM RTN]
- G: GRN/YEL [GND]
- H: SHIELD
- J: ORG [CW ROT]
- L: SHIELD
- M: BRN [PAL RDY LITE RING]
- P: BLK [PC OP LOCK SW]
- Q: RED [WORK LITE]
- R: RED [FRNT DR SW]
- T: BLU [2ND ESTOP]
- U: WHT [2ND ESTOP RTN]
- V: RED/WHT [PAL UP SOL RTN]
BLK/WHT [PAL UP SOL RTN]
- W: BLK [PAL DWN SOL]
- X: BLK [PAL RDY SW RTN]
BRN [ROT RTN]
- Y: RED [PAL RDY SW]
- Z: ORG [PAL RDY LITE]
- b: BLK [WRK LITE RTN]
- d: RED [PAL UP SOL]
- e: BLU [PAL DWN SW RTN]

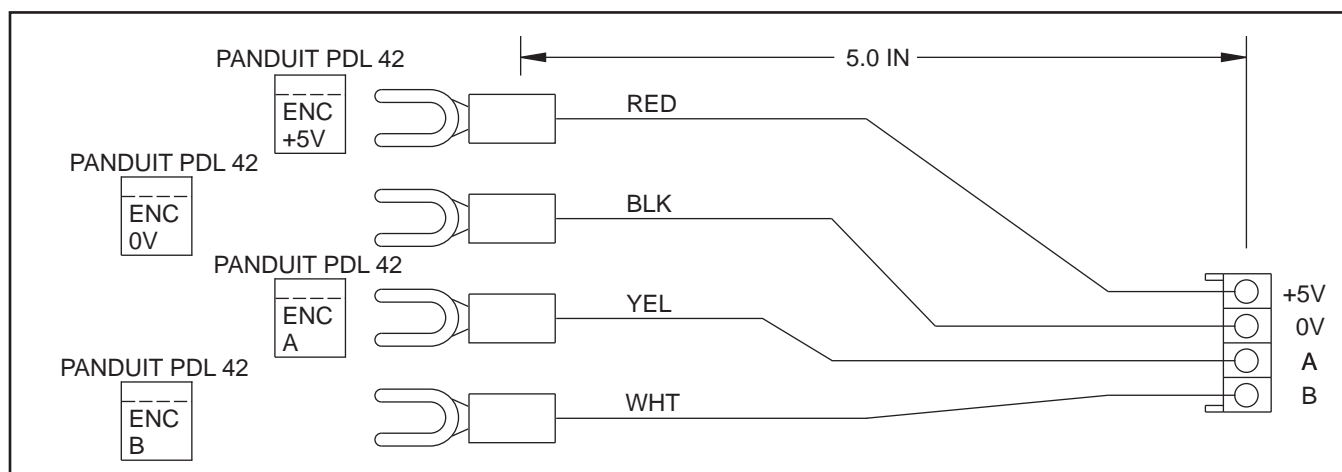


12V Signals

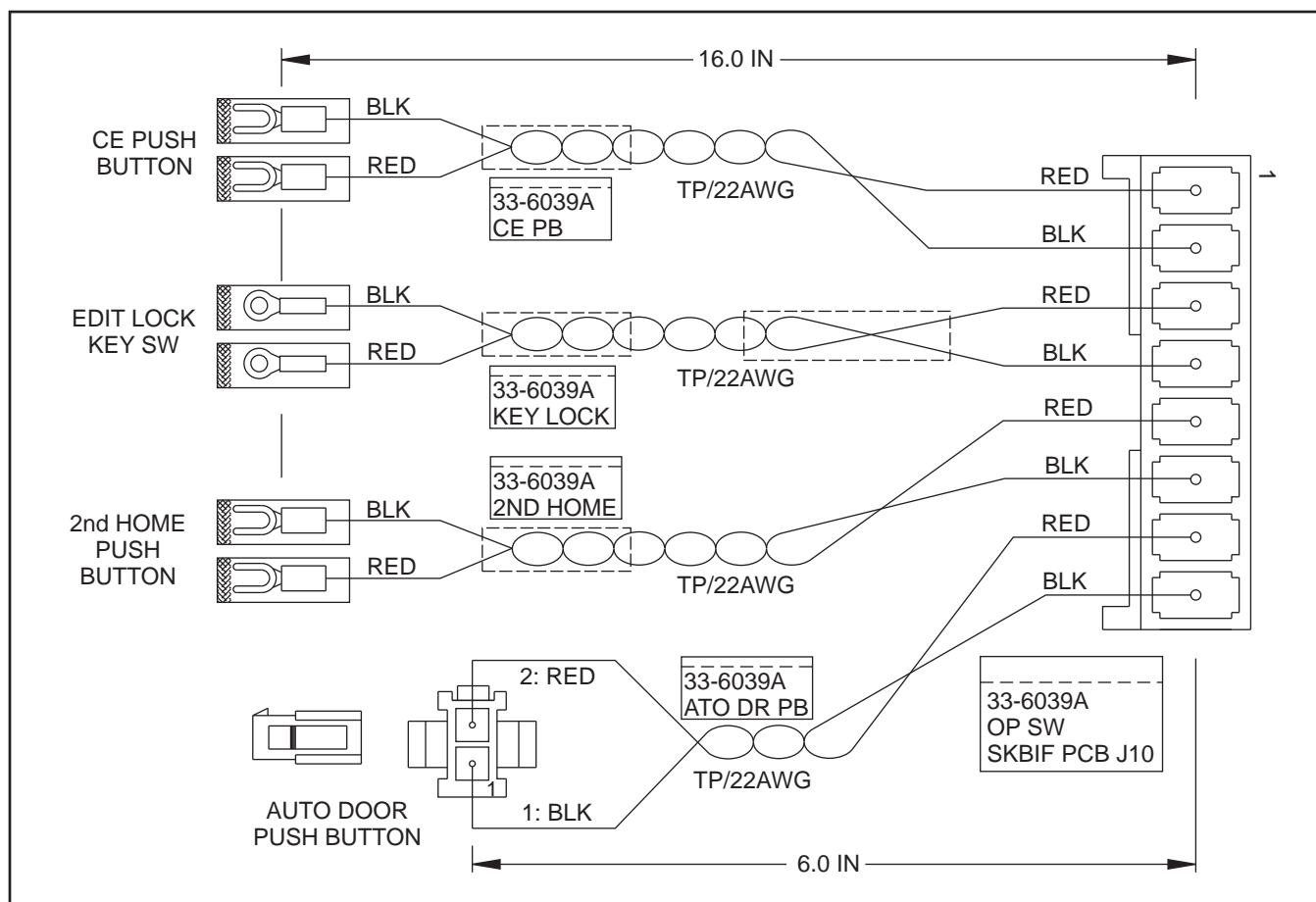




REMOTE JOG HANDLE ENCODER CABLE (33-5755)



CABLE, CE/KEY/2ND HOME/AUTO DOOR (33-6039A)





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. 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 performing Umbrella ATCS Recovery. First, correct any mechanical problem, press Reset until the alarms are clear, select Zero Ret mode, and select Auto All Axes. Some messages are displayed while editing to tell the operator what is wrong, but these are not alarms.

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. Where alarm numbers have different meanings between lathes and mills, it will be indicated with a **(L)** or a **(M)** directly after the alarm number or wording to which the text pertains. The **(L)** and **(M)** will not appear in the alarm numbers on the machine display.

101 COMM. FAILURE WITH MOCON/MOCON MEMORY FAULT - 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. Re-seat or replace ADDRESS and DATA bus cables. This alarm could also be caused by a memory fault which was detected on the MOCON. Check MOCON/PROCESSOR Status Lights. Verify correct power to 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 fault, or power failure. Will also appear upon start up of machine as an informative alarm. Press RESET to power servos on.

103 X SERVO ERROR TOO LARGE - Load on the X-axis Servomotor has exceeded parameter 9 X-axis Max Error. The servos will be turned off and you must push RESET to clear the alarm and turn on the servos. Dull cutting tools or an incorrect program is exceeding the Max Load for this axis. Lathe: Servo brake on X axis motor may not be disengaging. 24VDC is needed to release brake. Power for servo brake is supplied from Trans/Brake pcb P5/P9, or on I/O pcb P78/P79 when servos are powered on. Verify power to hydraulic card.

104 Y SERVO ERROR TOO LARGE - The load on the Live Tool Servomotor has exceeded parameter 23 Y-axis Max Error. The servos will be turned off and you must push RESET to clear the alarm and turn on the servos. Dull cutting tools or an incorrect program is exceeding the Max Load for this axis. **Horizontal mill:** Servo brake may not be disengaging. 24VDC is needed to release brake. Power for servo brake is supplied from Trans/Brake PCB P5/P9, or on I/O PCB P78/P79 when servos are powered on. Verify power to AMP +/- 12 325VDC Buss.

105 Z SERVO ERROR TOO LARGE - The load on the Z-axis Servomotor has exceeded parameter 37 Z-axis Max Error. The servos will be turned off and you must push RESET to clear the alarm and turn on the servos. Dull cutting tools or an incorrect program is exceeding the Max Load for this axis. **Vertical mill:** Servo brake may not be disengaging. 24VDC is needed to release brake. Power for servo brake is supplied from Trans/Brake pcb P5/P9, or on I/O pcb P78/P79 when servos are powered on. Verify power to AMP +/- 12 325VDC Buss.

106 A SERVO ERROR TOO LARGE - Load on the A-axis Servomotor has exceeded parameter 51 Z-axis Max Error. The servos will be turned off and you must push RESET to clear the alarm and turn on the servos. This is the Turret Index Servo; this alarm indicates that there is a problem with the Turret. The Turret may have hit something while trying to index, or a mechanical problem that prevents normal movement may have occurred. Verify power to AMP +/- 12 325VDC Buss.



Lathe: Turret may need motor coupling adjustment (See mechanical service manual for details). Turret may have rotated before being completely unclamped. Check adjustment of Turret Locked/Unlocked switches.

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 Servo Off alarm. This alarm will also be generated if there is a low pressure condition in the hydraulic counterbalance system. In this case, the alarm will not reset until the condition has been corrected.

108 X SERVO OVERLOAD - The load on the X-axis Servo motor has been exceeded. Adjust your program to reduce the tool load placed on the X-axis. **Lathe:** Servo brake on X axis motor may not be disengaging. 24VDC is needed to release brake. Power for servo brake is supplied from Trans/Brake pcb P5/P9, or on I/O pcb P78/P79 when servos are powered on. Verify power to AMP +/- 12 325VDC Buss.

109 Y SERVO OVERLOAD - The load on the Live Tool Servo motor has been exceeded. Adjust your program to reduce the tool load placed on the Live Tool Servo. **Horizontal mill:** Servo brake may not be disengaging. 24VDC is needed to release brake. Power for servo brake is supplied from Trans/Brake pcb P5/P9, or on I/O pcb P78/P79 when servos are powered on. Verify power to AMP +/- 12 325VDC Buss.

110 Z SERVO OVERLOAD - The load on the Z-axis Servo motor has been exceeded. Adjust your program to reduce the tool load placed on the Z-axis. **Vertical mill:** Servo brake may not be disengaging. 24VDC is needed to release brake. Power for servo brake is supplied from Trans/Brake pcb P5/P9, or on I/O pcb P78/P79 when servos are powered on. Verify power to AMP +/- 12 325VDC Buss.

111 A SERVO OVERLOAD - Excessive load on A-axis servo. Something is obstructing the turret; this is an indication that there is a problem with the Turret Index Servo. **Vertical mill with rotary:** Rotary brake system may not be releasing. Test brake system by temporarily disconnecting supplied air to brake. Verify correct rotary model is selected in setting 30. Verify rotary parameters are correct.

112 NO INTERRUPT - Electronics fault. Call your dealer. No communication between processor and Mocon. Power failure can be verified if Status LED on Mocon blinks four times at power up. Test +12 / -12 vdc to Mocon pcb from LVPS.

113 (L) 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.

113 (M) SHUTTLE IN FAULT - Tool changer is not completely to the right. During tool changer operation, the tool in/out shuttle failed to get to the in position. Parameters 62 and 63 can adjust the time-out times— Verify parameters 62 and 63 are set to Haas specifications. This alarm can be caused by anything that jams the motion of the slide, the presence of a tool in the pocket facing the spindle, incorrect spindle orientation or a loss of power to the tool changer. Check relays K9-K12 and fuse F1 on I/O PCB. Check the shuttle arm clutch for wear. Check shuttle motor for rotation during tool change. Check motor brushes and test for power at motor.

114 (L) 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. If the Turret has not rotated to the correct position, the motor coupling may need adjustment. Debris between the male and female turret couplings can prevent the turret from locking completely.

114 (M) SHUTTLE OUT FAULT - Tool changer is not completely to the left. During a tool changer operation the tool in/out shuttle failed to get to the out position. Parameters 62 and 63 can adjust the time-out times— Verify parameters 62 and 63 are set to Haas specifications. This alarm can be caused by anything that jams the motion of the slide, the presence of a tool in the pocket facing the spindle (Not when moving away from the spindle), a loss of power to the tool changer. Check the shuttle arm clutch for wear. Check shuttle motor for rotation during tool change. Check motor brushes and test for power at motor. Check relays K9-K12 on and fuse F1 on I/O PCB.

Recover: Make sure shuttle is clear to move away from the spindle. Place something soft under the spindle to catch a tool, which may fall. Press ZERO RET, then ALL to manually move shuttle to the left.



115 (L) TURRET ROTATE FAULT - Tool motor not in position. 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, relays 1-8, 2-3, and 2-4.

115 (M) TURRET ROTATE FAULT - Tool carousel motor not in position. During a tool changer operation, the tool turret failed to start moving or failed to stop at the right position. Turret motor may have rotated too fast or too slow, causing the turret to stop in an incorrect position. Parameters 60 and 61 can adjust the time-out times. This alarm can be caused by anything that jams the rotation of the turret, or a loss of power to the tool changer. Check relays K9-K12 and fuse F1 on I/O PCB. Check turret motor brushes.

116 SPINDLE ORIENTATION FAULT - Spindle did not orient correctly. During a spindle orientation function, the spindle rotated but never achieved proper orientation. This can be caused by failure of encoder, cables, belts, MOCON or vector drive. Parameter 257 Spindle Orient Offset may not be set correctly, causing misalignment with toolchangers.

117 SPINDLE HIGH GEAR FAULT - Gearbox did not shift into high gear. During a change to high gear, the spindle is rotated slowly while air pressure is used to move the gears but the high gear sensor was not detected in time. Parameters 67, 70 and 75 can adjust the time-out times for troubleshooting only. Check the air pressure, the circuit breaker CB4 for the solenoids, and the spindle drive. In Diagnostics, check the status of discrete inputs Spindle Hi Gear and Spindle Low Gear- One bit should read 0, the other a 1, then the bits should change status when a gear change has completed.

118 SPINDLE LOW GEAR FAULT - Gearbox did not shift into low gear. During a change to low gear, the spindle is rotated slowly while air pressure is used to move the gears but the low gear sensor was not detected in time. Parameters 67, 70 and 75 can adjust the time-out times for troubleshooting only. Check the air pressure, the solenoid's circuit breaker CB4, and the spindle drive. In Diagnostics, check the status of discrete inputs Spindle Hi Gear and Spindle Low Gear- One bit should read 0, the other a 1, then the bits should change status when a gear change has completed.

119 OVERVOLTAGE - Incoming line voltage is above maximum. The servos are turned off and the spindle, tool changer, and coolant pump stop. If this condition persists, an automatic shutdown will begin after the interval specified by Parameter 296. Under certain conditions, SMTC Recovery must be performed to clear the alarm. Incorrect power or loss of power to Mocon can also cause this alarm. For office machines and all other machines that use the 320V power supply, Parameter 315 bit 8 (Mini power supply) needs to be set to 1.

120 LOW AIR PRESSURE - Air pressure dropped below 80 psi for period defined by Parameter 76. The Low Air PR alarm appears on the screen as soon as the pressure gets low, and this alarm appears after some time has elapsed. Check your incoming air pressure for at least 100 psi and ensure that the regulator is set at 85 psi. Test the I/O by jumpering pins 1 to 3 on P12 and watch diagnostics bit Low Air Press. Under certain conditions, SMTC Recovery must be performed to clear the alarm.

121 LOW LUBE 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. Test the lube pressure by manually operating the pump by hand and watching the oil pressure gauge. With a full stroke of the pump, the pressure should read 35-40psi and should drop gradually to zero between 8-10 minutes. The pressure switch should also change state when pump is cycled and its status can be viewed in diagnostics. Test the I/O by jumpering pins 1 to 2 on P13 and watch diagnostics.

122 REGEN OVERHEAT - The regenerative load temperature is above a safe limit. This alarm will turn off the servos, 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 spindle.

123 SPINDLE DRIVE FAULT - Failure of spindle drive, motor or regen load. This can be caused by a shorted motor, overvoltage, overcurrent, undervoltage, failure of drive or shorted or open regen load. Undervoltage and overvoltage of DC bus are also reported as alarms 160 and 119, respectively.



124 LOW BATTERY - Memory batteries need replacing within 30 days. This alarm is only generated at power on and indicates that the 3.3V Lithium battery is below 2.5 volts. If this is not corrected within about 30 days, you may lose your stored programs, parameters, offsets, and settings. Back up memory before replacing the battery as follows: Mill version 15 software and Lathe version 8 or earlier: Go to the position page, type a file name, then press F2 to save parameters, offsets, and settings onto a floppy or USB device. Mill 16 and Lathe 9 or later: Go to List Programs, select the USB Device or NET drive tab, press F4, highlight Save All- Back Up, and press Write/Enter.

125 (L) TOOL TURRET FAULT - Turret has not seated itself properly. There may be something obstructing the turret between the housing and the turret itself.

125 (M) SHUTTLE FAULT - Tool shuttle not initialized at power on, Cycle Start, or spindle motion command. This means that the tool shuttle was not fully retracted to the Out position. The shuttle In/Out switches may not be functioning normally. This alarm can be caused by anything that jams the motion of the slide, a loss of power to the tool changer. Check the shuttle arm clutch for wear. Check shuttle motor for rotation. Check motor brushes and test for power at motor. Check relays K9-K12 on and fuse F1 on I/O PCB.

126 GEAR FAULT - Gearshifter is out of position when a command is given to start a program or rotate the spindle. This means that the two speed gear box 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 (L) DOOR FAULT - The machine has detected a problem with the Auto Door. The door either did not Close or Open as commanded. An obstruction or a faulty proxamaty switch can cause this.

127 (M) NO TURRET MARK - Tool carousel motor not in position. The Auto All Axes button will correct this, but be sure afterwards that the pocket facing the spindle does not contain a tool. M39 can be used to command the turret to rotate if the pocket facing the spindle contains a tool.

128 (M) SUPER TRAVEL ENABLED ON MULTIPLE AXES - Two or more axes are enabled for super travel. Only one axis is allowed super travel capability. Super travel is enabled when a tool change offset parameter is greater than or less than normal travel limits. Check the Zero Axis TC, Max Travel, and Tool Change Offset parameter values for the X and Y axes.

129 M FIN FAULT - M-Fin was active at power on. Check the wiring to your M code interfaces. This test is only performed at power-on. Parameter 734 bit M-CODE FINISH may be inverted.

130 (L) CHUCK UNCLAMPED - The Cycle Start Button was push while the chuck was Un-Clamped. Clamp the Chuck and Re-Start the cycle. Check setting #92 for proper chuck clamping.

130 (M) TOOL UNCLAMPED - The tool appeared to be unclamped during spindle orientation, a gear change, a speed change, or TSC start-up. The alarm is also generated if the tool release piston is energized during Power Up. This can be caused by incorrect TRP switch function or adjustment, an air solenoid fault, relays on the I/O assembly, draw bar assembly, or the wiring.

131 (M) TOOL NOT CLAMPED - When clamping or powering up the machine, the Tool Release Piston is not Home. Check TRP switches for correct operation and adjustment. There is a possible fault in the air solenoids, relays on the I/O Assembly, drawbar assembly, or wiring.

132 POWER DOWN FAILURE - Machine did not turn off when an automatic power-down was commanded. Check wiring to Power Interface (POWIF) card on power supply assembly, relays on the I/O assembly, and the main contactor K1.

133 (L) SPINDLE BRAKE ENGAGED - The Spindle was commanded to start while the spindle was clamped (M14) correct your part program (M15) to Un-Clamp the spindle.

133 (M) SPINDLE INOPERATIVE - Spindle does not respond when spindle motion is commanded. This can be caused by failure of encoder, cables, belts, MOCON, or vector drive.



134 (L) LOW HYDRAULIC PRESSURE - Hydraulic pressure is sensed to be low or has not come up to pressure within the time allowed in parameter 222. Check pump pressure and hydraulic tank oil level. Verify proper pump and machine phasing. Also check 3-phase power phasing. Phase detector on power card should have green light under PASS when machine is powered up.

134 (M) TOOL CLAMP FAULT - While Unclamping, the tool did not release from spindle when commanded. Check air pressure, solenoid circuit breaker CB4, and for maladjustment of the draw bar assembly.

135 X-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

136 Y-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

137 Z-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

138 A-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes. (Mill) Check parameter 43 bit OVER TEMP NC. Make sure the correct model rotary has been selected in setting 30.

139 X-AXIS MOTOR Z FAULT - Encoder marker pulse count failure. This alarm usually means that the encoder has been damaged and encoder position data is unreliable. It can also be caused by damaged motor cable or a loose encoder cable connection on motor or encoder input on the Mocon pcb.

140 Y-AXIS MOTOR Z FAULT - Encoder marker pulse count failure. This alarm usually means that the encoder has been damaged and encoder position data is unreliable. It can also be caused by damaged motor cable or a loose encoder cable connection on motor or encoder input on the Mocon pcb.

141 Z-AXIS MOTOR Z FAULT - Encoder marker pulse count failure. This alarm usually means that the encoder has been damaged and encoder position data is unreliable. It can also be caused by damaged motor cable or a loose encoder cable connection on motor or encoder input on the Mocon pcb.

142 A-AXIS MOTOR Z FAULT - Encoder marker pulse count failure. This alarm usually means that the encoder has been damaged and encoder position data is unreliable. It can also be caused by damaged motor cable or a loose encoder cable connection on motor or encoder input on the Mocon pcb. (Mill) Check A-axis cable connection on side of electrical cabinet.

143 (L) SPINDLE ORIENTATION LOST - Spindle orientation lost during a fine spindle control motion. This can be caused by failure of encoder, cables, belts, MOCON, or vector drive. It can also be caused by failure to orient spindle prior to G05, Fine Spindle Control Motion. Be sure to run M19 before G05.

143 (M) SPINDLE ORIENTATION LOST - Spindle orientation lost during a tool change operation. This can be caused by failure of encoder, cables, belts, MOCON, or vector drive.

144 TIMEOUT - 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. Home switch input changed state while machine was in use. Stored stroke limits should stop the slides before they hit the limit switches. Verify the value of Parameter 125, Grid Offset, and check the wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw. X limit switch may need replacement.

146 Y LIMIT SWITCH - Live Tooling hit limit switch or switch disconnected. Home switch input changed state while machine was in use. Stored stroke limits should stop slides before they hit the limit switches. Verify the value of Parameter 126, Grid Offset, and check the wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw. Y limit switch may need replacement.



147 Z LIMIT SWITCH - Axis hit limit switch or switch disconnected. Home switch input changed state while machine was in use. Stored stroke limits should stop the slides before they hit the limit switches. Verify the value of Parameter 127, Grid Offset, and check the wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw. Z limit switch may need replacement.

148 A LIMIT SWITCH - Normally disabled for rotary axis.

149 (L) SPINDLE TURNING - The machine has detected that the spindle is still turning when it expects it to be stopped. This is most likely caused by an incorrect parameter setting. Call your dealer for assistance correcting this problem.

149 (M) SPINDLE TURNING - A signal from spindle drive indicating that 'spindle drive is stopped' is not present while a tool change operation is going on.

150 (L) I_MODE OUT OF RANGE - Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that led to the alarm.

150 (M) Z AND TOOL INTERLOCKED - Tool changer not at home and either the Z or A or B axis (or any combination) is not at machine zero position. If RESET, E-STOP, or POWER OFF occurs during tool change, Z-axis motion and tool changer motion may not be safe. Check the position of the tool changer and remove the tool if possible. Re-initialize with the AUTO ALL AXES button but be sure that the pocket facing the spindle afterwards does not contain a tool. For machines initialized as VR parameters 212 and 213 tool change offset need to be set and parameters 269 and 270 Bit 4 both need to be 1 for a tool change to occur without this alarm. This alarm can occur after a software upgrade with incorrect parameters.

151 (L) 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.

151 (M) LOW THRU SPINDLE COOLANT - For mills with Through the Spindle Coolant only. This alarm will shut off the coolant spigot, feed, and pump all at once. It will turn on purge, wait for the amount of time specified in Parameter 237, and then turn off the purge. Check for low coolant tank level, any filter or intake strainer clogging, or for any kinked or clogged coolant lines. Verify proper pump and machine phasing. If no problems are found with any of these, and none of the coolant lines are clogged or kinked, call your dealer.

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 processor board stack at the top left of the control. Call your dealer.

153 X AXIS Z CH MISSING - Z Reference signal from encoder was not received as expected. All servos are turned off. Can be caused by loose connections, encoder contamination, or parameter error.

154 Y AXIS Z CH MISSING Z - Reference signal from encoder was not received as expected. All servos are turned off. Can be caused by loose connections, encoder contamination, or parameter error.

155 Z AXIS Z CH MISSING Z - Reference signal from encoder was not received as expected. All servos are turned off. Can be caused by loose connections, encoder contamination, or parameter error.

156 A AXIS Z CH MISSING - Z Reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

157 MOCON WATCHDOG FAULT - The self-test of the MOCON has failed. Call your dealer. Test +12, -12, and +5 volt power at Mocon PCB. Unreliable power from LVPS can cause this alarm. Check alarm history for Axis Drive Faults. A faulty axis driver can cause fluctuated or imbalanced low volt power to logic stack. Problem may be caused by a shorted coolant level sensor, voltage sensor from vector drive, or thermocouple sensor from X-axis ballscrew (lathe). Disconnecting cables, one at a time, on P34, P26, P27, P28, P17, P21, and P22, may isolate the problem.

158 VIDEO/KEYBOARD PCB FAILURE - During power-on tests, the control has detected a problem in either the keyboard or the 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 switch down during power-on.

160 (L) LOW VOLTAGE - The line voltage to control is too low. This alarm occurs when the AC line voltage drops below the voltage specified by Parameter 294.

160 (M) LOW VOLTAGE - The line voltage to control is too low. This alarm occurs when the AC line voltage drops more than 10% below nominal and when another alarm is already present. The voltage range of the 160VDC power supply can be from 145VDC to 175VDC and is adjusted by moving the taps on the main transformer. The output voltage level is displayed on the second page of the diagnostics display.

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. Can be caused by running the axis into a mechanical stop, a short in the motor, or a short of one motor lead to ground.

162 Y AXIS DRIVE FAULT - (L) Current in Live Tooling servo motor beyond limit, **(M)** Current in Y servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. Can be caused by running the axis into a mechanical stop, a short in the motor, or a short of one motor lead to ground.

163 Z AXIS DRIVE FAULT - Current in Z servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. Can be caused by running the axis into a mechanical stop, a short in the motor, or a short of one motor lead to ground.

164 A AXIS DRIVE FAULT - Current in A servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. Can be caused by running the axis into a mechanical stop, a short in the motor, or a short of one motor lead to ground.

165 X ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. It 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. Check grid offset.

166 Y ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. It 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. Check grid offset.

167 Z ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. It 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. Check grid offset.

168 A ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. It 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. Check grid offset.

169 SPINDLE DIRECTION FAULT - Problem with rigid tapping hardware. The spindle started turning in the wrong direction.

170(M) ENABLED AXIS NEEDS MOCON2 - An axis is enabled that has its MOCON channel parameter set to a channel on MOCON 2 but a MOCON 2 was not detected.

171 (L) rpm TOO HIGH TO UNCLAMP - The spindle speed exceeded the max speed allow in Parameter 248 to unclamp. Reduce the speed of the spindle to a value less than or equal to Parameter 248.



171 (M) APC-PALLET CLAMP TIMEOUT - The pallet in the mill did not clamp in the time allowed. Check for foreign objects under the pallet and between the pallet and the clamp plate. Verify an adequate supply of air pressure and volume. Check air solenoids for sticking and air release ports for clogging. Check pallet position switch for correct operation, the switch and wiring for damage, and pallet alignment. Check the pallet clamp mechanism for correct operation. After determining cause and correcting problem, run M50 P1 in MDI to recover the pallet changer and continue operation. Parameter 320 specifies the pallet clamp timeout period.

172 (L) DOOR IS OPEN AND SPINDLE IS TURNING - The chuck is not allowed to unclamp while the door is open and the spindle is on.

172 (M) APC-PALLET UNCLAMP TIMEOUT - The pallet in the mill did not unclamp in the time allowed. Check for foreign objects between the pallet and the clamp plate. Verify there is an adequate supply of air pressure and air volume. Check air solenoids for sticking and air release ports for clogging. Check the pallet position switch for correct operation, the switch and wiring for damage and pallet alignment. Check the pallet clamp plate for damage. After determining the cause and correcting the problem, run M50 P1 in MDI to recover the pallet changer and then continue operation. Parameter 321 specifies the unclamp timeout period.

173 SPINDLE ENCODER Z CH MISSING - The Z channel pulse from the spindle encoder is missing for rigid tapping synchronization.

174 (L) TOOL LOAD EXCEEDED - The tool load limit is set and the load limit for a tool was exceeded in a feed. Reset the tool load limits in current commands for Spindle loads.

174 (M) TOOL LOAD EXCEEDED - The tool load limit is set and the load limit for a tool was exceeded in a feed. Reset the tool load limits in current commands for Spindle loads.

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 OVERHEAT SHUTDOWN - An overheat condition persisted longer than the interval specified by Parameter 297 and caused an automatic shutdown.

177 OVERVOLTAGE 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 led to the alarm.

179 LOW PRESSURE TRANS OIL - Transmission oil is low or low pressure condition in oil lines.

180 (M) PALLET/FIXTURE NOT CLAMPED - Pallet/Fixture clamped input indicates pallet or fixture is not clamped and it is unsafe to run the spindle, jog an axis, or start a part program by pressing Cycle Start. It could also mean that a previous pallet change was incomplete and the pallet changer needs to be recovered. **EC-300:** Make sure there is no debris obstructing pallet clamp assy. The pallet clamp switch assembly may need servicing. The switch assembly is located under the pallet, behind the clamp plate. **EC-400/500:** The machine gets this alarm at beginning of a program if there is no pallet on the receiver. Check for debris between pallet and receiver. Check air pressure. Test switches at rotary union located under receiver. **VFAPC:** Alarm occurs when the spindle is commanded, but the pallet is unclamped. E-Stop may have been pressed during a pallet change. Run an M50 to reset the pallet changer. Pallet clamp switch may need servicing.

181 MACRO NOT COMPLETED - SPINDLE DISABLED - Macro code operating Haas optional equipment (bar feeder, etc.) was not completed (E-Stop, 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 (L) LIVE TOOLING CABLE FAULT - Cable from Live Tooling motor encoder does not have valid differential signals.



183 (M) Y CABLE FAULT - Cable from Y-axis encoder does not have valid differential signals.

184 Z CABLE FAULT - Cable from Z-axis encoder does not have valid differential signals.

185 A CABLE FAULT - Cable from A-axis encoder does not have valid differential signals.

186 SPINDLE NOT TURNING - The spindle is not turning; check your program for G99 Feed Per Revolution or G98 Feed Per Minute.

187 (L) B SERVO ERROR TOO LARGE - Too much load or speed on B-axis motor. The difference between the motor position and the commanded position has exceeded a parameter. The motor may also be stalled, disconnected, or the driver failed. 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.

187 (M) B SERVO ERROR TOO LARGE - Too much load or speed on B-axis motor. The difference between the motor position and the commanded position has exceeded Parameter 159. The motor may also be stalled, disconnected, or the driver failed. 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. On machines with servo based tool changer chains, the chain was unable to move. On Machines with servo based tool changer arms, the arm was unable to move, possibly due to a stuck tool.

188 B SERVO OVERLOAD - Excessive load on B-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.

189 B-AXIS MOTOR OVERHEAT - Servo motor overheat. The motor's temperature sensor indicates over 150° F. This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

190 B MOTOR Z FAULT - Encoder marker pulse count failure. It usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose encoder connectors.

191 B LIMIT SWITCH - Normally disabled for rotary axis.

192 B AXIS Z CH MISSING - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

193 B AXIS DRIVE FAULT - Current in B servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. Running the axis into a mechanical stop can cause this. A short in the motor or a short of one motor lead to ground can also cause it.

194 B ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. 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.

195 B CABLE FAULT - Cable from B-axis encoder does not have valid differential signals.

196 (M) COOLANT SPIGOT FAILURE - Spigot failed to achieve commanded location after two (2) attempts.

197 MISC. SOFTWARE ERROR - This alarm indicates an error in the control software. Call your dealer and report this problem.

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 - A negative spindle RPM was entered. Spindle speed commands must always be a positive value.



200 VD OVER TEMP. - Vector drive over temperature. The Vector Drive's temperature sensor indicates over 90°C (194° F) near the bridge rectifier. This can be caused by an extended overload condition of the Vector Drive, a stopped fan or high room temperature. Check the fan to ensure it is working.

201 PARAMETER CRC ERROR - Parameters lost by low battery. Check for low battery/low battery alarm.

202 SETTING CRC ERROR - Settings lost by low battery. Check for a low battery/low battery alarm.

203 LEAD SCREW CRC ERROR - Lead screw compensation tables lost by low battery. Check for low battery and low battery alarm. Save parameters to USB or other device. Original parameters may need to be reloaded. Lead Screw Comp Tables can be viewed by pressing PARAM DGNOS, then END, then <DOWN ARROW>. Take note of comp tables. Are any numbers entered? Corrupted Comp tables can be cleared, if needed, by pressing 0, then ORIGIN. Arrow down to Y and Z tables and clear them as well.

204 OFFSET CRC ERROR - Offsets lost by low battery. Check for a low battery and low battery alarm.

205 PROGRAMS CRC ERROR - Users program lost by low battery. Check for low battery and alarm.

206 INTERNAL PROG 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 led 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 led 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 led to the alarm.

210 INSUFFICIENT MEMORY - Not enough memory to load user program. Check the space available in the LIST PROG and delete or download some programs to free memory.

211 ODD PROG BLOCK - Possible corrupt program. Save all programs to disk, delete all, and then reload.

212 PROG 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; possibly with main processor. 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. Possible processor problem, if this persists call your dealer. This can happen when extended memory is turned on.

215 FREE MEMORY PTR CHANGED - Indicates amount of memory used by programs counted in system disagrees with variable that points to free memory. Possible processor board problem. Call your dealer.

216 (L) PROBE ARM DOWN WHILE RUNNING - Indicates probe arm pulled down while running a program.

216 (M) EPROM SPEED FAILURE - Possible processor board problem.

217 X PHASING ERROR - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error. Call your dealer.

218 Y PHASING ERROR - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

219 Z PHASING ERROR - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

220 A PHASING ERROR - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.



221 B PHASING ERROR - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

222 C PHASING ERROR - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

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 count pulses 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 PCB.

225 Y TRANSITION FAULT - Illegal transition of encoder count pulses in Live Tooling. 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 PCB.

226 Z TRANSITION FAULT - Illegal transition of encoder count pulses in Z-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 PCB.

227 A TRANSITION FAULT - Illegal transition of encoder count pulses in A-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 PCB.

228 B TRANSITION FAULT - Illegal transition of count pulses in B-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 PCB.

229 C TRANSITION FAULT - Illegal transition of count pulses in C-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 PCB.

230 (L) DOOR OPEN - Spindle rpm has exceeded max value in Parameter 586 while the door is open. Stop the spindle, close the door, or lower spindle rpm to a value less than or equal to the value of Parameter 586.

231 JOG HANDLE TRANSITION FAULT - Illegal transition of count pulses 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 count pulses 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 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. Loose encoder connectors at P1-P4 can also cause this.

236 SPINDLE MOTOR OVERLOAD - The 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).



238 (M) AUTOMATIC DOOR FAULT - The automatic door was commanded to operate, but did not complete the operation. The door was:

- 1) Commanded to close but failed to contact the closed switch in the time allowed.
- 2) Commanded to open but failed to contact opened switch (not all doors have switch) in time allowed.
- 3) Commanded to open but did not begin moving in the time allowed.

Check door switch, door for mechanical binding, and that the door motor and clutch are functioning correctly.

239 UNKNOWN MOCON1 ALARM - Mocon has reported an alarm to the current software. The current version of software was unable to identify the alarm. Check for loose Mocon cable connections. See MOCON software release notes for additional diagnostics.

240 EMPTY PROG OR NO EOB - DNC program not found or no end of program found. Program structure isn't correct, there needs to be a % at the beginning or end of file. The program must have a program number beginning with the letter "O". Possible there is electrical noise effecting data transfer.

241 INVALID CODE - RS-232 load was bad. Data was stored as comment. Check the program received. The erroneous data will be placed on the MESSAGES page as a comment with trailing question mark. Invalid code will be visible in program as a comment with a trailing question mark.

242 NUMBER FORMAT ERROR-OR TOO LONG - Check input file for an improperly formatted number. Number may have too many digits or multiple decimal points. The erroneous data will be placed on the MESSAGES page as a comment with trailing question mark.

243 BAD NUMBER - Data entered is not a number.

244 MISSING (...) - Comments must begin '(' and end with a ')'. This alarm also occurs with a comment greater than 80 characters long. The erroneous data is placed on the MESSAGES page as a comment with trailing question mark. The offending blocks may also be visible in the program as a comment, search for (?).

245 UNKNOWN CODE - Check input line or data from RS-232. Alarm can occur while editing data into a program or loading from RS-232. The erroneous data will be placed on the MESSAGES page as a comment with trailing question mark. The offending blocks may also be visible in the program as a comment, search for (?).

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 led to the alarm.

248 NUMBER RANGE ERROR - Number entry is out of range. This could be caused by too many digits in an alphabetical address or macro variable. The erroneous data will be placed on the MESSAGES page. Invalid code may be visible in program as a comment with a trailing question mark.

249 PROG DATA BEGINS ODD - Possible corrupt program. Save all programs to disk, delete all, then reload.

250 PROG DATA ERROR - Possible corrupt program. Save all programs to disk, delete all, and then reload. If the error persists, programs may have to be searched for error on PC, corrected then reloaded.

251 PROG DATA STRUCT ERROR - Possible corrupt program. Save all programs to disk, delete all, and then reload. If the error persists, programs may have to be searched for error on PC, corrected then reloaded. Back up all programs on USB or other device, delete all, and reload. Problem may return when programs are reloaded. Programs should be reloaded one at a time to isolate the corrupted program. If any programs cannot be deleted, please contact your dealer.

252 MEMORY OVERFLOW - Possible corrupt program. Save all programs to disk, delete all, and then reload. If the error persists, programs may have to be searched for error on PC, corrected then reloaded.

253 ELECTRONICS OVERHEAT - The control box temperature has exceeded 140° F (60° C). This can be caused by an electronics problem, high room temperature, or clogged air filter. Test +12, -12, and +5 volt power at Mocon PCB.



254 SPINDLE MOTOR OVERHEAT - Motor driving spindle is too hot. This alarm is only generated in machines equipped with a Haas vector drive. The spindle motor temperature sensor sensed a high temperature for greater than 1.5 seconds.

255 (M) NO TOOL IN SPINDLE - There is an invalid tool number in the spindle entry of the Pocket-Tool table. The spindle entry cannot be 0 and must be listed in the body of the table. If there is no tool in the spindle, enter the number for an empty pocket into the spindle entry. If there is a tool number in the spindle entry, make sure that it is in the body of the table and that the pocket is empty.

256 (M) CURRENT TOOL UNKNOWN - Current tool information has been lost. This is most likely due to re-initialization. It is likely that the next commanded tool change will result in a collision between the spindle and a tool in a pocket. To eliminate the possibility of a crash, perform Tool Changer Restore. Do not use Power Up/Restart, this will cause the machine to try to return a tool to the carousel.

257 PROG DATA ERROR - Possible corrupt program. Save all programs to disk, delete all, and then reload. If the error persists, programs may have to be searched for error on PC, corrected then reloaded.

258 INVALID DPRNT FORMAT - Macro DPRNT statement not structured properly, check the formatting of the DPRNT commands.

259 LANGUAGE VERSION - Problem with language files. Please reload foreign language files.

260 LANGUAGE CRC - Indicates 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 CRC error. Indicates a loss of memory - possible processor board problem.

262 PARAMETER CRC MISSING - RS-232 or disk read of parameter had no CRC when loading from disk or RS-232.

263 LEAD SCREW CRC MISSING - Lead screw compensation tables have no CRC when loading from disk or RS-232.

264 ROTARY CRC MISSING - Rotary table parameters have no CRC when loading from disk or RS-232.

265 MACRO VARIABLE FILE CRC ERROR - Macro variable file has a CRC error. Indicates a loss of memory. Possible corrupted file or processor board problem.

266 (M) TOOL CHANGER FAULT - Run Tool Changer Recovery.

267 (M) TOOL DOOR OUT OF POSITION - This alarm will be generated on a horizontal mill during a tool change when Parameter 278, TL DR Switch is set to 1, and the tool carousel air door switch indicates that the door is open after it was commanded closed, or closed after it was commanded open. This alarm will most likely be caused by a stuck or broken switch.

268 DOOR OPEN @ M95 START - Generated whenever an M95 (Sleep Mode) is encountered and the door is open. The door must be closed in order to start sleep mode.

269 (M) TOOL ARM FAULT - The tool changer arm is not in position. Run Tool Changer Recovery.

270 C SERVO ERROR TOO LARGE - Too much load or speed on C-axis motor. The difference between the motor position and the commanded position has exceeded Parameter 506. The motor may also be stalled, disconnected, or the driver failed. 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.

271 C SERVO OVERLOAD - Excessive load on C-axis motor. This can occur if load on motor over a period of several seconds or minutes is large enough to exceed the motor's continuous rating. The servos are turned off when this occurs. This alarm can be caused by anything that causes a very high load on the motors.



272 C-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F. This can be caused by an extended overload of the motor such as leaving the slide at the stops for several minutes.

273 C MOTOR Z FAULT - Encoder marker pulse count failure. It usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose encoder connectors.

274 C LIMIT SWITCH - Axis hit limit switch or switch disconnected. Stored stroke limits should stop the slides before they hit the limit switches. Verify the value of parameter Grid Offset and check wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw.

275 C AXIS Z CH MISSING - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

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 the axis 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 - This alarm will occur if the home/limit switches move or are misadjusted. 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.

278 C CABLE FAULT - Cable from C-axis encoder does not have valid differential signals.

279 (M) X AXIS LINEAR SCALE Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the Z Fault encoder has been damaged and encoder position data is unreliable. This can also be caused by loose scale connectors.

280 (M) Y AXIS LINEAR SCALE Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the Z Fault encoder has been damaged and encoder position data is unreliable. This can also be caused by loose scale connectors.

281 (M) Z AXIS LINEAR SCALE Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the Z Fault encoder has been damaged and encoder position data is unreliable. This can also be caused by loose scale connectors.

282 (M) A AXIS LINEAR SCALE Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the Z Fault encoder has been damaged and encoder position data is unreliable. This can also be caused by loose encoder connectors.

283 (M) X AXIS LINEAR SCALE Z CH MISSING - Broken wires or encoder contamination. All servos are turned off. This Z Channel Missing can also be caused by loose scale connectors.

284 (M) Y AXIS LINEAR SCALE Z CH MISSING - Broken wires or encoder contamination. All servos are turned off. This Z Channel Missing can also be caused by loose encoder connectors.

285 (M) Z AXIS LINEAR SCALE Z CH MISSING - Broken wires or encoder contamination. All servos are turned off. This Z Channel Missing can also be caused by loose encoder connectors.

286 (M) A AXIS LINEAR SCALE Z CH MISSING - Broken wires or encoder contamination. All servos are turned off. This Z Channel Missing can also be caused by loose encoder connectors.

287 (M) X AXIS LINEAR SCALE CABLE FAULT - Cable from X-axis scale has no valid differential signals.

288 (M) Y AXIS LINEAR SCALE CABLE FAULT - Cable from Y-axis scale has no valid differential signals.

289 (M) Z AXIS LINEAR SCALE CABLE FAULT - Cable from Z-axis scale has no valid differential signals.

290 (M) A AXIS LINEAR SCALE CABLE FAULT - Cable from A-axis scale has no valid differential signals.

291 (M) LOW AIR VOLUME/PRESSURE DURING ATC - An Automatic Tool Change was not completed due to insufficient volume or pressure of compressed air. Check air supply line.



292 320V VD/MMPS FAULT - 320V VECTOR DRIVE OR MINI MILL POWER SUPPLY fault has occurred. This alarm is generated whenever a condition of over voltage, under voltage, short circuit, over temperature, or shorted regen occurs. This alarm should be followed by another alarm with a detailed explanation of the power supply condition. Press RESET key to continue. If RESET does not clear all alarms CYCLE POWER TO CONTINUE!!

293 INVALID CHAMFER OR CORNER ROUNDING DISTANCE IN G01 - Check your geometry.

294 NO END MOVE FOR G01 CHAMFER CORNER ROUNDING - A chamfer or corner-rounding move was requested in a G01 command, but no end move was commanded. Check your geometry.

295 MOVE ANGLE TOO SMALL IN G01 CORNER ROUNDING - Tangent of half angle is zero. Move Angle must be greater than 1 degree. Check your geometry.

296 INVALID PLANE SELECTION IN G01 CHAMFER OR CORNER ROUNDING - Chamfer or corner rounding move and end move must be in the same plane as the beginning move. Check your geometry.

297 (M) ATC SHUTTLE OVERSHOOT - The ATC shuttle failed to stop within the allowable standby position window during a tool change. Check for a loose drive belt, damaged or overheated motor, sticking or damaged shuttle standby switch or shuttle mark switch, or burned gear motor control board relay contacts. Use Tool Changer Restore to recover the ATC, then resume normal operation.

298 (M) ATC DOUBLE ARM OUT OF POSITION - ATC double arm mark switch, or CW/CCW position switch is in an incorrect state. Check for sticking, misaligned or damaged switches, mechanism binding, damaged motor, or debris build up. Use Tool Changer Restore to recover the ATC, then resume normal operation.

299 (M) ATC SHUTTLE OUT OF POSITION - The ATC shuttle mark switch is in an incorrect state. Check for a sticking, misaligned, or damaged switch, mechanism binding, damaged motor, or debris build up. Use Tool Changer Restore to recover the ATC, then resume normal operation.

301 (L) NORMAL STOP - A program stop was encountered.

302 INVALID R IN G02 OR G03 - R must be greater than or equal to half the distance from start to end with an accuracy of 0.0010 inches (0.010 mm.). Check your geometry.

303 (L) INVALID X,B OR Z IN G02 OR G03 - Intersection points in G02 and G03 start and end must have an accuracy of 0.0010 inches (0.010 mm.). Check your geometry.

303 (M) INVALID X, Y OR Z IN G02 OR G03 - Intersection points in G02 and G03 start and end must have an accuracy of 0.0010 inches (0.010 mm.). Check your geometry.

304 INVALID I,J OR K IN G02 OR G03 - Radius at start and end must match radius at end of arc with an accuracy of 0.0010 inches (0.010 mm.). Check your geometry.

305 INVALID Q IN CANNED CYCLE - Q variable in a canned cycle cannot be zero. Check your program.

306 INVALID I,J,K, OR Q IN CANNED CYCLE - I, J, K, and Q variables in a canned cycle must be greater than zero. Check your program.

307 SUBROUTINE NESTING TOO DEEP - Subprogram nesting is limited to twenty levels. Simplify your program by using fewer subroutines.

308 (L) INVALID TOOL OFFSET - A tool offset not within the range of the control was used.

309 EXCEEDED MAX FEEDRATE - Use a feed rate less than or equal to parameter 59. Check setting 9 for correct dimensional units, this can be caused by trying to run MM program in INCH.

310 INVALID G CODE - G code not defined and is not a macro call check parameters 91 through 100. Alias G-code not listed in parameters 91 through 100. To alias a G-code specify program to alias to in the corresponding parameter.

311 UNKNOWN CODE - Program contained a line or code that is not understood. Check your program.



312 PROGRAM END - End of subroutine reached before M99. Need an M99 to return from subroutine. Check your sub routine or sub program for M99. Sub routines and sub programs need to have M99 to return to where they were called from with the M96, M97, M98 or G65.

313 NO P CODE IN M96, M97, M98, M143, M144, or G65 - M96, M97, M98 or G65 must put subprogram number in P code. P0 for text engraving or P1 for sequential serial number when using G47 text engraving.

314 SUBPROGRAM NOT IN MEMORY - Check that a sub-program called by the P code in M98 or G65 is in memory. When calling a sub program with FNC the sub program must reside on the same device and in the same directory as the main program, which calls them. Also, for files that were transferred from USB to hard drive check the case of the file name on the hard drive, sub programs called must have upper case O and lower case extensions. For example: O1234.nc.

315 (L) INVALID P CODE IN M97, M98 OR M99 - An invalid P Code has been detected in M97, M98, M99, M133, M134, or canned cycle G71, G72, G73, or G70. 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 all other uses.

315 (M) INVALID P CODE IN M98, M97, M96, G47 OR G65 - 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. If G47 commanded, then P must be 0 for text engraving and 1 for sequential serial numbers or ASCII value between 32 and 126.

316 X OVER TRAVEL RANGE - Commanded X-axis move would exceed the machine travel. Machine coordinates are in the negative direction. This indicates either an error in the user's program or improper offsets.

317 (L) Y OVER TRAVEL RANGE - Commanded Y-axis move would exceed machine travel. Machine coordinates are in the negative direction. This indicates either an error in the user's program or improper offsets.

317 (M) Y OVER TRAVEL RANGE - Commanded Y-axis move would exceed machine travel. Machine coordinates are in the negative direction. This indicates either an error in the user's program or improper offsets.

318 Z OVER TRAVEL RANGE - Commanded Z-axis move would exceed the machine travel. Machine coordinates are in the negative direction. This indicates either an error in the user's program or improper offsets.

319 A OVER TRAVEL RANGE - Commanded A-axis move would exceed the machine travel. Machine coordinates are in the negative direction. This indicates either an error in the user's program or improper offsets.

320 NO FEED RATE - Must have an F code commanded for interpolation functions. For G93 inverse time, there must be an F code on each G01 block. F address is modal and if not previously commanded machine will not know what feed rate is specified for a G01, G02 or G03 feed block.

321 AUTO OFF ALARM - Occurs in debug mode only.

322 SUB PROG WITHOUT M99 - Add M99 code to end of program called as a subroutine. Check program.

323 (M) ATM CRC ERROR - Advanced Tool Management (ATM) variables lost maybe by low battery. Check for a low battery and low battery alarm.

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 led 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, 98 - L code not required here. Remove L Code.

328 INVALID TOOL NUMBER - Tool number must be between 1 and value in Parameter 65 for tool changer.

329 UNDEFINED M CODE - That M code is not defined and is not a macro call. Check your program.



330 UNDEFINED MACRO CALL - A macro called a program number not in memory, or a macro variable was accessed by user program but that macro program is not loaded into memory. Check your program.

331 RANGE ERROR - Alphabetic number assignment too large. Check your program.

332 (M) H AND T NOT MATCHED - This alarm is generated when Setting 15 is turned ON. An H code number in a running program does not match the T number in the spindle. Correct the H codes, select the right tool, or turn off Setting 15 to run programs don't have corresponding H and T codes.

333 X AXIS DISABLED - Parameter has disabled this axis.

334 (L) Y AXIS DISABLED - Parameter has disabled Live Tooling.

334 (M) Y AXIS DISABLED - Parameter has disabled this axis.

335 Z AXIS DISABLED - Parameter has disabled this axis.

336 (L) A AXIS DISABLED - An attempt was made to program the A-axis while it was disabled (Disabled bit in Parameter 43 set to 1).

336 (M) A AXIS DISABLED - Attempt was made to program the A-axis while it was disabled (Disabled bit in Parameter 43 set to 1), invisible (Invis Axis bit in Parameter 43 set to 1), or a program commanded the A-axis while it was the outside rotary table (Rotary Index button feature, Map 4TH Axis bit in Parameter 315 set to 1).

337 GOTO OR P LINE NOT FOUND - Subprogram is not in memory, or P code is incorrect. P Not Found. Check your program.

338 INVALID IJK AND XYZ IN G02 OR G03 - Intersection points in G02 and G03 start and end must have an accuracy of 0.0010 inches (0.010 mm.). Check your geometry check plane selection G17, G18 or G19.

339 MULTIPLE CODES - Only one M, X, Y, Z, A, Q etc. allowed in a block. Only one G code from the same group per block.

340 CUTTER COMP BEGIN WITH G02 OR G03 - Cutter compensation must begin with a linear move. Check program and turn on cutter compensation on in a G01 block.

341 CUTTER COMP END WITH G02 OR G03 - Cutter compensation must end with a linear move. Check program and turn off cutter compensation on in a G01 block.

342 CUTTER COMP PATH TOO SMALL - Geometry not possible to apply specified compensation amount. Check your geometry use a smaller tool.

343 DISPLAY QUEUE RECORD FULL - Cycle power on the machine. If the alarm reoccurs, call your dealer and report the sequence of events that led to the alarm.

344 (L) CUTTER COMP WITH G17 & G19 - Cutter compensation G41 or G42 not allowed in planes other than XY plane (G17).

344 (M) CUTTER COMP WITH G18 & G19 - Cutter compensation G41 or G42 not allowed in planes other than XY plane (G17).

345 (L) INVALID R VALUE IN M19 OR G105 - R value must be positive.

346 (L) M CODE DISABLED - M80 or M81 was commanded. These commands are allowed only for the Auto Door feature with Setting 51 DOOR HOLD OVERRIDE set to ON, parameter 57 SAFETY CIRC disabled (0), and Parameter 57 DOOR STOP SP disabled (0). -OR- B. An M17 or M18 was commanded in program restart. These commands are illegal in program restart.

346 (M) M CODE DISABLED A - M80 or M81 was commanded. These commands are allowed only for the Auto Door feature with Setting 51 DOOR HOLD OVERRIDE set to ON, parameter 57 SAFETY CIRC disabled (0), and Parameter 57 DOOR STOP SP disabled (0). -OR- B. An M17 or M18 was commanded in program restart. These commands are illegal in program restart.



348 (L) 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.

348 (M) MOTION NOT ALLOWED IN G93 MODE - This alarm is generated if the mill is in Inverse Time Feed mode, and a G12, G13, G70, G71, G72, G150, or any Group 9 motion command is issued.

349 PROG STOP WITHOUT CANCELING CUTTER COMP - A cutter compensation exit move with G40 is required before a program stop M00, M01, or end of program M30. Check your program to be sure that cutter compensation ends when path is completed.

350 CUTTER COMP LOOK AHEAD ERROR - There are too many non-movement blocks between motions when cutter compensation is being used. Remove intervening blocks.

351 INVALID P CODE - In a block with G103, value for P must be between 0 and 15. Check your program.

352 AUX AXIS POWER OFF - Aux C, U, V, or W axis indicate servo off. Check auxiliary axes. Status from control was Off.

353 (L) AUX AXIS NO HOME - A Zero Ret has not been done yet on the aux axes. Check auxiliary axes. Status from control was Loss.

353 (M) AUX AXIS NO HOME - A Zero Ret has not been done yet on the aux axes. Check auxiliary axes.

354 AUX AXIS DISCONNECTED - Aux axis not responding. Check auxiliary axes and RS-232 connections.

355 AUX AXIS POSITION MISMATCH - Mismatch between machine and aux axis 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 (M) INVALID I, J OR K IN G12 OR G13 - Check your program for G12 and G13 formatting of variables.

360 TOOL CHANGER DISABLED - Check Parameter 57 in Mills. Not a normal condition for Lathes.

361 GEAR CHANGER DISABLED - Check Parameter 57 in Mills. Not a normal condition for Lathes.

362 TOOL USAGE ALARM - Tool life limit was reached. To continue, hi-light the usage counter in the current commands tool life display and press ORIGIN. Then press RESET to clear alarm and continue.

363 COOLANT LOCKED OFF - Setting 32 is set to off when coolant was turned on in programmed M-codes or by keypad.

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. If using G154 command, then P value must be between 1 and 99. Check your program for formatting of the code.

366 (M) MISSING I, K, OR L IN G70, G71, G72 - Check canned cycles for missing values I, K or L.

367 CUTTER COMP INTERFERENCE - Programmed path cannot be computed with tool size. Use a different size tool or adjust the radius offset.

368 GROOVE TOO SMALL - Tool too big to enter cut. Use a smaller tool.

369 TOOL TOO BIG - Tool too big to enter cut. Use a smaller tool.

370 (L) TAILSTOCK EXCESSIVE DRIFT - The tailstock position has changed even though it has not been commanded to do so. Check to make sure that the part is not moving back.



370 (M) POCKET DEFINITION ERROR - Check geometry for G150. Check the sub program for path intersection and main program for starting X and Y. Move the starting location of the tool before the G150.

371 INVALID I, J, K OR Q - Check G150 cycle for missing or incorrect values for I, J, K or Q.

372 TOOL CHANGE IN CANNED CYCLE - Tool change not allowed while canned cycle is active. Cancel canned cycles with G80 before advancing program to next tool.

373 INVALID CODE IN DNC - A code found in a DNC program could not be interpreted because of DNC restrictions. Check your program.

374 (L) MISSING XBZA IN G31 OR G36 - G31 skip function requires an axis motion.

374 (M) MISSING XYZA IN G31 OR G36 - G31 skip function requires an axis motion.

375 (M) MISSING Z OR H IN G37 - G37 Automatic tool length measurement function requires H code, Z value, and tool offset enabled. X, Y, and A values not allowed.

376 NO CUTTER COMP IN SKIP - Skip G31 and G37 functions cannot be used with cutter compensation. Check your program and move the skip functions to another location.

377 NO SKIP IN GRAPH/SIM - Graphics mode and program restart cannot simulate skip function. Use block delete in program blocks with skip functions for graphic simulation of tool path containing G31 or probing routines.

378 SKIP SIGNAL FOUND - Skip signal check code included but skip was found when it was not expected.

379 SKIP SIGNAL NOT FOUND - Skip signal check code included but skip not found when it was expected.

380 X, Y, A OR G49 NOT ALLOWED IN G37 - G37 may only specify Z-axis and must have tool offset defined. Program the correct tool length compensation when using G37.

381 G43,G44 NOT ALLOWED IN G36 OR G136 - Auto work offset probing must be done without tool offset active. Check your program.

382 D CODE REQUIRED IN G35 - A Dnn code is required in G35 in order to store the measured tool diameter. Check your program.

383 INCH IS NOT SELECTED - G20 Inch mode was specified but settings have selected metric. Change setting 9.

384 METRIC IS NOT SELECTED - G21 MM mode was specified but settings have selected inches. Change setting 9.

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. Check your program format.

386 INVALID ADDRESS FORMAT - An alphabetical address was used improperly. Check your program.

387 CUTTER COMP NOT ALLOWED WITH G103 - If block lookahead has been limited, cutter compensation will not function. Remove the block limit for cutter compensation. Check your program.

388 CUTTER COMP NOT ALLOWED WITH G10 - Coordinates cannot be altered while Cutter Comp is active. Move the G10 outside of Cutter Compensation enablement.

389 G17, G18, G19 ILLEGAL IN G68 - Planes of rotation cannot be changed while rotation is enabled. Cancel rotation then select new plane.

390 NO SPINDLE SPEED - Required S code has not been commanded. Check your program for a spindle speed command.

391 FEATURE DISABLED - An attempt was made to use a software feature not enabled by a parameter bit. If the option was purchased and the parameter bit is 0 enter the unlock code for the option if available. Code is enclosed in the user manual list of option printout.



392 (L) B AXIS DISABLED - An attempt was made to program the B-axis while it was disabled (Disabled bit in Parameter 151 set to 1).

392 (M) B AXIS DISABLED - Attempt made to program the B-axis while it was disabled (Disabled bit in Parameter 151 set to 1), invisible (Invis Axis bit in Parameter 151 set to 1), or program commanded the B-axis while it was the outside rotary table (Rotary Index button feature, Map 4TH Axis bit in Parameter 315 set to 1).

393 (L) INVALID MOTION IN G84 OR G184 - Rigid Tapping can only be in the Z minus direction. Make sure that the distance from the initial position to the commanded Z depth is in the minus direction.

393 (M) INVALID MOTION IN G74 OR G84 - Rigid Tapping G74 or G84 can only be in the Z minus direction. Make sure that the distance from the reference position to the commanded Z depth is in the minus direction. Check your program for G74 or G84 formatting.

394 (L) B OVER TRAVEL RANGE - Tailstock (B-axis) will exceed stored stroke limits. This is in a negative direction and is machine zero in the positive direction. It only occurs during the operation of a user's program.

394 (M) B OVER TRAVEL RANGE - B-axis will exceed stored stroke limits. This is in a negative direction and is machine zero in the positive direction. It only occurs during the operation of a user's program.

395 (L) 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.

395 (M) NO G107 ROTARY AXIS SPECIFIED - For axis substitution, a rotary axis must be specified in order to perform cylindrical mapping to function. Check your program for G107 formatting and program the linear axis that is going to be mapped.

396 (L) CONFLICTING AXES - An Incremental and Absolute command cannot be used in the same block of code. For example, X and U cannot be used in the same block.

396 (M) INVALID G107 ROTARY AXIS SPECIFIED - The rotary axis specified in G107 is not a valid axis, or has been disabled. G107 requires either A or B axis to be commanded. Check your program for G107 formatting and program the linear axis that is going to be mapped to the rotary.

397 (L) INVALID D CODE - A D value entered in a Canned Cycle must be a positive value. The D will always refer to the Depth of cut. Check your program.

397 (M) AUX AXIS IN G93 BLOCK - Auxiliary axis interpolation cannot be commanded in G93 feed mode. Check your program. An auxiliary axis cannot be programmed to move in a feed mode with any other axis.

398 AUX AXIS SERVO OFF - Aux. axis servo shut off due to a fault.

399 (L) INVALID U CODE - In the context that the U code was used it had an invalid value. Was it positive?

400 SKIP SIGNAL DURING RESTART - A skip signal G-code (G31, G35, G36, G37, G136) was found during program restart. Graphics mode and program restart cannot simulate skip function. Use block delete in program blocks with skip functions for graphic simulation of tool path.

401 (L) INVALID TANGENT IN GROUP 1 CORNER ROUNDING - Check your geometry.

401 (M) INVALID TANGENT IN GROUP 1 CORNER ROUNDING OR CHAMFERING - The point or angle calculated has yielded invalid results in automatic chamfering or corner rounding. This can be for one of the following reasons: 1.) Tangent of angle was too close to zero. 2.) Cosine of angle was invalid. 3.) Hypotenuse of calculated right triangle was shorter than side. 4.) Calculated point did not line on arc or line. Check your program for geometry error and recalculate your coordinates.

402 POSSIBLE CORRUPTED FILE - Parameters being loaded do not match the expected number of parameters. This can be due to loading an older or newer parameter file than the system binary, or a corrupt file.

403 TOO MANY PROGS - Program storage in control memory cannot exceed 500 individual program numbers.



404 RS-232 NO PROG NAME - Program number required in file when sending to CNC. Program must have a name beginning with the letter "O". Check program for proper name format. The program number may have a block number in front of it, if it does, remove the block number and reload the program.

405 RS-232 ILLEGAL PROG NAME - Check files being loaded. Program name must be Onnnn and must be at beginning of a block by itself. The program number must be located in the second block of the program in a block by itself directly after the first %. The program number may have a block number in front of it, if it does, remove the block number and reload the program.

406 RS-232 MISSING CODE - Bad data was received. The program is stored but the bad data is turned into a comment. Check your program. Check program for (?) or message screen for displayed block with error.

407 RS-232 INVALID CODE - The program will be stored but the bad data is turned into a comment. Check program for comment (?) or message screen for displayed block with error.

408 RS-232 NUMBER RANGE ERROR - Check your program. The program will be stored but the bad data is turned into a comment. Check program for comment (?) or message screen for displayed block with error.

409 (L) RS-232 INVALID N CODE - Bad Parameter or Setting data. User was loading settings or parameters and something was wrong with the data.

409 (M) FILE INVALID N CODE - Positive number must exist after the N character in parameter and setting files, and the block data cannot be longer than 5 digits.

410 (L) RS-232 INVALID V CODE - Bad Parameter or Setting data. User was loading settings or parameters and something was wrong with the data.

410 (M) FILE INVALID V CODE - Positive or negative number must exist after the 'V' character in the parameter and setting files, and the block data cannot exceed 10 digits.

411 RS-232 EMPTY PROG - Between % signs in file there was no program number found. Check your file for formatting.

412 RS-232 UNEXPECTED END OF INPUT - Program should begin and end with % sign. No text should follow the second % sign. Check your file.

413 RS-232 LOAD INSUFFICIENT MEMORY - Program received does not fit into available free memory. Check the space available in the LIST PROG and possibly delete some programs to free memory space.

414 RS-232 BUFFER OVERFLOW - Computer sending data may not be responding to XOFF. Data sent too fast to CNC, try slower baud rate and check PC for settings for XOFF.

415 RS-232 OVERRUN - Data sent too fast to CNC. Data sent too fast to CNC, try slower baud rate.

416 RS-232 PARITY ERROR - Data received by CNC has bad parity. Check parity settings, number of data bits and speed. Check your cable configuration, cable needs to be null modem.

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 - O code in program being loaded to machine memory did not match O code entered at the keyboard to receive. This is a warning message only and does not stop the transfer.

421 (M) NO VALID POCKETS - Pocket Table is full of dashes.

422 (M) POCKET TABLE ERROR - If the machine has a 50 taper spindle, there must be 2 dashes between L's. L's must be surrounded by dashes. Reorganize tools in changer.



423 (L) 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

423 (M) X SCALE/SCREW MISMATCH - Scale-induced correction exceeds one motor revolution.

424 (L) SERVO BAR METRIC UNSUPPORTED - Metric mode currently unsupported, change Setting 9 to inch.

424 (M) Y SCALE/SCREW MISMATCH - Scale-induced correction exceeds one motor revolution.

425 (L) SERVO BAR LENGTH UNKNOWN - Both the bar length and reference position are unknown. Unload the bar, Run G105 Q4 followed by G105 Q2 or Q3.

425 (M) Z SCALE/SCREW MISMATCH - Scale-induced correction exceeds one motor revolution.

426 (L) SERVO BAR ILLEGAL CODE G105 - Feed Bar commanded with an illegal code on block. Legal codes are I, J, K, P, Q, R

426 (M) A SCALE/SCREW MISMATCH - Scale-induced correction exceeds one motor revolution.

427 INTERRUPT OVERRUN - The control detected an interrupt overrun condition. An interrupt occurred before the previous interrupt was completed. Call your dealer.

428 (L) SERVO BAR SWITCH FAILURE - One of the switches controlling the Servobar failed.

429 DISK DIR INSUFFICIENT MEMORY - CNC memory was full when an attempt was made to read the directory. Check the space available in the LIST PROG and possibly delete or download some programs to free memory space.

430 (L) FILE BEGINNING/END MARKER MISSING - Beginning or ending % sign not found. Check program for start and end of file characters % format as required.

430 (M) FILE UNEXPECTED END OF INPUT - Ending % sign not found. Check your program. An ASCII EOF code was found in the input data before program receive was complete. This is a decimal code 26.

431 (L) DISK NO PROG NAME - Need name in programs when receiving All; otherwise, no way to store them.

431 (M) FILE NO PROG NAME - Program number missing in file when loading.

432 (L) DISK ILLEGAL PROG NAME - Check files being loaded. Program must be Onnnnn and must be at the beginning of a block.

432 (M) FILE ILLEGAL PROG NAME - Check files being loaded. Program must be Onnnnn and must be at the beginning of a block.

433 (L) DISK EMPTY PROG - Check your program. Between % and % there was no program found.

433 (M) FILE EMPTY PROG - Check your program. Between % and % there was no program found.

434 (L) DISK LOAD INSUFFICIENT MEMORY - Program received does not fit. Check the space available in the List Prog mode and possibly delete some programs.

434 (M) FILE LOAD INSUFFICIENT MEMORY - Program loading into memory does not fit in available space. Check space available in the LIST PROG mode, download and delete some programs to free memory space.

435 DISK ABORT - Could not read disk. Possible corrupted or unformatted disk, pressing reset during transmission. Try a known good disk or a new disk formatted FAT file system. Also caused by dirty drive heads. Use an appropriate cleaning kit.

436 DISK FILE NOT FOUND - Could not find file by that name. File name needs to be entered as it is on floppy. Possible corrupted or unformatted disk. Try a known good disk or a new disk formatted FAT file system. Can also caused by dirty drive heads. Use an appropriate cleaning kit. Verify file is on disk.



437 (L) TAILSTOCK UNDERSHOOT - The tailstock did not reach its intended destination point. Check the value of parameter 293 or check Setting 107 compare it to the actual position of the B axis.

438 (L) TAILSTOCK MOVED WHILE HOLDING PART - The part moved while turning a part. Check Setting 107 and the actual position of the B axis as compared to setting 107.

439 (L) TAILSTOCK FOUND NO PART - During an M21 or G01, the tailstock reached the hold point without encountering the part.

440 (L) SERVO BAR MAX PARTS REACHED - Job Complete. Reset Current # Parts Run on Servobar current commands page.

441 (L) SERVO BAR MAX BARS REACHED - Job Complete. Reset Current # Bars Run on Servobar current commands page.

442 (L) SERVO BAR MAX LENGTH REACHED - Job Complete. Reset Current Length Run on Servobar current commands page.

443 (L) SERVO BAR ALREADY NESTED - An Illegal G105 Pnnn was found in cutoff subprogram.

444 (M) REGEN ON TOO LONG - The power supply detected a condition in which the Regen stays active too long. This condition indicates that the incoming AC voltage is too high elevating the DC bus, that the regen load is open or disconnected, or there is excessive power being dumped by the spindle motor. This can also be caused by a DECEL parameter too high. Check the connections and resistance of the Regen load, the incoming AC voltage and the value of Parameter 186. Cycle power to continue.

445 (L) SERVO BAR FAULT - Servobar program error.

446 (L) SERVO BAR BAR TOO LONG - Bar that was just loaded is longer than Length of Longest Bar as displayed on Servobar current commands page. The system was unable to accurately measure it. Remove the loaded bar and measure its length. In Current Commands, page up to the Servo Bar System Variables. Make sure variable 3109 LENGTH OF LONGEST BAR has a value which is longer than the length of the bar.

447 (L) SERVO BAR BAR IN WAY - The end of bar switch was depressed and a load or unload bar was commanded. Remove the bar. Check the function of the switch in diagnostics display. End of Bar Switch input should normally be 0, then change to 1 when depressed.

448 (L) SERVO BAR OUT OF BARS - Add more Bars.

450 (L) BAR FEEDER FAULT - This means that discrete input 1030 (BFSPLK) is high. See Parameter 278 bit 20 CK BF Status.

451 (L) BAR FEEDER SPINDLE INTERLOCK - This means that discrete input 1027 (BF FLT) is high. See parameter 278 bit 21 CK BF SP ILK.

452 (L) 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. There may be problem with the I/O board. Macro commands can be used for troubleshooting, #1110=1 for mills, and #1108=1 for lathes. The motor should come on instantly and run until stopped by pressing the reset button.

453 (L) C AXIS ENGAGED - A spindle command was given with the C-axis drive engaged. The C-axis motor must be disengaged with M155 before a spindle brake or gear change.

454 (L) 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 (L) 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 (L) PARAMETER CONFLICT - Conflict between two or more of the Axis MOCON Channel parameters.



457 AUX AXIS IS ENABLED - One or more auxiliary axes are enabled. For the macro variables 750 and 751 to work the auxiliary axes must be disabled. Make sure Setting 38 is set to 0.

458 (M) LINEAR SCALES ENABLED WITHOUT MOTIF - Linear scales is enabled on an axis but a MOTIF card was not detected.

459 (L) APL DOOR FAULT - Door was not completely open while APL was inside CNC, or Parameter 315 bit 5 was set to zero.

460 (L) APL ILLEGAL CODE - Internal software error; call your dealer.

461 (L) APL GRIPPER TIMEOUT - The gripper failed to reach its target position within the allowed time.

462 (L) U OVER TRAVEL RANGE - Commanded U-axis move would exceed allowed machine range. Coordinates are in the negative direction, and indicates an error in the user's program or improper offsets.

463 (L) V OVER TRAVEL RANGE - Commanded V-axis move would exceed allowed machine range. Coordinates are in the negative direction, and indicates an error in the user's program or improper offsets.

464 (L) W OVER TRAVEL RANGE - Commanded W-axis move would exceed allowed machine range. Coordinates are in the negative direction, and indicates an error in the user's program or improper offsets.

468 (L) U LIMIT SWITCH - Axis hit limit switch or switch disconnected. Stored stroke limits should stop slides before they hit limit switches. Verify value of Parameter 373, Grid Offset and check wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw.

469 (L) V LIMIT SWITCH - Bar feeder hit limit switch or switch disconnected. Stored stroke limits should stop slides before they hit limit switches. Verify value of Parameter 409, Grid Offset and check wiring to limit switch. Can also be caused by a loose encoder shaft at back of the motor or coupling of motor to the screw.

470 (L) W LIMIT SWITCH - Axis hit limit switch or switch disconnected. Stored stroke limits should stop slides before they hit limit switches. Verify value of Parameter 445, Grid Offset and check wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or coupling of motor to the screw.

471 (M) OUT OF TOOLS - The life of all tools in the programmed group have expired. Change tools and reset tool life data in the tool group to continue.

472 (M) ATM FAULT - Indicates an error related to the Advanced Tool Management feature. ATM software encountered a group which does not exist. Usually can be fixed by adding the corresponding group.

473 (L) INVALID GEOMETRY - The geometry specified by the G-code parameters is invalid. If using G76 or G92, either reduce Setting 95 (Thread Chamfer Size) or increase the number of threads.

474 (M) G02 Or G03 Not Allowed With G143 - G02 and G03 are allowed in G143 mode only if A and B axes are at machine zero position. Current A and B axes machine positions must be zero. Also, G02 or G03 must not command A or B axis to a non-zero machine position. Also verify work offsets for A and B axes are zero.

485 USB Reset Occurred - The USB firmware experienced a reset. This can occur if the USB media is extremely fragmented, or if there are many files in the directory. Try a faster USB. Defragment USB using Windows disk tools, or use a USB device with fewer files on it. If this problem persists, call your dealer.

486 USB TIMEOUT OCCURRED - The USB firmware experienced a timeout. This can occur if the USB media is extremely fragmented, or if there are many files in the directory. Try a faster USB. Defragment USB using Windows disk tools, or a USB device with fewer files on it. If this problem persists, call your dealer.

487 USB DEVICE INAPPROPRIATELY UNMOUNTED - A USB device was removed during a critical operation. USB devices should not be disengaged during FNC or when the system is utilizing the USB device. Wait for transfer operation to complete before removing USB key.

501 TOO MANY ASSIGNMENTS IN ONE BLOCK - Only one assignment macro assignment is allowed per block. Divide assignment blocks 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. Check your macro program.

503 ILLEGAL MACRO VARIABLE REFERENCE - Macro variable was programmed that is not supported by this control. Use the correct macro variable. Operator manual lists all the system variables that are available for use.

504 UNBALANCED BRACKETS IN EXPRESSION - Unbalanced brackets, [or], were found in an expression. Add or delete a bracket. Check the macro formatting.

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. Check macro formatting.

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. Check macro formatting.

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. Check macro formatting.

508 DIVISION BY ZERO - A division in a macro expression attempted to divide by zero. Re-configure the macro expression. Check macro formatting for a calculation or call that is referencing a zero value variable.

509 ILLEGAL MACRO VARIABLE USE - See Operator manual macro section for valid variables.

510 ILLEGAL OPERATOR OR FUNCTION USE - See Operator manual macro section for valid variables.

511 UNBALANCED RIGHT BRACKETS - Number of right brackets not equal to the number of left brackets. Check macro formatting.

512 ILLEGAL ASSIGNMENT USE - Attempted to write to a read-only macro variable. See Operator manual macro section for valid variables. Parameter and setting variables are read only.

513 VARIABLE REFERENCE NOT ALLOWED WITH N OR O - Alphabetic addresses N and O are illegal variables. You cannot declare N#1, etc. See Operator manual macro section for valid variables.

514 ILLEGAL MACRO ADDRESS REFERENCE - Alphabetic addresses N and O are illegal variables. You cannot declare N#1, etc. See Operator manual macro section for valid variables.

515 TOO MANY CONDITIONALS IN A BLOCK - Only one conditional expression is allowed in any WHILE or IF-THEN block. Check macro formatting.

516 ILLEGAL CONDITIONAL OR NO THEN - A conditional expression was found outside of an IF-THEN, WHILE, or M99 block. Check macro formatting.

517 EXPRSN. NOT ALLOWED WITH N OR O - Alphabetic addresses N and O are illegal variables. You cannot declare N#1, etc. See Operator manual macro section for valid variables.

518 ILLEGAL MACRO EXPRESSION REFERENCE - Alphabetic addresses N and O are illegal variables. You cannot declare N#1, etc. See Operator manual macro section for valid variables.

519 TERM EXPECTED - In the evaluation of a macro expression, an operand was expected but not found. Check macro formatting.

520 OPERATOR EXPECTED - In the evaluation of a macro expression, an operator was expected but not found. Check macro formatting.

521 ILLEGAL FUNCTIONAL PARAMETER - An illegal value was passed to a function, such as SQRT[or ASIN[. Check macro formatting.



522 ILLEGAL ASSIGNMENT VAR OR VALUE - A variable was referenced for writing. The variable referenced is read only. See Operator manual macro section for valid variables. Parameter and setting variables are read only.

523 CONDITIONAL REQUIRED PRIOR TO THEN - A THEN was encountered and a conditional statement was not processed in the same block. Check macro formatting.

524 END FOUND WITH NO MATCHING DO - An END was encountered without encountering a previous matching DO. DO-END numbers must agree. Check macro formatting.

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. Check macro formatting.

528 PARAMETER PRECEDES G65 - On G65 lines, all parameters must follow the G65 G-code. Place parameters after G65.

529 ILLEGAL G65 PARAMETER - Alphabetic addresses G, L, N, O, and P cannot be used to pass variables. See Operator manual macro section for valid variables. Select an alternate address.

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. Check macro formatting.

531 MACRO NESTING TOO DEEP - Only nine levels of macro nesting can occur when using G65. Reduce the number of nested macro calls.

532 UNKNOWN CODE IN POCKET PATTERN - Macro syntax is not allowed in a pocket pattern subroutine. Check macro formatting.

533 MACRO VARIABLE UNDEFINED - A conditional expression evaluated to an UNDEFINED value, i.e. #0. Return True or False. Check macro formatting.

534 DO OR END ALREADY IN USE - Multiple use of a DO that has not been closed by an END in the same subroutine. Close condition with END and use another DO number.

535 ILLEGAL DPRNT STATEMENT - A DPRNT statement has been formatted improperly, or DPRNT does not begin block. Check format of DPRNT statements.

536 COMMAND FOUND ON DPRNT LINE - A G-code was included on a DPRNT block. Make two separate blocks, only DPRNT statement on block allowed. Check macro formatting.

537 RS-232 ABORT ON DPRNT - While a DPRNT statement was executing, the RS-232 communications failed. Check to see that PC is ready to receive with port open.

538 MATCHING END NOT FOUND - While-Do statement does not contain a matching "End" statement. Add the proper "End" statement.

539 ILLEGAL GOTO - Macro statement includes an expression after GOTO that is 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.

542 OPERATION NOT AVAILABLE - This operation is not compatible with FNC mode.



600 (L) 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. Examine the highlighted line for improper G-code.

600 (M) U OVER TRAVEL RANGE - Commanded U-axis move would exceed allowed machine range. Machine coordinates are in the negative direction. This indicates either an error in the user's program or improper offsets.

601 (L) 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.

601 (M) V OVER TRAVEL RANGE - Commanded V-axis move would exceed the allowed machine range. Machine coordinates are in the negative direction. This indicates either an error in the user's program or improper offsets.

602 (L) NON-MONOTONOUS PQ BLOCKS IN X - The path defined by PQ was not monotonic in the X-axis. A monotonic Path is one that does not change direction starting from the first Motion block. The control is looking for the X-axis to move in a continuous motion from small to big or big to small. You cannot change direction in the X-axis without defining the tool path as a type II canned cycle. If this is the case you need to add a Z-axis reference on the same line as the first X-axis move after the G71.

602 (M) W OVER TRAVEL RANGE - Commanded W-axis move would exceed the allowed machine range. Machine coordinates are in the negative direction. This indicates either an error in the user's program or improper offsets.

603 (L) NON-MONOTONOUS PQ BLOCKS IN Z - The path defined by PQ was not monotonic in the Z-axis. A monotonic Path is one that does not change direction starting from the first motion block. The control is looking for the Z-axis to move in a continuous motion from the face of the part towards the chuck or from the face of the chuck towards the end of the part. You cannot change direction in the Z-axis without defining the tool path as a type II canned cycle. If this is the case you need to add a X-axis reference on the same line as the first Z-axis move after the G71.

603 (M) U 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 373, Grid Offset and check the wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or the coupling of the motor to the screw.

604 (L) NON-MONOTONOUS ARC IN PQ BLOCK - A non-monotonic 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.

604 (M) V 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 409, Grid Offset and check the wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or the coupling of the motor to the screw.

605 (L) INVALID TOOL NOSE ANGLE - An invalid angle 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°.

605 (M) W 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 445, Grid Offset and check the wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or the coupling of the motor to the screw.

606 (L) 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°.

607 (L) INVALID W CODE - In the context that the W code was used it had an invalid value. Was it positive?



608 INVALID Q CODE - Q address code used as a numeric value that was incorrect in the context used. In M96 Q can reference only bits 0 to 63. Use the appropriate value for Q in the range of 0 to 63.

609 (L) 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.

609 (M) U SERVO ERROR TOO LARGE - Too much load or speed on U-axis motor. The difference between the motor position and the commanded position has exceeded Parameter 362. The motor may also be stalled, disconnected, or the driver failed. 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.

610 (L) 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.

610 (M) V SERVO ERROR TOO LARGE - Too much load or speed on V-axis motor. The difference between the motor position and the commanded position has exceeded Parameter 398. The motor may also be stalled, disconnected, or the driver failed. 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.

611 (L) 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).

611 (M) W SERVO ERROR TOO LARGE - Too much load or speed on W-axis motor. The difference between the motor position and the commanded position has exceeded Parameter 434. The motor may also be stalled, disconnected, or the driver failed. 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.

612 (L) G71/G72 TYPE II ALARM - This alarm is similar to Alarm 611, but indicates that the control has selected Type II roughing.

612 (M) U SERVO OVERLOAD - Excessive load on U-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. The servos will be turned off when this occurs. This can be caused by running into the mechanical stops or by anything that causes a very high load on the motors.

613 COMMAND NOT ALLOWED IN CUTTER COMPENSATION - At least one command in the highlighted block cannot be executed while cutter compensation is active. Block Delete characters ('/') are not allowed. Your program must have a G40 and a cutter compensation exit move before these can be commanded.

614 (M) V SERVO OVERLOAD - Excessive load on V-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. The servos will be turned off when this occurs. This can be caused by running into the mechanical stops or by anything that causes a very high load on the motors.

615 (L) NO INTERSECTION TO OFFSETS IN CC - While cutter comp was in effect, a geometry was encountered whose 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.

615 (M) W SERVO OVERLOAD - Excessive load on W-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. The servos will be turned off when this occurs. This can be caused by running into the mechanical stops or by anything that causes a very high load on the motors.



616 (L) CANNED CYCLE USING P & Q IS ACTIVE - A canned cycle using P & Q is already executing. A canned cycle cannot be executed by another PQ canned cycle.

616 (M) U-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

617 (L) MISSING ADDRESS CODE - A canned cycle using P & Q is already executing. A canned cycle cannot be executed by another PQ canned cycle.

617 (M) V-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

618 (L) INVALID ADDRESS VALUE - An address code is being used incorrectly. For Value example, a negative value is being used for an address code that should be positive. Refer to the documentation of the G code that causes the alarm.

618 (M) W-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

619 (L) STROKE EXCEEDS START POSITION - Stock removal stroke in canned cycle projects past start position. Change start position.

620 C AXIS DISABLED - Parameters have disabled this axis.

621 C OVER TRAVEL RANGE - C-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.

622 (L) C AXIS ENGAGEMENT FAILURE - The C-axis failed to engage or disengage in the time specified in Parameter 572. Either the gears are not meshing or the mechanical stop is not set properly. Check the engage and disengage switches and the mechanical stop. Also, check the grid offset for the C-axis. This alarm can also be caused by an obstruction or by low air pressure to the actuating piston.

622 (M) TOOL ARM FAULT - This alarm is generated by the tool changer if the arm is not at the Origin position or the arm motor is already running when a tool change process is started.

623 (L) INVALID CODE IN G112 - Only G0 to G3 and G17 are used in G112. G113 cancels G112. No incremental axes are used in G112. G18 cancels G17. G41 and G42 tool nose compensations are permitted.

624 (L) COMMAND NOT ALLOWED IN G14 MODE - G87 and G88 are not supported in G14 mode.

625 (M) CAROUSEL POSITIONING ERROR - This alarm is generated by the tool changer if the conditions are not correct when:

- Carousel or tool arm was started and illegal conditions are present; for example, carousel or arm motor already running, arm is not at the Origin, tool carousel is not at TC mark, or tool pocket is not locked.
- The tool carousel was in motion and the Tool One Mark was detected, but the current pocket facing the spindle was not at pocket one, or the current pocket is at pocket one but Tool One Mark is not detected.

626 (M) TOOL POCKET SLIDE ERROR - This alarm is generated by the tool changer if the tool pocket has not moved to its commanded position (and settled) within the total time allowed by Parameters 306 and 62.

627 (M) ATC ARM MOTION - Alarm is generated by the sidemount disk type tool changer if the tool arm failed to move within the time specified by Parameter 309, Arm Start Timeout; if the tool arm failed to move to the designated position (origin, clamp, or unclamp) within the time specified by Parameter 308, Arm Rotate Time; or the tool pocket failed to move up or down within the time specified by Parameter 306, Pocket Up/Dn Delay.



628 (M) ATC ARM POSITIONING ERROR - This alarm is generated by the tool changer if:

- The arm was being moved from the Origin position to the Clamp position and it coasted past the Motor Stop point, or could not get to the Clamp point.
- The arm was being moved from the Clamp position to the Unclamp position and it coasted past the Motor Stop point or could not get to the Unclamp point (same physical point as Clamp).
- The arm was being moved back to the Origin position and it coasted past the Motor Stop point or could not get to the Origin point.

629 (L) EXCEEDED MAX FEED PER REV - For G77, reduce diameter of part or change geometry. For G5, reduce X or Z travel.

629 (M) APC-PIN CLEAR/HOME SWITCH FAULT - A pin clear switch was contacted when all pallets were at their home positions. The most likely cause is debris on a switch. Check for accumulation of debris on the pin clear switches and the pallet home switches. Check switches and their electrical wiring for damage. After correcting the condition run M50 (with P code for the pallet to be loaded) to continue machining.

630 (M) APC-DOOR SW FAULT-SWITCH NOT EQUAL TO SOLENOID - The APC Door Switch indicates the door is open but the solenoid shows the door has been commanded to close. Either the door failed to close and is stuck or the switch itself is broken or stuck. The door switch wiring may also have a fault. Check switch then cable. After correcting the condition, run M50 to continue machining.

631 (M) PALLET NOT CLAMPED - Vertical Mills: APC-Pallet not clamped or home. Do not move X or Y axes until the APC is in a safe condition. One pallet is at home but the other pallet is neither clamped nor at home. Locate the unclamped pallet and return to home if possible. If drive pin is engaged or pallet is partially clamped, go to the lube/air panel at rear of mill and continuously press both white buttons in center of solenoid air valves while assistant pulls the pallet off the receiver. After correcting the condition, run M50 to continue machining.

Horizontal Mills: RP-Pallet not clamped. RP pallet change was not completed or the pallet was not clamped properly when a spindle command was given. After correcting the condition, run M50 to continue machining.

632 (M) APC-UNCLAMP ERROR - The pallet did not unclamp in the amount of time allowed. This can be caused by a bad air solenoid, a blocked or kinked airline, or a mechanical problem. After correcting the condition, run M50 to continue machining. **VF-APC:** Discrete Input "M-Code Finish" or "Pallet Clamp SW" should change from 1 to zero when pallet is unclamped.

633 (M) APC-CLAMP ERROR - The pallet did not clamp in the amount of time allowed by Parameter 316. This alarm is most likely caused by the mill table not being in the correct position. This can be adjusted using the setting for the X position (#121, #125) as described in the 'Installation' section. If the pallet is in the correct position but not clamped, push the pallet against the hard stop and run M18. If the pallet is clamped, but not correctly, run M17 to unclamp, push the pallet to the correct position, and run M18 to clamp the pallet. Less common causes could be that the slip clutch is slipping, the motor is at fault, or an airline is blocked or kinked. After correcting the condition, run M50 to continue machining.

634 (M) APC-MISLOCATED PALLET - A pallet is not in the proper place on the APC. The pallet must be pushed back against the hard stop by hand. After correcting the condition, run M50 to continue machining.

635 (M) APC-PAL NUM CONFLICT REC & CH - Pallet Number Conflict Receiver and Pallet Changer: The pallet number in memory does not agree with the actual pallet in use. Run M50 to reset this variable.

636 (M) APC UNLOAD-SWITCH MISSED PAL 1 - Pallet #1 did not return from the receiver to the APC in the allowable amount of time. This can be caused by the chain switch block missing the limit switch, or another mechanical problem, such as clutch slippage. After correcting the condition, run M50 to continue machining.

637 (M) APC UNLOAD-SWITCH MISSED PAL 2 - Pallet #2 did not return from the receiver to the APC in the allowable amount of time. This can be caused by the chain switch block missing the limit switch, or another mechanical problem, such as clutch slippage. After correcting the condition, run M50 to continue machining.



638 (M) APC-DOOR NOT OPEN - The automatic door did not open (in the allowable time), or may have fallen during an APC function. This can be caused by a bad air solenoid, a blocked or kinked airline, or a mechanical problem. After correcting the condition, run M50 to continue machining.

639 (M) APC-DOOR NOT CLOSED - The automatic door did not close (in the allowable time) when necessary after an APC function has been performed. This can be caused by a bad air solenoid, a blocked or kinked airline, or a mechanical problem. After correcting the condition, run M50 to continue machining.

640 (M) APC-MISSING PALLET @ REC - Pallet change sequence halted because receiver switch not activated. Pallet either unclamped or not on receiver. Ensure the pallet is correctly located on receiver (against hard stop), then run M18 to clamp the pallet. After correcting the condition, run M50 to continue machining.

641 (M) APC-UNKNOWN CHAIN LOCATION - Neither chain location switch is tripped, so the control cannot locate the chain position. This can occur if a pallet change is interrupted for any reason; such as an alarm or an E-Stop. To correct this problem, the pallets and chain must be moved back into a recognized position, such as both pallets home or one pallet home and one on the receiver. The chain position adjustment tool must be used to rotate the chain into position. The pallets must be pushed into place by hand. After correcting the condition, run M50 to continue machining.

642 (M) 642 APC-PIN CLEAR SWITCH FAULT - One of the pallet changer pin clear switches was contacted unexpectedly. The most likely cause is debris on a switch. Also check the pin clear switches for damage and their electrical wiring for damage. After correcting the condition, run M50 to continue machining.

643 (M) LOW BRAKE OIL A-AXIS - The oil level in the air/oil booster, supplying hydraulic pressure to the A-axis brake, is low. The booster is located on the front of the machine's table. Access the booster fill fitting and add Mobile DTE 24 oil to bring the oil level to the high oil level line marked on the booster. If the alarm reoccurs within 90 days, contact your Haas Dealer for service.

644 (M) APC-LOW AIR PRESSURE - A low air pressure condition was detected during pallet changer operation. Check that the air supply is 100 psi, minimum. Check that the air supply line is the correct diameter. Check that the mill pressure regulator is set to 85 psi. If this alarm continues to occur, check the entire pressurized air system for any abnormal air leakage.

645 (M) AMPLIFIER GROUND - Amplifier Ground Fault. A ground short was detected in the output of the amplifiers or spindle drive. This can be caused by a short to ground in the motor cables, servo or spindle motors. Check all cables and servo amplifiers, if the problem persists call your dealer. CYCLE POWER TO CONTINUE!!

646 (M) VAC INPUT PHASE - VAC Input Phase Fault. A phase loss or drop of the frequency in the incoming AC line was detected. This occurs when the incoming frequency is lower than 45Hz or higher than 65Hz, or a power brownout. Check your incoming AC line. CYCLE POWER TO CONTINUE!!

647 (M) REGEN LOAD SHORTED - A shorted REGEN load condition was detected. This is caused by shorted cables on the regen load or shorted regen load elements. Check the connections, cables and resistance of your regen load. CYCLE POWER TO CONTINUE!!

648 (M) DC BUS SHORTED - A shorted 320VDC bus condition was detected upon power-up. The DC bus monitor detected an improper charge-up. This can be caused by a shorted capacitor in 320V PS, shorted cable, shorted servo amplifier or shorted spindle drive. This can also be caused by a low incoming power. Check the Amplifier. Check the incoming AC lines. CYCLE POWER TO CONTINUE!! **Note:** This is only tested at power-up. If this fault occurs, it cannot be reset.

649 (M) DC BUS UNDER VOLTAGE - DC Bus Undervoltage. The DC Bus voltage has dropped too low. This alarm occurs during charge up with low AC lines or after charge up when the bus falls below 100Vdc. Check the incoming AC lines to ensure nominal levels. **Note:** If this fault occurs at power-up, it cannot be reset. If this fault occurs after power-up, it CAN be reset.



650 (M) DC BUS OVER VOLTAGE - DC Bus Overvoltage. The DC bus voltage has been raised too high. The most common cause is an open REGEN load and occurs during motor deceleration. It can also be caused by incoming AC power too high. Check REGEN load connections and resistance. Check incoming AC lines to ensure nominal levels. CYCLE POWER TO CONTINUE!!

651 (M) Z AXIS IS NOT ZEROED - The Z-axis has not been zeroed. In order to continue Tool Change Recovery, the Z-axis must be zeroed. Once the Z-axis has been zeroed, continue with Tool Change Recovery.

652 U ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. 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.

653 V ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. 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.

654 W ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. 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.

655 (L) MISMATCH AXIS WITH I, K CHAMFERING - I, (K) was commanded as X-axis (Z-axis) in the block with chamfering.

655 (M) U CABLE FAULT - Cable from U-axis encoder does not have valid differential signals.

656 (L) INVALID I, K, OR R IN G01 - The move distance in the block commanded with chamfering or corner rounding is less than the chamfering or corner rounding amount.

656 (M) V CABLE FAULT - Cable from V-axis encoder does not have valid differential signals.

657 (L) NOT ONE AXIS MOVE WITH CHAMFERING - Consecutive blocks commanded with chamfering or corner rounding, for example: G01 Xb Kk G01 Zb li. After each chamfering or corner rounding block, there must be a single move perpendicular to the one with chamfering or corner rounding.

657 (M) W CABLE FAULT - Cable from W-axis encoder does not have valid differential signals.

658 (L) INVALID MOVE AFTER CHAMFERING - The command after the block commanded with chamfering or corner rounding is either missing or wrong. There must be a move perpendicular to that of the chamfering or corner rounding block.

658 (M) U PHASING ERROR - Error occurred in phasing initialization of brushless motor. Can be caused by a bad encoder, or a cabling error.

659 (L) NOT ONE AXIS MOVE WITH CHAMFERING - Consecutive blocks commanded with chamfering or corner rounding, for example: G01 Xb Kk G01 Zb li. After each chamfering or corner rounding block, there must be a single move perpendicular to the one with chamfering or corner rounding.

659 (M) V PHASING ERROR - Error occurred in phasing initialization of brushless motor. Can be caused by a bad encoder, or a cabling error.

660 (M) W PHASING ERROR - Error occurred in phasing initialization of brushless motor. Can be caused by a bad encoder, or a cabling error.

661 (M) U TRANSITION FAULT - Illegal transition of count pulses in U-axis. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose MOCON or MOTIF PCB connectors.



662 (M) V TRANSITION FAULT Illegal transition of count pulses in V-axis. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose MOCON or MOTIF PCB connectors.

663 (M) W TRANSITION FAULT - Illegal transition of count pulses in W-axis. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose MOCON or MOTIF PCB connectors.

664 U AXIS DISABLED - Parameter has disabled this axis.

665 (L) V AXIS DISABLED - Parameter has disabled bar feeder.

665 (M) V AXIS DISABLED - Parameter has disabled this axis.

666 W AXIS DISABLED - Parameter has disabled this axis.

667 (M) U AXIS LINEAR SCALE Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the Z Fault encoder has been damaged and encoder position data is unreliable. This can also be caused by loose scale connectors.

668 (M) V AXIS LINEAR SCALE Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the Z Fault encoder has been damaged and encoder position data is unreliable. This can also be caused by loose scale connectors.

669 (M) W AXIS LINEAR SCALE Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the Z Fault encoder has been damaged and encoder position data is unreliable. This can also be caused by loose scale connectors.

670 (M) TT or B OVER TRAVEL RANGE - Commanded TT or B-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.

671 (M) TT or B 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 481, Grid Offset and check the wiring to the limit switch. Can also be caused by a loose encoder shaft at the back of the motor or the coupling of the motor to the screw.

673 (M) TT or B SERVO ERROR TOO LARGE - Too much load or speed on TT or B-axis motor. Difference between motor position and commanded position has exceeded Parameter 470. Motor may also be stalled, disconnected, or the driver failed. 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.

674 (M) TT or B SERVO OVERLOAD - Excessive load on TT or B-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. The servos will be turned off when this occurs. This can be caused by running into the mechanical stops or by a very high load on the motors. If this alarm occurs on a machine with a VF-SS type tool changer, the most likely cause is a tool over 4 pounds not identified as 'heavy' in the tool table.

675 (M) TT or B-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F. This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

676 (M) TT or B MOTOR Z FAULT - Encoder marker pulse count failure. It usually indicates that the encoder has been damaged and encoder position data is unreliable, or encoder connectors are loose.

677 (M) TT or B AXIS Z CH MISSING - Z Reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

678 (M) TT or B AXIS DRIVE FAULT - Current in TT or B servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop, a short in the motor, or a short of one motor lead to ground.



679 (M) TT or B ZERO RET MARGIN TOO SMALL - This alarm will occur if the home/limit switches move or are misadjusted. 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.

680 (M) TT or B CABLE FAULT - Cable from TT or B-axis encoder does not have valid differential signals.

681 (M) TT or B PHASING ERROR - Error occurred in phasing initialization of brushless motor. Can be caused by a bad encoder or a cabling error.

682 (M) TT or B TRANSITION FAULT - Illegal transition of count pulses in B-axis. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable. This can also be caused by loose MOCON or MOTIF connectors.

683 (M) TT or B AXIS DISABLED - Parameter has disabled this axis.

684 (M) TT or B AXIS LINEAR SCALE Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the Z Fault encoder has been damaged and encoder position data is unreliable. This can also be caused by loose scale connectors.

685 (M) V MOTOR Z FAULT - Encoder marker pulse count failure. It usually indicates that encoder has been damaged and encoder position data is unreliable. This can also be caused by loose encoder connectors.

686 (M) W MOTOR Z FAULT - Encoder marker pulse count failure. It usually indicates that encoder has been damaged and encoder position data is unreliable. This can also be caused by loose encoder connectors.

687 (M) U MOTOR Z FAULT - Encoder marker pulse count failure. It usually indicates that encoder has been damaged and encoder position data is unreliable. This can also be caused by loose encoder connectors.

688 (M) U AXIS Z CH MISSING - Z Reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

689 (M) V AXIS Z CH MISSING - Z Reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

690 (M) W AXIS Z CH MISSING - Z Reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

691 (M) U AXIS DRIVE FAULT - Current in U servo motor beyond limit. Possibly caused by a stalled or over-loaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop, a short in the motor, or a short of one motor lead to ground.

692 (M) V AXIS DRIVE FAULT - Current in V servo motor beyond limit. Possibly caused by a stalled or over-loaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop, a short in the motor, or a short of one motor lead to ground.

693 (M) W AXIS DRIVE FAULT Current in W servo motor beyond limit. Possibly caused by a stalled or over-loaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop, a short in the motor or a short of one motor lead to ground.

694 (M) ATC SWITCH FAULT - Conflicting switch states detected; such as simultaneous shuttle at spindle and shuttle at chain, or tool pocket up and down. Check for damaged or sticking switches, damaged wiring, or debris buildup. Use Tool Changer Restore to recover the ATC, then resume normal operation.

695 (M) ATC DOUBLE-ARM CYLINDER TIME OUT - ATC double arm did not complete extending or retracting within time allowed by Parameter 61. Check for proper spindle orientation, correct alignment of double arm with chain or spindle, adequate air supply, mechanism binding, air leakage, excessive tool weight, debris build up, adequate chain tension, correct chain guide strip adjustment, and interference between tool holder set screw and chain or tool gripper. Use Tool Changer Restore to recover the ATC, then resume normal operation.



696 (M) ATC MOTOR TIME OUT - The ATC shuttle motor or double arm motor failed to complete the commanded movement within the time allowed by Parameter 60. Check for mechanism binding, correct motor and switch operation, damaged gear motor control board relays, damaged electrical wiring, or blown fuses on the gear motor control board. Use Tool Changer Restore to recover the ATC, then resume normal operation.

697 (M) ATC MOTOR FAULT - The ATC shuttle motor or double arm motor was on unexpectedly. Use Tool Changer Restore to recover the ATC, then resume normal operation.

698 (M) ATC PARAMETER ERROR - The ATC type cannot be determined. Check Parameter 278, bit 10, HS3 HYD TC, or Parameter 209, bit 2, Chain TC, as appropriate for the installed tool changer. Use Tool Changer Restore to recover the ATC, then resume normal operation.

701 (L) U SERVO ERROR TOO LARGE MOCON2 - Too much load or speed on U-axis motor. Difference between motor position and commanded position has exceeded Parameter 362. The motor may also be stalled, disconnected, or the driver failed. 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.

702 (L) V SERVO ERROR TOO LARGE - Too much load or speed on bar feeder motor. The difference between the motor position and the commanded position has exceeded Parameter 398. The motor may also be stalled, disconnected, or the driver failed. 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.

703 (L) W SERVO ERROR TOO LARGE MOCON2 - Too much load or speed on W-axis motor. Difference between motor position and commanded position has exceeded Parameter 434. The motor may also be stalled, disconnected, or the driver failed. 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.

704 (L) Sp SERVO ERROR TOO LARGE - Too much load or speed on Sp-axis motor. The difference between the motor position and the commanded position has exceeded Parameter 184. The motor may also be stalled, disconnected, or the driver failed. 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.

705 (L) Tt SERVO ERROR TOO LARGE MOCON2 - Too much load or speed on Tt-axis motor. Difference between motor position and commanded position has exceeded Parameter 470. The motor may also be stalled, disconnected, or the driver failed. 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.

706 (L) Ss SERVO ERROR TOO LARGE MOCON2 - Too much load or speed on Ss-axis motor. Difference between motor position and commanded position has exceeded Parameter 542. The motor may also be stalled, disconnected, or the driver failed. 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.

707 (L) J SERVO ERROR TOO LARGE MOCON2 - Too much load or speed on J-channel motor. Difference between motor position and commanded position has exceeded a parameter. The motor may also be stalled, disconnected, or the driver failed. 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.

708 (L) S SERVO ERROR TOO LARGE MOCON2 - Too much load or speed on S-channel motor. Difference between motor position and commanded position has exceeded a parameter. The motor may also be stalled, disconnected, or the driver failed. 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.

711 (L) U SERVO OVERLOAD MOCON2 - Excessive load on U-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.



712 (L) V SERVO OVERLOAD - Excessive load on bar feeder motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.

713 (L) W SERVO OVERLOAD MOCON2 - Excessive load on W-axis motor. This can occur if load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.

714 (L) Sp SERVO OVERLOAD - Excessive load on Sp-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.

715 (L) Tt SERVO OVERLOAD MOCON2 - Excessive load on Tt-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.

716 (L) Ss SERVO OVERLOAD MOCON2 - Excessive load on Ss-axis motor. This can occur if load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.

717 (L) J SERVO OVERLOAD MOCON2 - Excessive load on J-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.

718 (L) S SERVO OVERLOAD MOCON2 - Excessive load on S-axis motor. This can occur if the load on the motor over a period of several seconds or even minutes is large enough to exceed the continuous rating of the motor. 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.

721 (L) U-AXIS MOTOR OVERHEAT MOCON2 - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

722 (L) V-AXIS MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

723 (L) W-AXIS MOTOR OVERHEAT MOCON2 - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

724 (L) Sp MOTOR OVERHEAT - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

725 (L) Tt MOTOR OVER HEAT MOCON2 - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

726 (L) Ss MOTOR OVER HEAT MOCON2 - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.



727 (L) J-AXIS MOTOR OVERHEAT MOCON2 - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

728 (L) S-AXIS MOTOR OVERHEAT MOCON2 - Servo motor overheat. The temperature sensor in the motor indicates over 150° F (65° C). This can be caused by an extended overload of the motor; such as leaving the slide at the stops for several minutes.

731 (L) U MOTOR Z FAULT MOCON2 - Encoder marker 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 encoder connectors.

732 (L) V MOTOR Z FAULT - Encoder marker pulse count failure. This alarm usually indicates that the encoder has been damaged and encoder position data is unreliable, or loose encoder connectors.

733 (L) W MOTOR Z FAULT MOCON2 - Encoder marker 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 encoder connectors.

734 (L) Sp MOTOR 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.

735 (L) Tt MOTOR Z FAULT MOCON2 - Encoder marker 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 encoder connectors.

736 (L) Ss MOTOR Z FAULT MOCON2 - Encoder marker 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 encoder connectors.

737 (L) J MOTOR Z FAULT MOCON2 - Encoder marker 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 encoder connectors.

738 (L) S MOTOR Z FAULT MOCON2 - Encoder marker 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 encoder connectors.

741 (L) U AXIS Z CH MISSING MOCON2 - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

742 (L) V AXIS Z CH MISSING - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

743 (L) W AXIS Z CH MISSING MOCON2 - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

744 (L) Sp AXIS Z CH MISSING - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

745 (L) Tt AXIS Z CH MISSING MOCON2 - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

746 (L) Ss AXIS Z CH MISSING MOCON2 - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

747 (L) J AXIS Z CH MISSING MOCON2 - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.

748 (L) S AXIS Z CH MISSING MOCON2 - Z reference signal from encoder was not received as expected. Can be caused by loose connections, encoder contamination, or parameter error.



751 (L) U AXIS DRIVE FAULT MOCON2 - Current in U servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop. It can also be caused by a short in the motor or a short of one motor lead to ground.

752 (L) V AXIS DRIVE FAULT - Current in bar feeder motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop. It can also be caused by a short in the motor or a short of one motor lead to ground.

753 (L) W AXIS DRIVE FAULT MOCON2 - Current in W servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop. It can also be caused by a short in the motor or a short of one motor lead to ground.

754 (L) Sp AXIS DRIVE FAULT - Current in Sp servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop. It can also be caused by a short in the motor or a short of one motor lead to ground.

755 (L) Tt AXIS DRIVE FAULT MOCON2 - Current in Tt servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop. It can also be caused by a short in the motor or a short of one motor lead to ground.

756 (L) Ss AXIS DRIVE FAULT MOCON2 - Current in Ss servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop. It can also be caused by a short in the motor or a short of one motor lead to ground.

757 (L) J AXIS DRIVE FAULT MOCON2 - Current in J servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop. It can also be caused by a short in the motor or a short of one motor lead to ground.

758 (L) S AXIS DRIVE FAULT MOCON2 - Current in S servo motor beyond limit. Possibly caused by a stalled or overloaded motor. The servos are turned off. This can be caused by running the axis into a mechanical stop. It can also be caused by a short in the motor or a short of one motor lead to ground.

761 (L) U CABLE FAULT MOCON2 - Cable from U-axis encoder does not have valid differential signals.

762 (L) V CABLE FAULT - Cable from bar feeder encoder does not have valid differential signals.

763 (L) W CABLE FAULT MOCON2 - Cable from W-axis encoder does not have valid differential signals.

764 (L) Sp CABLE FAULT - Cable from spindle motor encoder does not have valid differential signals.

765 (L) Tt CABLE FAULT MOCON2 - Cable from Tt-axis encoder does not have valid differential signals.

766 (L) Ss CABLE FAULT MOCON2 - Cable from Ss-axis encoder does not have valid differential signals.

767 (L) J CABLE FAULT MOCON2 - Cable from J-axis encoder does not have valid differential signals.

768 (L) S CABLE FAULT MOCON2 - Cable from S-axis encoder does not have valid differential signals.

771 (L) U PHASING ERROR MOCON2 - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

772 (L) V PHASING ERROR - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

773 (L) W PHASING ERROR MOCON2 - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

774 (L) Sp PHASING ERROR - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

775 (L) Tt PHASING ERROR MOCON2 - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.



776 (L) Ss PHASING ERROR MOCON2 - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

777 (L) J PHASING ERROR MOCON2 - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

778 (L) S PHASING ERROR MOCON2 - Error occurred in phasing initialization of brushless motor. This can be caused by a bad encoder, or a cabling error.

781 (L) U TRANSITION FAULT MOCON2 - Illegal transitions of count pulses in U-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 or MOTIF printed circuit board.

782 (L) V TRANSITION FAULT - Illegal transition of count pulses in bar feeder. 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 or MOTIF printed circuit board.

783 (L) W TRANSITION FAULT MOCON2 - Illegal transition of count pulses in W-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 or MOTIF printed circuit board.

784 (L) SP MOT ENC TRANSITION FAULT - Illegal transition of count pulses in Sp-axis. This alarm usually indicates that the encoder on the spindle motor has been damaged and encoder position data is unreliable. This can also be caused by loose connectors at the MOCON or MOTIF printed circuit board.

785 (L) Tt TRANSITION FAULT MOCON2 - Illegal transition of count pulses in Tt-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 or MOTIF printed circuit board.

786 (L) Ss TRANSITION FAULT MOCON2 - Illegal transition of count pulses in Ss-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 or MOTIF printed circuit board.

787 (L) J TRANSITION FAULT MOCON2 - Illegal transition of count pulses in J channel. 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 or MOTIF printed circuit board.

788 (L) S TRANSITION FAULT MOCON2 - Illegal transition of count pulses in S channel. 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 or MOTIF printed circuit board.

791 COMM. FAILURE WITH MOCON2 - During a self-test of communications between the MOCON2 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 MOCON2.

792 MOCON2 WATCHDOG FAULT - The self-test of the MOCON2 has failed. Call your dealer.

796 (L) SUB SPINDLE NOT TURNING - Status from subspindle drive indicates it is not at speed when expected. This can also be caused by commanding a feed when the spindle is stopped.

797 (L) SUB SPINDLE ORIENTATION FAULT - Spindle did not orient correctly. During a spindle orientation function, the spindle rotated but never achieved proper orientation. This can be caused by failure of encoder, cables, belts, MOCON or vector drive.

799 (M) UNKNOWN MOCON2 ERROR - MOCON2 has reported an alarm to the current software, which was unable to identify the alarm.

800 (L) P AND Q Exceeded Memory - Too many blocks were placed between the P and Q blocks for the G71, G72 or G73. Reduce the amount to correct.

801 (L) No Block Deletes Between P and Q - Block delete is not allowed between the P and Q blocks of a G71, G72 or G73.



802 Negative R and C Values Not Allowed - Negative values are not allowed when using the ,C ,R corner rounds and chamfering.

808 AUTOMATIC PROBE ARM FAULT - Automatic probe arm failed to complete command to extend or retract. Check for tools or parts in machining area that block motion of probe arm. Check for sufficient air pressure and volume. Check probe arm mechanism for broken parts, damaged air lines, or broken electrical connections. After resolving problem, command the probe arm to the home position and continue operation

809 PROBE ARM SWITCH FAULT - A switch fault was detected in the automatic probe arm system. For example, the switch signals indicated both switches simultaneously, or one of the switches indicates an unexpected position. Check the switches and trip flags for damage and the switch wiring for damage. After resolving the problem, command the probe arm to the home position and continue operation

810 PROBE ARM CHUCK CONFLICT - There must be no part in the chuck when the automatic probe arm is lowered (extended). Unclamp the spindle chuck, remove the part and then continue operation.

900 A PARAMETER HAS BEEN CHANGED - When the operator alters the value of a parameter, Alarm 900 is 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 resettable alarm; it is for information purposes only.

901 PARAMETERS HAVE BEEN LOADED BY DISK - When a file has been loaded from floppy disk, Alarm 901 is added to the alarm history along with the date and time. Note that this is not a resettable alarm; it is for information purposes only.

902 PARAMETERS HAVE BEEN LOADED BY RS232 - When a file has been loaded from RS-232; Alarm 902 is added to the alarm history along with the date and time. Note that this is not a resettable alarm; it is for information purposes only.

903 CNC MACHINE POWERED UP - When the machine is powered up, Alarm 903 is added to the alarm history along with the date and time. Note that this is not a resettable alarm; it is for information purposes only.

904 (M) ATC AXIS VISIBLE - The tool changer axis must be invisible for tool change operations with the HS tool changers. Set Parameter 462, bit 18, Invis Axis to 1. This will make the tool changer axis invisible and tool changes will be allowed.

905 (M) NO P CODE IN M14, M15, M36 - In M14, M15, M36 must specify pallet number with P code.

906 (M) INVALID P CODE IN M14, M15, M36 OR M50 - The P code must be the number of a valid pallet without a decimal point, and must be a valid integer number.

907 (M) APC UNLOAD-SWITCH MISSED PAL 3 - Pallet #3 did not return from the receiver to the APC in the allowable amount of time. This can be caused by the chain switch block missing the limit switch, or from another mechanical problem, such as clutch slippage.

908 (M) APC UNLOAD-SWITCH MISSED PAL 4 - Pallet #4 did not return from the receiver to the APC in the allowable amount of time. This can be caused by the chain switch block missing the limit switch, or from another mechanical problem, such as clutch slippage.

909 (M) APC-PROGRAM NOT LISTED - No program name in the Pallet Schedule Table for the loaded pallet. To run a program for the loaded pallet, enter the program name into the Program Name column of the Pallet Schedule Table for the required pallet, or remove M48 from the subprogram you want to use. Verify that the program and the pallet are compatible.

910 (M) APC-PROGRAM CONFLICT - The subprogram you are trying to run is not assigned to the loaded pallet. Another program is assigned to this pallet in the Pallet Schedule Table. Either enter the required program name into the Program Name column of the Pallet Status Table, or remove M48 from the subprogram you want to use. Verify that the subprogram and the pallet are compatible.



911 (M) APC-PAL LOAD/UNLOAD AT ZERO - One or more of the pallets on the APC has a load or unload position set to zero. This means that the APC set up procedure was incomplete. Establish correct load and unload positions for all pallets and enter the positions in the appropriate settings. See operator's manual for the APC model correct setting numbers.

912 (M) APC-NO P CODE OR Q CODE FOR M46 - M46 must have a P code and a Q code. The P code must be a line number in the current program. The Q code is the pallet number, if loaded, that causes a jump to the program line number.

913 (M) APC-NO P CODE OR Q CODE FOR M49 - M49 must have a Q code. The P code is the pallet number. The Q code is the status to give the pallet.

914 (M) APC-INVALID P CODE - The P code must be the name of a program stored in memory. The program name must not have a decimal point. Remove any decimal points from the program name.

915 (M) APC-ILLEGAL NESTING G188 or M48 - G188 is only legal in main program. M48 is only legal in a program listed in the Pallet Schedule Table or a first level subprogram.

916 (M) APC-NEGATIVE PAL PRIORITY INDEX - Software Error; call your dealer.

917 (M) APC-NUMBER OF PALLETS IS ZERO - Parameter 606 must have a value if Parameter 605 is not zero. Set Parameter 606 to the number of pallets in your FMS system.

918 (M) APC LOAD-SWITCH MISSED PAL 1 - Pallet #1 did not complete its move from the APC to the receiver in the allowable time. Pallet change sequence was halted because receiver switch was not activated. Pallet is either unclamped or not on the receiver. Ensure the pallet is correctly located on receiver (against hard stop), then run M18 to clamp the pallet. After correcting the condition, run M50 to continue machining.

919 (M) APC LOAD-SWITCH MISSED PAL 2 - Pallet #2 did not complete its move from the APC to the receiver in the allowable time. Pallet change sequence was halted because receiver switch was not activated. Pallet is either unclamped or not on the receiver. Ensure the pallet is correctly located on receiver (against hard stop), then run M18 to clamp the pallet. After correcting the condition, run M50 to continue machining.

920 (M) APC LOAD-SWITCH MISSED PAL 3 - Pallet #3 did not complete its move from the APC to the receiver in the allowable time. Pallet change sequence was halted because receiver switch was not activated. Pallet is either unclamped or not on the receiver. Ensure the pallet is correctly located on receiver (against hard stop), then run M18 to clamp the pallet. After correcting the condition, run M50 to continue machining.

921 (M) APC LOAD-SWITCH MISSED PAL 4 - Pallet #4 did not complete its move from the APC to the receiver in the allowable time. Pallet change sequence was halted because receiver switch was not activated. Pallet is either unclamped or not on the receiver. Ensure the pallet is correctly located on receiver (against hard stop), then run M18 to clamp the pallet. After correcting the condition, run M50 to continue machining.

922 (M) APC-TABLE NOT DECLARED - Software calling invalid tables. Software Error; call your dealer.

923 (L) LOW OIL PRESSURE - 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.

923 (M) A INDEXER IS NOT AT THE PROPER INCREMENTAL POSITION - The indexer has moved to a position that cannot be seated.

924 (L) SS LOW LUBE 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. Parameter 616 determines cycle time.

924 (M) B INDEXER IS NOT AT THE PROPER INCREMENTAL POSITION - The indexer has moved to a position that cannot be seated.

925 (M) A INDEXER IS NOT FULLY IN THE UP POSITION - The indexer is still seated. It is not completely in the up position and cannot be rotated. Reset, then rezero the indexer. The platter lift switch may need adjustment (See mechanical maintenance manual for details).



926 (M) B INDEXER IS NOT FULLY IN THE UP POSITION - The indexer is still seated. It is not completely in the up position and cannot be rotated. Reset, then rezero the indexer.

927 (M) ILLEGAL G1 CODE FOR ROTARY INDEXER - The rotary indexer only does rapid G0 motion. Feed G1 motion is not allowed.

932 (L) BAR 100- ZERO VALUE - You must enter a value for #3100 Part Length + Cutoff, #3102 Min Clamping Length and #3109 Length of Barstock on the Bar 100 Commands page.

933 (L) 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 (L) BAR 100- CURRENT BAR FINISHED - Load new bar. Reset alarm and press Cycle Start to continue.

935 (L) 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 led to the alarm.

937 INPUT LINE POWER FAULT - Input line power failed. This alarm will be generated whenever incoming power to machine falls below reference voltage value in Parameter 730 and duration of time in Parameter 731. Cycle the power to continue.

938 LANGUAGES LOADED - Foreign languages were recently loaded into the control.

939 LANGUAGES FAILED TO LOAD - Foreign languages failed to be loaded into the control. Languages either exceeded total flash memory, or not enough flash memory available. Try deleting a language from disk.

940 (M) SIDE MOUNT CAROUSEL ERROR - This alarm is generated by the tool changer if the carousel motor is still running when the tool pocket is unlocked and lowered prior to a tool change, if the carousel does not start to rotate after the allowed time specified by Parameter 60, Turret Start Delay, or does not stop rotating after the allowed time specified by Parameter 61, Turret Stop Delay.

941 (M) POCKET-TOOL TABLE ERROR - This alarm is generated by the tool changer if the tool specified by the program is not found in the Pocket Tool table, or the searched pocket is out of range.

942 (M) CAROUSEL POSITION TIMEOUT - This alarm is generated by the tool changer if the tool carousel has not moved after the allowed time or has not stopped after the allowed time specified by Parameter 60, Turret Start Delay and Parameter 61, Turret Stop Delay, respectively.

943 (M) UNPROCESSED QUEUE CELL IN TOOL CHANGE - There is an unknown command generated in the Tool change. Please save your current program to disk and notify your dealer.

944 (M) INDEXER OUT OF POSITION - The A-axis indexer is out of position. Jog A-axis to within 1° of a clamping position before running a program.

945 (M) APC-LIFT FRAME DOWN TIMEOUT - The pallet changer was commanded to lower but the down position switch was not contacted before the timeout period. Check for foreign objects under the lift frame. Verify there is an adequate supply of air pressure and air volume. Verify that Parameter 320 is correct. Check air solenoids for sticking and air release ports for clogging. Check pallet down position switch and wiring for damage, switch connections for positive electrical contact, and the lifting mechanism for proper operation. After determining the cause and correcting the problem, press RECOVER to enter pallet changer recovery, recover the pallet changer, and then continue operation. NOTE: The H Frame down switch is accessed through an opening on the side of the W-Axis Torque Tube on EC-400s and EC-500s. Some sheetmetal will need to be removed to access this switch.



946 (M) APC-PALLET CLAMP TIMEOUT - The pallet in the mill did not clamp in the time allowed. Check for foreign objects under the pallet and between the pallet and the clamp plate. Verify there is an adequate supply of air pressure and air volume. Check air solenoids for sticking and air release ports for clogging. Check the pallet clamped position switch for correct operation, the switch and wiring for damage, and pallet alignment. Check the pallet clamp mechanism for correct operation. After determining the cause and correcting the problem, press Tool Changer Restore to enter pallet changer recovery, recover the pallet changer, and then continue operation. Parameter 317 specifies the pallet clamp timeout period.

947 (M) APC-PALLET UNCLAMP TIMEOUT - The pallet in the mill did not unclamp in the time allowed. Check for foreign objects between the pallet and the clamp plate. Verify there is an adequate supply of air pressure and air volume. Check air solenoids for sticking and air release ports for clogging. Check the pallet clamped position switch for correct operation, the switch and wiring for damage and pallet alignment. Check the pallet clamp plate for damage or foreign objects. After determining the cause and correcting the problem, press Tool Changer Restore to enter pallet changer recovery, recover the pallet changer, and continue operation. Parameter 316 specifies the unclamp timeout period.

948 (M) APC-SOFTWARE ERROR - Fault in pallet changer software. Note the actions that caused this alarm. Also record the following information: On the control panel, press Param Dgnos key to get the Dgnos screen. Press Page Up to the PC Inputs page. Record the values of PC State, Alarm ST, and Alarm. If this alarm recurs regularly, call your dealer.

949 (M) APC-AXIS VISIBLE - The pallet changer axis must be invisible for the pallet changer to operate. Set the parameter bit Invis Axis to one for the axis that the pallet changer is installed on.

950 (M) APC-ILLEGAL SWITCH CONDITION, LIFT FRAME - The pallet changer lift frame switches indicate that the pallet changer lift frame is up and down at the same time. Verify there is an adequate supply of air pressure and air volume. Check the adjustment of the lift frame position switches and for debris on the switches. Check switch electrical connections and wiring. This may be a false alarm if the pallet changer was out of position by 90° (+/- 20) when a pallet change was in progress. After correcting the cause, press Tool Changer Restore to enter pallet changer recovery, recover the pallet changer, and then continue operation.

951 (M) APC-ILLEGAL SWITCH CONDITION, PALLET CLAMP - The pallet changer clamp switches indicate that the pallet changer is clamped and unclamped at the same time. Check the adjustment of the pallet clamp switches and for debris on the switches. Check switch electrical connections and wiring. After correcting the cause, press Tool Changer Restore to enter pallet changer recovery, recover the pallet changer, and then continue operation.

952 (M) APC-MISLOCATED LIFT FRAME - Pallet changer lift frame is not in expected position. The lift frame was either down when expected to be up, or up when expected to be down. For example, the lift frame must be up while rotating, and down when a pallet change starts, before clamping the pallet, before the A-axis or Z-axis can be jogged, or before starting a program with Cycle Start. If pallet began to lower during rotation, check lift mechanism for proper operation. If this alarm occurred at start of pallet change or when clamping the pallet, check for foreign objects or misalignment, preventing frame from lowering all the way. Verify there is an adequate supply of air pressure and air volume. After correcting the cause, press Tool Changer Restore to enter pallet changer recovery, recover the pallet changer, and then continue operation.

953 (M) APC-MISLOCATED PALLET CLAMP - Pallet changer clamp plate is not in the expected position. The clamp plate must be unclamped while the pallet changer is rotating or before the pallet is lifted. Verify there is an adequate supply of air pressure and air volume. Check operation of the clamp mechanism air solenoids. Check the pallet clamped position switch for correct operation, the switch and wiring for damage and pallet alignment. Check the pallet clamp plate for damage. After correcting the cause, press Tool Changer Restore to enter pallet changer recovery, recover the pallet changer, and then continue operation.

954 (M) APC-INCOMPLETE PALLET CHANGE - The last pallet change did not complete successfully or the mill has been initialized. Press Tool Changer Restore to enter pallet changer recovery, recover the pallet changer, and then continue operation.



955 (M) APC-INVALID PALLET CHANGER TYPE - Parameter 605 has an invalid pallet changer type.

Model	Basic Value
VF APC	2
MDC 500/EC-300	3
EC400/EC400PP/EC500	4
EC630	5

956 (M) APC-LIFT FRAME UP TIMEOUT - The pallet changer was commanded to lift but the up position switch was not contacted before the timeout period. The primary cause of this alarm is insufficient air pressure or air volume. Also, verify the pallet is unclamped and there are no obstructing objects. Check pallet up switch and wiring for damage, switch connections for positive electrical contact, and the lifting mechanism for proper operation. Verify Parameter 321 is correct. After determining and correcting the problem, press Tool Changer Restore to enter pallet changer recovery, recover the pallet changer, and then continue operation.

957 (M) APC-SWITCH FAULT - An illegal switch condition was detected. The pallet clamp switch did not function correctly. Use M17 and M18 commands to verify the input switch (input relay 26) changes state when the pallet clamps and unclamps. Check switch adjustment and check wiring for damage or unplugged connectors. The polarity of the clamp switch may be wrong. Parameter 734 is used to invert input switch polarity.

958 TOOL OFS WEAR HAS BEEN CHANGED - Whenever the tool wear offsets are changed, alarm 958 will be added to the alarm history along with the date and time the change was made. This is not an alarm; it is for information purposes only.

959 (M) NON-INDEXER POSITION - The position commanded for the A-axis incremental indexer is a non-indexer position. The indexer positions are multiples of Parameter 647. Parameter 647 is in thousandths of a degree. For example, a value of 2500 represents 2.5°.

906 (M) INDEXER SWITCH NOT FOUND IN TIME - The A-axis indexer down switch was not found within the allowed time specified by Parameter 659.

961 FLOPPY OFFSET NOT FOUND - This alarm is generated because FNC has lost the offset placemark it needs to correctly advance program. Try to reload program.

962 UNABLE TO RETRIEVE FILE INFORMATION - File functions taking too long to process. Try reloading.

963 UNABLE TO FNC FROM THIS DEVICE - This device may not function from FNC. Change setting 134 the connection-type to an appropriate FNC device and try again. Check the operators manual for devices that are capable of FNC.

964 TOOL TURRET ROTATE FAULT - The turret did not rotate to the correct location within the time specified in Parameter 60. Check for obstructions that would prevent the turret from rotating. Check the operation of the position sensors: slow, position_1, and in_position.

965 TURRET CLAMP/UNCLAMP FAULT - The turret did not clamp within the time specified in Parameter 62, or unclamp in the time specified in Parameter 63. Check the air supply. Check for obstructions preventing the turret from clamping. Check the operation of the position sensors: slow, position_1, and in_position.

967 SKBIF COMMUNICATION FAULT - A communication time out on the serial interface between the main control and the SKBIF has been detected. Any machine motion in progress at the occurrence of the time out has been stopped. An attempt is being made to re-establish communications. The communication time out may cause the pendant keypad and other controls, such as palette scheduling buttons, to become inoperative and to remain inoperative until the machine is powered down and then powered up.

968 DOOR HOLD OVERRIDE ENGAGED - Whenever Setting 51 is changed to On, Alarm 968 is added to alarm history along with the date and time of the change. Note that this is not a resettable alarm; it is for information purposes only.

970 NO AXIS COMMANED IN FEED CODE - There was an unknown command generated. If help is needed, please save your current program to disk and notify your dealer.



971 FAILED LOAD - The on board device computer failed to load network drivers. This is from an invalid network setting. Cycle power. CNC should go into DRIVERS NOT LOADED mode, change network settings and try again. If you continuously get FAILED TO LOAD alarms without DRIVERS NOT LOADED mode, notify your dealer. Note: The default network settings can be restored if needed. Press PRGRM CONVERS during power up, then Press P ENTER, then P5 ENTER.

976 PALLET POOL-INVALID PALLET - The requested pallet is not in the pallet pool system. To correct this problem do one of the following: Change the p-code with the M50 command, select a pallet from the PST that is already inside the machine, go to the 'SHELF' column of the PST screen and enter the shelf letter that a pallet is sitting on.

982 Zero Angle Move - This is caused by start and end point not coinciding and aligned with IJK. Set end point to the value of start point for a full circle move, or change end point to increase the angle.

983 (M) VD OVER CURRENT - Vector Drive over current. The Vector Drive has detected excessive current going to the motor. This can be caused by a stalled spindle, a high spindle load for a short duration, a spindle speed that is too low during a cut, a miswired spindle motor or a faulty Vector Drive. Check the spindle, spindle speed and surface speed.

984 (M) VD SHORT CIRCUIT - Shorted motor output. This can be caused by any of the motor leads shorted to each other or shorted to ground. This can also be caused by a faulty Vector Drive. Check all of the motor leads and make sure they are properly connected.

985 (M) DC BUS OV CHRГ - DC Bus over voltage during charge up. The DC bus monitor detected an improper charge-up. The DC bus voltage was too high during the 2-second charge up sequence. This can be caused by the incoming AC voltage being too high or because the main transformer is tapped improperly. Make sure the incoming line voltage and your main transformer taps are setup properly. **NOTE:** This can only happen at power-up. If this fault occurs, it cannot be reset.

986 Calibration Failed - The amplifier failed to self-calibrate within 30 sec. This can be caused by a faulty amplifier or a faulty Mocon.

991 Amplifier Over Temperature - The amplifier/vector drive temperature sensor indicates over 90 °C near the power transistors. This can be caused by an extended overload condition of the amplifier/vector drive, a stopped fan or high room temperature. Verify that the amplifier/vector drive fans are working.

992 Amplifier Over Current - The amplifier has detected excessive current going to the motor. This can be caused by a stalled motor, a high motor load for a short duration, a spindle speed that is too low during a cut, a motor improperly wired or a faulty amplifier. Check the motor, and the programmed spindle speed and surface speed. Make sure the axis did not hit a hard stop. This can also be caused by a faulty amplifier

993 Amplifier Short Circuit - This can be caused by any of the motor leads shorted to each other or shorted to the 320V return. This can also be caused by a faulty amplifier. Check all of the motor leads and make sure they are properly connected. This can also be caused by a faulty amplifier

994 Amplifier Overload - The amplifier has detected a high load for an extended period of time. This can be caused by running the amplifier at more than 100% load for an excessive amount of time. Check the programmed feeds and spindle speed, and for dull tools. This can also be caused by a faulty amplifier

995 Amplifier Current Error Too Large - Amplifier error too large. Difference between actual current and commanded current in amplifier is too great. This can be caused if Mocon commands more current than amplifier is capable of. Make sure Mocon is in working condition. This can also be caused by a faulty amplifier

995 (M) Error Too Large - Amplifier error too large. Difference between actual current and commanded current in amplifier is too great. This can be caused if the MOCON commands more current than the amplifier is capable of. Make sure the MOCON is in working condition. This can also be caused by a faulty amplifier.



996 (L) Tail Stock Must Be Zero Returned - The hydraulic tail stock has been adjusted to a new position. The B-axis must be zero returned before the tailstock can be used. Ensure that the correct lock bolt is securely tightened before pressing the zero return key. It is highly recommended that settings 93 and 94 be adjusted for the new tailstock position.

997 Too Many Files Have Been Opened On The Current Device - Device from which a program is running has reached maximum number of files which can be opened on it. Reduce the number of subroutines used.

998 A File Could Not Be Opened - A file on the current device could not be opened. Check the program number or name (check case).

Alarms 1000-1999 are user-defined by macro programs.



PARAMETERS

Parameters are seldom-modified values that change the operation of the machine. These include servo motor types, gear ratios, speeds, stored stroke limits, ballscrew 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. These are simply called "Settings". Under normal conditions, the parameter displays should not be modified. A complete list of the parameters is provided here. Where parameter numbers have different meanings between lathes and mills, it will be indicated with a **(L)** or an **(M)** directly after the parameter number or wording to which the text pertains. The **(L)** and **(M)** will not appear in the parameter numbers on the machine display.

The Page Up, Page Down, up and down cursor keys, and the jog handle can be used to scroll through the control parameter display screens. The left and right cursor keys scroll through 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** - Reverses the direction of encoder data.
- 1 REV POWER** - Reverses the direction of power to motor.
- 2 REV PHASING** - Reverses motor phasing.
- 3 DISABLED** - Disables the X-axis.
- 4 Z CH ONLY** - With **A** only, indicates no home switch.
- 5 AIR BRAKE** - With **A** only, indicates 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 (NC switch).
- 9 INV Z CH** - Inverted **Z** channel (normally high).
- 10 CIRC. WRAP** - **(M)** With **A** only, causes 360 wrap to return to 0. **(L)** With **A** only, causes 360 wrap to return to 0. Note that when Parameter 498 bit 10, is set to 1, the lathe automatically unwinds 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 and disengaged. When it is engaged again, the control zeroes it by unwinding as many times as it was 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** - Creates an invisible axis.
- 19 (L) DIAMETER PRG** - Sets diameter programming. When set to 1, it will interpret inputs as diameters instead of radii.
- 19 (M) ALM ON LM SW** - Rotary alarms at the limit switch.
- 20 (L) TRAVL LIMITS** - Travel limits are used.
- 20 (M) CK TRAVL LIM A** - Rotary travel limits are used. On mills with the Gimbaled Spindle (used on the VR series mills), A and B axes **CK TRAVL LIM** must be set to 1.
- 21 (L) NO LIMSW ALM** - Alarms are not generated at the limit switches.
- 21 (M) ROT TRVL LIM** - Rotary travel limits are used.
- 22 D FILTER X8** - Enables 8 tap FIR filter. Used to eliminate high frequency vibrations (depending on axis motor).



- 23 D FILTER X4** - Enables 4-tap FIR filter. Used to eliminate high frequency vibrations (depending on axis motor).
- 24 TORQUE ONLY** - For Haas diagnostic 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 diagnostic use only.
- 28 BRUSH MOTOR** - Enables the brushless motor option.
- 29 (L) 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.
- 29 (M) LINEAR DISPL** - Changes the display from degrees to inches (or millimeters) on the A and B axes.
- 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 a 6mm pitch screw give: $8192 \times 4 \times 25.4 / 6 = 138718$ (5 steps per unit inch/mm ratio).

6 X MAX TRAVEL (Steps)

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

7 X ACCELERATION

Maximum acceleration of axis in steps per second per second.

8 X MAX SPEED

Maximum speed for this axis in steps per second.

9 X MAX ERROR

Maximum error allowed in servo loop before alarm is generated. Units are encoder steps. This is the maximum allowable error in Hz between the commanded speed and the actual speed. The purpose of this parameter is to prevent "motor runaway" in case of phasing reversal or bad parameters. If this parameter is set to 0, it defaults to 1/4 of Parameter 183, Max Frequency.

10 X FUSE LEVEL

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

11 (L) X BACK EMF

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



11 (M) X TORQUE PRELOAD

Torque Preload is a signed number that should be set to a value from 0 to 4095, where 4095 is the maximum motor torque. It is applied at all times to the servo in the same direction. It is used to compensate, in the vertical direction, for gravity on a machine with an axis brake instead of a counterbalance. Normally, the brake is released when the servo motors are activated. When the vertical axis is commanded to move, the brake is released and the servo motors are activated. This parameter specifies the bias torque compensation for gravity.

12 X STEPS/REVOLUTION

Encoder steps per revolution of motor. An 8192 line encoder gives: **$8192 \times 4 = 32768$**

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 (L) Y BACK EMF

See Parameter 11 for description.

25 (M) Y TORQUE PRELOAD

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 (L) Z BACK EMF

See Parameter 11 for description.

39 (M) Z TORQUE PRELOAD

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 **and** be sure this parameter is set to enable the fourth axis before you try to enable the fourth axis from settings.

44 (L) TURRET P GAIN, (M) A P GAIN

See Parameter 2 for description.

45 (L) TURRET D GAIN, (M) A D GAIN

See Parameter 3 for description.

46 (L) TURRET I GAIN, (M) A I GAIN

See Parameter 4 for description.

47 (L) TURRET RATIO (Steps/Unit)

See Parameter 5 for description.



47 (M) A RATIO (Steps/Unit)

Defines number of encoder steps required for one full platter rotation. For example, an HRT 210 with a 90:1 gear ratio, a final drive ratio of 2:1, and an encoder count of 2000 lines would be: $2000 \times 4 \times (90 \times 2)/360 = 4000 \text{ steps}$

For a brushless HRT 210 with a 90:1 gear ratio, a final drive ratio of 2:1 and an encoder count of 8192 the formula would be: $8192 \times 4 \times (90 \times 2)/360 = 16384 \text{ steps}$

If, for example, 16384 ended up being 13107.2 (non integer), the user must make sure the single bits **SCALE FACT/X** and the combination of **SCALE/X LO** and **SCALE/X HI** are turned on in Parameter 43. When the scale factor/x bit is 1, the scale ratio is interpreted as divide by X; where X depends on **SCALE/X LO** and **SCALE/X HI** (see Parameter 1 for **SCALE/X LO** and **SCALE/X HI** values). For example: $8192 \times 4 \times (72 \times 2)/360 = 13107.2$

You would then turn on the **SCALE FACT/X** bit and the **SCALE/X LO** bit which would give you a factor of 5 thus: $13107.2 \times 5 = 65536 \text{ encoder steps}$

48 (L) TURRET MAX TRAVEL (Steps)

See Parameter 6 for description.

48 (M) A MAX TRAVEL (Negative Travel Limit) (Steps)

See Parameter 6 for description. Normally this parameter would not apply to the A axis; however, this parameter is used on mills with a gimbaled spindle (5-axis mills). On a VR-series mill, this parameter is used to limit the amount of angular movement of the spindle (A and B axes). The A and B axes are limited in movement to a distance between negative **Max Travel**, and positive **Tool Change Offset**. On 5-axes mills A- and B-axis **Rot Trvl Lim** must be set to 1, **Max Travel** and **Tool Change Offset** must be calibrated and set correctly.

49 (L) TURRET ACCELERATION, (M) A ACCELERATION

See Parameter 7 for description.

50 (L) TURRET MAX SPEED, (M) A MAX SPEED

See Parameter 8 for description.

51 (L) TURRET MAX ERROR, (M) A MAX ERROR

See Parameter 9 for description.

52 (L) TURRET FUSE LEVEL, (M) A FUSE LEVEL

See Parameter 10 for description.

53 (L) TURRET BACK EMF, (M) A BACK EMF

See Parameter 11 for description.

54 (L) TURRET STEPS/REVOLUTION, (M) A STEPS/REVOLUTION

See Parameter 12 for description.

55 (L) TURRET BACKLASH, (M) A BACKLASH

See Parameter 13 for description.

56 (L) TURRET DEAD ZONE, (M) A DEAD ZONE

See Parameter 14 for description.

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

57 COMMON SWITCH 1

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

- 0 **REVERSE CRANK DIR** - Reverses direction of jog handle.
- 1 **DISABLE TOOL CHANGER** - Disables tool changer operations.
- 2 **DISABLE GEARBOX** - Disables gearbox functions.
- 3 **POWER OFF AT E-STOP** - Stops spindle, then turns the power off at Emergency Stop.
- 4 **RIGID TAPPING** - Indicates hardware option for rigid tap.
- 5 **REV SPINDLE ENCODER** - Reverses sense direction of spindle encoder.
- 6 **UNUSED**
- 7 **EXACT STOP MODE CHG** - Selects exact stop in moves when mode changes.



- 8 SAFETY CIRCUIT** - Enables safety hardware, if machine is so equipped.
- 9 SPINDLE DRV LIN ACCEL** - Selects linear deceleration for rigid tapping. 0 is quadratic.
- 10 UNUSED**
- 11 COOLANT SPIGOT** - Enables coolant spigot control and display.
- 12 OVER TEMP IS N/C** - Selects Regen over temp sensor as NC.
- 13 UNUSED**
- 14 NONINV SPINDLE STOP** - Non-inverted spindle stopped status.
- 15 SPIND. LOAD MONITOR** - Spindle load monitor option is enabled.
- 16 SPIND. TEMP MONITOR** - Spindle temperature monitor option is enabled.
- 17 ENABLE ROT & SCALNG** - Enables rotation and scaling.
- 18 ENABLE DNC** - Enables DNC selection from MDI.
- 19 ENABLE BKGRND EDIT** - Enables Background Edit mode.
- 20 ENABLE GROUND FAULT** - Enables ground fault detector.
- 21 M19 SPINDLE ORIENT.** - Makes the P and R codes a protected feature, only enabled with an unlock code. The unlock code will be printed on the parameter listing. 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 it 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 CURSOR** - Enable use of jog handle to move cursor.
- 25 NEGATIVE WRK OFFSET** - Selects use of work offsets in negative direction.
- 26 TRANS OIL LOW PRESS** - Enables transmission low oil pressure detection.
- 27 QUICK CODE** - Enables conversational programming.
- 28 OILER ON/OFF** - Enables oiler power when servos or spindle is in motion.
- 29 INV BUSS PWR FAULT** - Inverts sense of over voltage signal. It must be set to zero on machines with a standard vector drive, and 1 on machines with a Smart Vector Drive or Mini Power Supply.
- 30 SPINDLE ENCODER #2** - Enables a second encoder that is mounted on the spindle motor and wired into the C-axis input of the MOCON. It controls 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 SPINDLE** - 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 MAXIMUM FEED

Maximum feedrate in inches per minute.

60 (L) TURRET IN POS DELAY

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

60 (M) TURRET START DELAY

Maximum delay allowed in start of tool turret. Units are milliseconds. After this time, an alarm is generated. On Horizontal mills with a side-mount tool changer, this parameter is used to specify the time (in milliseconds) allowed for motor driven motions of the shuttle and arm. If the motion has not completed within the time allowed by this parameter, Alarm 696, ATC Motor Time Out is generated.

61 (L) TURRET LOCK DELAY

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



61 (M) TURRET STOP DELAY

Maximum delay allowed in motion of tool turret. Units are milliseconds. After this time, an alarm is generated. On Horizontal mills with a side-mount tool changer, this parameter is used to specify the time (in milliseconds) allowed for air-pressure driven arm in/arm out moves. If the motion has not completed within the time allowed by this parameter, Alarm 695, ATC Air Cylinder Time Out is generated.

62 (L) TURRET UNLOCK ERROR TIME

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

62 (M) SHUTTLE START DELAY

The time (in milliseconds) needed to allow the tool pocket to settle (stop bouncing) after being lowered in preparation for a tool change.

63 (L) TURRET LOCK ERRTIME

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

63 (M) SHUTTLE STOP DELAY

Also used for vertical mills with Side-Mount Tool Changer. Specifies the time allowed (in milliseconds) for the tool arm motor to stop. If the arm has not stopped after the allowed time, Alarm 627, ATC Arm Position Timeout is generated.

64 (L) Z TOOL CHANGE OFFSET

For turret, displacement from home switch to tool 0.

64 (M) Z TOOL CHANGE OFFSET

On Vertical mills: For Z-axis; displacement from home switch to tool change position and machine zero. About 4.6 inches, so for an 8192 line encoder this gives: $4.6 \times 138718 = 638103$

Alternately used for machines with type 4 servo axis pallet changer. It positions the pallet for a pallet change. For example, Z-axis travel on the EC-400 is done by moving the pallet, not the column, and therefore will not affect a tool change. Also, Parameter 64 is generally used during zero return, and that usage is consistent in the EC-400.

65 NUMBER OF TOOLS

Number of tool positions in tool changer. This number must be set to the configuration of the machine. The maximum number of tool positions is 32, except for Horizontal mills with a side-mount tool changer.

66 SPINDLE ORI DELAY

Maximum delay allowed when orienting spindle. Units are 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 (M) 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 on A-axis prior to moving. Units are milliseconds.

70 MIN SPIN DELAY TIME

Minimum delay time (in milliseconds) in program after commanding new spindle speed and before proceeding.

71 (L) SPIN STALL DET DLAY

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

71 (M) DRAWBAR OFFSET

Offset provided in motion of Z-axis to accommodate the tool pushing out of the spindle when unclamping. Units are encoder steps.

72 (L) LIVE TOOL CHNG DLAY

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.



72 (M) DRAWBAR Z VEL UNCL

Speed of motion in Z-axis to accommodate tool pushing out of the spindle when unclamping. Units are encoder steps per second.

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. This parameter is not used in machines equipped with a Haas vector drive.

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. This parameter is not used in machines equipped with a Haas vector drive.

75 GEAR CHANGE SPEED

Command speed (maximum spindle rpm divided by 4096) used to rotate spindle motor when changing gears.

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 second.

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

Maximum delay time (in milliseconds) control will wait for spindle to get to commanded speed or to get to zero speed.

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). When using M37, the value 37 would be entered in Parameter 81 (for example). A program would be written to include the M37:

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

The control would run the program until it got to the M37, call program O9000, run that, 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, 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

See Parameter 81 for description.

83 M MACRO CALL O9002

See Parameter 81 for description.

84 M MACRO CALL O9003

See Parameter 81 for description.

85 M MACRO CALL O9004

See Parameter 81 for description.

**86 M MACRO CALL O9005**

See Parameter 81 for description.

87 M MACRO CALL O9006

See Parameter 81 for description.

88 M MACRO CALL O9007

See Parameter 81 for description.

89 M MACRO CALL O9008

See Parameter 81 for description.

90 M MACRO CALL O9009

See Parameter 81 for description.

91 G MACRO CALL O9010

G code that calls O9010, and 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). When using G45, the value 45 would be entered in Parameter 91 (for example).

A program would be written to include the G45:

G X0...

G45

.

.

M30

The control would run the program until it got to the G45, call program O9010, run that, return to the point that it left, and continue the main program. If program O9010 contains another G45, it will call itself, 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

See Parameter 91 for description.

93 G MACRO CALL O9012

See Parameter 91 for description.

94 G MACRO CALL O9013

See Parameter 91 for description.

95 G MACRO CALL O9014

See Parameter 91 for description.

96 G MACRO CALL O9015

See Parameter 91 for description.

97 G MACRO CALL O9016

See Parameter 91 for description.

98 G MACRO CALL O9017

See Parameter 91 for description.

99 G MACRO CALL O9018

See Parameter 91 for description.

100 G MACRO CALL O9019

See Parameter 91 for description.

101 (L) IN POSITION LIMIT X, (M) X AXIS IN POSITION LIMIT

How close the motor must be to the endpoint before any move is considered complete when not in exact stop (G09 or G61). Units are encoder steps. As of mill version 9.06, this parameter does not apply to feeds. This parameter should be equivalent to .050 inches.



102 (L) IN POSITION LIMIT Y, (M) Y AXIS IN POSITION LIMIT

See Parameter 101 for description.

103 (L) IN POSITION LIMIT Z, (M) Z AXIS IN POSITION LIMIT

See Parameter 101 for description.

104 (L) IN POSITION LIMIT A, (M) A AXIS IN POSITION LIMIT

See Parameter 101 for description.

105 (L) X MAX CURRENT

Fuse level in % of max power to motor. Applies only when motor is stopped.

105 (M) X AXIS MAX CURRENT

Corresponds to maximum peak current provided by the amplifier. 4095 = 30A (small amp), 45A (Medium amp), or 60A (large amp).

106 (L) X MAX CURRENT

See Parameter 105 (L) for description.

106 (M) Y AXIS MAX CURRENT

See Parameter 105 (M) for description.

107 (L) Z MAX CURRENT

See Parameter 105 (L) for description.

107 (M) Z AXIS MAX CURRENT

See Parameter 105 (M) for description.

108 (L) A MAX CURRENT

See Parameter 105 (L) for description.

108 (M) A AXIS MAX CURRENT

See Parameter 105 (M) for description.

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

Acceleration time constant. Units are 1/10000 seconds. This parameter provides for a constant ratio between profiling lag and servo velocity at the endpoint of a rapid motion.

114 Y ACC/DEC T CONST

See Parameter 113 for description.

115 Z ACC/DEC T CONST

See Parameter 113 for description.

116 A ACC/DEC T CONST

See Parameter 113 for description.

117 LUB CYCLE TIME

If this is set nonzero, it is the cycle time for the lube pump. The Lube pressure switch option is checked for cycling in this time. It is in units of 1/50 second.

**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

The motor phase offset for **Y** motor. This is arbitrary units.

123 Z PHASE OFFSET

The motor phase offset for **Z** motor. This is arbitrary units.

124 A PHASE OFFSET

The motor phase offset for **A** motor. This is arbitrary units.

125 X GRID OFFSET

Shifts the effective position of the encoder **Z** pulse. It can correct for a motor or home switch positioning error.

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

Controls the delay time to the gear change solenoids when performing a gear change.

131 MAX SPINDLE rpm

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.

Coefficient of heating of the ballscrew, and is used to decrease or shorten the screw length.

133 Z SCREW COMP. COEF.

Coefficient of heating of the ballscrew, and is used to decrease or shorten the screw length.

134 X EXACT STOP DIST.**135 Y EXACT STOP DIST.****136 Z EXACT STOP DIST.****137 A EXACT STOP DIST.**

Control how close each axis must be to its end point when exact stop is programmed. They apply 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

Compensate for friction on each of the four axes. The units are in 0.004V.

142 HIGH/LOW GEAR CHANG

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 (L) LIVE TOOL CHNG VEL

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.

143 (M) DRAWBAR Z VEL CLMP

Sets the speed of the Z-axis motion that compensates for tool motion during tool clamping. Units are in encoder steps per second.

144 RIG TAP FINISH DIST

Sets the finish tolerance for determining the end point of a rigid tapping operation. Units are encoder counts.

145 X ACCEL FEED FORWARD

146 Y ACCEL FEED FORWARD

147 Z ACCEL FEED FORWARD

148 A ACCEL FEED FORWARD

Set the feed forward gain for the axis servo. They have no units.

149 (M) PRECHARGE DELAY

Sets the delay time from precharge to tool release. Units are milliseconds.

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 47 for description.

156 B MAX TRAVEL (Steps)

See Parameter 6 for description. Normally this parameter would not apply to the A axis; however, this parameter is used on mills with a gimbaled spindle (5-axes mills). On a VR-series mill this parameter is used to limit the amount of angular movement of the spindle (A and B axes). The A and B axes are limited in movement to a distance between negative **Max Travel** and positive **Tool Change Offset**. On 5-axes mills A and B axes **Rot Trvl Lim** must be set to 1, **Max Travel** and **Tool Change Offset** must be calibrated and set correctly.

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 (L) IN POSITION LIMIT B, (M) B AXIS IN POSITION LIMIT

Same definition as Parameter 101.

166 B AXIS MAX CURRENT

Same definition as Parameter 105.

167 D*D GAIN FOR B

Second derivative gain in servo loop.

168 B ACC/DEC T CONST

Same definition as Parameter 113.

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

Same description as Parameter 145.

174 B SCREW COMP. COEF.

Coefficient of heating of the ballscrew, and is used to decrease or shorten the screw length.

175 B AIR BRAKE DELAY

Delay provided for air to release from brake on B-axis prior to moving. Units are milliseconds.

NOTE: The C-axis parameters (176-200) are used to control the Haas Vector Drive. Parameter 278 bit Haas Vect Dr must be set to 1 for these parameters to be available.

176 (L) Sp SWITCHES, (M) C 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

See Parameter 4 for description.

180 C SLIP GAIN

Calculated slip rate 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).

181 C MIN SLIP

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 = 1 Hz).

182 C ACCELERATION

Maximum acceleration of axis. The value is the units of encoder steps/second/second at the motor.

183 (L) C MAX SPEED

See Parameter 8 for description.

183 (M) C MAX FREQ

Frequency at which the motor will be run when maximum spindle rpm is commanded. Units: 0.01 Hz (two implied decimal places).

184 C MAX ERROR

Maximum allowable error (in Hz) between commanded spindle speed and actual speed. If set to zero, it will default to 1/4 of Parameter 183.

185 C FUSE LEVEL

See Parameter 10 for description.

186 (L) C BACK EMF

See Parameter 11 for description.

186 (M) C DECELERATION

Maximum deceleration of axis in encoder steps per second per second.

187 (L) C sp MOT HI GEAR ST/REV, (M) C HIGH GEAR STEPS/REV

Used when a Vector Drive is installed. It 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.) $N = (\text{Encoder steps/enc rev}) / (\text{Enc pulley ratio} \times \text{High Gear Ratio})$. 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

Proportional gain used in the position control loop when performing a spindle orientation.

189 C BASE FREQ

Rated frequency of the motor.

190 C HI SP CURR LIM

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 frequency to max frequency. This value is the max current at the max frequency.

191 C MAX CURRENT

Sets maximum current allowed from the vector drive to the spindle motor: 4095 = max.

192 C MAG CURRENT

Magnetization component of the current in the motor, also called the flux or field current.



193 C SPIN ORIENT MARGIN

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.

194 (L) C SP STOP SPEED, (M) SPINDLE STOP FREQ

Spindle considered stopped (discrete input SP ST*=0) when speed drops below this value. Units are encoder steps/millisecond.

195 C START/STOP DELAY

This delay is used at the start of motion to magnetize the rotor before acceleration starts. When the motor comes to a stop it remains energized for this amount of time. Units are in milliseconds.

196 C ACCEL LIMIT LOAD

Used when a Vector Drive is installed. It is % load limit during acceleration. If load reaches this limit, control slows down acceleration. If Vector Drive not installed, it is called C-axis **Exact Stop Distance**, and not used.

197 SWITCH FREQUENCY (Unit:Hz.)

Frequency at which the spindle motor windings are switched. Note that there is a hysteresis band around this point, defined by Parameter 198.

198 SWITCH HYSTERESIS (UNIT:Hz)

Defines the \pm hysteresis band around Parameter 197. For example, if Parameter 197 is 85 Hz, and Parameter 198 is 5 Hz, the switching will take place at 90 Hz when the spindle is speeding up, and at 80 Hz when the spindle is slowing down.

199 PRE-SWITCH DELAY (UNIT: ms)

Amount of time allowed for the motor current to drop before winding change contactors are switched.

200 POST-SWITCH DELAY (UNIT: ms)

Amount of time allowed for contactors to stabilize after switch is commanded, before current is applied to motor.

201 X SCREW COMP. COEF.

Coefficient of heating of the ballscrew and is used to shorten the screw length.

205 A SCREW COMP. COEF.

This parameter should be set to 0.

206 (M) SPIGOT POSITION

Vertical mills only. Maximum number of spigot positions.

207 (M) SPIGOT TIMEOUT (MS)

Vertical mills only. Maximum timeout allowed for spigot to traverse one spigot location.

208 SPIN. FAN OFF DELAY

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

209 (L) COMMON SWITCH 2

Parameter 209 is a collection of general purpose single bit flags used to turn some functions on and off. Use left and right cursor arrows to select the function being changed. All values are 0 or 1 only. Function names are:

- 0 LATHE T.C. - Designates control as a lathe.
- 1 RESET STOPS TL CHGR - Tool changer can be stopped with Reset button.
- 2 UNUSED
- 3 ENABLE CHIP CONVEYR - Enables chip conveyor, if machine is so equipped.
- 4 UNUSED
- 5 FRONT DOOR - When enabled, control looks for additional door switch and generates operator message.
- 6 UNUSED
- 7 UNUSED
- 8 UNUSED
- 9 SPIGOT KEY INVERT
- 10 T SUBROUTINE



11 RESERVED

12 REVERSED CONVEYOR - Reverses the direction of the chip conveyor.

13 M27-M28 CONVEYOR - 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.

14 RESERVED

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 CNVR DOOR HOLD 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 DISABLED COOLANT IN

19 T.C. 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 REMOTE TOOL RELEASE - 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 FLOPPY ENABLE - Enables an installed floppy disk drive.

23 MCODE RELAY BOARD - If set to 1, adds 16 additional relays, for a total of 56.

24 hpC ENABLE - When set to zero, the machine will behave normally. When 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.

28 UNUSED

29 HYDRAULICS - 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 SPINDLE 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.

209 (M) COMMON SWITCH 2

Parameter 209 is a collection of general purpose single bit flags used to turn some functions on and off. Use left and right cursor arrows to select the function being changed. All values are 0 or 1 only. Function names are:

0 HS SERIES CNC - Set to one for HS series mills; set to zero for all other mills.

1 RESET STOPS TL CHGR - Tool changer can be stopped with Reset button.

2 CHAIN TOOL CHANGER - On all HS mills with the 60 or 120 pocket chain-style tool changer, it must be set to 1. On all other mills, it must be set to zero.

3 ENABLE CHIP CONVEYR - Enables chip conveyor, if machine is so equipped.

4 50% RAPID KEYBOARD - When (1) the control will support the 50% rapid traverse key. For controls without a 50% rapid keypad set this bit to (0).

5 FRONT DOOR - When enabled, control looks for additional door switch and generates operator message.

6 NO Z HOME IN TL CHG - Horizontal mills only. Prevents Z-axis motion to machine zero prior to tool change.

7 M36 AUTO PAL ROTATE - Horizontal only. When set to (1), an M36 rotates the A-axis after the Part Ready button is pressed.

8 AUX AXIS TL CHANGER - Horizontal mills only. When enabled, means the tool changer carousel is driven by an aux. axis.



- 9 **SPIGOT KEY INVERT** - Controls the direction the spigot moves when the Coolant Up and Coolant Down buttons are pressed. Changing this bit reverses the direction the spigot moves when the buttons are pressed. It has no effect on the direction the spigot moves when commanded by the M34 and M35 codes.
- 12 **REVERSE CONVEYOR** - Reverses the direction of the chip conveyor.
- 13 **PRE-ORIENT TAP** - When this parameter bit is set to 1, a spindle orient command is issued automatically prior to the repeat rigid tap function.
- 14 **UNUSED**
- 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, 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 **CNVR DOOR HOLD 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 **DISABLE COOLANT IN** - If set to 1, low coolant input will not be used.
- 19 **UNUSED**
- 20 **REMOTE TOOL RELEASE** - If set to 1, allows use of remote tool release button on spindle head.
- 21 **FLOPPY ENABLE** - If set to 1, enables the optional disk drive.
- 22 **TL CHG RECOV KEYPAD** - If set to 1, enables tool changer restore button on keypad.
- 23 **MCODE RELAY BOARD** - If set to 1, allows for M-code addressing. Adds availability of additional outputs.
- 24 **TSC ENABLE** - When set to 1, **DSBL CLNT IN** bit is ignored, M24, M54, and M64 are disabled, and TSC will operate. When set to zero, the control functions normally.
- 25 **AUX JOG NACC** - If the jog handle is moved rapidly, the auxiliary axis will not develop extremely large lags.
- 26 **ALIAS M PROGR START** - Alias M codes during program restart.
- 27 **DISABLE JOG TEST** - Disables the encoder test for the jog handle.
- 28 **NO ZERO CLAMP** - During zero return of pallet changer, the general sequence is 1) lift, 2) home, 3) lower. When this bit is set to 1, only the first two steps are executed. The pallet remains in the unclamp position. This bit was added to prevent damage to the pallet changer prior to Grid Offset and Tool Change Offset (zero return offset for the pallet changer axis) set up.
- 29 **PAL READY BUTTON** - Accommodates both APC on vertical mill and Rotary Pallet Changer on Horizontal mill. This bit should be set to 1 on 2-pallet APC's to designate a single pallet button configuration. Four pallet APC's have a 2 schedule pallet button and should have this bit set to zero. This bit should be zero on Horizontal Mills, since it is intended for future pallet changer software that replaces the macro program.
- 30 **UNUSED**
- 31 **SPINDLE 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 checks and/or waits for it to come up to speed immediately before the next interpolated motion is initiated. This bit does not affect rigid tapping or the TSC option.

- 210 **(M) X AXIS TOOL CHANGE OFFSET**
Used on the HS-2RP mill for X axis displacement from the home position to tool change position. **If this parameter contains an incorrect value, a horizontal mill will crash when it does a tool change.**
- 211 **(M) Y AXIS TOOL CHANGE OFFSET**
Used on the HS-2RP mill for Y axis displacement from the home position to tool change position. **If this parameter contains an incorrect value, a horizontal mill will crash when it does a tool change.**
- 212 **A TOOL CHANGE OFFSET**
Sets the distance between the A-axis grid offset (Parameter 128) and the spindle home position. The A-axis is limited in movement to the area between the positive value of this parameter and the negative **Max Travel**.
- 213 **(M) B TOOL CHANGE OFFSET**
Sets the distance between the B-axis grid offset (Parameter 170) and the spindle home position. The B-axis will be limited in movement to the area between the positive value of this parameter and the negative **Max Travel**. This parameter must be used on all mills with the 60 or 120 pocket chain-style tool changer, as opposed to Parameter 215, Carousel Offset, which is used on other side-mount tool changers. Note that on a machine with a single MOCON board, the Tt-axis parameters are automatically copied to the B-axis parameters and only the Tt-axis parameters can be altered.



214 D:Y CURRENT RATIO % (Unit: %)

Defines the ratio between the two winding configurations. The default winding is Y, and the parameters are set for the Y winding. Used to adjust the parameters for the delta winding when the windings are switched.

215 (M) CAROUSEL OFFSET

Horizontal mills only. Precisely aligns tool 1 of tool changing carousel. Units are encoder steps.

216 CNVYR RELAY DELAY

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

217 CNVYR IGNORE OC TIM

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

218 CONVYR RETRY REV TIM

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

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.

220 CONVYR RETRY TIMEOUT

Time in 1/50 seconds between consecutive overcurrents in which an overcurrent is considered to be another retry. If this time passes between overcurrents, the retry count is set to (0).

221 MAX TIME NO DISPLAY

Maximum time (in 1/50 sec.) between screen updates.

222 (L) LOW HYD. IGNORE

Amount of time that the control ignores the LO HYD input bit after servos are engaged. The hydraulic unit requires a short period of time to come up to pressure.

222 (M) ROTARY AXIS INCRMNT

For Horizontal mills only. Sets the degrees of rotation of the A-axis at an M36 or Pallet Rotate.

223 (M) AIR TC DOOR DELAY

For Horizontal mills only. Sets the delay to open the tool changer door (in milliseconds). If the tool changer does not have a pneumatic door, this parameter is set to zero.

224 (M) ROT AXIS ZERO OFFSET

Shifts the zero point of A for a wheel fixture or tombstone.

225 (M) MAX ROT AXIS ALLOW

For Horizontal mills with a wheel fixture only. Sets the maximum rotation (in degrees) allowed before stopping at front door.

226 EDITOR CLIPBOARD

Assigns a program number (nnnnn) to the contents of the clipboard (for the advanced editor).

227 DISK DIR NAME

When the disk drive is enabled and a 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 disk drive. This parameter designates where to write the directory listing.

228 QUICKCODE FILE

Sets the program numbers to store in the Quick Code definition program.

229 X LEAD COMP 10E9

Sets the X-axis lead screw compensation signed parts per billion.

230 Y LEAD COMP 10E9

Sets the Y-axis lead screw compensation signed parts per billion.

**231 Z LEAD COMP 10E9**

Sets the Z-axis lead screw compensation signed parts per billion.

232 A LEAD COMP 10E9

Sets the A-axis lead screw compensation signed parts per billion.

233 B LEAD COMP 10E9

Sets the B-axis lead screw compensation signed parts per billion.

235 (L) AUTO DOOR PAUSE

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.

235 (M) TSC PISTON SEAT

With the 50 TSC option, the amount of time given for the piston to seat during system start-up. The default is 500 milliseconds. If machine has a **50 Taper spindle** and the TSC option, this parameter **must be set to 0**.

236 (L) AUTO DOOR BUMP

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.

236 (M) TSC LOW PR FLT

After the TSC system has stabilized following start-up, Alarm 151 is generated if coolant pressure falls below 40 psi for the amount of time set in this parameter.

237 (L) hpC PRESSURE BLEED

Supports 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.

237 (M) TSC CLNT LINE PURGE

Amount of time given for the coolant to purge when the TSC system is shut off. May be increased to a higher value to help purge coolant from small orifice tooling.

238 (L) SPINDLE AT SPEED %

Allows program to command spindle to certain speed and then continue to next block before 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.

238 (M) MAX TSC SPINDLE rpm

When TSC is enabled and in use, this parameter limits the maximum spindle speed.

239 SPNDL ENC STEPS/REV

Sets the number of encoder steps per revolution of the spindle encoder.

240 1ST AUX MAX TRAVEL

Sets the maximum travel of the first auxiliary (C) axis in the positive direction.

241 2ND AUX MAX TRAVEL

Sets the maximum travel of the second auxiliary (U) axis in the positive direction.

242 3RD AUX MAX TRAVEL

Sets the maximum travel of the third auxiliary (V) axis in the positive direction.

243 4TH AUX MAX TRAVEL

Sets the maximum travel of the fourth auxiliary (W) axis in the positive direction.

244 1ST AUX MIN TRAVEL

Sets the maximum travel of the first auxiliary (C) axis in the negative direction.

**245 2ND AUX MIN TRAVEL**

Sets the maximum travel of the second auxiliary (U) axis in the negative direction.

246 3RD AUX MIN TRAVEL

Sets the maximum travel of the third auxiliary (V) axis in the negative direction.

247 4TH AUX MIN TRAVEL

Sets the maximum travel of the fourth auxiliary (W) axis in the negative direction.

248 (L) MAX SPINDLE SPEED ALLOWED

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.

248 (M) SMTCLY ON/OFF DLY

Vertical mills with sidemount tool changers only. It specifies the time needed (in milliseconds) between turning off one relay and turning on the other one, when reversing the carousel.

249 (L) DLY AFTER CHUCK IS CLMPED

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

249 (M) TOOL CLAMP DELAY

Provides a delay after the tool has been clamped and before retraction of the tool carousel at the end of a tool change. For most mills, this parameter should be set to zero. Units are milliseconds.

250 (L) DLY AFTER CHUCK IS UNCLMP

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

250 (M) TOOL UNCLAMP DELAY

provides a delay after the tool has been unclamped and before the spindle is backed away at the beginning of a tool change. For most mills, this parameter should be set to zero. Units are in milliseconds.

251 A DOOR OPEN ERRTIME

Supports the Auto-Door feature. It is used for several things:

- 1) It specifies the number of 50ths of a second for the motor to run to open the door.
- 2) The value of this parameter plus one second specifies the number of 50ths of a second for the motor to run to close the door.
- 3) If, at the end of the door-close time, the door has not yet reached the switch, Alarm 238, Door Fault is generated.

252 (L) TAILSTOCK OVERLOAD -DIR

Determines overload limit when the tailstock is traveling in the minus direction, toward the spindle. It is an arbitrary value based on effective voltage being sent to the tailstock servo motor. If too low, you may not be able to move the tailstock. Increase the value until you are able to move the tailstock. It is used for ball screw tailstock or TL-15.

252 (M) GEAR MOTOR TIMEOUT

Supports the Auto-Door feature. It specifies the length of time (in ms) that is allowed for the door to begin opening. If the door does not move off the door-closed switch within this amount of time, Alarm 238, Door Fault will be generated.

253 (L) TAILSTOCK 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.

253 (M) SPIGOT FWD POS DLY

Specifies the length of a delay (units are ms) when moving the coolant spigot forward. This parameter should be set to zero on all machines.



254 (L) SPINDLE CENTER

Reserved for service use only.

254 (M) TC AIR DOOR CLEARANCE

Incorporates the X-axis door clearance for the Mini-horizontal. This position is used during a tool change to avoid hitting the tool changer door, since part of the door enters the machining area during a tool change.

This parameter also supports the VB-1 Bridge Mill tool carousel air door. The air door is a clamshell shaped door covering the tool carousel, which raises up at one side by air power to allow the spindle to access the tools. In order for it to open and close, there must be sufficient clearance between it and the spindle. This parameter must be set to the correct value (in encoder units), Parameter 223, Air TC Door Delay must be set to a non-zero value, Parameter 267, Zero Axis TC must be set to 1, and Parameter 278, TC DR Switch must be set to 1. When a tool change is commanded, the following steps are performed:

- 1) The Y-axis is moved to the position specified by Parameter 254.
- 2) The air door is commanded to open.
- 3) There is a delay specified by Parameter 223 to allow the door to open fully.
- 4) The Y-axis is moved to zero and the tool change is performed.
- 5) The Y-axis is moved to the position specified by Parameter 254.
- 6) The air door is commanded to close.
- 7) There is a delay specified by Parameter 223 to allow the door to close fully.

255 CONVEYOR TIMEOUT

The number of minutes 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 turn 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

The setting for EC-300 must be 26, the EC-400 must be 32, and the MDC-1 must be 27, or Alarm 180 will occur when the spindle is turned on. This parameter should be set to zero on all lathes.

257 SPINDL ORIENT OFFSET

If the machine is equipped with a spindle vector drive (as set in bit 7 of Parameter 278), this bit sets the spindle orientation offset. The offset is the number of encoder steps between the Z pulse and the correct spindle orientation position. It is used to orient the spindle properly anytime it needs to be locked, such as prior to a tool change, or orient spindle command.

258 (M) COLD SPINDLE TEMP

The first time Cycle Start is pressed after the machine has been turned on, the control will compare the micro processor temperature (in degrees Fahrenheit) against the value of this parameter. If the microprocessor is colder, the control will assume that the spindle is too cold or inadequately lubricated to be run safely at high speed and the following message will be displayed:

!!!WARNING!!!
YOUR MACHINE IS COLD, RUN A WARM-UP PROGRAM BEFORE RUNNING THE SPINDLE AT HIGH SPEED
OR DAMAGE MAY RESULT
PRESS 'CANCEL' TO CONTINUE

The user must press Cancel before continuing. It is recommended that a spindle warm-up program be run immediately. This message will only appear once each time the machine has been turned on. The initial value for this parameter is 70 (degrees F). To disable this feature, change it to zero.

259 (M) COLD SPINDLE DAYS

The first time Cycle Start is pressed after the machine is turned on, the control will compare the number of days that have passed since the machine was turned off against the value of this parameter. If the machine has been off longer, the control will assume that the spindle is too cold or inadequately lubricated to be run safely at high speed and the following message will be displayed:

!!!WARNING!!!
YOUR MACHINE IS COLD, RUN A WARM-UP PROGRAM BEFORE RUNNING THE SPINDLE AT HIGH SPEED
OR DAMAGE MAY RESULT
PRESS 'CANCEL' TO CONTINUE

The user must press CANCEL before continuing. It is recommended that a spindle warm-up program be run immediately. This message will only appear once each time the machine has been turned on. The initial value for this parameter is 3 (days). To disable this feature, change it to 999999.



266 (L) 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** - Used for Ballscrew 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:
- 4 **X 2ND HOME BTN** - Moves axis to coordinate specified in Work Offset G129.
- 5 **X NEG COMP DIR** - Negates the direction of thermal compensation.
- 7 **MAX TRAV INP**
- 8 **NO ZERO/NOHOME** - Intended for lathes that have extra tools mounted on the outside of the turret. If this bit is set to zero, it has 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.

266 (M) 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** - Enables linear scales for the X axis.
- 1 **X INVRT LN SCL** - Inverts the X-axis linear scale.
- 2 **DSBL SCALE Z** - Disables the linear scale Z test.
- 3 **X ZERO AXIS TC** - Returns axis to the position specified by the Tool Change Offset parameter prior to a tool change. On mills with a gimbaled spindle, this bit must be set to 1 on the A and B axes (Parameter 269 and 270) and 0 on all other axes.
- 4 **X 2ND HOME BTN** - Moves axis to coordinate specified in Work Offset G129.
- 5 **X NEG COMP DIR** - Negates the direction of thermal compensation.
- 6 **X DELAY AXIS 0** - Used with an APL to ensure X-axis is zeroed before A-axis of APL
- 7 **X MAX TRAVEL INP** - This bit is set to 1 on five axis machines. This bit indicates that there is a switch (visible through MOCON) that detects if the axis has rotated all the way round. It is used to tell the control to skip the first zero switch when zeroing so it can unwrap the cables.
- 9 **X TEMP SENSOR** - Performs Ballscrew 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 this feature can only be used when temperature sensors are installed.
- 16 **SCALE Z HIST** - For Haas diagnostic use only.

267 (L) 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** - Enables linear scales for the Y-axis.
- 1 **Y INVRT LN SCL** - Inverts the Y-axis linear scale.
- 2 **Y DSBL LS ZTST** - Disables the linear scale Z test.
- 3 **TH SNSR COMP** - Used for Ballscrew 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.
- 4 **Y 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129
- 5 **Y NEG COMP DIR** - Negates the direction of thermal compensation
- 7 **MAX TRAV INP**



- 8 **NO ZERO/NOHOME** - 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 (M) 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** - Enables linear scales for the Y-axis.
- 1 **Y INVRT LN SCL** - Inverts the Y-axis linear scale.
- 2 **DSBL SCALE Z** - Disables the linear scale Z test.
- 3 **Y ZERO AXIS TC** - Returns axis to the position specified by the Tool Changer Offset parameter prior to a tool change. On mills with a gimbaled spindle, this bit must be set to 1 on the A and B axes (Parameter 269 and 270) and 0 on all other axes.
- 4 **Y 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129.
- 5 **Y NEG COMP DIR** - Negates the direction of thermal compensation.
- 6 **Y DELAY AXIS 0** - Used with an APL to ensure Y-axis is zeroed before A-axis of APL.
- 7 **Y MAX TRAVEL INP** - This bit is set to 1 on five axis machines. This bit indicates that there is a switch (visible through MOCON) that detects if the axis has rotated all the way round. It is used to tell the control to skip the first zero switch when zeroing so it can unwrap the cables.
- 9 **Y TEMP SENSOR** - Performs Ballscrew 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 this feature can only be used when temperature sensors are installed.
- 16 **SCALE Z HIST** - For Haas diagnostic use only.

268 (L) 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** - Enables linear scales for the Z-axis.
- 1 **Z INVRT LN SCL** - Inverts the Z-axis linear scale.
- 2 **Z DSBL LS ZTST** - Disables the linear scale Z test.
- 3 **TH SNSR COMP** - Used for Ballscrew 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.
- 4 **Z 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129
- 5 **Z NEG COMP DIR** - Negates the direction of thermal compensation
- 7 **MAX TRAV INP**
- 8 **NO ZERO/NOHOME** - 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 (M) 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** - Enables linear scales for the Z-axis.
- 1 **Z INVRT LN SCL** - Inverts the Z-axis linear scale.
- 2 **DSBL SCALE Z** - Disables the linear scale Z test.



- 3 **Z ZERO AXIS TC** - Returns axis to the position specified by the Tool Changer Offset parameter prior to a tool change. On mills with a gimbaled spindle, this bit must be set to 1 on the A and B axes (Parameter 269 and 270) and 0 on all other axes.
- 4 **Z 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129.
- 5 **Z NEG COMP DIR** - Negates the direction of thermal compensation.
- 6 **Z DELAY AXIS 0** - Used with an APL to ensure Z-axis is zeroed before A-axis of APL.
- 7 **Z MAX TRAVEL INP** - This bit is set to 1 on five axis machines. This bit indicates that there is a switch (visible through MOCON) that detects if the axis has rotated all the way round. It is used to tell the control to skip the first zero switch when zeroing so it can unwrap the cables.
- 9 **Z TEMP SENSOR** - Performs Ballscrew 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 this feature can only be used when temperature sensors are installed.
- 16 **SCALE Z HIST** - For Haas diagnostic use only.

269 (L) 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** - Enables linear scales for the A-axis.
- 1 **A INVRT LN SCL** - Inverts the A-axis linear scale.
- 2 **A DSBL LS ZTST** - Disables the linear scale Z test.
- 3 **TH SNSR COMP** - Used for Ballscrew 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.
- 4 **A 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129.
- 5 **A NEG COMP DIR** - Negates the direction of thermal compensation.
- 7 **MAX TRAV INP**
- 8 **NO ZERO/NOHOME** - 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 (M) 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** - Enables linear scales for the A-axis.
- 1 **A INVRT LN SCL** - Inverts the A-axis linear scale.
- 2 **DSBL SCALE Z** - Disables the linear scale Z test.
- 3 **A ZERO AXIS TC** - Returns axis to the position specified by the Tool Changer Offset parameter prior to a tool change.
- 4 **A 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129.
- 5 **A NEG COMP DIR** - Negates the direction of thermal compensation.
- 6 **A DELAY AXIS 0** - Used with an APL to ensure A-axis is zeroed before B-axis of APL.
- 7 **A MAX TRAVEL INP** - This bit is set to 1 on five axis machines. This bit indicates that there is a switch (visible through MOCON) that detects if the axis has rotated all the way round. It is used to tell the control to skip the first zero switch when zeroing so it can unwrap the cables.
- 9 **A TEMP SENSOR** - Performs Ballscrew 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 this feature can only be used when temperature sensors are installed.
- 16 **SCALE Z HIST** - For Haas diagnostic use only.



270 (L) 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** - Enables linear scales for the B-axis.
- 1 **B INVRT LN SCL** - Inverts the B-axis linear scale.
- 2 **B DSBL LS ZTST** - Disables the linear scale Z test.
- 3 **TH SNSR COMP** - Used for Ballscrew 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.
- 4 **B 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129
- 5 **B NEG COMP DIR** - Negates the direction of thermal compensation
- 7 **MAX TRAV INP**
- 8 **NO ZERO/NOHOME** - 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 (M) 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** - Enables linear scales for the B-axis.
- 1 **B INVRT LN SCL** - Inverts the B-axis linear scale.
- 2 **DSBL SCALE Z** - Disables the linear scale Z test.
- 3 **B ZERO AXIS TC** - Returns axis to the position specified by the Tool Changer Offset parameter prior to a tool change. On mills with a gimbaled spindle, this bit must be set to 1 on the A and B axes (Parameter 269 and 270) and 0 on all other axes. On all mills with 60 or 120 pocket chain-style tool changer, this bit must be set to 1. It will cause to tool changer offset parameter to be used for tool changes.
- 4 **B 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129.
- 5 **B NEG COMP DIR** - Negates the direction of thermal compensation.
- 6 **B DELAY AXIS 0** - Used with an APL to ensure B-axis is zeroed before A-axis of APL.
- 7 **B MAX TRAVEL INP** - This bit is set to 1 on five axis machines. This bit indicates that there is a switch (visible through MOCON) that detects if the axis has rotated all the way round. It is used to tell the control to skip the first zero switch when zeroing so it can unwrap the cables.
- 9 **B TEMP SENSOR** - Performs Ballscrew 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 this feature can only be used when temperature sensors are installed.
- 16 **SCALE Z HIST** - For Haas diagnostic use only.

271 (L) 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** - Enables linear scales for the C-axis.
- 1 **C INVRT LN SCL** - Inverts the C-axis linear scale.
- 2 **C DSBL LS ZTST** - Disables the linear scale Z test.
- 3 **TH SNSR COMP** - Used for Ballscrew 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.
- 4 **C 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129
- 5 **C NEG COMP DIR** - Negates the direction of thermal compensation
- 7 **MAX TRAV INP**



- 8 NO ZERO/NOHOME** - 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 (M) C SWITCHES

Parameter 271 is a collection of single-bit flags used to turn servo related functions on and off. This parameter is not used when the machine is equipped with a Haas vector drive. 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** - Enables linear scales for the C-axis.
- 1 C INVRT LN SCL** - Inverts the C-axis linear scale.
- 2 DSBL SCALE Z** - Disables the linear scale Z test.
- 3 C ZERO AXIS TC** - Returns axis to the position specified by the Tool Changer Offset parameter prior to a tool change.
- 4 C 2ND HOME BTN** - Moves the axis to coordinate specified in Work Offset G129.
- 5 C NEG COMP DIR** - Negates the direction of thermal compensation.
- 6 C DELAY AXIS 0** - Used with an APL to ensure C-axis is zeroed before A-axis of APL.
- 16 SCALE Z HIST** - For Haas diagnostic use only.

272 X SCREW COMP T. CONST.

Thermal compensation time constant, and is the time constant governing the rate of cool down of the screw.

273 Y SCREW COMP T. CONST.

Thermal compensation time constant, and is the time constant governing the rate of cool down of the screw.

274 Z SCREW COMP T. CONST.

Thermal compensation time constant, and is the time constant governing the rate of cool down of the screw.

275 A SCREW COMP T. CONST.

This parameter should be set to 0.

276 B SCREW COMP T. CONST.

This parameter should be set to 0.

278 (L) COMMON SWITCH 3

Parameter 278 is a collection of general purpose single bit flags used to turn some functions on and off. Left and right cursor arrows are used to select function to change. All values are 0 or 1 only. 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 UNUSED**
- 2 CHECK PALLET IN**
- 3 CHK HIDDEN MACRO VAR**
- 4 DISPLAY ACTUAL rpm** - When set to 1, displays the actual spindle speed on the Current Commands display page.
- 5 TSC PURGE ENABLE**
- 6 HYDRAULIC TAILSTOCK** - Enables the hydraulic tailstock
- 7 SPINDLE DRIVE LOCK** - Must be set to 0 if machine is equipped with a Haas vector spindle drive.
- 8 CHUCK OPEN CSTART** - 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). This feature is ineffective when the CE safety circuit is enabled.
- 9 CONCURRENT 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** - Must be set to 1 in order to enable the Tool Pre-Setter.
- 11 HAAS VECTOR DRIVE** (Haas Vector Drive) - Must be set to 1 if machine is equipped with a Haas vector spindle drive. When set to 1, voltage to the vector drive is displayed in the diagnostics display as DC BUSS.



- 12 **uP ENCLOSURE TEMP** (Microprocessor enclosure temperature) - When set to 1, enclosure temperature will be displayed on INPUTS2 screen of the diagnostics display.
- 13 **HAAS REMOTE JOG HDL** (Haas remote jog handle) - Must be set to 1 if the machine is equipped with a Haas 5-axis Remote jog handle.
- 14 **SPIN MOTOR OTEMP NC** (Spindle Motor Over Temperature Normally Closed) - 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) - Type, (normally open/normally closed) of the subspindle temperature sensor.
- 16 **UNUSED**
- 17 **NO MFIN CKPU** - When it is set, it will prevent checking of MFIN at power-up.
- 18 **DEL:Y SWITCH ENABLE** (Delta Wye switch enable) - 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 **DEL:Y SWITCH ON FLY** (Delta Wye switch enable) - 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 **CHK BARFEED STATUS** - 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 **CHK BF SPIND I-LOCK** - 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.
- 22 **UNUSED**
- 23 **UNUSED**
- 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** - 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** - Enables M154 and M155. It must be set to 1 for all lathes with the C-axis.
- 27 **UNUSED**
- 28 **VSMTC ENABLE**
- 29 **DOOR SAFETY SW INV** - 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.
- 30 **UNUSED**
- 31 **INV SPIND SPD DECEL** (Inverse spindle speed deceleration) - When this parameter is set to 1, the spindle decelerates faster at lower speeds, resulting in a shorter deceleration time.

278 (M) COMMON SWITCH 3

Parameter 278 is a collection of general purpose single bit flags used to turn some functions on and off. This bit will cause the machine to use discrete outputs 21 and 26 to command the shuttle to move in and out. On mills with the Air Driven Shuttle it must be set to 1. On all other mills it must be set to 0. 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 GEARBOX SIGS** - Allows an alternate gearbox configuration. It inverts the sense of the gearbox inputs. Used for 50 taper option.
- 1 **DPR SERIAL** - Causes the main serial inputs/outputs to go through the disk video board.
- 2 **CHECK PALLET INPUT** - If set to 1, the discrete input specified by Parameter 256, Pallet Lock Input is checked prior to the execution of a spindle command. If the input was high (i.e., an open circuit), Alarm 180 would be generated. The input is also checked while the spindle is turning and will generate the same alarm if it goes high. Thus, the input can now be used to stop a program after the spindle has been commanded to turn (such as by a pressure switch from the user's clamp or fixture).
- 3 **CHK HIDDEN MACRO VAR** - Used on horizontal mills only.



- 4 **DISPLAY ACTUAL rpm** - When set to 1, displays the actual spindle speed on the Current Commands display page.
- 5 **TSC PURGE ENABLE** - Enables purge output on TSC option.
- 6 **SINGLE CLAMP SWITCH** - Enables the control to rely upon a single switch to detect the clamp position of the Side-Mount Tool Changer arm. When this bit is set to zero, both the upper and the lower switches are used to detect the arm position. When it is set to one, only the lower switch will be used. This means that the control will not wait until the upper switch is tripped to conclude that the tool is clamped, so subsequent operations can begin immediately. This increases tool change speed.
- 7 **SPINDLE DRIVE LOCK** - Must be set to 1 if machine is equipped with a non-Haas vector spindle drive. This bit must be set to 1 if the machine has a 50 taper spindle or a non-Haas vector drive.
- 8 **UNUSED**
- 9 **CONCURRENT SPINDLE** - When set to 1, the spindle will be commanded to start concurrently with other commands in the same block. In the following example, with this bit set to 1, the spindle will start at the same time as the rapid move: **G0 X-1. S7500 M3;**
- 10 **HS3 HYDRAULIC TL CH** - Used with the 38-tool SMTc on the HS-3. When this is set to zero, the mill will behave normally. When it is set to 1, the control will recognize that the toolchanger is a 38-tool SMTc.
- 11 **HAAS VECTOR DRIVE** - 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 ENCLOSURE TEMP** (Microprocessor Enclosure Temperature) - When set to 1, enclosure temperature will be displayed on INPUTS2 screen of the diagnostics display.
- 13 **HAAS REMOTE JOG HDL** (Haas Remote Jog Handle) - Must be set to 1 if the machine is equipped with a Haas 5-Axes Remote Jog Handle.
- 14 **SPIN MOTOR OTEMP NC** (Spindle Temperature Sensor Normally Closed) - Type (normally open/normally closed) of the spindle temperature sensor. This bit should be set to 1.
- 15 **AIR DRIVE SHUTTLE** - Causes machine to use discrete outputs 21 and 26 to command the shuttle to move in and out. On mills with the Air Driven Shuttle it must be set to 1. On all other mills it must be set to 0.
- 16 **GIMBAL SPINDLE** - Used on 5-axes mills. Causes the machine to check that the Z, A, and B axes are at zero before a tool change is started. If one is not, Alarm 150 will be generated. On mills with the gimbaled Spindle it must be set to 1. On all other mills it must be set to 0.
- 17 **NO MFIN CHK ON P-UP** - When this bit is set, it will prevent checking of MFIN at power-up. It should be set for 1 for all machines that have the Haas Automatic Pallet Changer attached, and 0 for all other machines.
- 18 **DEL:Y SWITCH ENABLE (Delta Wye switch enabled)** - Used for the Vector Drive. Enables the switching of spindle motor windings, provided the hardware Enable is installed, and the proper parameters are set. If this switch is set, but bit 19 is not, the winding switching will only be done when the spindle is at rest, depending on the target speed of the spindle.
- 19 **DEL:Y SWITCH ON FLY** - Enables switching on the fly, as the spindle motor is accelerating or decelerating through the switch point. If bit 18 is not set, this switch will be ignored.
- 20 **5 AX TOFS -X** - Used with G143 (modal 5 axes tool length compensation) on machines with a gimbaled spindle. If it is set to 1, this means that when the corresponding rotary axis is moved, the sign of the X Position must be inverted. Normally, this bit should be set to 0.
- 21 **5 AX TOFS -Y** - Used with G143 (modal 5 axes tool length compensation) on machines with a gimbaled spindle. If it is set to 1, when the corresponding rotary axis is moved, the sign of the Y Position must be inverted. Normally, this bit should be set to 0.
- 22 **B+C 5 AXES** - Used with G142 (modal 5 axes tool length compensation) on machines with a gimbaled spindle. The B-axis normally moves the A-axis, but if this is not true, this bit can be set to change which is the inner axis. Normally, this bit should be set to 0.
- 23 **TL CHGR DOOR SWITCH** - Horizontal tool carousel door configuration. This bit specifies the Horizontal Mill tool carousel door configuration. If it is set to 0, it indicates the configuration where the door is driven open by a timed operation. If it is set to 1, it indicates the configuration where the door is spring-loaded closed and is driven open by the timed operation against the door open switch. In open position, the door switch signal is 0 (low). Switch status is checked before and after commanding the door to open to be fail-safe. For all horizontal mills that have the switch installed, this bit must be set to 1. For all other mills, this bit must be set to 0.
- 24 **HS2 SMTc CAROUSEL**
- 25 **HS3 SMTc CAROUSEL**



26 S MNT BIT 1 - Bits 26, 27, and 28 work together to specify the type of sidemount tool changer that is installed on a vertical mill. The following table shows the bit combinations that must be used:

Bit	26	27	28	
	0	0	0	No side-mount tool changer installed
	1	0	0	Serpentine 1
	0	1	0	Serpentine 2
	1	1	0	Serpentine 3
	0	0	1	Disk 1
	1	0	1	Disk 2
	0	1	1	Disk 3
	1	1	1	Disk 4

27 S MNT BIT 2 - Bits 26, 27, and 28 work together to specify the type of sidemount tool changer that is installed on a vertical mill.

28 S MNT BIT 3 - Bits 26, 27, and 28 work together to specify the type of sidemount tool changer that is installed on a vertical mill.

29 DOOR SAFETY SW INV - Supports the CE door interlock that locks when power is turned off.

30 SWAP A & C AXES - Causes the A and C axes to be swapped internally.

31 INV SPIND SPD DECEL (Inverse Spindle Speed Deceleration) - When this parameter is set to 1, the spindle decelerates faster at lower speeds, resulting in a shorter deceleration time.

279 (M) X SCALE GAIN MULT

Used on machines with linear scales. Linear scales are used to continuously correct any errors in the encoder position. The parameter determines the gain of the correction factor; that is, how fast it corrects, and should be set to 40.

280 (M) Y SCALE GAIN MULT

See Parameter 279 for description.

281 (M) Z SCALE GAIN MULT

See Parameter 279 for description.

282 (M) A SCALE GAIN MULT

See Parameter 279 for description.

283 (M) B SCALE GAIN MULT

See Parameter 279 for description.

284 RESERVED

285 X LINEAR SCREW OFFS

Used on machines with linear scales. This parameter accounts for the unused portion of the ballscrew between zero and the actual motor.

286 Y LINEAR SCREW OFFS

See Parameter 285 for description.

287 Z LINEAR SCREW OFFS

See Parameter 285 for description.

288 A LINEAR SCREW OFFS

See Parameter 285 for description. N/A for lathes.

289 B LINEAR SCREW OFFS

See Parameter 285 for description. N/A for lathes.

291 (L) HYDRAULIC TAIL STK NO MOTION DETEC TIME

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.

**291 (M) A AXIS BRAKE OIL TIME**

Supports the EC-1600 A-axis brake oil sensor. The units are seconds. When this parameter is set to a non-zero number and the sensor indicates a low oil condition for more than that amount of time, the control will cause the red beacon to flash and display the message LOW BK OIL on the screen. If the low oil condition continues, Alarm 643, Low Brake Oil A-axis will be generated when the program ends.

292 (L) HYD TS RTRACT MARGN (Hydraulic Tailstock Retract Margin)

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.

292 (M) AUTO DOOR PAUSE

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. It works in conjunction with Parameter 293.

293 (L) HYD TS SLOW DISTNCE (Hydraulic Tailstock Slow Distance)

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.

293 (M) AUTO DOOR BUMP

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 292. This causes the motor to close the door fully and smoothly. This parameter should be set to 2 (0.04 seconds) nominally.

294 MIN BUSS VOLTAGE

Minimum Haas Vector Drive buss voltage. It should be set to 200 (the units are volts). Alarm 160 will be generated if the voltage falls below this value.

295 (M) SHTL SETTLE TIME

Used on mills with an air driven shuttle. Allows settling time for the shuttle after it has moved toward the spindle and before a tool change is performed. It should be set to approximately half a second (500) on all mills with the air driven shuttle. This may vary. All other mills can be set to 0, since they are unaffected.

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 (L) 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 Subspindle Rigid Tap when the tool has reached the bottom of the hole and must reverse direction to back out.

298 (M) MAX FEED (DEG/MIN)

Used on 5-axis mills. Maximum rotary feedrate in degrees per minute. Any attempt at cutting faster than this will result in "LIM" being displayed next to the Feed message on the Program Command Check screen. On mills with a gimbaled spindle, this parameter must be set to 300. For all other mills, it should be set to 99999.

299 AUTOFEED-STEP-UP

Works with Autofeed. It specifies the feedrate step-up percentage per second and should initially be set to 10.

300 AUTOFEED STEP-DOWN

Works with the Autofeed feature. It specifies the feedrate step-down percentage per second and should initially be set to 20.



301 AUTOFEED-MIN-LIMIT

Works with the Autofeed feature. It specifies the minimum allowable feedrate override percentage that the Autofeed feature can use and should initially be set to 1.

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

NOTE: In Lathes, last commanded feedrate is restored at the end of the program execution, or when the operator presses Reset or turns off Autofeed.

NOTE: In Lathes, the operator may use the feedrate 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 feedrate will be recognized as the new commanded feedrate by the Autofeed feature. However, if the tool load limit has already been exceeded, the control will ignore the feedrate override buttons and the commanded feedrate will remain unchanged.

302 (M) FEED ACCEL MEDIUM

Supports the motion control feature. This is the acceleration that applies to feed motion in encoder steps per second squared selected by Setting 191 or the G187 command. For vertical mills, 1/2 of the value of Parameter 7 is a good starting point.

303 (M) FEED T CONST MEDIUM

Supports the motion control feature. It is the base 2 exponent of the feed time constant in milliseconds when Medium smoothness is selected by Setting 191 or the G187 command.

304 (L) SPINDLE BRAKE DELAY

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.

304 (M) SPIGOT REV POS DLY

Length of a delay (units are ms) when moving the coolant spigot in reverse. This parameter should be set to zero on all machines.

305 (L) SERVO PO BRK DLY

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.

305 (M) SERVO PO BRK DLY

The **SRV PO** (Servo Power On) discrete output is used to engage and disengage an axis brake. This parameter is used to specify a time in milliseconds that the control should wait after activating the **SRV PO** output and turning off power to the servo motors via the MOCON. This parameter also specifies the time to wait after deactivating the **SRV PO** output and reactivating the servo motors via the MOCON.

306 (M) POCKET UP/DN DELAY

Supports the side-mount tool changers. It specifies the time allowed (in milliseconds) for the tool pocket to be raised or lowered. If the pocket does not move to its commanded position within the time allowed by this parameter and by Parameter 62, Alarm 626, Tool Pocket Slide Error is generated.

307 (M) POCK UN/LOCK DELAY

Supports the side-mount tool changers. It specifies the time allowed (in milliseconds) to lock or unlock a tool pocket. For mills without a side-mount tool changer, this parameter should be set to 0.

308 (M) ARM ROTATE TIME

Supports the side-mount tool changers. It specifies the time allowed (in milliseconds) for the arm to rotate to the next position. The positions are, Clamp, Unclamp, and Origin. If the arm does not move to the commanded position within the allowed time, Alarm 622, Tool Arm Fault is generated. For mills without a side-mount tool changer, this parameter should be set to 0.



309 (M) MOTOR COAST TIME

Supports side-mount tool changers. It specifies time allowed for the tool changer to start only. If the arm has not moved after the allowed time, Alarm 627, ATC Arm Position Timeout is generated. Units are milliseconds.

310 (M) CAM LOCK DELAY

Supports side-mount tool changers. It specifies the time allowed (in milliseconds) to lock the cam by pushing the shot pin in, or to unlock the cam by pulling the shot pin out. If the shot pin has not moved to its commanded position within the allowed time, Alarm 625, Invalid TC Start Condition is generated.

311 (M) ARM BUMP TIME/DEG

Supports side-mount tool changers. During tool change recovery, the arm may be moved a small amount by pressing the ATC FWD or ATC REV key. Each press of the key will cause the arm motors to run for the amount of time (in milliseconds) specified by this parameter. For mills without a side-mount tool changer, this parameter should be set to 0.

For the high speed tool changer, this parameter specifies the number of thousandths of degrees to bump the arm (i.e., 1000 = 1 deg.)

On horizontal mills with a side-mount tool changer, the arm may be rotated a small amount by pressing the End or Page Down keys. The shuttle may be moved by pressing the Left Arrow or Right Arrow keys. Each press of the key causes the motor to run for the amount of time (in milliseconds) specified by this parameter.

312 (M) CAROUSEL BUMP TIME

Supports side-mount tool changers. During tool change recovery, the carousel may be moved a small amount by pressing the Left Arrow or Right Arrow key. Each press of the key will cause the carousel motors to run for the amount of time (in milliseconds) specified by this parameter. For mills without a side-mount tool changer, this parameter should be set to 0.

313 (M) POCKET INCREMENT

Used for the bridge mill. Under normal circumstances it should be set to 1. If, for example, it is set to 2, the control will only recognize every other pocket; that is, it will treat the tools and pockets as follows:

Tool 1 is in pocket 1
Tool 2 is in pocket 3
Tool 3 is in pocket 5
Tool 4 is in pocket 7
etc...

If this parameter is set to 3, the control will only recognize every third pocket, and so on. **It is the operator's responsibility to ensure that the total number of pockets in the tool changer is evenly divisible by this parameter value.** If not, the control will pick the wrong pocket after the carousel has exceeded a full revolution.

314 (M) FEED DELTA V MEDIUM

Supports the motion control feature. It is the maximum change in velocity (in encoder steps per millisecond) allowed between motion steps when Medium smoothness is selected by Setting 191 or the G187 command. The basic value is given by the formula: $(\text{Feed Delta V}) = (\text{Feed Accel}) \text{ times } 2 \text{ to the power of } (\text{Feed T Const}) \text{ divided by } 1 \text{ million.}$

315 (L) COMMON SWITCH 4

- 0 **ALIS M GRPHC** - All user defined M codes (such as M50) are 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, set this bit to 1.
- 1 **NO SPIND CAN CYCLE**
- 2 **UNUSED**
- 3 **UNUSED**
- 4 **UNUSED**
- 5 **DOOR OPEN SWITCH** - 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.
- 6 **SIMPLE TAILSTOCK** - 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 **BRUSHLESS BAR FEEDER** - Supports the brushless bar feeder. When it is set to 1, it indicates that a brushless bar feeder is present.
 - 8 **MINI POWER SUPPLY** - 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 that Parameter 294, Min Buss Voltage must be set to zero on all Mini Lathes.
 - 9 **AUTO PARTS LOADER** - 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 **ZERO RET ON C ENGAGE** - 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 gearbox) before engaging the C-axis.
 - 11 **SETTING 92 ENABLE** - 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 E-Stop 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 SPIND ENCODR** - Reverses sense direction of subspindle encoder
 - 17 **SS VEC DRIVE ENCODR** - 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** - 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 SWITCH ENABL** (Delta Wye switch enable) - 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 SWITCH ON FLY** (Delta Wye switch on the fly) - 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 DISABLE GEARBOX** - Disables gearbox 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 TURING CENTER** This bit is used for the VTC-48.
 - 24 **SS INVERT GEARBOX** - Allows 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 **POWER DISCONN RELAY** - 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.
 - 26 **STATUS RELYS**
 - 27 **SS NONINV SPD STOP** - Sub-spinlde non-inverted spindle stopped status.
 - 28 **UNUSED**
 - 29 **RND5 TRM/TRL**
 - 30 **RND5 HANDWHEEL**
 - 31 **INTUITIVE PROG SYS** - When it is set to 1, the Intuitive Programming System is activated.
- 315 (M) COMMON SWITCH 4**
- 0 **ALIS M GRPHC** - When this bit is set to 0, all user defined M codes (such as M50, normally used to do a pallet change on a horizontal mill) are ignored when a program is run in graphics mode. If it is necessary to have graphics recognize such M codes, this bit should be set to 1.
 - 1 **GANTRY**



- 2 **NO X MOVE NEXT TOOL** - Horizontal mills only, primarily intended for use on the HS-3. If this bit is set to zero, it will have no affect. If it is set to one, the X-axis will not move following a Next Tool button press. The reason for this is because after pressing Next Tool on an HS-1 or HS-2, the spindle, which is mounted on the X-axis, is moved closer to the operator so the next tool can be manually installed. On an HS-3, the X-axis is on the table and there is no advantage to moving it. Setting this bit to one will save time.
- 3 **EXTRA-LARGE TOOLS** - Specifies that large tools are considered to be extra large, and allows the Tool Pocket table to be set up as shown below. This parameter bit should be set to 1 on all mills with the 50 Taper Side-Mount Tool Changer. It will enable the control to recognize tools that occupy three pockets. An example of a tool pocket table with extra large tools:

1 –
2 L
3 –
4 –
5 L
6 –

When this parameter bit is set to 1, the following tool pocket configuration is not allowed (see Alarm 422).

–
L
–
L
–

- 4 **HIGH SPD MACHINING** - Enables the High Speed Machining feature. It requires an unlock code in order to set the bit to 1. This option requires the Floating Point Co-Processor and Floating Point software. If this option is turned on when non-floating point software is installed, the High Speed option will have no effect.
- 5 **FAEMAT SPINDLE** - Controls the tool clamp and unclamp sequence for different spindles. This improvement is intended primarily for the VB-1 bridge mill.
- 6 **MANUAL TOOL CHANGER** - Must be set to 1 when a TM-1 has no tool changer, and zero when it has a tool changer. When set to 1, M06 will stop the program and display a message requesting the operator to change tools manually.
- 7 **RESET STOPS PAL CHG** - Enables the Reset button to stop a pallet change. It is intended for use with the future hard-coded pallet changer macro program. It should be set to zero.
- 8 **MINI POWER SUPPLY** - When Parameter 315, bit 8, Mini Mill is set to 1, the Over Voltage discrete input will be displayed as P.S. Fault. When it is set to 1:
- (a) DC BUSS voltage displayed on the diagnostics screen for a vector drive machine is not displayed.
 - (b) Conditions that would normally generate Alarm 119, Over Voltage and Alarm 160, Low Voltage will instead generate Alarm 292, 320V Power Supply Fault. This alarm will be added to the alarm history only after a 1 second delay, to prevent false 292 alarms being added to the alarm history at the moment power is turned off. This parameter bit must be set to 1 on all Mini Mills.
- 9 **DOOR OPEN SWITCH** - Allows the software to work with an optional door-open switch. This bit should be set to 1 on machines fitted with the second door switch. If this bit is set to 1, the control will look for a second door switch when the door is opened automatically to the fully open position. If the switch is not found, Alarm 238, Door Fault will be generated. If this bit is set to zero, the control behaves as before.
- 10 **PALLET HARDCODE** - Supports the hard-coded APC pallet changer function. It must be set to 1 when an APC is present that is wired for two APC door switches. On all other machines, it must be set to 0.
- 11 **M50 CLOSES DOOR** - The MDC-1 pallet changer station auto door closes before an M50 pallet rotate and opens afterward, provided this parameter bit is set to 1. If the bit is set to zero, a flashing message directing the operator to close the pallet changer door (manually or by pushing the Part Ready button) will be displayed and the pallet change will not occur until the door is closed. Note that the door will not close automatically if the Pallet Schedule Table is used to schedule a pallet.
- 12 **MANUAL JOG TRM/TRL** - Enables the manual jog feature for the Tool Room Mill's handwheels.
- 13 **SAFTY SWITCH** - When set to zero, the control behaves as normal. When it is set to 1, the Toolroom Mill's safety switch must be pressed by the operator for controlled motion to start or continue.
- 14 **FOURTH AXIS** - Prevents unauthorized use of the 4th (A) axis. It can only be set to 1 with a magic code. When it is set to zero, it prevents the user from altering Setting 30 and prevents the user from zeroing the Parameter 43, Disabled bit. When this parameter bit is changed to zero, Setting 30 will be returned to Off and the Parameter 43, Disabled bit will be set to 1.



- 15 FIFTH AXIS** - Prevents unauthorized use of the 5th (B) axis. It can only be set to 1 with a magic code. When set to zero, it prevents the user from altering Setting 78 and from zeroing the Parameter 151, Disabled bit. When this parameter bit is changed to zero, Setting 78 will be returned to Off and the Parameter 151, Disabled bit will be set to 1. Note that when Parameter 209, Horizontal is set to 1, Setting 78 is unavailable and not displayed because the B-axis is used for the tool changer.
- 16 TOOL CAGE DOOR** - Supports the machines fitted with the side-mount tool changer cage door.
- 17 VIBRATION SENSOR** - Enables the vibration sensor. When it is set to 1, the output from the sensor will be converted to Gs and displayed on the Current Commands Tool Load screen. When this parameter is set to zero, No Sensor will be displayed instead.
- 18 HIGH Z TOOL CHANGER** - Setting this parameter to 1 and commanding either a G28 move of all the axes, or pressing Second Home will cause the Z-axis to move to the maximum position prior to moving to machine zero. When this parameter is set to zero, the Z-axis will move directly to machine zero. Previously, the Z-axis would move directly to machine zero regardless of this parameter bit. This enhancement was made primarily for the Gantry Router mills.
- 19 PAL LOAD AUTODOOR** - Tells the control that the pallet changer has an automatic door, as opposed to the operator Auto Door feature.
- 20 MAP 4TH AXIS** - Enables the Rotary Index button at the load station and prevents movement of the rotary outside of the work area (i.e., rotary mounted on the outside pallet position).
- 21 INV PAL DOOR SWITCH** - Must be set to 1 on the MDC1 and zero on all other machines. This bit indicates the polarity of the pallet changer door closed switch.
- 22 PAL RECIEVER SWITCH** - Supports the APC pallet receiver position switch. When the switch is present, the bit must be set to 1; otherwise, it must be set to zero.
- 23 RAPID -> HS FEED** - Enables straight line rapid moves. Normally, during a rapid move of two or more axes, the axis with the shorter distance will finish first. When this parameter is set to 1, the control will treat rapid moves as high-speed feeds, and all axes will complete their motion at the same time.
- 25 POWER DICONN RELAY** - When set to zero, the machine behaves as before. When set to 1, Parameter 57, Safety Circ is set to 1, and the door is opened, I Gain on all axes will be cleared. With the door closed and power to the servos restored, the I Gain values will be restored. This is intended for use in conjunction with special hardware by customers who require the servo power to be cut when the door is opened.
- 26 STATUS RELAYS** - Supports Machine Data Collection. The default value for all machines is zero.
- 27 UNUSED**
- 28 ADVANCED TOOL MGMT.** - Allows the user to specify groups of tools. When the life of a tool (based on feed time, total time, usage, number of holes, tool load, or vibration) has expired, the control will automatically use another tool from the same group. When all the tools from a group are used up, the control will alarm.
- 29 RND5 TRM/TRL** - This parameter is intended for the tool room machines. When it is zero, the machine behaves as before. When it is set to 1, all X and Z position displays are rounded to .0005. This does not affect programming.
- 30 RND5 HANDWHEEL** - This parameter is intended for the tool room machines. When it is zero, the machine behaves as before. When it is set to 1, and the user is jogging an axis using the manual handle-wheels, the position displays will be rounded to .0005. This will not affect the operation of the standard jog handle or programming.
- 31 INTUITIVE PROG SYS** - When set to 1, the Intuitive Programming System is activated.
- 316 (L) MEASURE BAR RATE**
Supports the Haas Servo Bar 300 bar feeder. It is the rate at which the bars are measured. Units are inches*1000.
- 316 (M) APC PAL. CLAMP TIME**
Time required to clamp the APC pallet to the receiver. Units are milliseconds.
- 317 (L) MEASURE BAR INC**
Supports the Haas Servo Bar 300 bar feeder. This is the increment used for bar measurement. Units are inches*10,000
- 317 (M) APC UNCLAMP TIME**
Time required to unclamp the APC pallet from the receiver. Units are milliseconds.

**318 (L) GEAR MOTOR TIMEOUT**

Supports the Haas Servo Bar 300 bar feeder. This is the timeout value for gearmotor operations. Units are in milliseconds.

318 (M) APC PAL. CHAIN TIME

Time required to cycle the chain. It should be set to 8000. Units are milliseconds.

319 (L) MAX RETRACT POS

Supports the Haas Servo Bar 300 bar feeder. This is the maximum V axis position when retracted. Units are inches * 10000.

319 (M) APC DOOR CLOSE TIME

Time required to close the door. It should be set to 6000. Units are milliseconds.

320 (L) MIN RETRACT POS

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

320 (M) RP DRAWBAR DOWN

Time required for the drawbar to move down. Units are milliseconds.

321 (L) PUSH ROD ZERO POS

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

321 (M) RP DRAWBAR UP TIME

Time required for the drawbar to move up. Units are milliseconds.

322 (L) GEARMOTOR BUMP TIME

Supports the Haas Servo Bar 300 bar feeder. Gear motor run time for bump and internal functions. Units are in milliseconds.

323 (L)PUSH RATE

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

324 (L) GEAR MOTOR SETTLE

Supports the Haas Servo Bar 300 bar feeder. This is the minimum dwell time for reversing the gear motor direction. Units are in milliseconds.

325 (L)STANDARD BAR LEN

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

326 (L) G5 DECELERATION

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 SCALES PER INCH

Used on machines equipped with linear scales.

328 Y SCALES PER INCH

Used on machines equipped with linear scales.

329 Z SCALES PER INCH

Used on machines equipped with linear scales.

330 A SCALES PER INCH

Used on machines equipped with linear scales.

331 B SCALES PER INCH

Used on machines equipped with linear scales.

**333 X SCALES PER REV**

Used on machines equipped with linear scales.

334 Y SCALES PER REV

Used on machines equipped with linear scales.

335 Z SCALES PER REV

Used on machines equipped with linear scales.

336 A SCALES PER REV

Used on machines equipped with linear scales.

337 B SCALES PER REV

Used on machines equipped with linear scales.

339 X SPINDLE THERM COEF.

Supports Spindle Head Thermal Compensation feature.

340 Y SPINDLE THERM COEF.

See Parameter 339 for description.

341 Z SPINDLE THERM COEF.

See Parameter 339 for description.

342 A SPINDLE THERM COEF.

See Parameter 339 for description.

343 B SPINDLE THERM COEF.

See Parameter 339 for description.

345 X SPINDLE THERM TIME.CONST.

Supports Spindle Head Thermal Compensation feature.

346 Y SPINDLE THERM TIME.CONST.

See Parameter 345 for description.

347 Z SPINDLE THERM TIME.CONST.

See Parameter 345 for description.

348 A SPINDLE THERM TIME.CONST.

See Parameter 345 for description.

349 B SPINDLE THERM TIME.CONST.

See Parameter 345 for description.

351 THRM L SENSOR OFFSET

Used for Ballscrew Thermal Compensation via a temperature sensor attached to the ball nut.

352 RELAY BANK SELECT

Allows the user to change which bank of relays is to be used (Parameter 209, bit 23, MCD RLY BRD assumes that relay bank one 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. This parameter requires a revision "S" I/O board. If a previous board is installed (without the additional banks of relays), this parameter should be set to zero.

Bank #	Relay Location	Description
0	I/O PCB	Internal machine functions.
1	I/O PCB	User relay outputs (some may be used for internal functions).
2	1st M-code PCB	8M option. 8 additional user outputs.
3	2nd M-code PCB	Typically used for built in options such as, side-mount tool changer, etc.

353 (L) MAX SUBSPINDLE RPM

Maximum rpm available to the subspindle, and works in conjunction with parameters 570 and 571.

**354 (L) U SWITCH A**

See Parameter 1 for description.

390 (L) V SWITCH A

See Parameter 1 for description.

426 (L) W SWITCH A

See Parameter 1 for description.

430 (M) W RATIO (STEPS/UNIT)

For the EC-300 and MDC-1, this parameter is set to 57344. This parameter controls the rotation of the pallet. When a pallet change is performed, the pallet will rotate 180 degrees. It is essential that this parameter is checked after a software upgrade.

498 (L) C SWITCH A

See Parameter 1 for description.

570 (L) SUBSPIN ENC ST/REV

Sets the number of encoder steps per revolution of the subspindle encoder.

571 (L) SUBSPINDLE ST/REV

Sets the number of encoder steps per revolution of the subspindle. It only applies to the subspindle rigid tapping option.

572 (L) 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 (L) 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 (L) 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. Units are milliseconds and should be set to 250 for all lathes.

575 (L) THRD PTCH FACT PPM

Allows the customer to factor the feedrate on G32, G76 and G92 threading as necessary for particular applications. The units are ppm (parts per million.) This parameter can be adjusted, 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.

576 (L) 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 (L) 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 (L) 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 (L) 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 (L) TS HYD RETRACT TIME

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 affect when Simple TS is set to 1.

581 (L) APL FLIPPER SETTLE

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 (L) APL FLIPPER TIME OT

Supports the Haas Lathe APL. Units are milliseconds.

583 (L) APL MAX POSITIONS

Supports the Haas Lathe APL. It specifies the number of switch positions in rotation.

584 (L) APL GRIP OPEN TIME

Supports the Haas Lathe APL. It specifies the maximum allowable time for opening the gripper. Units are milliseconds.

585 (L) APL GRIP CLOSE TIME

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

Maximum allowable spindle rpm after the door has been opened manually or commanded open by an M80. 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.

587 (L) EXTENDED PUSH TIME

Supports the bar feeder pusher rod which is mounted on the bar feeder trolley (for bar feeders 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

This axis parameter works in place of the axis parameters **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** is 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.

600 PEAK SPIN. PWR (KW)

Supports the spindle kilowatt (KW) load display that appears on the current commands page, next to the spindle load percentage. It should be set to the peak power output in KW for the spindle motor.

601 (M) TOOL CHANGE DELAY

On a mill where the operator must be warned that a running program doing a tool change (no enclosure) it will beep and delay for the duration specified by Parameter 601. If Parameter 601 is set to zero, there will be no beep or delay. If the operator changes tools by pressing buttons on any kind of tool changer, there will be no beep or delay. If the machine has a manual tool changer and M06 is commanded from a running program, there will be no beep or delay. The control will stop and prompt the operator to manually insert the tool.

602 (L) CHUCK FACE DISTANCE

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

605 (M) PALLET CHANGER TYPE

Defines the type of pallet changer on the machine. Also see Parameter 606

606 (M) NUMBER OF PALLETS

Number of pallets present in the installed pallet changer. Also see Parameter 605.

Pallet Changer	Parameter 605	Parameter 606
APC (Pallet Ready button)	0	2
APC (Schedule Pallet Buttons)	2	2
Rotary Pallet Changer (HS 1/2)	1	2
Quad APC	2	4
MDC-1 / EC300	3	2
EC400	4	2
2 Pallet APC	2	2

611 (L) BAR FEEDER TYPE

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.

612 (M) SPIGOT TYPE

Supports the programmable coolant spigot. Type 0 uses the peaks of the spigot fan for positioning. Type 1 uses the peaks and valleys of the spigot fan for positioning. All other values are treated the same as type 0. Note that if Parameter 253, Spigot Fwd Pos Dly and Parameter 304, Spigot Rev Pos Dly are non-zero, type 1 processing uses those values; otherwise, the type 1 processing calculates the delay value for positioning from Parameters 613 and 614.



613 (M) SPIGOT FWD MTR DLY

Supports the programmable coolant spigot. It specifies the delay time in ms from the moment the spigot motor is turned off, to the moment the spigot is stopped in the forward direction.

614 (M) SPIGOT REV MTR DLY

Supports the programmable coolant spigot. It specifies the delay time in ms from the moment the spigot motor is turned off, to the moment the spigot is stopped in the reverse direction.

616 (L) SS LUBE CYCLE TIME

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 (L) SS SPIN.FAN OFF DEL

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.

618 (M) TC CAROUSEL TYPE

This parameter supports the Servo Side Mount Tool Changer. It should be set to 1 for the standard DC motor tool carousel and 2 for the servo tool carousel.

619 (L) PRE GEAR CHANGE DLY

Delay time (in milliseconds) 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.

620 (M) X-AXIS PLUS TRAVEL LIMIT

Note that only Parameters 623 and 624 for the A and B axes are intended to be used, and only on the Trunnion Mills (VF5TR and VF6TR) where it is necessary to place the home switch in the middle of the travel range (in order to keep the table flat when at the home position) and limit movement to +/-120 degrees. The **Plus Travel Limit** parameter is used to store the number of encoder steps that a rotary can take in the plus direction from its current home position. The control takes into account these updated travel limits for jog and feed conditions. For example, if the steps/unit on the A-axis is 4000 and the **Plus Travel Limit** is set to 20000, the control will allow the A rotary to go up to +5 degrees before stopping (assuming that the encoder scale factor is set to zero). The same applies for the B-axis. This feature will enable the home switch to be moved to any desired location so that a rotary can make the proper orientation during zero return. Note that Parameter 591 and 592, **AB Enc. Scale Factor** will be applicable in determining the limits. If this parameter is set to 3, in the above example the rotary will be allowed to go up to +15 degrees due to encoder scaling. Similar results will be achieved when the **SCALE FACT/X** bit is set to 1 (based on **SCALE/X LO** and **SCALE/X HI** bits = 0). To deactivate this feature on any axis, the **Plus Travel Limit** should be set to zero.

621 (M) Y-AXIS PLUS TRAVEL LIMIT

See Parameter 620.

622 (M) Z-AXIS PLUS TRAVEL LIMIT

See Parameter 620.

623 (M) A-AXIS PLUS TRAVEL LIMIT

See Parameter 620.

624 (M) B-AXIS PLUS TRAVEL LIMIT

See Parameter 620.

629 (M) Sp-AXIS PLUS TRAVEL LIMIT

See Parameter 620.

626 (M) U-AXIS PLUS TRAVEL LIMIT

See Parameter 620.

627 (M) V-AXIS PLUS TRAVEL LIMIT

See Parameter 620.

628 (M) W-AXIS PLUS TRAVEL LIMIT

See Parameter 620.



630 (M) Tt-AXIS PLUS TRAVEL LIMIT

See Parameter 620.

644 (M) X-AXIS INDEXER INCREMENT

Note that only Parameters 647 and 648 for the A and B axes are intended to be used, and only on Horizontal Mills fitted with a Rotary Indexer. The Rotary Indexer is a device that holds a part to be machined and rotates in one-degree increments. It can rotate only in rapid motion (G00), it cannot rotate in a feed motion (G01). It can be jogged by pressing a jog button, or with a jog handle. Before it can be rotated, air is applied to lift the indexer from its clamped position. The message, **A UNCLMP** (for example) will appear at the bottom of the screen, and remain as long as the rotary indexer is in the up position. When the commanded position is reached, the indexer will automatically move forward or backward to the closest proper locking angle, then settle into its clamped position. The locking angle is computed from the **Indexer Increment** parameter which is in units of one-thousandth of a degree. For example, if the A-axis **Indexer Increment** parameter is set to 1000 (1.0 degrees) and the A-axis is jogged to 25.5 degrees, when the operator leaves jog mode, the indexer will automatically settle and clamp itself at 26.0 degrees. If the parameter contains a 1 (one-thousandth of a degree) or less, the rotary indexer feature is turned off and a regular rotary platform is assumed.

632 (L) X AXIS MOCON CHANNEL

Enables each axis to be mapped to a particular MOCON channel.

633 (L) Y AXIS MOCON CHANNEL

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

634 (L) Z AXIS MOCON CHANNEL

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

635 (L) A AXIS MOCON CHANNEL

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

636 (L) B AXIS MOCON CHANNEL

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

637 (L) C AXIS MOCON CHANNEL

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

638 (L) X AXIS MOCON CHANNEL

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

639 (L) Y AXIS MOCON CHANNEL

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

640 (L) Z AXIS MOCON CHANNEL

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

641 (L) A AXIS MOCON CHANNEL

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

642 (L) B AXIS MOCON CHANNEL

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

643 (L) C AXIS MOCON CHANNEL

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

645 (M) Y AXIS INDEXER INCREMENT

See Parameter 644.

646 (M) Z AXIS INDEXER INCREMENT

See Parameter 644.

647 (M) A AXIS INDEXER INCREMENT

See Parameter 644.

**648 (M) B AXIS INDEXER INCREMENT**

See Parameter 644.

650 (M) U AXIS INDEXER INCREMENT

See Parameter 644.

651 (M) V AXIS INDEXER INCREMENT

See Parameter 644.

652 (M) W AXIS INDEXER INCREMENT

See Parameter 644.

653 (M) Sp AXIS INDEXER INCREMENT

See Parameter 644.

654 (M) Tt AXIS INDEXER INCREMENT

See Parameter 644.

659 (M) INDEXER DOWN TIMEOUT

Supports indexer rotary table. It specifies time (in ms) allowed for seeking indexer Down-switch. If switch is not detected within allowed time, Alarm 960, Indexer Switch not Found in Time is generated. When it is set to zero, the feature is bypassed. Parameter 69, Air Brake Delay is used as allowed time for seeking the Up-switch. If switch is not detected within the allowed time, Alarm 925, A Indexer is not Fully in the Up Position is generated.

680 – 689 (M) LEAD COMPENS SHIFT

Amount of shift needed for proper indexing into the Lead Screw Compensation table. Note that these parameters are very similar to Parameter 58. The difference is that these parameters hold a non-zero value, they take precedence over the general Parameter 58. For example:

Param 58 [LEAD COMPENS SHIFT] = 14 (General Parameter)

Param 683 [A LEAD COMPENS SHIFT] = 12 (Axis Parameter A)

Param 684 [B LEAD COMPENS SHIFT] = 0 (Axis Parameter B)

In the above example, the A-axis will take its lead screw shift value from Parameter 683 since it is a non-zero value, but the B-axis will get its shift value from Parameter 58 (NOT from Parameter 684). Determining the appropriate value for lead screw compensation: assume Steps Per Unit on A is 2800 (Parameter 47).

- Take steps per unit and multiply by 360 (unscaled) $2800 \times 360 = 1008000$.
- Apply Enc. scale factor (if present). For example, with a scale factor set to 3, we have: $(1008000/3) = 336000$.
- Determine smallest number 'n' that holds inequality: $336000/(2^n) < 256 \Rightarrow 336000/(2^{11}) < 256$; so $n = 11$
- Therefore, set Parameter 683 to 11.

671 (M) INDEXER DOWN SETTLE

Supports the indexer rotary table. It specifies the amount of time (in ms) the machine is allowed to settle after detecting the indexer Down-switch. If the parameter is zero, the feature is backward compatible.

692 (L) STEADY REST OUTPUT

Supports the steady rest option. If a lathe has the option, it 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 (L) STEADY REST INOUT

Supports the steady rest option. If a lathe has the option and a foot pedal for the steady rest, it 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.

696 (M) MOM TYPE

Turns the MOM option ON.

697 (M) MOM PURGE SIZE (MS)

Sets pump ON time (in milliseconds).

698 MOM PURGE OFF TIME

Sets pump off time.



699 MOM POWER UP PURGE

Sets number of purge cycles on power-up restart.

702 SHUTTLE MIN TIME IN

Minimum time for the shuttle to reach the In position.

704 SMTc2 UNCLAMP POS

Supports the high speed tool changer. It specifies the absolute position in degrees *1000 which the TT axis will stop at in order to unclamp the tool.

705 SMTc2 CLAMP POS

Supports the high speed tool changer. It specifies the absolute position in degrees *1000 which the TT axis will stop at in order to clamp the tool.

708 PALLET CHANGER AXIS

Specifies the MOCON channel of the MDC-1 and EC-300 pallet changer. It enables both the servo axis pallet changer and the Super SMTc tool changer to operate on the same machine. On an MDC-1 with a single MOCON board, this parameter must be set to 4. On an MDC-1 or EC-300 with two MOCON boards, this parameter must be set to 8. On all other machines, this parameter must be set to 0. Note also that when set to 4, B-axis parameters are used to control the pallet changer and the message "Use Tt Params" is displayed. When this parameter is set to 8, the W-axis parameters are used to control the pallet changer.

709 SMTc DR Output Rely

Output relay that should be activated for the tool changer door. Set to 39 for the EC-300. Set to 1 for the EC-400. Set to 26 for the HS series mills. Set to zero for all other mills without a tool changer door.

710 (L) TOOL CHANGER TYPE

Supports the lathe tool turrets. Set this parameter to 2 on lathes fitted with the 4-tool turret, set to 3 for the 8-tool turret (Note that for the 8-tool turret, parameter 65 Number of Tools must be set to 8. For all other lathes, it should be set to 1.).

710 TOOL CHANGER TYPE

Type of tool changer installed on the machine. Note that if this parameter is set to zero, the control will automatically reset it based upon the parameters which previously specified the tool changer type. The following types are recognized:

- 1 Generic Geneva or umbrella type - This is the default.
- 2 Horizontal type using W-axis
- 3 Horizontal type using B-axis
- 4 TT-4 Lathe 4-position tool turret
- 5 Generic Vertical Side-Mount Tool Changer (VSMTC)
- 6 Super2 VSMTC, using TT-axis
- 7 Chain Type
- 8 Mori Side-Mount Tool Changer
- 9 Manual Tool Changer

711 (M) POCKET UP SETTLE

Supports a vertical mill side-mount tool changer. It specifies the amount of time, in 50ths of a second, a carousel is to wait after a tool change before it is allowed to move.

712 VD/MINI P.S. TYPE

This parameter specifies the Vector Drive or Mini Power supply type. The possible values were:

715 COLOR MESSAGE

Used to change the color of the text messages displayed at the bottom of an LCD monitor. The color chart can be displayed in Debug mode. Access the Curnt Comands screen and page up. Any value from 0 to 255 can be used. The following are some suggestions:

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



716 COLOR CMD POSITION

Changes 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

Changes 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

Changes 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

Changes 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 COLOR OVERRIDE

Changes 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.

721 (M) 'RUNNING' RELAY

Supports the Machine Data Collection feature which specifies an output relay that will be turned on when the machine is in Running mode. Note that this only works when it is set to 32 or larger, specifies an actual relay, and Parameter 315, bit 26, Status Relays is set to zero. Note also that if **Single Block** is activated while the machine is running, the relay may not turn off at the end of the current block.

727 (M) APC CHAIN MIN TIME

Defines the time to wait **before** some switch fault checks are to begin. It should be set to 3000 on all APC mills and zero on all others. The units are milliseconds.

728 (L) Peak Sub SP. PWR.KW

This parameter is used to calculate subspindle load, which is displayed as SS LOAD on the Current Commands screen.

730 PWR FAULT THRESHOLD

731 PWR FAULT MAX TIME

Parameters 730 and 731 support the optional Power Failure Detect Module. Parameter 730, Pwr Fault Threshold units are an analog to digital value. Parameter 731, Pwr Fault Max Time units are millisecond/20. If the Power Failure Detection Module is not installed, Parameters 730 and 731 should both be set to zero.

732 (M) IPS PROBE

The operator can use the intuitive probe screens, on a Tool Room mill, with the IPS feature activated, a probe, and this parameter set to 1. These screens (displays) are within the setup tab, and are used to calibrate both the work and tool probe. The user can probe the length and diameter of the tools during set up. This feature allows probing of the work piece to set up the work zero offset. Refer to Engineering Document ES0566 - Intuitive Probing.

733 (M) APC AIR BLAST RELAY

Defines output relay that turns on the air blast on the EC-300 and MDC-500. Set to 39 for the Mill Drill Center and EC-300, or zero for all other mills.



734 INPUT MASK (Used for the Office Lathes)

0	TOOL TURRET UNLOCKD	16	SPINDLE LOCK
1	TOOL TURRET LOCKED	17	SPINDLE FAULT
2	C AXIS DISENGAGED	18	SPINDLE STOPPED
3	SPARE	19	SPINDLE AT SPEED
4	C AXIS ENGAGED	20	LOW HYDRAULIC PRESS
5	SPINDLE HIGH GEAR	21	TAILSTOCK FOOT SW
6	SPINDLE LOW GEAR	22	PROBE NOT HOME
7	EMERGENCY STOP	23	SPARE
8	DOOR SWITCH	24	TOOL UNCLAMP REMOTE
9	M-CODE FINISH	25	SPARE
10	OVERVOLTAGE	26	BRFEED EOB/SB LB SW
11	LOW AIR PRESSURE	27	BRFEED Flt/SB PR SW
12	LOW LUBE PRESSURE	28	GROUND FAULT
13	REGEN OVERHEAT	29	G31 BLOCK SKIP
14	LOW TRANS OIL PRESS	30	BRFEED SP LK/SB EOB
15	SPARE	31	CONVEYR OVERCURRENT

734 INPUT MASK (Used for the Office Mills)

0	TOOL CHANGER IN	16	SPARE
1	TOOL CHANGER OUT	17	SPARE
2	TOOL #1 IN POSITION	18	SPARE
3	LOW TSC PRESSURE	19	SPARE
4	TOOL IN POSITION	20	LOW TRANS OIL PRESS
5	SPINDLE HIGH GEAR	21	APC DOOR
6	SPINDLE LOW GEAR	22	APC PIN CLEAR #1
7	EMERGENCY STOP	23	APC PIN CLEAR #2
8	DOOR/SAFETY SWITCH	24	TOOL UNCLAMP REMOTE
9	M-CODE FINISH	25	SPARE
10	BUSS PWR FAULT	26	APC PALLET #2 HOME
11	LOW AIR PRESSURE	27	APC PALLET #1 HOME
12	LOW LUBE PRESSURE	28	GROUND FAULT
13	REGEN. OVERHEAT	29	G31 BLOCK SKIP
14	DRAWBAR OPEN	30	SPIGOT POSITION
15	DRAWBAR CLOSED	31	CONVEYR OVERCURRENT

736 SPINDLE TYPE

Supports the Office Mill (OM) and Office Lathe (OL) NSK spindle. On all OM models, this parameter must be set to 2. On all other mills, it must be set to 1. On all OL models (Office Lathes) this parameter must be set to 3. On all other lathes, set to 1.

737 COMMON SW 5

0 Lock Out KBD TL CHG – When set to 1, no tool change is performed when Power-Up-Restart is pressed. Also, when Power-Up-Restart, ATC FWD, ATC REV or Next Tool is pressed, the message TOOL CH LOCKED is displayed.

1 Rotary Index Button Activates the Rotary Index button on the remote control panel of the EC300 and EC1600. The button controls the A-axis rotary table. Setting 164 is used to set the rotary increment.

3 Extended Memory

7 Worklight Via SKBIF – This parameter must be set to 1 when the high voltage switch cable and corresponding high voltage switch in the pendant is replaced by a cable from the SKBIF to a low voltage switch in the pendant. Otherwise, it is set to zero.

738 FIXTURE CLAMP INPUT

This parameter can be set to a discrete input value that specifies the user's fixture sensor. A zero deactivates the feature. If the fixture is unclamped, running the spindle will generate alarm 973 FIXTURE CLAMP FAILURE and will stop the program and the spindle.

744 COLOR RUNPROG1

This controls the colors of highlighted text, executed blocks, and remaining blocks in a G-Code program when it is running or in feed hold. Also see parameter 715.

**745 COLOR RUN PROG2**

See Parameter 744

746 COLOR RUN PROG3

See Parameter 744

749 (M) FEED ACCEL ROUGH

Applied when Rough smoothness is selected. See the definition for parameter 302.

750 (M) FEED T CONST ROUGH

Applied when Rough smoothness is selected. See the definition for parameter 303.

751 (M) FEED DELTA V ROUGH

Applied when Rough smoothness is selected.

752 (M) FEED ACCEL FINISH

Applied when Finish smoothness is selected. See the definition for parameter 302.

753 (M) FEED T CONST FINISH

Applied when Finish smoothness is selected. See the definition for parameter 303.

754 FEED DELTA V FINISH

Applied when Finish smoothness is selected. See the definition for parameter 314.

761 TC AIR DOOR TYPE

Supports the Air Curtain feature. On machines that have a tool changer fitted with an air curtain, this parameter should be set to 2. On all other machines, it can be set to zero or 1.

Parameters 762 -772: These parameters allow the axis to position prior to clamping the brake.

762 X Axis Air Brake On Delay**763 Y Axis Air Brake On Delay****764 Z Axis Air Brake On Delay****765 A Axis Air Brake On Delay****766 B Axis Air Brake On Delay****767 C Axis Air Brake On Delay****768 U Axis Air Brake On Delay****769 V Axis Air Brake On Delay****770 W Axis Air Brake On Delay****771 Sp Axis Air Brake On Delay****772 Tt Axis Air Brake On Delay**

Parameters 801, 802 and 803 are for Haas Air Closer: The pneumatically control air closer uses these 3 parameters and (248, 800) to govern the operation of the system. The parameters are set as follows:

798 (M) CONVEY WASHDOWN RLY

This parameter specifies the output relay for the conveyor wash down pump.

799 (M) SHOWER COOLANT RLY

This parameter specifies the output relay for the shower coolant pump. When the feature is installed, it should be set to 32, otherwise it should be zero.

801 (L) CHUCK AIR on DELAY

This parameter is the amount of delay in ms to turn pneumatic air on.

802 (L)CHUCK CLOSER DELAY

This parameter is the amount of delay in ms for the pneumatic mechanism to clamp and unclamp.



803 (L) CHUCK AIR OFF DELAY

This parameter is the amount of time in ms to turn pneumatic air off. There are two more existing parameters that must be set as follows:

248 Chuck Unclamp RPM. This must be set to 0.

800 Chuck Closer Type. This must be set to 1.

804 (M) TC CAROUSEL AXIS

This parameter supports the Servo Side Mount Tool Changer. It should be set to 6 for the servo tool carousel to specify the U axis. It can be set to 6 for all other types also as it is not used for them.

807 DOOR OPEN SW DELAY

This parameter specifies a delay in 50ths of a second that stops the door motor and clutch after the door reaches the open-door switch.

BALLSCREW COMPENSATION (MILLS)

Separate ballscrew compensation is provided for each of the **X**, **Y**, and **Z** axes. The operator-entered compensation values are spaced at 0.5 inch intervals within the machine coordinate system. The compensation values are entered in inches with a resolution of 0.0001 inch. The values are used to interpolate into a table of 256 entries. The spacing between two entries in the table of 256 is defined by Parameter 58. The entered values are limited to +/-127 encoder steps; so the limit in inches is dependent on Parameters 5, 19, and 33.

Note that the first entry corresponds to machine position zero and subsequent entries are for increasingly negative positions in the machine coordinate system. The user should not ever need to adjust the ballscrew compensation tables.

ELECTRONIC THERMAL COMPENSATION

When ballscrews rotate they generate heat. Heat causes the ballscrews to expand. In constant duty cycles, the resultant ballscrew growth can lead to cutting errors on the next morning start up. The 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 lead 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 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 Z-axis to compensate for thermal growth.

X-AXIS THERMAL COMPENSATION (LATHES)

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 program accuracy accordingly.

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



COMMON ABBREVIATIONS

°/sec or deg/sec – Degrees per second I/O PCB – Input Output Printed Circuit Board
μ – Micron ID – Inside Diameter
AC – Alternating Current IGBT – Isolated Gate Bipolar Transistor
AMP (or A) – Ampere in – Inch
APC – Automatic Pallet Changer in-lb – Torque (inch-pounds)
APL – Automatic Parts Loader ipm – Inches per Minute
arc-sec – Arc seconds kg – Kilogram
ASCII – American Standard Code for Information Interchange kVA – Kilovolt ampere
ATC – Automatic Tool Changer kW – Kilowatt
ATC FWD – Automatic Tool Changer Forward l – Liter
ATC REV – Automatic Tool Changer Reverse LAN – Local Area Network
AWG – American Wire Gauge lb – Pound
bar – Metric air pressure LCD – Liquid Crystal Display
BHCS – Button Head Cap Screw LED – Light Emitting Diode
blocks/sec – Blocks per second LO CLNT – Low Coolant
BT – British Tooling (Common usage) LOW AIR PR – Low Air Pressure
CAD – Computer Assisted Design lpm – Liters per Minute
CAM – Computer Assisted Manufacturing (Assisted Machining) LVPS – Low Voltage Power Supply
CAT-5 – Category 5 Cable m – Meter
CB – Circuit Breaker m² – Square meter
CC – Cubic Centimeter M-FIN – M-code Finished
CCW – Counter Clock Wise m/min – Meters per Minute
CFM – Cubic Feet per Minute MB – Megabyte (1 million)
CMM – Coordinate Measuring Machine MCD RLY BRD – M-Code Relay Board
CNC – Computer Numerical Control MDI – Manual Data Input
CNCR SPINDLE – Concurrent Spindle with axis motion MEM – Memory
CRC – Cyclic Redundancy Check digit MHz – Megahertz
CRT – Cathode Ray Tube mm – MilliMeter
CT – Caterpillar Tooling MOCON – Motor Control
CTS – Clear To Send MOTIF – Motor Interface
CW – Clock Wise mph – Miles per hour
DB – Drawbar MSG – Message
DC – Direct Current MSHCP – Metric Socket Head Cap Screw
DGNOS – Diagnostic N (unit of force) – Newton/newtons
DHCP – Dynamic Host Configuration Protocol NC – Numerical Control
DIR – Directory NC – Normally Closed
DNC – Distributive Numerical Control Nm – Torque/metric - Newton meters
DOS – Disk Operating System NO – Normally Open
DTE – Data Terminal Equipment OD – Outside Diameter
ENA CNVR – Enable Conveyor OPER – Operator
EDM – Electrical Discharge Machining oz – Ounce
EOB – End Of Block P – Pocket
EOF – End Of File PARAM – Parameter
EPROM – Erasable Programmable Read Only Memory PCB – Printed Circuit Board
E-STOP – Emergency Stop PGM – Program
FHCS – Flat Head Cap Screw POR – Power On Reset
fpm – Feet per Minute POSIT – Positions
ft – Foot PROG – Program
FU – Fuse psi – Pounds per Square Inch
FWD – Forward PST – Pallet Schedule Table
GA – Gauge PWM – Pulse Width Modulation
gal – Gallon RAM – Random Access Memory
gpm – Gallons per Minute RET – Return
HHB – Hex Head Bolts REV CNVR – Reverse Conveyor
hp – Horsepower RJH – Remote Jog Handle
HS – Horizontal Series of Machining Centers rpm – Revolutions Per Minute
I/O – Input/Output RTS – Request To Send
RXD – Receive Data



SDIST – Servo Distribution PCB
SFM – Surface Feet per Minute
SHCS – Socket Head Cap Screw
SIO – Serial Input/Output
SKBIF – Serial Key Board Inter Face PCB
SMTC – Side-Mount Tool Changer
SP – Spindle
sq ft or ft² – Square feet
T – Tool Number
TC – Tool Changer
TIR – Total Indicated Runout
TNC – Tool Nose Compensation
ft-lb – Torque (foot-pounds)
TRP – Tool Release Piston
TS – Tail Stock
TSC – Thru the Spindle Coolant
TXD – Transmit Data
V – Volt
V AC – Volts alternating current
V DC – Volts direct current
VDI – Verein Deutscher Ingenieure
VMC – Vertical Machining Center
WAN – Wide Area Network