

**AUTO:** AUTO KEY or 2 - MEMORY / 1 - RUN / 1 - AUTOMATIC

**BACKLASH:** 2 - MEMORY / 6 - SETTINGS / 1 - BACKLASH

**CHANGE DEVICE:** 2 - MEMORY / 3 - INPUT/OUTPUT / 4 - BAUDRATE

**COLD START:** 9 - COLDSTART

**DIAGNOSTIC MODE:** 7 - DIAGNOSTICS / 3 - CONTROLLER

**DNC:** 2 - MEMORY / 1 - RUN / 2 - DNC

**DISPLAY FIXTURE OFFSETS:** 1 - SETUP / 2 - FIXTURE / 1 - FIXTURE OFFSET TABLE

**DISPLAY TOOL TABLE:** 1 - SETUP / 1 - TOOL / 3 - OFFSET TABLE

**HOME ALL AXES:** 4 - HOME AXES

**LEARN MODE:** 2 - MEMORY / 4 - LEARN

**LIST PROGRAM LINES:** 6 - COMMAND

**MANUAL DATA INPUT:** 3 - MDI

**MEMORY FREE:** 2 - MEMORY / 5 - CLEAR / 3 - DISPLAY FREE MEMORY

**MENU:** 6 - COMMAND

**NEW PROGRAM:** 2 - MEMORY / 5 - CLEAR / 1 - CURRENT PROGRAM

**PAGE EDITOR:** SPACEBAR

**PROGRAM LIBRARY:** 2 - MEMORY / 2 - PROGRAM LIBRARY

**PUNCH PROGRAM:** 2 - MEMORY / 3 - INPUT/OUTPUT / 2 - OUTPUT

**REINITIALIZE:** 2 - MEMORY / 5 - CLEAR / 2 - OFFSETS OR ALL MEMORY

**RESET HOME TO COLD START POSITION:** 4 - HOME AXES /  
2 - RETURN FOR POWER OFF

**RESET TOOL CHANGER:** 1 - SETUP / 1 - TOOL / 4 - TURRET LOCATION

**RESET SYSTEM PARAMETERS:** 2 - MEMORY / 6 - SETTINGS / 2 - PARAMETERS

**SET LENGTH OFFSET:** 1 - SETUP / 1 - TOOL / 1 - SINGLE / 3 - STORE LENGTH

**SET (PARAMETER):** 1 - SETUP / 3 - AXIS ZERO

**SUM PROGRAM:** 2 - MEMORY / 1 - RUN PROGRAM / 3 - SUMMARY

**TAPE (PROGRAM) INPUT:** 2 - MEMORY / 3 - INPUT/OUTPUT / 1 - INPUT

**TOOL CHANGER OPEN:** 1 - SETUP / 1 - TOOL / 1 - SINGLE / 1 - GET TOOL

**TOOL DATA INPUT:** 1 - SETUP / 1 - TOOL / 3 - OFFSET TABLE

**UTILITIES:** 1 - SETUP / 1 - TOOL / 2 - MULTIPLE TOOLS  
1 - SETUP / 2 - FIXTURE / 2 - READ FROM JOG

**VERIFICATION OF PUNCHED TAPE:** 2 - MEMORY / 3 - INPUT/OUTPUT / 3 - VERIFY

## PAGE EDIT KEYS

**BOTTOM OF PROGRAM:** B KEY

**CHANGE PROGRAM BLOCKS:** C KEY

**COPY PROGRAM BLOCKS:** O KEY

**CURSOR DOWN ONE LINE:** D KEY

**CURSOR UP ONE LINE:** U KEY

**CURSOR ONE PAGE DOWN:** ENTER KEY

**CURSOR ONE PAGE UP:** BACKSPACE KEY

**DELETE PROGRAM BLOCK:** DEL KEY

**FUNCTIONS:** F KEY

**GRAPHICS:** G KEY

**INSERT PROGRAM BLOCKS:** I KEY

**NUMBER PROGRAM BLOCKS:** N KEY

**PROGRAM LIBRARY:** P KEY

**REPLACE PROGRAM DATA:** R KEY

**SEARCH FOR PROGRAM TEXT:** S KEY

Fadal  
Fadal Machining Centers

**AUTO:** AU, START FROM, TO, DRY RUN, DIRECT BLOCK START  
START FROM: LINE NUMBER TO BEGIN EXECUTION FROM  
TO: LINE NUMBER TO END EXECUTION AT  
DRY RUN OPT: 1=(G0)150ipm (G1)AS PROG, 2=(G0)150ipm, 3=(G0)300ipm (G1)75ipm  
DIR.BLK.START OPT:0=PROCESS PROGRAM FROM BEGINNING & EXECUTE AT START FROM  
1=BEGIN EXECUTION AT START FROM, WITH NO PROCESSING BEFORE  
LINE NUMBER = PROCESS FROM LINE NUMBER & BEGIN EXECUTION AT START FROM

**BACKLASH:** BL, AXIS #, AMOUNT AT CENTER, AT NEGATIVE END, AT POSITIVE END  
AXIS #: X=1 Y=2 Z=3 A=4 B=5 / AMOUNT IS IN TENTHS: i.e. 10=.0010

**CHANGE DEVICE:** CD, BAUD RATE, LINE FEED OPTION, ECHO OPTION, DEVICE OPTION  
BAUD RATE: 1=110 2=150 3=300 4=6-- 5=1200 6=2400 7=4800 8=9600 9=19200  
10=38400 11=57600 12=115200  
LINE FEED OPT: 0=LINE FEEDS, 1=NO LINE FEEDS  
ECHO OPT: 0=ECHO, 1=NO ECHO  
DEVICE OPT: 0=EXTERNAL, 1=INTERNAL

**CHANGE PROGRAM LINE:** CH, FROM, THROUGH

**COLD START:** CS

**COPY PROGRAM LINES:** CO, FROM, THROUGH, TO JUST AFTER

**DELETE PROGRAM LINE:** DE, FROM, THROUGH

**DIAGNOSTIC MODE:** DI (TRAINED MAINTENANCE PERSONNEL ONLY)

**DNC (DNCX):** DNC (DNCX), VIDEO OPTION, ERROR OPTION, DRY RUN, START LINE NUMBER  
VIDEO OPT: 1=SCREEN  
ERROR OPT: 1=DISABLES ERROR CHECKING  
DRY RUN OPT: 1=(G0)150ipm (G1)AS PROG, 2=(G0)150ipm, 3=(G0)300ipm (G1)75ipm  
START LINE NUMBER: SPECIFIES WHICH LINE TO BEGIN EXECUTION

**DISPLAY FIXTURE OFFSETS:** DF

**DISPLAY TOOL TABLE:** DT

**DISPLAY TIME TABLE:** DTT

**DRAW:** DR (DRAWS THE CURRENTLY ACTIVE PROGRAM) (-4 and -5 ONLY)

**FIXTURE OFFSET:** FO, NUMBER, (X AMOUNT), (Y AMOUNT), (Z AMOUNT)

**HOME ALL AXES:** HO

**INSERT PROGRAM LINES:** IN, FROM, SEQUENCE INCREMENT

**LEARN MODE:** LE, FIRST BLOCK NUMBER, INCREMENT, TOOL NUMBER

**LIST PROGRAM LINES:** LI, FROM, THROUGH  
[DISPLAY SCROLL, SPEED CONTROL: 1(SLOWEST) – 9(FATEST), 0(PAUSE SCROLL)]

**MACRO:** MA

**MANUAL DATA INPUT:** MD

**MEMORY FREE:** ME

**MENU:** MU

**NEW PROGRAM:** NE (THIS DELETES THE CURRENTLY ACTIVE PROGRAM)

**NUMBER PROGRAM LINES:** NU, INCREMENT FOR LINE NUMBERS

**PAGE EDITOR:** PA, OPTIONAL FROM

**PROGRAM MAINTENANCE:** PR, OPTIONAL PROGRAM NUMBER

**PUNCH PROGRAM:** PU, DATA OPTION, CODE OPTION, TTY OPTION

DATA OPT: 0=CURRENTLY ACTIVE PROGRAM & OFFSETS, 1=OFFSETS ONLY

DATA OPT: 2=CURRENTLY ACTIVE PROGRAM, 3=ALL PROGRAMS IN MEMORY

4=PUNCH OUT PARAMETERS

CODE OPT: 0=ASCII, 1=EIA

TTY OPT: 0=COMPUTERS, 3=LEADER, PROGRAM, TRAILER

**REINITIALIZE:** RI

1) DELETE THE TOOL TABLE & RESET THE TURRET

2) DELETE THE FIXTURE OFFSET TABLE

3) DELETE THE ENTIRE PROGRAM LIBRARY, CURRENT PROGRAM & RESET TURRET

**RESET HOME TO COLD START POSITION:** SETCS

**RESET TOOL CHANGER:** SETTO (SETS CURRENT TURRET POSITION TO ONE)

**RESET SYSTEM PARAMETERS:** SETP (AXES MUST BE AT CS POSITION)

**SET (AXIS):** SETX or SETY or SETZ or SETA or SETB or SETH

**SET LENGTH OFFSET:** SL, TOOL NUMBER, OPTIONAL CHANGE VALUE

**SUM PROGRAM:** SU, DISPLAY FROM, THROUGH, CRC OPTION, DISPLAY OPTION

DISPLAY FROM: DISPLAY DATA STARTING AT DISPLAY FROM NUMBER

THROUGH: STOP DISPLAYING DATA AT THROUGH NUMBER

CRC OPT: 1=IGNORE G41 & G42

DISPLAY OPT: 0=ERROR MESSAGES ONLY

OPT: 1=INCREMENTAL MOVES & ERROR MESSAGES

OPT: 2=INCREMENTAL MOVES, ERROR MESSAGES & ABSOLUTE POSITIONS

OPT: 3=CURRENT G CODE STATUS AND ALL OTHER OPTIONAL INFORMATION

[DISPLAY SCROLL, SPEED CONTROL: 1(SLOWEST) – 9(FATEST), 0(PAUSE SCROLL)]

**SURVEY:** SV (TRAINED MAINTENANCE PERSONNEL ONLY)

**TAPE (PROGRAM) INPUT:** TA, DEVICE OPTION, ERROR OPTION, ADD AT END

DEVICE OPT: 0=INTERNAL TAPE READER

OPT: 1=INPUT THROUGH RS-232 PORT

ERROR OPT: 1=IF DATA HAS PARITY ERRORS

OPT: 2=TO IGNORE ERRORS AND GIVE ERROR COUNT

OPT: 3=TO ACCEPT DATA FROM OTHER CNC CONTROLS

ADD AT END: 1=ALLOWS DATA TO BE ADDED TO THE END OF CURRENTLY ACTIVE PROGRAM

**TOOL CHANGER OPEN:** TC, 1 (OPENS TOOL CHANGER AT CURRENT POSITION)

**TOOL DATA INPUT:** TO, TOOL NUMBER, DIAMETER, LENGTH OFFSET

**UTILITIES:** UT (FOR SETTING TOOL & FIXTURE OFFSETS, or FOR TESTING PROBES & PALLET UTILITIES)

\*ALTERNATE USE: UT, # (# SPECIFIES A TOOL NUMBER TO PICK UP FROM THE TURRET)

**VERIFICATION OF PUNCHED TAPE:** VT, 1

*Error numbers help discern the location of the problem the axis or spindle is reporting. The error number will follow the message. CALL THE SERVICE DEPARTMENT AND REPORT THE MESSAGE AND NUMBER ON THE SCREEN TO CORRECT THESE PROBLEMS.*

**1 NO MOTOR FEEDBACK**

This message appears on power up if no motor feedback (resolver or encoder) or no motor motion is detected by the axis controller.

**2 ENCODER NOT RESPONDING PROPERLY**

This message appears during the rigid tap operation if the encoder feedback is interrupted during the spindle operation for any period longer than 3 seconds. The spindle operation is halted and this error message is displayed.

**3 LOGIC JUMPER INCORRECT or COMMAND SIGNAL MISSING**

This message appears on power up. An illogical motor-tach jumper configuration or failed component may cause the axis to runaway in the opposite direction of the command signal. To prevent runaway, axis operation is halted and this error message is displayed.

**4 ENCODER IS NOT 1024 LINE**

This message appears on power up, only for axes with a 1024-line encoder as motor feedback, if the count of the encoder lines per revolution of the screw is not 1024 lines per turn.

**5 NO INDEX MARK DETECTED**

This message appears during the cold start process if the index mark of the axis' primary feedback device, encoder or scale is not detected.

**6 SWITCH 1 DISABLED- not used**

**7 RIGID TAP PRE-CYCLE ENCODER COUNT PROBLEM. NOT ENOUGH COUNT**

This message indicates that the spindle feedback is not functioning properly. Prior to the rigid tap cycle the spindle feedback is checked for operational accuracy. Malfunction of the feedback results in termination of the cycle and display of this error message.

**8 SPINDLE MAGNET NOT DETECTED or SPINDLE NOT RUNNING**

This error message appears during spindle operation if the spindle magnet is not detected for any period longer than 3 seconds. This problem could be related to either command signal, spindle not turning, or spindle magnet malfunction.

**9 SPINDLE FAULT LINE DOWN**

The fault line signal down to the inverter should stay high during spindle operation. If this signal is held low when the spindle is running then this error message will be displayed.

**10 ENCODER AND MAGNET NOT RESPONDING or SPINDLE NOT RUNNING**

This is a spindle operation error message. During spindle operation, the encoder feedback and spindle magnet are monitored. If no proper response from either of them is detected for any period longer than 3 seconds, then this error message is displayed. This error could also be caused by the command signal, i.e., if the spindle is not turning.

**11 MOTOR OVERLOAD. EXCESSIVE FOLLOWING ERROR- not used**

**12 MOTOR OVERLOAD. STEP COMMAND CHECKSUM ERROR**

This message appears after the completion of a move. At the end of a move, the number of pulses required to complete that move is checked against the number of pulses taken by the axis controller. If the checksum is not corrected then the operation is stopped and this message is displayed.

**13 MOTOR OVERLOAD. FOLLOWING ERROR GREATER THAN THE OVERLOAD FACTOR- not used**

**14 MOTOR OVERLOAD. MISSING 0 OR 1 COMMAND**

This message appears if an axis move command is not initialized properly, usually due to a hardware-related problem.

**15 TIME OUT ON RIGID TAP PRE-CYCLE TEST**

If the spindle rotation is interrupted or the spindle magnet is not detected for a length of time during the rigid tap pre-cycle test, then this operation is stopped and this error message is displayed.

**16 TIME OUT ON RESOLVER RESPONSE**

This message appears any time the resolver "zero-crossing" pulse is not detected within the allowable time (4-10 msec). This pulse is hardware-generated every 1 msec.

**17 BAD READING ON RESOLVER PORT**

This message appears if the value of the resolver “counts”, read from the resolver port when the “zero-crossing” pulse is detected, is too large, indicating possible failure of the resolver cables, 1010-4 card, or the resolver itself. Also caused by severe motor vibrations.

**18 SERVO AMPLIFIER FAULT LINE DOWN**

This message appears if the axis card no longer detects the fault line signal from the amplifier, or the signal strength drops below 10V, indicating a possible amplifier fault.

**19 STACK OVERFLOW. OVERLOADED WITH STEP COMMAND**

This message appears if the stack on the axis card (used to store CPU commands until they have been serviced) overflows.

**20 MOVE TRANSFER FAULT. INCOMPLETE DATA FOR MOVE COMMAND**

This message appears when an axis move command is improperly transferred to the axis card, as indicated by a checksum comparison between what the CPU sent and what the axis card has received.

**21 SPURIOUS INTERRUPTS. NOT SERVICEABLE**

This error appears if the interrupt currently being processed is not an expected interrupt, and thus cannot be serviced, indicating possible failure of the 1010-4, 1030, or main CPU.

**22 BAD SCALE READING**

This error appears if the feedback from the scale port is outside allowable limits, indicating possible failure of the EXE box, scales, cables, or 1010-4 card. Also caused by severe motor vibrations.

**23 MOTOR OVERLOAD. ERROR > OVERLOAD FACTOR IN STANDBY MODE**

This message appears (in stand-by mode) when the following error exceeds the user-defined overload factor, which sets, in motor turns, the maximum following error for the axis operation. MESSAGES 23, 24, 25, and 26 ARE NO LONGER RELATED TO ERROR 13.

**24 MOTOR OVERLOAD. ERROR > OVERLOAD FACTOR IN POINT TO POINT MODE**

See ERROR 23

**25 MOTOR OVERLOAD. ERROR > OVERLOAD FACTOR IN CONTOURING MODE**

See ERROR 23

**26 MOTOR OVERLOAD. ERROR > OVERLOAD FACTOR IN JOB MODE**

See ERROR 23

**27 TIME OUT ON RETURN TO MAGNET**

During rigid tapping at completion of each tap cycle, spindle magnet reorientation check is required within 6 seconds or this message is displayed.

**28 TIME OUT. NOT DETECTING THE LAST MAGNET HENCE NO CALIBRATION**

This message appears if the spindle controller could not detect the magnet within 10 seconds, either during spindle orientation or on the last rotation during rigid tap pre-cycle.

**29 RIGID TAP PRE-CYCLE ENCODER COUNT PROBLEM. TOO MANY COUNTS**

See ERROR 7

**30 SURVEY TABLE CLEARED DUE TO BAD SURVEY**

A checksum is run on the survey table during cold start. If the checksum is bad then the table is cleared and this message is displayed.

**31 TIME OUT ON ORIENTATION**

If the spindle magnet does not align within 10 seconds of an orient spindle then this error message is displayed.

**32 SPINDLE WILL NOT STOP. CHECK INVERTER ZERO SPEED**

If the spindle does not stop in 3 seconds from entering a spindle stop command then this error message is displayed.

**33 ENCODER CHANNELS ARE REVERSED (RIGID TAP)**

This message will display if the encoder connection for spindle motor is reversed at spindle control card.

# Program Code Quick Reference

<b>G0</b>	Rapid Travel
<b>G1</b>	Linear Interpolation
<b>G2</b>	Circular Interpolation (Clockwise)
<b>G3</b>	Circular Interpolation (Counter Clockwise)
<b>G4</b>	Dwell P= Time in Milliseconds Also: Non Modal In-position Check
<b>G5</b>	Non Modal Rapid Travel
<b>G8</b>	Accelerate (No Feed Ramps)
<b>G9</b>	Decelerate (Feed Ramps) Also: In Position Check
<b>G10</b>	Programmable Data Input L02= Fixture X, Y, Z, A, B, P= 0, 1-48 L10= Length, P= 1-99, R0= Amount L12= Diameter, P= 1-99, R0= Amount L13= Read Fixture, P= 1-24, R0= Z, R1= X, R2= Y L14= Read Length, P= 1-99, R0= Amount L15= Read Diameter, P= 1-99, R0= Amount L100 to L109= R Values, P= Amount
<b>G15</b>	YZ Circular Interpolation with the A Axis
<b>G17</b>	XY Plane Selection Also: Y Axis Cam Wrapping Q= A Axis Ratio/ [5p (cam dia. in inches)] Q= A Axis Ratio/ [[5/25.4p (cam dia. in mm)] P0= A Axis, P1= B Axis
<b>G17.1</b>	A/B Word Swap On
<b>G17.2</b>	A/B Word Swap Off
<b>G18</b>	ZX Plane
<b>G19</b>	YZ Plane
<b>G20</b>	Check for Inch Parameter Setting
<b>G21</b>	Check for Metric Parameter Setting
<b>G28</b>	Return to Zero
<b>G28.1</b>	Return from Jog Away
<b>G29</b>	Return from Zero
<b>G31</b>	Probe Touch Function
<b>G31.1</b>	Probe No Touch Function
<b>G40</b>	Cutter Radius Compensation Cancel
<b>G41</b>	Cutter Radius Compensation Left (climb)
<b>G42</b>	Cutter Radius Compensation Right (conve.)
<b>G43</b>	Tool Length Compensation Positive
<b>G44</b>	Tool Length Compensation Negative
<b>G45</b>	Tool Length Offset Single Expansion
<b>G46</b>	Tool Length Offset Single Reduction
<b>G47</b>	Tool Length Offset Double Expansion
<b>G48</b>	Tool Length Offset Double Reduction
<b>G49</b>	Tool Length Offset Cancel
<b>G50</b>	Ramp Slope Control Cancel
<b>G50.1</b>	Mirror Image Cancel
<b>G51</b>	Ramp Slope Control R0= Ramp Speed Value of .5 - 2. R0+= Z Axis, R0-= XY Axis
<b>G51.1</b>	Mirror Image
<b>G51.2</b>	Tool Load Compensation State Feed Rate Before the G51.2 Line R1= Target Spindle Load R2= Min. Percentage Feed Rate Reduction R3= Max. Percentage Feed Rate Increase R4= Time at Min. Feed Rate to Initiate Slide Hold
<b>G51.3</b>	Axis Scaling R1= Program (All three axes) R2= X R3= Y R4= Z
<b>G52</b>	Coordinate System Shift

<b>G53</b>	Use Machine Coordinate System
<b>G54-59</b>	Fixture Offsets 1-6
<b>G66</b>	Modal Subroutine Call
<b>G67</b>	Modal Subroutine Cancel
<b>G68</b>	Rotation (R0= Angle, XY= Center of Rotation)
<b>G69</b>	Rotation Cancel
<b>G70</b>	Check for Inch Parameter
<b>G71</b>	Check for Metric Parameter
<b>G73</b>	Peck Drill Q= Peck Size P= Feed Distance before next Peck (optional) I= Initial Peck J= Reducing Value for Subsequent Pecks K= Minimum Peck Size
<b>G74</b>	Left Hand Tap Format 1 Q= Thread Lead (1/pitch), F= RPM Format 2 S= RPM, F= Feed (Lead * RPM)
<b>G74.1</b>	Left Hand Rigid Tap Format 1 Q= Thread Lead (1/pitch), F= RPM Format 2 S= RPM, F= Feed (Lead * RPM)
<b>G74.2</b>	Prepare for G74.1
<b>G75</b>	Tapping Head Cycle Format 1 Q= Thread Lead (1/pitch), F= RPM Format 2 S= RPM, F= Feed (Lead * RPM)
<b>G76</b>	Fine Boring Q= Amount of Y+ Shift or I= Amount & Direction of X Shift J= Amount & Direction of Y Shift
<b>G80</b>	Fixed Cycle Cancel
<b>G81</b>	Drill, Spot Drill
<b>G82</b>	Center Drill, Counterbore P= Dwell Time in Milliseconds 180,000/RPM= Dwell time for 3 revolutions
<b>G83</b>	Deep Hole Cycle Q= Peck Size P= Feed Distance before next Peck (optional) I= Initial Peck J= Reducing Value for Subsequent Pecks K= Minimum peck Size
<b>G84</b>	Right Hand Tap Format 1 Q= Thread Lead (1/pitch), F= RPM Format 2 S= RPM, F= Feed (Lead * RPM)
<b>G84.1</b>	Right Hand Rigid Tap Format 1 Q= Thread Lead (1/pitch), F= RPM Format 2 S= RPM, F= Feed (Lead * RPM)
<b>G84.2</b>	Prepare for G84.1
<b>G85</b>	Bore In / Out
<b>G86</b>	Bore In / Spindle Off / Rapid Out
<b>G87</b>	Bore In / Out
<b>G88</b>	Bore In / Dwell / Out, P= Milliseconds
<b>G89</b>	Bore In / Dwell / Out, P= Milliseconds
<b>G90</b>	Absolute Positioning
<b>G91</b>	Incremental Positioning
<b>G91.1</b>	High Speed Execution (-Z System Only)
<b>G91.2</b>	High Speed Execution Cancel Also: Binary Compress / Analyzer End Point
<b>G91.3</b>	Binary Compress / Analyzer Start Point
<b>G92</b>	Absolute Preset
<b>G93</b>	1/T Feed Rate Specification (Inverse Time)
<b>G94</b>	Feed Rate Specification DPM, IPM
<b>G98</b>	Return to Initial Plane
<b>G99</b>	Return to R0 Clearance Plane

## Fixed Subroutines

<b>L9101</b>	Probe Functions R1+1-10, See User's Manual for details
<b>L9201</b>	Engraving: R1+0= Standard font R1+1= Stencil font R1+2= Serialized standard R1+3= Serialized stencil R2+= Height of letters R3+= Angle of word R4+= Serial increment R0= Clearance plane Z= Final depth F= Feed rate
<b>L93NN</b>	Bolt Circle R0= 1 (incremental X distance and direction from 1st position to center) R1= J (incremental Y distance and direction from 1st position to center) R2= Angular step between holes (+ angles for CCW, - angles for CW) NN= Amount of holes
<b>L94NN</b>	Mill Boring cycle CCW: R0+= Feed, R1+= Diameter of hole, NN= Repetitions
<b>L95NN</b>	Mill Boring cycle CW: R0+= Feed, R1+= Diameter of hole, NN= Repetitions
<b>L9601</b>	Rectangular pocket CCW: R0+= Feed, R1+= Corner radius on tool, R2+= X, R3+= Y
<b>L9701</b>	Rectangular pocket CW: R0+= Feed, R1+= Corner radius on tool, R2+= X, R3+= Y
<b>L9801</b>	Circular pocket CCW: R0+= Feed, R1+= Corner radius on tool, R2+= Diameter of hole
<b>L9901</b>	Circular pocket CW: R0+= Feed, R1+= Corner radius on tool, R2+= Diameter of hole
<b>Note:</b> Input the tool diameter in the tool table before using fixed subroutines, and use the D word in Format 2.	

## M Codes

<b>M0</b>	Program Stop	<b>M48.2</b>	Dual Rotary Pot Active Pallet A
<b>M1</b>	Optional Stop	<b>M48.3</b>	Dual Rotary Pot Active Pallet B
<b>M2</b>	End of Program	<b>M49</b>	Feed Rate and RPM Pot Inactive
<b>M3</b>	Spindle On Clockwise	<b>M49.1</b>	Servo Coolant Pot Inactive
<b>M3.1</b>	Sub-Spindle On Ignore Magnet CW	<b>M49.2</b>	Dual Rotary Pot Inactive Pallet A
<b>M3.2</b>	Acknowledge Spindle Magnet	<b>M49.3</b>	Dual Rotary Pot Inactive Pallet B
<b>M4</b>	Spindle On Counter Clockwise	<b>M60-69</b>	User Attached Devices
<b>M4.1</b>	Sub-Spindle On Ignore Magnet CCW		M60 A Axis Brake On      M65 TS-20 Probe Active
<b>M4.2</b>	Acknowledge Spindle Magnet		M61 A Axis Brake Off      M66 MP-12 Probe Active
<b>M5</b>	Spindle Off		M62 B Axis Brake On      M67 Laser Probe Active
<b>M6</b>	Tool Change		M63 B Axis Brake Off      M68 Delta Motor
<b>M7.1</b>	Servo Coolant On		M64 MP Probe Active      M69 Wye Motor
<b>M8</b>	Coolant On	<b>M80</b>	Automatic Doors Open
<b>M8.1</b>	Servo Coolant On	<b>M81</b>	Automatic Doors Close
<b>M9</b>	Coolant Off	<b>M90</b>	Default Gain (from SV Command)
<b>M10</b>	Cancel Reciprocation	<b>M90.1</b>	Advanced Feed Forward Gain Enable P=Gain (50-250)
<b>M11</b>	X Axis Reciprocation	<b>M91</b>	Normal Gain
<b>M12</b>	Y Axis Reciprocation	<b>M92</b>	Intermediate Gain
<b>M13</b>	Z Axis Reciprocation	<b>M94</b>	Feed Forward
<b>M14</b>	B Axis Reciprocation		P= Angle Tolerance
<b>M15</b>	A Axis Reciprocation		O= Line Length (Moves less than this not checked)
<b>M16</b>	C Axis Reciprocation		Example: M94 P91 Q.002
<b>M17</b>	End of Subroutine	<b>M94.1</b>	Feed Forward by Feed Rate Modification
<b>M18</b>	Cycle Cushman Indexer		State Feed Rate Before M94.1 Line
<b>M19</b>	Spindle Stop/Orient		P= Angle
<b>M20</b>	Cycle General Purpose Indexer		O= Percentage change each modification
	Also: Automatic Doors Close		R0+= Min. Feed Rate Modification
	Also: Toggle On/Off Hydrosweep		R1+= Length to ignore M94.1
<b>M30</b>	End of all Subroutines		R2+= Modify feed every, this angle, from P
	Also: End of Program (Format 2)		Example: M94.1 P170 Q10. R0+50. R1+1. R2+15.
<b>M31</b>	Exchange Pallets	<b>M94.2</b>	Advanced Feed Forward On,
<b>M32</b>	Store/Load Pallet A		P= Ramp, Q= Detail Window
<b>M32.1</b>	Load and Verify Pallet A	<b>M95</b>	Feed Forward Cancel
<b>M33</b>	Store/Load Pallet B	<b>M95.1</b>	Feed Forward Modify Cancel
<b>M33.1</b>	Load and Verify Pallet B	<b>M95.2</b>	Advanced Feed Forward Cancel
<b>M41</b>	Low Range RPM	<b>M96</b>	Roll CRC
<b>M42</b>	High Range RPM	<b>M97</b>	Intersectional CRC
<b>M45</b>	Execute Fixed Cycle	<b>M98</b>	Execute Sub Program
<b>M46</b>	Positive Approach On		P= Program #
<b>M47</b>	Cancel Positive Approach		L= # of Repetitions
<b>M48</b>	Feed Rate and RPM Pot Active	<b>M99</b>	End of Sub Program
<b>M48.1</b>	Servo Coolant Pot Active		Also: Line Jump, P= Line #, Example: M99 P#