
Index

Numerics

3 Phase 5% Low 181

A

A & B Fixtures Offsets 286

A = AUTO 147

A Axis 265

 Direction of Motion 265

 G90 Absolute Mode 265

 G91 Incremental Mode 266

A Axis Brake 268

A Axis Cold Start 266

A Axis Home Position 266

A Axis Ratio 278

A Value 151

A/B Word Swap 55

A-Axis Brake 184

A-Axis Ratio 183

Absolute Input 72

Absolute Mode 285

ABSOLUTE MODE REQUIRED AT N = 225

Absolute Preset 73

Acceleration 49

Acknowledge Spindle Magnet 23, 24

Advanced Feed Forward 42

AFF Cancel 44

Air Ratcheting Indexer 30

AMPLIFIER FAULT ON AXIS 225

Analyzer Software 479

 Advantages of Analyzer 479

 Description 479

 Sample File DATA.ABS 481

 Using the Analyzer 480

Angular Limits 269

 Maximum & Minimum 269

Applying Compensation with a Z Move 221

Applying Compensation with a Z Move on a Circle 223

Arc Center 290

Arc Direction 291
ARM MUST BE LEFT 225
ARRAY EXCEEDS ALLOWABLE NUMBER 225
ATC FAILURE 226
ATC TURRET FAILURE 226
ATC WILL NOT MOVE TO POSITION 226
ATTEMPT TO CHANGE CRC SIDE WITHOUT G40 AT N = 229
ATTEMPT TO CHANGE TOOL WHILE IN CRC MODE, N = 230
ATTEMPT TO SWITCH PLANE DURING CRC 230
ATTEMPTED DIVISION BY ZERO 229
ATTEMPTED SQR OF A NEGATIVE NUMBER 229
AU 138
Auto 131, 138
Automatic Doors 467
 Description 467
 M80 Automatic Doors Open 468
 M81 Automatic Doors Close 468
Automatic Doors Close 38
Automatic Doors Open 38
AXIS CONTROLLER DOES NOT RESPOND DURING POWER UP SEQUENCE 230
AXIS CONTROLLER DOES NOT RESPOND TO NC 230
AXIS CONTROLLER IS NOT A 1010-4 252
AXIS DATA TRANSFER IS STALLED 230
AXIS DOES NOT RESPOND 230
AXIS FAULT(S) AS FOLLOWS 230
Axis Limits 284
AXIS OVERFLOW 231
Axis Position Variable 426
Axis Scaling 65
Axis/Spindle Controller Error Messages 256

B

B Value 151
Background Editing 158
 MU 158
 SPACE BAR 158
Backlash 139
Backspace 130
BAD CIRCLE OR MISSING G AT N 231
BAD DATA OR NO TOOL DIA. 231
BAD FIXTURE NO. 231
BAD INTERPOLATION TYPE AT N 231
BAD R FIELD 231
BAD R1 USING L91 AT N = 232
BAD READING ON RESOLVER PORT 258

BAD SCALE READING 259
BAD T WORD AT N= 232
BAD Z OR RO IN CANNED CYCLE CALL, N = 232
BAUD RATE 139
 2400 172
Baud Rate 139
B-Axis Brake 185
B-Axis Ratio 184
Belt Drive Range 34
Binary Buffers 255 179
BL 139
Blind Holes 97
Block Skip Switch 127
Bolt Circle 118
Bore In 83, 94
Bore Out 83

C

C = CLEAR 147
Cable Configuration 319
CALCULATED RADIUS ERROR OF 232
Cam Diameter 277
Cam Wall Angles 281
Cam Wrapping 277
 Canceling 280
 Writing a Program 281
CANCEL CRC BEFORE G50.1 OR G51.1 AT N = 232
CANCEL CRC BEFORE N = 233
Cancel Cutter Radius Compensation 204
Cancel Intersectional CRC 219
Cancel JOG AWAY 56
Cancel Modal Subroutine 70
Cancel Positive Approach 35
Cancel Reciprocation 28
CANCEL Z AXIS MIRROR BEFORE TOOL CHANGE AT N 233
Canceling 65
CANNOT RETURN FROM SUBPROGRAM OR SUBROUTINE CALLING LINE CANNOT BE FOUND 233
CANNOT START DIRECTLY IN A SUBPROG. 233
CC 408
CD 139
Center Drilling 82
CH 140
Change Axis Gain 38
Change Device 139
Change Program 140

- CHAR. SIZE OR DEPTH EXCEEDS 2.5 IN. 233
- Character Code 311
- Character Summary 2
- CHECK EMERGENCY STOP SWITCH AND MOTOR OVERLOAD RELAYS 233
- CHECK SPINDLE LUBE, WAY LUBE AND AIR PRESSURE 234
- Chip Auger and Wash Down 472
 - Description 472
 - Operation 472
- Circle Examples 291
- Circular Boss 295
- Circular Interpolation
 - Using G18 & G19 297
 - Using Radius Designation 301
- Circular Interpolation Arc Clockwise 48
- Circular Interpolation Arc Counterclockwise 48
- Circular Pocket Clean-out 124
 - L9801 Circular Pocket Clean-out Counterclockwise 124
 - L9901 Circular Pocket Clean-out Clockwise 125
- CL 141
- CLEAR AN EMERGENCY STOP CONDITION 234
- Clearance 96
- Climb and Conventional Cutting 205
- Climb Cut 204
- Climb Cutting 206
 - Advantages of 206
- Clock for All Run Time 408
- Clock for Current Part 408
- Clock from Power On 408
- Clocks 200
- CMD Menu 182
- CNC 88 Commands 315
- CNC 88HS Graphics 485
 - Graphics Menu 485
 - Plotting Options 485
- CNC Main Errors 336
- CNC88 HS Optional Diskette Drive 481
 - Access from Control 481
 - Access from Program Using Macro Statement #DISK 482
 - Diskette Drive Error Codes 483
 - Restrictions on User-Defined Subroutines 483
 - Specifications 481
 - Subprograms and Fixed Subroutines ARE Allowed 483
- CO 143
- Cold Start 143
- Cold Start Function 389

Command Echo Option 139, 140
COMMAND ERROR 234
Command List 137
Command Lock 141
Command Mode Function 388
COMMAND PROHIBITED BY THE KEY LOCK 234
Communications 311
 Cables 329
 Computer and Computer IO Port 331
 Environment 326
 File 327
 Software 332
 Troubleshooting 326
 VMC 328
Compression Tap Holder Series 101
Contoured Slot 296
Control Parameters 322
Conventional Cut 204
Conventional Cutting 207
 Advantages of 207
Coolant Off 28
Coolant One On 26
Coolant Options 26
Coolant Two On 27
Coolant-1 136
Coolant-2 136
Coordinate System Rotation 70
Coordinate System Rotation Cancel 71
Coordinate System Shift 66
Coordinate Systems 261
Copy Program 143
Corner Rounding 218
Counter Boring 82
Counting Loops 431
CP 408
CR 408
CRC 208, 210
 Applying 210
 Canceling 210
 Guidelines for Using 208
 Z Axis Moves 220
CRC CALLED WITH NO TOOL ASSIGNED AT N = 234
CRC Mode 177
CS 143
Cutter Compensation Cancel 59

Cutter Compensation Left 59
Cutter Compensation Right 59
Cutter Radius Compensation 203
 Format 1 203
 Format 2 203
 with Helical Moves 306
Cycle Execution 76
 Format 1 76
 Format 1 & Format 2 77
 Format 2 77
Cycle Summary 83

D

D OR H TOO LARGE 234
D1 - D99 409
DATA TRANSFER FAULT 234
DE 144
Deceleration 50
Decimal Degrees 268
Deep Hole Drill
 G83 102
Deep Hole Drilling
 Using I, J, K 82
 Using Q 82
Deep Hole Programming 102
DEFAULT
 G0 170
 G17 171
 G90 170
 INCH 176
Default Status 5
 Default G Codes 6
 Reset 5
Degree Feedrate Calculation 271
Delete 130
Delete Blocks 144
Device Communications Procedures 324
Device Option 139, 140
DF 146
DFF 144
DI 146
Diagnostics 146
Diagnostics Function 388
 Abort 388
 Align Axes 389

- Continue 388, 389
- Controller 388
- MP Probe 388
- Touch Probe 388
- Dial Indicator 197
- Direct Numerical Control 146
- Direction of Motion 283
- Display Clocks 200
- Display Feed Forward Parameters 144
- Display Fixture Offsets 146
- Display Tool Table 149
- Display Tool Time Table 150
 - Timers 151
- Display Variable Table Command 151
- DNC 146
- DNC MODE 235
- DNC Mode 317
- DNC Protocols 318
- DNCX 147
- DO YOU WANT REINITIALIZE MEMORY? 235
- DO YOU WANT TO MOVE TO THE LAST HOME POSITION? 235
- DO YOU WANT TO ZERO FIXTURE OFFSETS? 235
- DO YOU WANT TO ZERO TOOL TABLE? 235
- DOOR BEGAN TO CLOSE WHILE ARM WAS MOVING 235
- DR 147
- Draw 147
- Drill Grid Pattern Macro 438
 - Decimal Increments 439
 - Whole Number Increments 438
- Dry Run 146, 147
- DRY RUN OPTION __ IS IN EFFECT 235
- DRY RUN OPTIONS 138
- Dry Run Options 158
- Dry Run Summary 158
- DT 149
- DTT 150
- DUPLICATE NAME 235
- DUPLICATE OR BAD PROG. NAME 235
- DV 151
- Dwell 48, 83
- DWELL, HIT START TO INTERRUPT 236

E

- E WORD MAY ONLY BE USED WITH G0 OR G1 N= 236
- Edit Menu 382

BACKSPACE-PAGE UP 383
B-BOTTOM 383
C-CHANGE 383
D-DOWN 383
DEL-DELETE 383
ENTER-PAGE DOWN 383
F-FUNCTIONS 383
I-INSERT 383
N-NUMBER 383
O-COPY 383
Options 383
P-PROGRAM 383
R-REPLACE 383
S-SEARCH 383
T-TOP 383
U-UP 383
Emergency Stop 136
Emergency Stop Button 12
EMERGENCY STOP-TAKE APPROPRIATE ACTION 236
ENCODER AND MAGNET NOT RESPONDING or SPINDLE NOT RUNNING 257
ENCODER CHANNELS ARE REVERSED 260
ENCODER IS NOT 1024 LINE 257
ENCODER NOT RESPONDING PROPERLY 257
End Of All Subroutines 31
End Of Program 32
End of Program 22
End Of Subprogram 46
End of Subroutine 29
Engraving 111
 Computing Actual Letter Height from the R2 Variable 114
 Computing End Spacing 115
 Computing Engraving Length 115
 Computing Start Position 115
 Computing Start Spacing 114
 Engraving a Constant String 112
 Engraving a Serialized String 113
 L93NN Bolt Circle 118
 Letter Width Factor Values 116
 Parameters 111
 Restrictions 112
 Serialization Range 113
 Spacing, Positioning, & Tool Path Calculations 114
Enter 130
ENTER AGAIN OR HIT MANUAL TO EXIT 236
ENTER COMMAND MU TO SEE THE MENU 237

ENTER COMMAND SETP AND SET THE MACHINE PARAMETERS 237
ERROR 237
ERROR IN USER PROGRAM, 'SUM' TO SEE MESSAGE 237
Error Messages 225
ERROR N WORD EXCEEDS 99999 237
Error Option 146, 147
ERROR WHILE PROCESSING BLOCK 237
ERROR(S) READING TAPE 238
Exchange Pallets 32
Execute Fixed Cycle 34
External Slide Hold 133

F

F = FULL TABLE 148
Feed Distance Before Next Peck
 P# 102
Feed Forward by Feed Rate Modification 40
Feed Forward by Feed Rate Modification Cancel 44
Feed Forward Cancel 44
Feed Forward Function 39
Feed Ramps 50
Feed Rate 96
Feed Rate Override Potentiometer 128
Feed Rate Specification 272
Feed Rate Specification MMPM, IPM or DPM 74
FILE OVERFLOW 238
Fillet Radii 216
Find 90° Corner 199
Find Center of Circle 197
Find Corner 199
Find Midpoint 198
Fine Boring 81
First Block Number 153
Fixed Cycle Cancel 71
Fixed Cycle Parameters 77
 F Word 77
 Fixed Cycle Examples 79
 I Word 78
 J Word 78
 K Word 78
 L Word 78
 P Word 78
 Q Word 78
 R Plane 79
 S Word 79

- Z Word 79
- Fixed Cycles 71, 75
 - Definition 75
 - Procedure to Initialize 75
- Fixed Subroutines 111, 375
- Fixture Offset 151
- FIXTURE OFFSET MUST BE APPLIED WITH GO OR G1 238
- FIXTURE OFFSET OUT OF RANGE 238
- Fixture Offset Setting 193
- Fixture Offset Variables 409
- Fixture Offsets 68, 261
- Flat Cam 277
- Flood Coolant Through the Spindle 465, 531
- FO 151
- Format 1 511
 - Notes on Format 1 Style Programming 511
 - Overview 511
 - Parameter Settings 517
- Format 1 Programming 511
- Format 2
 - Overview 511
 - Parameter Settings 519
 - Parameters Applicable to Format 2 Only 530
 - N-WORDS ORDERED 530
 - TOOL TABLE 530
- Format 2 Programming 514
 - Notes on Format 2 Style Programming 514
- Format Classification Sheet 14
 - D Function Code 16
 - F Function Range 15
 - Format Classification Shorthand 14
 - Format Detail 14
 - G Function Codes 15
 - Geometric Relationship 20
 - H Function Code 16
 - H99 Q Value 17
 - M Function Codes 15
 - Machine 14
 - Maximum Working Dimensions 17
 - S Function 15
 - T Function Code 16
- Formats 511
 - 3 PHASE 5% LOW
 - NO 527
 - 5th AXIS PROGRAMMABLE HEAD 529

A-AXIS RATIO 522
AIR VALVE FEEDBACK 530
A-PALLET 529
ASPECT 526
AUTO BRAKE 529
AXIS DISPLAY 528
BAUD RATE 522
B-AXIS RATIO 523
BINARY BUFFERS, 255 526
B-PALLET 529
CMD MENU 527
CRC MODE 525
Default Parameters, SETP Command 516
DEFAULT, G0 521
DEFAULT, G17 521
DEFAULT, G90 521
DEFAULT, INCH 525
G0 DETAIL 529
GAIN 526
HIGH TORQUE 527
IMM. FIXED CYCLE 524
IPM 528
M60/A-AXIS BRAKE 524
M62/B-AXIS BRAKE 524
M7-FLOOD M8-MIST 526
ORIENTATION FACTOR 525
OVERLOAD 528
PALLET 526
PENDANT 524
PU FORMAT 525
RAMP 527
RPM FACTOR 522
SCREW 528
SPINDLE AFTER M6 523
SPINDLE OFF 525
SPINDLE TYPE 523
TIMERS 527
TOOL CHANGER CAP 523
TRAVEL 522
TURRET FACTOR 526
VECTOR 528
X,Y,Z Axes 521
XYZ RAMP 528
Z TAP GAIN 528
Function Menu 157, 384, 487

Abort 385
Angles 490
Automatic 386
Backlash 387
Baud Rate 387
Begin 386, 387
Blend Radius 492
Change 388
Circles 491
Clear 387
Coordinate System 489
Current Program 387
Cursor Movement 157, 487
Display 387
Display Free Memory 387
DNC 386
Enter Diameter 385
Fixture 385
Getting Started 157, 487
Input 386
Input/Output 386
Jog Key 385
Learn Mode 387
Lines 491
Memory Function 386
Modify Length 385
Multiple 385
Offset Table 385
Offsets and All Memory 387
Options 387
Output 387
Parameters 388
Points 489
Program Library 386
Read From Jog 385
Reset Current Tool Location As 1 385
Run Program 386
Select Baud Rate 387
Select Options 386
Settings 387
Setup Function 384
Store Length 385
Summary 386
The Menus 157, 488
Turret Location 385

Using 157, 487

Verify 387

Zero Axes 385

Function Menu Display 492

ANGLE OF A LINE 493

BLEND RADIUS FROM A CIRCLE TO A CIRCLE 500

BLEND RADIUS FROM A CIRCLE TO A LINE 499

BLEND RADIUS FROM A CIRCLE TO A POINT 502

BLEND RADIUS FROM A LINE TO A CIRCLE 499

BLEND RADIUS FROM A LINE TO A LINE 498

BLEND RADIUS FROM A LINE TO A POINT 501

BLEND RADIUS FROM A POINT TO A CIRCLE 501

BLEND RADIUS FROM A POINT TO A LINE 500

BLEND RADIUS FROM A POINT TO A POINT 502

BOLT CIRCLE 506

BORING CYCLES 509

CIRCLE FUNCTION 503

CIRCULAR POCKET 508

DRILLING CYCLES 508

END OF PROGRAM 505

ENGRAVING 506

FINDING A PARALLEL LINE USING A LINE OR CIRCLE 494

FIXED CYCLES AND SUBROUTINE FUNCTIONS 505

Function menus 492

INTERSECTION OF 2 CIRCLES 495

INTERSECTION OF 2 LINES 495

INTERSECTION OF A LINE AND CIRCLE 496

MAIN MENU 492

MILL BORING 507

NINE BLEND RADIUS FUNCTIONS 498

RECTANGULAR POCKET 507

TANGENT POINT OF A LINE AND CIRCLE 497

TANGENT POINTS OF TWO CIRCLES 497

TAPPING CYCLES 509

THREE INTERSECTION FUNCTIONS 494

TOOL CALL 504

TOOL CALL AND END OF PROGRAM 504

TRIANGLE SOLVER 503

TWO LINE FUNCTIONS 493

TWO TANGENT FUNCTIONS 496

G

G 98 Return to I Plane after Final Z 76

G Codes 2, 47

Preparatory Functions 2

Summary Table 3

G Macro	
Layout	412
G0 Rapid Travel	47
G1 Linear Interpolation	48
G10 Programmable Data Input	51
L10	52
L100 - L109	53
L12	52
L13	52
L14	52
L15	52
L2	51
T	53
G15	274
G15 YZ Circular Interpolation With The A Axis	54
G17.1-G17.2 A/B Word Swap	55
G17-G19 Plane Selection	54
G2 Circular Interpolation Arc Clockwise	48
G20 Inch Programming	55
G21 Metric Programming	55
G28 AND G29 USED WITH CUTTER RADIUS COMP AT SEQ	238
G28 Return to Zero	55
Format 1	55
Format 2	56
G28.1 Cancel JOG AWAY	56
G29 Return from Zero	56
G3 Circular Interpolation Arc Counterclockwise	48
G31	
Using	350
G31 Probe Touch Function	57, 348
G31 USED WITH AN INCOMPATIBLE WORD OR MODE	238
G31.1 Probe No Touch Function	59, 350
G4 Dwell	48
as a Program Stop	49
as an In-Position Check	49
G40	204
G40 Cutter Compensation Cancel	59
G41	204
G41 Cutter Compensation Left	59
G42	204
G42 Cutter Compensation Right	59
G43 Tool Length Compensation Positive	59
G44 Tool Length Compensation Negative	59
G45 Tool Offset Single Expansion	60

G45-G48 & G52 ARE NOT ALLOWED WITH ROTATION, N = 238
G46 Tool Offset Single Reduction 61
G47 Tool Offset Double Expansion 61
G48 Tool Offset Double Reduction 61
G49 Tool Length Offset Cancel 61
G5 Non Modal Rapid 49
G50 Ramp Control Cancel 62
G50.1 Mirror Image Cancel 62
G51 Ramp Control 62
G51.1 Mirror Image 63
G51.2 Canceling 65
G51.2 Tool Load Compensation 64
 R1 = Target Spindle Load 64
 R2 = Minimum Percentage Feed Rate Reduction 64
 R3 = Maximum Percentage Feed Rate Increase 64
 R4 = Number of Seconds at Minimum Feed Rate Until the Control Activates Slide Hold 64
G51.3 Axis Scaling 65
G52 Coordinate System Shift 66
 Cancel G52 67
G53 Machine Coordinate System 67
G54-G59 Fixture Offsets 68
G66 Modal Subroutine 68
G67 Cancel Modal Subroutine 70
G68 Coordinate System Rotation 70
G69 Coordinate System Rotation Cancel 71
G70 Inch Programming 71
G71 Metric Programming 71
G73 Peck Drilling 81
 Using I, J, K 81, 85
 Using Q 81, 84
G73-G76, G81-G89 Fixed Cycles 71
G74 Left Hand Tapping 81
 Format 1 86
 Format 2 87
G74.1 Left Hand Rigid Tapping 81
G75 Tapping Head Cycle 81
 Formats 1 & 2 88
G76 Fine Boring 81
 Using Q 88
G76 Fine Boring Using
 I, J 89
G8 Acceleration 49
G80 Fixed Cycle Cancel 71
G81 Spot Drilling 81, 89
G82 Counter Boring 90

G82 Counter Boring, Center Drilling, Spot Facing 82
G83 Deep Hole Drilling
 Using I, J, K 91
 Using Q 90
G83 Deep Hole Drilling Using Q 82
G84 Right Hand Tapping 82
 Format 1 92
 Format 2 93
G84 Right Hand Tapping Using P Word 82
G84.1 Right Hand Rigid Tapping 83
G85 Bore In, Bore Out 83, 93
G86 Bore In, Spindle Off, Orient, Rapid Out 83
G86 Bore In, Spindle Off, Rapid Out 94
G87 Bore In, Bore Out 83, 94
G88 Bore In, Dwell, Bore Out 83, 95
G89 Bore In, Dwell, Bore Out 83, 95
G9 Deceleration 50
 as an In-Position Check 50
G90 Absolute Input 72
G91 Incremental Input 72
G91.1 High Speed Execution 73
G91.2 High Speed Execution Cancel 73
G91.2 IS NOT ALLOWED IN FORMAT 1 238
G92 Absolute Preset 73
G92 CANNOT BE USED IN CRC MODE, N = 238
G92 MUST BE ONLY G CODE IN BLOCK 239
G93 - 1/T 272
G93 I/T Feed Rate Specification 74
G94 Feed Rate Specification MPPM, IPM or DPM 74
G98 Return to Initial Plane 74
G99 Return to R0 Plane after Final Z 76
Gain 181
Gain Setting 38
General Purpose Indexer 31
General Rules 209
GNN IS AN UNSUPPORTED G CODE AT N 239
Graphics 485
Graphics Menu 158, 485

H

H and D Word with CRC 206
 Use 206
Handshaking 311
Helical Interpolation 302
HELICAL MOVE TOO SHORT, N = 239

Helical Moves

Partial Arcs 307

HELICAL RADIUS TOO SMALL, N = 239

HELICAL RISE TOO STEEP, N = 239

Help 160

High Speed Execution 73

High Speed Execution Cancel 73

High Torque 182

HO 152

HO Macro

Layout 413

Home Axes Function 388

Return For Power Off 388

Return To Home 388

Home Axis 152

Hydro Sweep 466

Chip Removal System 466

Operation 466

I

I Macro

Layout 411

I Plane 75

I, J, OR K MUST BE SPECIFIED AT N = 239

I/T Feed Rate Specification 74

IBM-Compatible PC-DB9 to DB25 for DTE Equipment-Null Modem Included 320

IBM-Compatible PC-Simple DB25 Null Modem 320

ID Thread 309

Cutting 309

ILLEGAL G CODE DURING G91.1 MODE AT N = 239

ILLEGAL O WORD 239

Imm. Fixed Cycle 175

IMPROPER USE OF CANNED SUBR. 239

IN 153

Inch Programming 55, 71, 164

INCHES MODE REQUIRED - OPERATOR MUST SET 240

INCOMPATIBLE G CODES AT SEQ 240

Increment 153

INCREMENT DIVIDED BY TWO 240

INCREMENT TOO LARGE 240

INCREMENT TOO SMALL 240

Incremental Input 72

Incremental Mode 285

Indefinite Subroutine Repetitions 108

Initial Connection 311

Initial Peck

 I# 102

INPUT XMODEM TRANSMIT BLOCK MISSED ERROR 240

Insert Blocks 153

 From 153

 Increment 153

Interpolation 287

 Circular 288

 End Point 288

 Linear 287

Interpolation Modes 287

Intersectional CRC 219

Intersectional Cutter Compensation 45

Intersectional Cutter Compensation Canceled 44

J

J 153

JOG = ZOOM 148

JOG AXES TO HOME POSITIONS, THEN ENTER THE CS COMMAND 240

Jog Axis 153

 Axis ID 153

 Direction 153

Jog Key and the Hand Wheel 129

Jog Mode 267

Jog to Locate 194

K

Key Lock 12

Key Lock Switch 127

L

L9101 Probe Functions 111, 352

L9201 Engraving Functions 111

Last Screen Function 389

LE 153

Learn Mode 153

Left Hand Rigid Tapping 81

Left Hand Tapping 81

LI 154

Light On/Off Switch 127

LINE FEED OPTION 140

Line Feed Option 139

Line Jump 46

Linear Interpolation 48

List Program 154

From 154
Through 154
Load and Store Pallet 33
Load Pallet A & Verify Pallet A Has Been Loaded 33
Load Pallet B & Verify Pallet B Has Been Loaded 34
Locator Diameter 196
LOGIC JUMPER INCORRECT or COMMAND SIGNAL MISSING 257
Logical Operators 430
LOOK AHEAD WAS CANCELED BY OPERATOR 241

M

M = TOGGLE DISPLAY MOD 148
M 33.1 Load Pallet B & Verify Pallet B Has Been Loaded 34
M FUNCTION TOO LARGE AT N = 241
M Functions 6, 21
 Modal 6
 Non Modal 6
 Summary Table 7
M,S,T LOCKOUT IS IN EFFECT 241
M0 Program Stop 21
M1 Optional Program Stop 22
M10 Cancel Reciprocation 28
M11 X Axis Reciprocation 28
M12-M16 Reciprocation for Y, Z, B, A 29
M17 End of Subroutine 29
M18 Air Ratcheting Indexer 30
M19 Spindle Stop and Orient 31
M2 End of Program 22
 Format 1 22
 Format 2 22
M20 General Purpose Indexer 31
M3 Spindle CW 23
M3.1 Sub-Spindle On, Ignore Magnet 23
M3.2 Acknowledge Spindle Magnet 23
M30 End Of All Subroutines 31
M30 End Of Program 32
M31 Exchange Pallets 32, 392
M32 Load and Store Pallet A 33
M32 Store Pallet B and Load Pallet A 392
M32.1 392
M32.1 Load Pallet A & Verify Pallet A Has Been Loaded 33
M33 Store and Load Pallet B 33
M33 Store Pallet A and Load Pallet B 392
M33.1 393
M4 Spindle CCW 24

- M4.1 Sub-Spindle On, Ignore Magnet 24
- M4.2 Acknowledge Spindle Magnet 24
- M41-M43 Belt Drive Range 34
- M45 Execute Fixed Cycle 34
 - Used with Fixture Offsets 34
- M46 Positive Approach 35
- M47 Cancel Positive Approach 35
- M48 Potentiometer Controls In 35
- M48.1 & M49.1 Servo Coolant Potentiometer Controls In/Out 36
- M48.2 394
- M48.2 & M49.2 Pallet A Rotary Table Override Potentiometer 36
- M48.3 394
- M48.3 & M49.3 Pallet B Rotary Table Override Potentiometer 37
- M49 Potentiometer Controls Out 36
- M49.2 394
- M49.3 394
- M5 Spindle Off 24
- M6 Tool Change 25
 - SETP Parameter 25
 - T-# Move Tool Changer 26
- M60 184
- M60 - M69 User Attached Devices 37
 - M-60 & M-62 for Fixed Cycles 38
- M62 185
- M7 Coolant One On 26
 - SETP Parameter 26
- M7.1 Programmable Coolant On 27
 - SETP Parameter 27
- M7-FLOOD 178
- M8 Coolant Two On 27
 - SETP Parameter 27
- M8.1 Programmable Coolant On 27
 - SETP Parameter 28
- M80 Automatic Doors Open 38
- M81 Automatic Doors Close 38
- M8-MIST 178
- M9 Coolant Off 28
- M90 Change Axis Gain
 - P Word 38
- M90-M93 Gain Setting 38
- M94 Feed Forward Function 39
 - P Word 40
 - Q Word 40
- M94.1 Feed Forward by Feed Rate Modification 40
 - P Word 41

- Q Word 41
- R0+# 41
- R1+# 41
- R2+# 41
- M94.2 Advanced Feed Forward 42
 - Acceleration 43
 - Deceleration 43
 - Detail 43
 - P Word 43
 - R1 43
 - R2 43
- M95 Feed Forward Cancel 44
- M95.1 Feed Forward by Feed Rate Modification Cancel 44
- M95.2 AFF Cancel 44
- M96 219
- M96 and M97 219
 - When to use 219
- M96 Intersectional Cutter Compensation Canceled (Roll CRC) 44
- M97 219
- M97 Intersectional Cutter Compensation 45
- M98 Subprogram 45
 - L Word 46
 - P Word 45
- M99 End Of Subprogram 46
- M99 Line Jump 46
 - P Word 46
- MA 154
- Machine Coordinate System 67, 261
- Machine Grounding 311
- Macintosh II Mini-8 Connector 321
- Macintosh Plus DIN-8 Connector 322
- Macintosh Plus DIN-9 Connector 321
- Macro 154
- Macro Commands 417
 - AND, OR, and NOT 423
 - CLEAR 417
 - GOTO 417
 - IF - THEN 418
 - INDEX 419
 - INPUT 419
 - LABELS 420
 - Labels 418
 - PRINT 420
 - SET 420
 - SET DEBUG 421

- SET DEGREES / RADIANS 421
- SET RND# 421
- SET RUN 422
- SINPUT 422
- SPRINT 422
- START # 422
- Macro Language Examples 432
 - D-Hole Macro 432
 - Sub Program 800 433
 - Sub Program 900 436
- Macro Tutorial 424
 - Calculations 425
 - Comments 425
 - Conventions 425
 - Overview 424
 - Summary 424
- Macro Variables 410
- Macros 401, 403
 - Functions 415
 - ABS 415
 - ATN 415
 - COS 415
 - INT 415
 - RND 416
 - SGN 416
 - SIN 416
 - SIN/COS 416
 - SQR 417
- MAIN PROG. NOT FOUND 241
- Main Program 104
- Manual 136
- Manual Data Input 154
- Mathematical Functions 406
 - Calculations 407
 - Comments 407
 - Decimals 407
 - Exponential Form 407
 - Macros 406
 - Order of Calculation 406
- MD 154
- MDI Function 388
- ME 155
- Memory 155
- MEMORY ERROR, RELOAD PROGRAM 242
- MEMORY ERROR, RESPOND WITH Y TO DELETE BAD BLOCKS 242

Menu 155
METRIC MODE REQUIRED - OPERATOR MUST SET 242
Metric Programming 55, 71, 164
Metric Threads 98
Mid Program Start 281
Mill Boring 119
 L94NN Mill Boring Cycle Counterclockwise 119
 L95NN Mill Boring Cycle Clockwise 120
Minimum Peck
 K# 102
Mirror Image 63
Mirror Image Cancel 62
Miscellaneous Control Options 477
 Input from a Tape Punch or Computer 477
 Key Lock 478
 NOEDIT Feature 479
Modal & Non Modal Functions 3
 Modal 3
 Non Modal 3
Modal Subroutine 68
MOTOR OVERLOAD 242
MOTOR OVERLOAD. ERROR > OVERLOAD FACTOR IN CONTOURING MODE 259
MOTOR OVERLOAD. ERROR > OVERLOAD FACTOR IN JOB MODE 259
MOTOR OVERLOAD. ERROR > OVERLOAD FACTOR IN POINT TO POINT MODE 259
MOTOR OVERLOAD. ERROR > OVERLOAD FACTOR IN STANDBY MODE 259
MOTOR OVERLOAD. EXCESSIVE FOLLOWING ERROR 257
MOTOR OVERLOAD. FOLLOWING ERROR GREATER THAN THE OVERLOAD FACTOR 258
MOTOR OVERLOAD. MISSING 0 OR 1 COMMAND 258
MOTOR OVERLOAD. PULSE COMMAND STEP COMMAND CHECKSUM ERROR 258
MOVE EXCEEDS AXIS LIMIT AT N = CHECK PROGRAM AND TOOL OR FIXTURE OFFSETS 242
Move to Fixture Offset 199
Move to Home 267
Move Tool Changer 26
MOVE TRANSFER FAULT. INCOMPLETE DATA FOR MOVE COMMAND 258
MOVE TURRET TO TOOL 1 AND ENTER SETTO COMMAND 243
MP Series Probe 348
 General Rules 348
MP8 Probe Calibration 366
MU 155

N
NC Word Summary 1
NE 155
Nesting 105
New Program 155

NEXT ENTRY IS OUT OF RANGE 243
NO ANGLE, THE POINTS ARE THE SAME 243
No Feed Ramps 49
NO INDEX MARK DETECTED 257
NO MEMORY AVAILABLE FOR NEW PROGRAM 243
NO MOTOR FEEDBACK 256
NO OTHER WORDS ALLOWED WITH O WORD 243
NO PARAMETERS OR PARAMETERS CORRUPTED MACHINE DEFAULTS USED 244
NO RESPONSE FROM AXIS 244
NO TOUCH OR INCOMPLETED POINT AT N = 244
NOEDIT 11
Non Modal Rapid 49
NOTE ERROR THEN HIT MANUAL 244
NU 156
NUMBER OUT OF RANGE 244
Numerical Format 268
N-Words Ordered 185

O

O = OPTIONS PLOTTING 148
O Macro
 Layout 413
O Word 10
O WORD OUT OF RANGE 245
OD Thread 308
 Cutting 308
OFFSET ENTRY ERROR 244
Offset Number 151
Offset Utility Option 3 199
Offset Utility Option 4 199
Offset Utility Option 5 199
Offset Utility Option 6 200
Offset Utility Options 193
 Item 1 193
 Item 2 194
 Item 3 196
 Item 4 197
 Item 5 198
 Item 6 199
 Item 7 199
 Item 8 199
 Item 9 199
 Option 1 193
 Option 2 193
Offsets 159

ONLY BLOCK SKIP ALLOWED WITH MACRO 244
ONLY M3, M4 & M5 ARE ALLOWED WITH M6 AT N = 245
ONLY Z, L, R & F WORDS ALLOWED 245
Operation Formats 169
Operator Interaction 427
 INPUT 427
 PRINT 427
Optional Program Stop 22
Optional Stop Switch 127
Orient 83
Orientation Factor 176
ORIENTATION FAILURE 245
ORIENTATION TIME-OUT OR TAPPING CALIBRATION FAILURE 259
O-Ring Groove 214
OUT OF FILE SPACE, A FILE COMPRESSION IS BEING TRIED 245

P

P WORD TOO LARGE 248
PA 156
Pallet 178
Pallet A Rotary Table & Pallet B Rotary Table Override Potentiomete 393
Pallet A Rotary Table Override Potentiometer 36
Pallet B Rotary Table Override Potentiometer 37
Pallet Changer 199, 391
 Mechanical Overview 391
 Word Swap 391
PALLET DISABLED IN PARAMETERS 245
PALLET IN STORAGE 245
PALLET MUST BE CLAMPED 246
PALLET NOT FULLY STORED 245
Pallet Programming 165
PARAMETER ERROR 246
Parametric Programming 107, 401
 Example Program 402
Parametric Variables 414
PARITY ERROR 246
PARITY ERROR DURING DNC 246
Peck Drill
 G73 102
Peck Drilling 81
Pendant 175
Perpendicular Rule 215
Plane Selection 54
PLEASE PUT AN O WORD AT THE FIRST OF THE CURRENT PROGRAM THE FOLLOWING PROGRAMS ARE
IN MEMORY 246

Plotting Options 485
 A = AUTO 485
 C = CLEAR 485
 F = FULL TABLE 486
 JOG = ZOOM 487
 M = TOGGLE DISPLAY MODE 486
 O = OPTIONS PLOTTING 486
 S = SINGLE STEP 486
 V = VIEW TOP OR ISOMETRIC 486

POINTS ARE ON SAME LINE AT N = 247

Position Check 362

POSITION LIMIT 247

Positive Approach 35

POSSIBLE PROBE OVER TRAVEL 247

Potentiometer Controls In 35

Potentiometer Controls Out 36

PR 161

PRESS Y TO KEEP THIS POSITION PRESS N TO RETURN TO LAST POSITION 247

Probe Fixture Offset Numbe 342

Probe No Touch Function 59

Probe Offsets 342
 Locating Length Using the JOG Function 344
 Locating Length Using the Probe 344
 Z Fixture Offsets 342

PROBE TEST = FAILURE 247

Probe Touch Function 57

Probe Touch Point Variables 413

PROBLEM POSITIONING SLIDES TO ZERO 247

PROCUNIER 97

Procurier Series 101

PROGRAM BLOCK NOT FOUND 248

Program Branching 428
 GOTO 428
 IF-THEN 428
 LABELS 428

Program Coding 98

Program Coordinate System 263

PROGRAM DOES NOT EXIST RETRY OR HIT MANUAL TO EXIT 247

Program Maintenance Library 161

PROGRAM NOT FOUND 248

Program Number 10

Program Numbers, Protection & Storage 10
 O Word 10
 Program Number 10

Program Page Edit 156

- Program Protection 11
 - Emergency Stop Button 12
 - Key Lock 12
 - NOEDIT 11
 - Program Data Input 13
 - Program Storage 12
- Program Stop 21
- Program Storage 12
- Program Tape Input 9
- Programmable Coolant On 27
- Programmable Data Input 51
- Programming Formats 165
 - Format 1 166
 - Format 2 167
- PU 161
- PU Command 316
- PU FORMAT 177
- Punch Program Tape 161
 - Code Option 161
 - Data Option 161
 - TTY Option 161

Q

- Q Word 278
- Quick Keys Menu 379
 - AXIS ZERO 380
 - CUSTOM MACRO 382
 - DRY RUN 379
 - NEXT TOOL 379
 - OFFSETS 380
 - PUNCH 380
 - READ 380
 - SET FIXTURE 380
 - SET LENGTH 380
 - ZERO RETURN 380

R

- R Plane 76
- R Variable Definition 402
- Radius Variables 409
- RAILS NOT ALIGNED 248
- Ramp 183
- Ramp Control 62
- Ramp Control Cancel 62
- Ramping 96

Rapid Out 83, 94
Rapid Travel 47
Rapid Travel Selector 128
Receiving Data 323
Reciprocation for Y, Z, B, A 29
Rectangular Pocket Clean-out 121
 L9601 Rectangular Pocket Clean-out Counterclockwise 121
 L9701 Rectangular Pocket Clean-out Clockwis 122
Reducing Factor
 J# 102
Reinitialize 163
Remote Machine Control 395
Renumber Program 156
 Increment 156
Repeating Helical Moves 302
 Using Copied Lines 303
 Using Line Repetitions 303
 Using Subroutines and Subprograms 303
Reset Clocks 201
Reset Function 388
RESET THE EMERGENCY STOP SWITCH 248
RESOLVER FAULT OR SCALE ERROR 248
Return from Zero 56
RETURN PALLET TO THE LOAD POSITION 248
Return to I Plane after Final Z 76
Return to Initial Plane 74
RETURN TO MAGNET TIME-OUT 259
Return to R0 Plane after Final Z 76
Return to Zero 55
RI 163
Right Hand Rigid Tapping 83
Right Hand Tapping 82
Right Hand Tapping Using P Word 82
Rigid Tap 182
RIGID TAP PRECYCLE ENCODER COUNT PROBLEM (NOT ENOUGH COUNT) 257
RIGID TAP PRECYCLE ENCODER FAILURE 260
Rigid Tapping 98
Roll CRC 44
Rolling 219
Rotary Axes 265
ROTARY AXIS MOVE TOO LONG. N = 248
Row Column Pattern Macro 436
RPM FACTOR 171
RS-232 ERROR DURING DNC 248
RS-232-C Interface Connection 318

S

S = SINGLE STEP 148
SCALE ERROR 249
SEE MENU FOR NEW CD FORMAT 249
Select Number/Locator 193
Sending Data 323
SEQUENCE NUMBER TOO LARGE 249
SEQUENCE NUMBER TOO SMALL 249
SERVO AMPLIFIER FAULT 249
SERVO AMPLIFIER FAULT LINE DOWN 258
Servo Coolant 468
 Continuous Sweep Mode 471
 CS Procedure 469
 Description 468
 Setup Procedure 469
Servo Coolant Potentiometer Controls In/Out 36
SET 164
Set Cold Start 163
Set Home Position For One Axis 164
Set Home Position Of All Axes 163
Set System Parameters 164
Set Time 201
Set Tool Length Offset 187
 Optional Change Value 187
 Tool Number 187
Set Turret Order 186
SETCS 163
SETH 163
SETIN 164
SETME 164
SETP 164
SETP Parameter 25
SETPA and SETPB 165
SETPB 165
SETTO 186
Shift 129
SINGLE STEP 249
Single Step 135
SL 187
SLIDE HOLD 249
Slide Hold 132
Slide Hold, JOG AWAY 132
Software Error Codes 335
Spacebar, Background Editing 134
Spindle After M6 174

Spindle CCW 24
SPINDLE CONTROLLER DOES NOT RESPOND 250
SPINDLE CONTROLLER OR DRIVER FAULT 250
SPINDLE CONTROLLER SOFTWARE UPDATE IS REQUIRED 250
Spindle CW 23
SPINDLE DRIVER FAULT 250
SPINDLE FAILURE DURING REVERSAL 251
SPINDLE FAILURE WHILE TAPPING 250
SPINDLE FAULT LINE 251
SPINDLE FAULT LINE DOWN 257
SPINDLE HAS FAILED TO TURN ON 251
SPINDLE MAGNET NOT DETECTED or SPINDLE NOT RUNNING 257
SPINDLE MOTOR TEMPERATURE FAULT 251
Spindle Off 24, 83, 94
Spindle On/Off 130
Spindle Speed 96
Spindle Speed Override Potentiometer 129
Spindle Stop and Orient 31
Spindle Type 174
SPINDLE WILL NOT STOP. CHECK INVERTER ZERO SPEED 260
SPINDLE WOULD NOT STOP 251
Spiral Cut Macro 437
Spot Drilling 81
Spot Facing 82
SPURIOUS INTERRUPTS. NOT SERVICEABLE 259
STACK OVERFLOW 251
STACK OVERFLOW. OVERLOADED WITH STEP COMMAND 258
Start 135
Start Block Num 147
Start Block Num. 146
Step Downs 216
Store and Load Pallet B 33
Store Location 196
Storing Probed Positions 58
 Saving Positions Through the Rs-232 Port 58
 Saving Positions to P Words 58
 Saving the Position As a V Variable 58
SU 188
Sub Program 810 437
Subprogram 45
Subprograms 108
SUBR. DOES NOT EXIST 251
SUBR. NESTING ERROR 251
SUBROUTINE CALL IS NOT ALLOWED IN MDI 251
Subroutines 103

- Beginning 103
- Calling 103
- Ending 104
- Sub-Spindle On, Ignore Magnet 23, 24
- Sum Program 188
 - CRC Option 188
 - Display From 188
 - Display Option 188
 - Through 188
- Survey 189
- SURVEY CLEARED DUE TO BLANK OR CORRUPT SURVEY 260
- SURVEY CONTAINS ERRORS, PLEASE REVIEW 252
- SURVEY WAS NOT WRITTEN TO THE AXIS CONTROLLER 252
- SV 189
- SWITCH 1 DISABLED 257
- Symbolic Operators 429
- Syntax Errors 337

T

- TA 190
- Table 59
- Tap Sizes 97
- Tape Input 190, 315
 - Add at the End Option 190
 - Device Option 190
 - Error Option 190
- TAPE INPUT TERMINATED 252
- TAPE IS GOOD 252
- Tape Punch 325
- Tape Verification 202
- TAPMATIC 97
- Tapmatic NCR Series 99
- Tapmatic SPD Series 100
- Tapping Cycles 96
 - Feed Rate Calculation 97
 - General Tapping Rules 96
 - Format 1 96
 - Format 2 96
 - Program Examples 98
- Tapping Head Cycle 81
- TC,1 191
- Teletype 325
- TEMPERATURE FAULT 252
- TEMPORARY CONFLICT WITH AUTO 252
- Termination 311

Test MP Probe 199
Test TS-20 Probe 199
THERE IS NO SURVEY 252
THREAD LEAD NOT SPECIFIED AT N = 252
Thread Milling 307
Tilt Cold Start 283
Tilt Home Position 283
Tilt Rotary Table 283
Tilt Table Brake 284
TIME OUT ON RESOLVER RESPONSE 258
TIME OUT ON RIGID TAP PRE-CYCLE TEST 258
TIME-OUT ON ORIENTATION 260
Timers 173
TLC 64, 65
TLC Manual Target Power Override 65
TN 414
TO 191
TOO MANY BLOCKS FOR GAP 253
TOO MANY CONSECUTIVE NON MOTION BLOCKS 253
TOO MANY M FUNCTIONS AT N= 253
TOO MANY PARAMETERS 253
TOO MANY SUBR. CALLS 253
Tool Breakage Detection 362
TOOL BREAKAGE DETECTION = FAILURE AT N = 253
Tool Change 25
Tool Changer Cap 173
Tool Changer Open 191
Tool Diameter 409
TOOL DIAMETER TOO LARGE AT N= 253
Tool Length Compensation Negative 59
Tool Length Compensation Positive 59
Tool Length Offset Cancel 61
Tool Load Compensation 64
TOOL NN IS IN THE SPINDLE 254
Tool Number 153, 414
TOOL NUMBER TOO HIGH 254
Tool Offset Double Expansion 61
Tool Offset Double Reduction 61
TOOL OFFSET NOT ALLOWED DURING Z MIRROR 254
Tool Offset Single Expansion 60
Tool Offset Single Reduction 61
Tool Parameter Definition 191
 Diameter 191
 Length Offset 191
 Number 191

Tool Table 186
Tool Time 414
TOOL TURRET LOCATION IS NOT SET 254
Tool Used 414
Tooling Coordinate System - Home 261
Touch Check 362
Touch Probes 339

- Calculate Diameter 365
- Compute Center and Radius 354
- Entering Radial Over Travel 367
- Entering XY Shift Values 366
- Jog to Position 341
- Length Offset 339
- Locate Touch Point 353
- Locating the Points 348
- Mid-Point and Angle 359
- Part Orientation 356
- Probe Mount 341
- Radial Over Travel 365
- Set Calibration 365
- Set Counter 367
- Set Touch Point 368
- Storing Probed Positions 349
- Tool Breakage Detection 345
- Tool Diameter Offset 347
- Tool Setting Cycle 339
- True or False Comparison 364
- Using with Macro Statements 371
- XY Shift Error 365
- Z Datum Location 360

TRANSFER ERROR, PLEASE RETRY 254
TRAVEL 172
TROUBLE READING THE EXTERNAL SLIDE HOLD SWITCH 254
TT 414
TU 414
Turret CCW 136
Turret CW 136
Turret Factor 180
Tutorial Program Explanations 442

- Program Number 1 442
- Program Number 2 443
- Program Number 3 444
- Program Number 4 446
- Program Number 5 448
- Program Number 6 449

- Program Number 7 451
- Program Number 8 453
- Program Number 9 455
- Tutorial Program Listings 458
 - Program Number 1 458
 - Program Number 2 458
 - Program Number 3 459
 - Program Number 4 459
 - Program Number 5 460
 - Program Number 6 460
 - Program Number 7 461
 - Program Number 8 462
 - Program Number 9 463
- Tutorial Program Summaries 440
 - Program Number 1 440
 - Program Number 2 440
 - Program Number 3 440
 - Program Number 4 440
 - Program Number 5 440
 - Program Number 6 440
 - Program Number 7 441
 - Program Number 8 441
 - Program Number 9 442
 - Synopsis 440
- TYPE A Y TO IGNORE, OR TURN POWER OFF AND THEN ON AGAIN 254

U

- UNDEFINED MACRO ERROR 254
- Unwrapping 278
- User Attached Devices 37
- UT 192
- Utility 192
 - Tool Number 192
- Utility Menu 395

V

- V= VIEW TOP OR ISOMETRIC 148
- V1-V100 415
- Variables 408, 425
 - Arrays 408, 425
 - Axis Position Variables 408
 - CLEAR 426
 - V1-V100 425
- Video On/Off Switch 127
- Video Option 146, 147

VMC Communications Procedures 322
VT 202

W

WAIT 2 SEC., THE AXIS DRIVERS ARE BEING RESET 254
WAITING 255
WAITING ON AIR VALVE 255
WARNING POSSIBLE GOUGE AT N = 255
WAY LUBE PRESSURE SWITCH FAILURE 255
Wrapping X on B Axis 277
WRITING ERROR, WAIT 2 MIN. AND RETRY 255

X

X Axis Reciprocation 28
X Value 151
X,Y OR Z MOVE MUST BE SPECIFIED AT N = 255
XModem Direct Numerical Control 147
XMODEM for DNCX 312
 How to Send a File Using 312
XMODEM Protocol 312
XON/XOFF Protocol 312
XYZ Axes 169

Y

Y Value 151
YOU CANNOT DELETE THE PROGRAM THAT IS CURRENTLY ACTIVE 255
YOU HAVE A VERSION UPGRADE OR MEMORY HAS BEEN CORRUPTED ... MEMORY NEEDS TO BE ZEROED
255
YOU MUST ENTER THE BACKLASH TABLE 255
YOUR VERSION OF CNC MAIN NEEDS TO BE UPDATED 256
YZ Circular Interpolation With The A Axis 54
YZA Circular Interpolation 274

Z

Z & M6 LOCKOUT IS IN EFFECT 256
Z AXIS MUST BE AT COLD START FOR TC,1 256
Z Value 151
Z, Q, OR F MISSING IN CANNED CYCLE CALL, N = 256