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 R0 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 G0 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
Fadal User Manual

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 MMPM, 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
   # 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 Potentiometer 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
Procunier 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
Fadal

Index

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 Clockwise 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