

# **Sodick**

**WIRE-CUT EDM NC POWER SUPPLY UNIT**

## **CODE INSTRUCTIONS**

**LPW/LQW/LQWDX/LNW**

Before operating the machine, read this manual carefully and make sure that you fully understand the information it contains.

Appoint someone to be responsible for this manual and keep it in a designated place so that it is accessible at all times.

**Ver4.0**

# TABLE OF CONTENTS

|                                                                                              | <u>PAGE</u> |
|----------------------------------------------------------------------------------------------|-------------|
| CHAPTER 1 OUTLINE .....                                                                      | 1-1         |
| 1. DEFINITION OF "WORD" .....                                                                | 1-1         |
| 2. DEFINITION OF "ADDRESS" .....                                                             | 1-2         |
| 3. ADDRESS AND DATA .....                                                                    | 1-3         |
| 3-1. N, O (Sequence Number) .....                                                            | 1-3         |
| 3-2. G (Preparatory Functions<br>(Linear Interpolation, Circular Interpolation, etc.)) ..... | 1-3         |
| 3-3. X, Y, Z, U, V, W (Axis Travel) .....                                                    | 1-3         |
| 3-4. I, J (Coordinates of Center of Circular Arc) .....                                      | 1-3         |
| 3-5. T (Machine Control Items) .....                                                         | 1-4         |
| 3-6. D, H (Offset Number) .....                                                              | 1-4         |
| 3-7. A (Angle in Taper Machining) .....                                                      | 1-4         |
| 3-8. P (Subprogram Number) .....                                                             | 1-4         |
| 3-9. L (Number of Repetitions of Subprogram) .....                                           | 1-4         |
| 3-10. C (Machining Condition Number) .....                                                   | 1-5         |
| 3-11. M (Auxiliary Function) .....                                                           | 1-5         |
| 3-12. Q (File Call-up) .....                                                                 | 1-5         |
| 3-13. F (Feedrate) .....                                                                     | 1-5         |
| 3-14. ON, OFF, etc. (Change of Machining Condition Parameters) .....                         | 1-6         |
| 4. COORDINATE SYSTEMS .....                                                                  | 1-7         |
| 5. COMMENTS .....                                                                            | 1-8         |
| CHAPTER 2 BLOCKS .....                                                                       | 2-1         |
| 1. DEFINITION .....                                                                          | 2-1         |
| 2. PROCESSING ORDER OF NC CODES IN ONE BLOCK .....                                           | 2-2         |
| CHAPTER 3 SEQUENCE NUMBERS .....                                                             | 3-1         |
| CHAPTER 4 BLOCK SKIP ("I") .....                                                             | 4-1         |
| CHAPTER 5 G CODES .....                                                                      | 5-1         |
| 1. G00 (POSITIONING) .....                                                                   | 5-8         |
| 2. G01 (LINEAR INTERPOLATION) .....                                                          | 5-8         |
| 3. G02, G03 (CIRCULAR INTERPOLATION) .....                                                   | 5-9         |
| 4. G04 (DWELL) .....                                                                         | 5-12        |
| 5. G05, G06, G07, G09 (MIRROR IMAGE AND CANCEL) .....                                        | 5-13        |
| 5-1. G05, G06, G07 and G09 .....                                                             | 5-13        |

## TABLE OF CONTENTS

|                                                                                                                  | <u>PAGE</u> |
|------------------------------------------------------------------------------------------------------------------|-------------|
| 6. G08, G09 (X-Y EXCHANGE AND CANCEL) .....                                                                      | 5-15        |
| 7. G11, G12 (BLOCK SKIP ON/OFF) .....                                                                            | 5-17        |
| 8. G13, G14, G15<br>(WIRE BREAKAGE RECOVERY FUNCTION ON/OFF) .....                                               | 5-18        |
| 9. G17 (PLANE SELECTION) .....                                                                                   | 5-18        |
| 10. G22, G23 (SOFTWARE LIMIT) .....                                                                              | 5-19        |
| 11. G26, G27 (FIGURE ROTATION ON/OFF) .....                                                                      | 5-20        |
| 12. G28, G29, G60 (MAIN REFERENCE POINT) .....                                                                   | 5-21        |
| 13. G30 (RETURN TO G92/G97 SET POINT) .....                                                                      | 5-21        |
| 14. G40, G41, G42 (WIRE ELECTRODE OFFSET) .....                                                                  | 5-22        |
| 15. G48, G49 (EDGE CONTROL ON/OFF) .....                                                                         | 5-23        |
| 16. G50, G51, G52 (TAPER MACHINING) .....                                                                        | 5-24        |
| 17. G53 (POSITIONING IN MACHINE COORDINATE SYSTEM) .....                                                         | 5-25        |
| 18. G54 TO G958, G959 (WORK COORDINATE SYSTEMS 54 TO 958,<br>MACHINE COORDINATE SYSTEM) .....                    | 5-26        |
| 19. G74, G75 (FOUR-AXIS OFFSET ON/OFF) .....                                                                     | 5-28        |
| 20. G80, G380 (TRAVEL UNTIL CONTACT DETECTION IS ACTIVATED) .....                                                | 5-29        |
| 21. G280 (TRAVEL UNTIL CONTACT DETECTION IS ACTIVATED<br>WITH THE AWT PIPE) .....                                | 5-32        |
| 22. G81 (TRAVEL TO LIMIT OF MECHANICAL SYSTEM) .....                                                             | 5-32        |
| 23. G82 (TRAVEL TO HALF OF DISTANCE BETWEEN PRESENT<br>POSITION AND ORIGIN) .....                                | 5-33        |
| 24. G83 (READ NC INFORMATION INTO SPECIFIED OFFSET TERM) .....                                                   | 5-35        |
| 25. G90 (ABSOLUTE PROGRAMMING MODE)<br>G91 (INCREMENTAL PROGRAMMING MODE) .....                                  | 5-37        |
| 26. G92, G97 (COORDINATE SYSTEM SHIFT) .....                                                                     | 5-39        |
| 27. G104, G105 (CORNER DWELL ON/OFF) .....                                                                       | 5-40        |
| 28. G113, G114 (MACHINING SLIT WIRE THREADING ON/OFF) .....                                                      | 5-41        |
| 29. G122, G123 (SET SOFTWARE LIMIT) .....                                                                        | 5-42        |
| 30. G126, G127 (COORDINATE ROTATION ON/OFF) .....                                                                | 5-42        |
| 31. G128, G129 TO G928, G929 (SUB-REFERENCE POINT) .....                                                         | 5-43        |
| 32. G132, G133, G134, G135, G136, G137<br>(INTERFERENCE CHECK AND AVOIDANCE) .....                               | 5-44        |
| 33. G140, G141, G142 (COMPLEX SHAPE) .....                                                                       | 5-45        |
| 34. G148, G149, G248, G249, G348, G349, G448, G449, G548, G549,<br>G648, G649, G748, G749 (CORNER CONTROL) ..... | 5-46        |
| 35. G152 (LOCAL COORDINATE SYSTEM) .....                                                                         | 5-47        |
| 36. G153 (MOVE TO THE STROKE END) .....                                                                          | 5-49        |
| 37. G183 (READ SETTING INFORMATION INTO SPECIFIED OFFSET TERM) .....                                             | 5-50        |
| 38. G192 (HALF-COORDINATE SET) .....                                                                             | 5-54        |

# TABLE OF CONTENTS

|                                                                                                          | <u>PAGE</u> |
|----------------------------------------------------------------------------------------------------------|-------------|
| CHAPTER 6 X, Y, Z, U, V, W COORDINATE AXES .....                                                         | 6-1         |
| CHAPTER 7 I, J COORDINATE AXES .....                                                                     | 7-1         |
| CHAPTER 8 T CODES .....                                                                                  | 8-1         |
| 1. T80 (WIRE RUN)<br>T81 (WIRE RUN STOP) .....                                                           | 8-3         |
| 2. T82 (AUTO DRAIN OFF)<br>T83 (AUTO DRAIN ON) .....                                                     | 8-3         |
| 3. T84 (PUMP ON)<br>T85 (PUMP OFF) .....                                                                 | 8-4         |
| 4. T86 (FLUSHING ON)<br>T87 (FLUSHING OFF) .....                                                         | 8-4         |
| 5. T88 (OIL SUBMERGED MACHINING)<br>T89 (WATER FLUSH MACHINING)<br>T94 (WATER SUBMERGED MACHINING) ..... | 8-4         |
| 6. T90 (AWT I)<br>T91 (AWT II) .....                                                                     | 8-5         |
| 7. T96 (FLUID FEED ON)<br>T97 (FLUID FEED OFF) .....                                                     | 8-7         |
| CHAPTER 9 M CODES .....                                                                                  | 9-1         |
| 1. LIST OF M CODES .....                                                                                 | 9-1         |
| 2. M00 (PROGRAM STOP) .....                                                                              | 9-1         |
| 3. M01 (OPTIONAL PROGRAM STOP) .....                                                                     | 9-1         |
| 4. M02 (END OF PROGRAM) .....                                                                            | 9-2         |
| 5. M03 (M03 SEARCH BLOCK) .....                                                                          | 9-2         |
| 6. M05 (ST CANCEL) .....                                                                                 | 9-2         |
| 7. M06 (NO DISCHARGE) .....                                                                              | 9-2         |
| 8. M10 TO M47 (EXTERNAL SIGNAL OUTPUT) .....                                                             | 9-3         |
| 9. M70 TO M77 (EXTERNAL SIGNAL INPUT) .....                                                              | 9-3         |
| 10. M98 (SUBPROGRAM CALL) .....                                                                          | 9-3         |
| 11. M99 (END OF SUBPROGRAM) .....                                                                        | 9-3         |
| 12. M199 (TERMINATION OF Q FILE EXECUTION) .....                                                         | 9-3         |
| CHAPTER 10 C CODES .....                                                                                 | 10-1        |
| CHAPTER 11 FLAG CODES .....                                                                              | 11-1        |
| 1. FLAG 0 (M03 PATTERN) .....                                                                            | 11-1        |
| 2. FLAG 1 (PERMISSIBLE ERROR BETWEEN START/END POINT RADII) .....                                        | 11-2        |
| 3. FLAG 2 (OPTIONAL STOP) .....                                                                          | 11-4        |
| 4. FLAG 3 (MACHINING SHAPE SCALE) .....                                                                  | 11-5        |

# TABLE OF CONTENTS

|                                                                                       | <u>PAGE</u> |
|---------------------------------------------------------------------------------------|-------------|
| 5. FLAG 4 (DRY RUN PATTERN) .....                                                     | 11-5        |
| 6. FLAG 5 (AUTO POWER OFF (NO MAN)) .....                                             | 11-5        |
| 7. FLAG 6 (STROKE CHECK) .....                                                        | 11-6        |
| 8. FLAG 7 (BATCH OFFSET OF WIRE ELECTRODE OFFSET<br>IN THE PROGRAM) .....             | 11-7        |
| CHAPTER 12 SUBPROGRAMS .....                                                          | 12-1        |
| 1. HOW TO USE SUBPROGRAMS .....                                                       | 12-1        |
| 2. SPECIAL APPLICATIONS WHEN RETURNING FROM A SUBPROGRAM<br>TO THE MAIN PROGRAM ..... | 12-3        |
| 3. SETTINGS RELATING TO SUBPROGRAMS .....                                             | 12-4        |
| 4. SEARCHING ORDER .....                                                              | 12-5        |
| CHAPTER 13 WIRE ELECTRODE OFFSET .....                                                | 13-1        |
| 1. OUTLINE .....                                                                      | 13-1        |
| 2. OFFSET AMOUNTS (D, H) .....                                                        | 13-2        |
| 3. START-UP OF THE OFFSET MODE .....                                                  | 13-3        |
| 4. CANCELING THE OFFSET MODE .....                                                    | 13-3        |
| 5. OFFSET PATH .....                                                                  | 13-4        |
| 5-1. Straight Line – Straight Line .....                                              | 13-4        |
| 5-2. Straight Line – Arc (or Arc – Straight Line) .....                               | 13-6        |
| 5-3. Arc – Arc .....                                                                  | 13-8        |
| 6. OFFSET CHANGES .....                                                               | 13-10       |
| 6-1. Straight Line – Straight Line .....                                              | 13-10       |
| 6-2. Straight Line – Arc (Arc – Straight Line) .....                                  | 13-11       |
| 6-3. Arc – Arc .....                                                                  | 13-12       |
| 6-4. Examples of Programs Containing Offset Code Change Blocks .....                  | 13-13       |
| 6-5. Notes on Changing the Amount of Offset .....                                     | 13-15       |
| 6-6. G00 Offset and Taper Machining Mode Cancel .....                                 | 13-16       |
| 7. NOTES IN PROGRAMMING .....                                                         | 13-17       |
| 7-1. Changing the Direction of Offset on a Full-circle Path .....                     | 13-17       |
| 7-2. Changing the Offset Amount on a Straight Line Path .....                         | 13-18       |
| 7-3. Axis Movements in Offset Mode .....                                              | 13-19       |
| 7-4. Codes that Cancel Offset Temporarily .....                                       | 13-19       |
| CHAPTER 14 TAPER MACHINING .....                                                      | 14-1        |
| 1. OUTLINE .....                                                                      | 14-1        |
| 2. PROGRAMMING FOR TAPER MACHINING .....                                              | 14-2        |
| 2-1. G Codes .....                                                                    | 14-2        |
| 2-2. Angle of Inclination .....                                                       | 14-2        |

## TABLE OF CONTENTS

|                                                                                                     | <u>PAGE</u> |
|-----------------------------------------------------------------------------------------------------|-------------|
| 2-3. Start of Taper Machining .....                                                                 | 14-3        |
| 2-4. End of Taper Machining .....                                                                   | 14-4        |
| 2-5. Taper Machining for the Geometry Defined<br>by Straight Line – Straight Line .....             | 14-5        |
| 2-6. Taper Machining for the Geometry Defined by Straight Line – Arc<br>(Arc – Straight Line) ..... | 14-6        |
| 2-7. Taper Machining for the Geometry Defined by Arc – Arc .....                                    | 14-7        |
| 3. PARAMETER DATA NECESSARY FOR TAPER MACHINING .....                                               | 14-9        |
| 3-1. Description of Parameters .....                                                                | 14-9        |
| 3-2. Basic Examples .....                                                                           | 14-10       |
| 3-3. Examples – Workpiece Bottom Surface not Aligned<br>with Table Top Surface .....                | 14-11       |
| 3-4. Determining the Distance between Upper and Lower Guides .....                                  | 14-12       |
| 4. CHANGES IN THE TAPER ANGLE .....                                                                 | 14-14       |
| 4-1. Straight Line – Straight Line .....                                                            | 14-14       |
| 4-2. Straight Line – Arc .....                                                                      | 14-15       |
| 4-3. Arc – Arc .....                                                                                | 14-16       |
| 4-4. Examples of Programs in which the Taper Angle is Changed .....                                 | 14-17       |
| 4-5. Notes on Changing the Taper Angle .....                                                        | 14-19       |
| 5. SETTINGS RELATED TO TAPER MACHINING .....                                                        | 14-20       |
| 5-1. Automatic Setting of Upper Guide Position .....                                                | 14-20       |
| 5-2. TP, TN, TZ, TU, and TL Codes .....                                                             | 14-20       |
| 5-3. Table to Limit Distance (TABLE TO LIMIT) .....                                                 | 14-20       |
| 6. NOTES IN PROGRAMMING .....                                                                       | 14-21       |
| CHAPTER 15 CORNER ROUNDING (CORNER R) FUNCTION .....                                                | 15-1        |
| 1. OUTLINE .....                                                                                    | 15-1        |
| 2. CODES .....                                                                                      | 15-2        |
| 3. CONDITIONS .....                                                                                 | 15-2        |
| 4. CORNER R OPERATION EXAMPLES .....                                                                | 15-3        |
| 5. SETTINGS RELATED TO CORNER R FUNCTION .....                                                      | 15-5        |
| 6. NOTES IN PROGRAMMING .....                                                                       | 15-6        |
| CHAPTER 16 FOUR-AXIS OFFSET .....                                                                   | 16-1        |
| 1. OUTLINE .....                                                                                    | 16-1        |
| 2. G CODES .....                                                                                    | 16-1        |
| 3. EXAMPLE PROGRAM .....                                                                            | 16-2        |
| 4. G74 PATTERN .....                                                                                | 16-3        |
| 5. NOTES IN PROGRAMMING .....                                                                       | 16-5        |

# TABLE OF CONTENTS

|                                                                                   | <u>PAGE</u> |
|-----------------------------------------------------------------------------------|-------------|
| CHAPTER 17 COMPLEX SHAPE PROGRAMMING .....                                        | 17-1        |
| 1. OUTLINE .....                                                                  | 17-1        |
| 2. G CODES .....                                                                  | 17-1        |
| 3. EXAMPLE PROGRAM .....                                                          | 17-2        |
| 4. NOTES IN PROGRAMMING .....                                                     | 17-7        |
| CHAPTER 18 INTERFERENCE CHECK .....                                               | 18-1        |
| 1. OUTLINE .....                                                                  | 18-1        |
| 2. G CODES .....                                                                  | 18-1        |
| 3. EXAMPLE PROGRAM .....                                                          | 18-2        |
| 4. INTERFERENCE BLOCK .....                                                       | 18-6        |
| 5. NOTES IN PROGRAMMING .....                                                     | 18-6        |
| CHAPTER 19 FIGURE ROTATION .....                                                  | 19-1        |
| 1. OUTLINE .....                                                                  | 19-1        |
| 2. CODES .....                                                                    | 19-1        |
| 3. EXECUTING FIGURE ROTATION .....                                                | 19-2        |
| 4. SETTING THE ANGLE OF ROTATION .....                                            | 19-2        |
| 5. SETTING THE COORDINATES FOR THE CENTER OF FIGURE ROTATION ....                 | 19-3        |
| 6. EXAMPLE PROGRAM .....                                                          | 19-3        |
| 7. NOTES IN PROGRAMMING .....                                                     | 19-4        |
| CHAPTER 20 M03 FUNCTION .....                                                     | 20-1        |
| 1. OUTLINE .....                                                                  | 20-1        |
| 2. CONFIRMING THE STATUS AT OCCURRENCE OF M03 SEARCH .....                        | 20-3        |
| 3. M CODES IGNORED DURING M03 SEARCH .....                                        | 20-4        |
| CHAPTER 21 HOW TO USE SOFTWARE LIMITS .....                                       | 21-1        |
| 1. SOFTWARE LIMIT ON/OFF G CODES .....                                            | 21-1        |
| 2. CHANGING THE SOFTWARE LIMIT RANGE .....                                        | 21-1        |
| 3. INPUTTING SOFTWARE LIMIT VALUES .....                                          | 21-2        |
| CHAPTER 22 Q COMMANDS .....                                                       | 22-1        |
| 1. OUTLINE .....                                                                  | 22-1        |
| 2. CODES .....                                                                    | 22-1        |
| 3. METHOD FOR RETURNING FROM A Q FILE .....                                       | 22-2        |
| 4. ERROR MESSAGES .....                                                           | 22-3        |
| 5. METHOD FOR SPECIFYING A FILE NAME FOR A Q COMMAND<br>WITH AN OFFSET TERM ..... | 22-3        |

## TABLE OF CONTENTS

|                                                                                           | <u>PAGE</u> |
|-------------------------------------------------------------------------------------------|-------------|
| 6. EXAMPLE PROGRAM .....                                                                  | 22-4        |
| 7. FUNCTION FOR PROGRAM EXECUTION FROM SEQUENCE NUMBER<br>SPECIFIED IN Q COMMAND .....    | 22-6        |
| CHAPTER 23 CALCULATIONS .....                                                             | 23-1        |
| 1. OUTLINE .....                                                                          | 23-1        |
| 2. TYPES OF CALCULATION .....                                                             | 23-1        |
| 3. ORDER OF PRIORITY FOR CALCULATIONS .....                                               | 23-2        |
| 4. FORMAT FOR EXPRESSIONS .....                                                           | 23-2        |
| 5. UNIT SYSTEM FOR CALCULATIONS .....                                                     | 23-2        |
| 6. ARITHMETIC OPERATIONS ON TIME DATA .....                                               | 23-5        |
| 7. FACTORS THAT INFLUENCE THE RESULTS OF CALCULATIONS .....                               | 23-6        |
| 8. ERRORS RELATING TO CALCULATIONS .....                                                  | 23-7        |
| 9. NOTES IN PROGRAMMING .....                                                             | 23-7        |
| CHAPTER 24 USER MACRO FUNCTION .....                                                      | 24-1        |
| 1. OUTLINE .....                                                                          | 24-1        |
| 2. TYPES OF MACRO COMMAND .....                                                           | 24-1        |
| 2-1. Assignment Statements .....                                                          | 24-1        |
| 2-2. IF Statements .....                                                                  | 24-2        |
| 2-3. JUMP Statements .....                                                                | 24-3        |
| 2-4. KEYIN Statements .....                                                               | 24-3        |
| 2-5. CRT Statements .....                                                                 | 24-4        |
| 2-6. HOLD Statements .....                                                                | 24-4        |
| CHAPTER 25 WIRE BREAKAGE RECOVERY FUNCTION .....                                          | 25-1        |
| 1. OUTLINE .....                                                                          | 25-1        |
| 2. OPERATION FOR WIRE BREAKAGE RECOVERY .....                                             | 25-2        |
| 3. CONDITIONS FOR EXECUTING THE WIRE BREAKAGE<br>RECOVERY FUNCTION .....                  | 25-3        |
| 4. COMBINATION OF THE WIRE BREAKAGE RECOVERY<br>AND M03 FUNCTIONS .....                   | 25-5        |
| CHAPTER 26 PRESS DIE CORNER CONTROL FUNCTION .....                                        | 26-1        |
| 1. OUTLINE .....                                                                          | 26-1        |
| 2. PARAMETERS AND CONDITIONS FOR EXECUTING<br>THE PRESS DIE CORNER CONTROL FUNCTION ..... | 26-2        |
| 3. NOTES IN PROGRAMMING .....                                                             | 26-5        |
| CHAPTER 27 COORDINATE ROTATION .....                                                      | 27-1        |
| 1. OUTLINE .....                                                                          | 27-1        |

# TABLE OF CONTENTS

|                                                                             | <u>PAGE</u> |
|-----------------------------------------------------------------------------|-------------|
| 2. CODES .....                                                              | 27-1        |
| 3. EXECUTING COORDINATE ROTATION .....                                      | 27-1        |
| 4. SETTING THE ANGLE OF ROTATION .....                                      | 27-2        |
| 5. COORDINATES FOR THE CENTER OF COORDINATE ROTATION .....                  | 27-2        |
| 6. PRESENT POSITION DISPLAY IN THE ROTATED COORDINATE SYSTEM ....           | 27-3        |
| 7. NOTES IN PROGRAMMING .....                                               | 27-4        |
| CHAPTER 28 CORNER CHAMFERING FUNCTION .....                                 | 28-1        |
| 1. OUTLINE .....                                                            | 28-1        |
| 2. CORNER CHAMFERING SPECIFIED WITH OTHER FUNCTIONS .....                   | 28-4        |
| CHAPTER 29 SF CORNER CONTROL (SFCC) .....                                   | 29-1        |
| 1. OUTLINE .....                                                            | 29-1        |
| 2. CODES .....                                                              | 29-1        |
| 3. EXAMPLE PROGRAM .....                                                    | 29-2        |
| 4. NOTES IN PROGRAMMING .....                                               | 29-4        |
| CHAPTER 30 COMBINING X/Y MIRROR IMAGE, X-Y EXCHANGE AND FIGURE ROTATION .   | 30-1        |
| 1. OUTLINE .....                                                            | 30-1        |
| 2. CODES .....                                                              | 30-1        |
| 3. X/Y MIRROR IMAGE .....                                                   | 30-2        |
| 3-1. Mirror Image .....                                                     | 30-2        |
| 3-2. Executing the Mirror Image Function .....                              | 30-3        |
| 3-2-1. Execution in NC Program .....                                        | 30-3        |
| 3-2-2. Execution in Manual Operation .....                                  | 30-3        |
| 4. X-Y EXCHANGE .....                                                       | 30-4        |
| 4-1. X-Y Exchanged Image .....                                              | 30-4        |
| 4-2. Executing the X-Y Exchange Function .....                              | 30-4        |
| 4-2-1. Execution in NC Program .....                                        | 30-4        |
| 4-2-2. Execution in Manual Operation .....                                  | 30-4        |
| 5. COMBINING X/Y MIRROR IMAGE AND X-Y EXCHANGE FUNCTIONS .....              | 30-5        |
| 5-1. Executing X/Y Mirror Image and X-Y Exchange Functions .....            | 30-5        |
| 5-1-1. Execution in NC Program .....                                        | 30-5        |
| 5-1-2. Execution in Manual Operation .....                                  | 30-5        |
| 5-2. Executing Order of the Mirror Image and X-Y Exchange Functions .....   | 30-6        |
| 5-3. Combining X/Y Mirror Image and X-Y Exchange Functions .....            | 30-6        |
| 5-3-1. When the NC Setting Item<br>"MIRR SWAP REVERSE 1, 2" Is "OFF": ..... | 30-6        |
| 5-3-2. When the NC Setting Item<br>"MIRR SWAP REVERSE 1, 2" Is "ON": .....  | 30-7        |
| 6. COMBINING THE FIGURE ROTATION FUNCTION .....                             | 30-8        |

## TABLE OF CONTENTS

|                                                                                      | <u>PAGE</u> |
|--------------------------------------------------------------------------------------|-------------|
| 6-1. Executing the Mirror Image Function .....                                       | 30-8        |
| 6-1-1. Execution in NC Program .....                                                 | 30-8        |
| 6-1-2. Execution in Manual Operation .....                                           | 30-8        |
| 6-2. Executing Order .....                                                           | 30-9        |
| 6-3. Combining the Mirror Image and Figure Rotation Functions .....                  | 30-9        |
| 6-3-1. When Executing Mirror Image → Figure Rotation: .....                          | 30-9        |
| 6-3-2. When Executing Figure Rotation → Mirror Image: .....                          | 30-11       |
| 6-4. Combining the X-Y Exchange and Figure Rotation Functions .....                  | 30-12       |
| 6-4-1. When Executing X-Y Exchange → Figure Rotation: .....                          | 30-12       |
| 6-4-2. When Executing Figure Rotation → X-Y Exchange: .....                          | 30-13       |
| 6-5. Combining the Mirror Image, X-Y Exchange<br>and Figure Rotation Functions ..... | 30-14       |
| 6-5-1. When the NC Setting Item "MIRR SWAP<br>REVERSE 1, 2" Is "OFF": .....          | 30-14       |
| 6-5-2. When the NC Setting Item "MIRR SWAP<br>REVERSE 1, 2" Is "ON": .....           | 30-16       |
| CHAPTER 31 INITIAL SETTINGS OF G CODES AND T CODES .....                             | 31-1        |
| CHAPTER 32 OPERATION STATUS DURING M00 (M01) PROGRAM STOP .....                      | 32-1        |
| CHAPTER 33 CONTACT DETECTION .....                                                   | 33-1        |
| 1. STOP PATTERNS BY CONTACT DETECTION .....                                          | 33-1        |
| 2. SETTING FOR CONTACT DETECTION .....                                               | 33-2        |
| 3. ERROR MESSAGES RELATED TO CONTACT DETECTION .....                                 | 33-2        |
| CHAPTER 34 NC SETTING ITEMS CLOSELY RELATED TO CODES .....                           | 34-1        |
| 1. FLAG DATA .....                                                                   | 34-1        |
| 2. ACTION DATA .....                                                                 | 34-3        |
| CHAPTER 35 MESSAGES .....                                                            | 35-1        |
| 1. OUTLINE .....                                                                     | 35-1        |
| 2. ERROR MESSAGES .....                                                              | 35-4        |
| 3. HALT MESSAGES .....                                                               | 35-58       |
| 4. COMMENT MESSAGES .....                                                            | 35-92       |
| CHAPTER 36 TO USERS OF MARK20 SERIES POWER SUPPLY .....                              | 36-1        |