



*S16 (P),(D)*

*S20 (P),(D)*

*S25 (P),(D)*

**SUPER SWISS TURN**  
**CNC Precision Automatic Lathes**

# **OPERATION MANUAL**



**PRECISION TSUGAMI**

| CONTENTS                                                                       | Page |
|--------------------------------------------------------------------------------|------|
| FOREWORD .....                                                                 | 1    |
| SECTION 1: SAFETY .....                                                        | 3    |
| 1-1 Cautions concerning operation of machine .....                             | 3    |
| 1-2 Cautions concerning the tooling .....                                      | 4    |
| 1-3 Cautions concerning the electrical system .....                            | 4    |
| 1-4 Cautions concerning untended operations .....                              | 4    |
| SECTION 2: DESCRIPTION OF MACHINES .....                                       | 6    |
| 2-1 Description of machines .....                                              | 6    |
| 2-2 Peripheral equipment .....                                                 | 7    |
| 2-3 Standard specifications and accessories .....                              | 8    |
| 2-4 Optional specifications and accessories .....                              | 14   |
| 2-5 Machine dimensions and nomenclature of major components .....              | 22   |
| 2-6 Transporting the machine .....                                             | 33   |
| 2-7 Installing the machine .....                                               | 34   |
| SECTION 3: OPERATION .....                                                     | 37   |
| 3-1 Operation panels and controls .....                                        | 37   |
| 3-2 Operation .....                                                            | 43   |
| 3-2-1 Basic operations .....                                                   | 43   |
| 3-2-2 Manual operations .....                                                  | 45   |
| 3-2-3 Automatic operations .....                                               | 47   |
| 3-2-4 Setting the T-axis offset .....                                          | 48   |
| 3-2-5 Setting the B-axis offset .....                                          | 54   |
| 3-3 Original TSUGAMI displays and procedures for use .....                     | 56   |
| 3-3-1 Title display .....                                                      | 57   |
| 3-3-2 #1 operator's panel display .....                                        | 58   |
| 3-3-3 Bar-feeder operation setting display .....                               | 61   |
| 3-3-4 #2 operator's panel display .....                                        | 62   |
| 3-3-5 #3 operator's panel display .....                                        | 63   |
| 3-3-6 #1 timer setting display .....                                           | 64   |
| 3-3-7 #2 timer setting display .....                                           | 65   |
| 3-3-8 BFA timer setting display for bar feeder for<br>S16/20/25 machines ..... | 66   |
| 3-3-9 BFB timer setting display for bar feeders made<br>by other makers .....  | 67   |
| 3-3-10 Product-counter setting display .....                                   | 68   |
| 3-3-11 Running-time indicator display .....                                    | 69   |
| 3-3-12 Lamp-indicator (LED) displays .....                                     | 70   |

|                                                                                         |     |
|-----------------------------------------------------------------------------------------|-----|
| 3-3-13 Status display (NC) .....                                                        | 71  |
| 3-3-14 Status displays (output signals to machine side) .....                           | 72  |
| 3-3-15 Status display (output signals to operation panel) .....                         | 75  |
| 3-3-16 Status display (output signals to TSUGAMI bar<br>feeder for S16/20/25) .....     | 77  |
| 3-3-17 Status display (output signals to bar feeders made<br>by other makers) .....     | 78  |
| 3-3-18 Status displays (input signals from machine side) .....                          | 79  |
| 3-3-19 Status displays (input signals from bar feeders made<br>by other makers) .....   | 82  |
| 3-3-20 Alarm messages .....                                                             | 83  |
| 3-3-21 Bar-feeder alarm messages .....                                                  | 102 |
| 3-3-22 Alarm messages for bar feeders made by other makers .....                        | 103 |
| 3-4 Optional functions .....                                                            | 110 |
| SECTION 4: ADJUSTMENTS, INSPECTIONS & MAINTENANCE .....                                 | 115 |
| 4-1 Changing guide-bushing adapters .....                                               | 115 |
| 4-2 Adjusting guide-bushing clearance .....                                             | 117 |
| 4-3 Changing spindle/sub-spindle collet chucks .....                                    | 117 |
| 4-4 Adjusting the spindle collet-chuck chucking force and<br>changing toggles .....     | 119 |
| 4-5 Adjusting the sub-spindle collet-chuck chucking force and<br>changing toggles ..... | 121 |
| 4-6 Checking and adjusting belt tension .....                                           | 122 |
| 4-7 Inspecting the lubrication and coolant systems .....                                | 123 |
| 4-8 Adjusting the lubricating-oil volume and changing filters .....                     | 124 |
| 4-9 Setting the machine origin positions .....                                          | 125 |
| 4-9-1 X-axis origin position .....                                                      | 127 |
| 4-9-2 Z-axis origin position .....                                                      | 128 |
| 4-9-3 T1-axis origin position .....                                                     | 128 |
| 4-9-4 T2-axis origin position .....                                                     | 129 |
| 4-9-5 B-axis origin position .....                                                      | 129 |
| 4-10 Cautions when setting the T1- and T2-axis origin positions .....                   | 130 |
| 4-11 Original TSUGAMI-developed alarms .....                                            | 131 |
| 4-12 Maintenance parts .....                                                            | 132 |
| SECTION 5: PROGRAMMING .....                                                            | 141 |
| 5-1 Programming methods .....                                                           | 142 |
| 5-2 Coordinate system .....                                                             | 144 |
| 5-3 M-codes .....                                                                       | 147 |

|       |                                                                                                |     |
|-------|------------------------------------------------------------------------------------------------|-----|
| 5-4   | G-codes .....                                                                                  | 153 |
| 5-5   | S-codes .....                                                                                  | 157 |
| 5-6   | T-codes .....                                                                                  | 158 |
| 5-7   | Special functions .....                                                                        | 159 |
| 5-7-1 | Back-end-machining control functions .....                                                     | 159 |
| 5-7-2 | Z-axis-following control function .....                                                        | 161 |
| 5-7-3 | Sub-spindle control .....                                                                      | 162 |
| 5-7-4 | Bar-feeder program example .....                                                               | 165 |
| 5-7-5 | Programming method for synchronized control of<br>spindle and sub-spindle .....                | 166 |
| 5-8   | Program preparation .....                                                                      | 167 |
| 5-8-1 | Considerations prior to preparing a program .....                                              | 167 |
| 1)    | Parts drawing .....                                                                            | 167 |
| 2)    | Machining processes .....                                                                      | 167 |
| 3)    | Tooling zone .....                                                                             | 168 |
| 4)    | Tool layout .....                                                                              | 168 |
| 5)    | Machining conditions .....                                                                     | 170 |
| 6)    | Program preparation .....                                                                      | 170 |
| 5-8-2 | Program preparation .....                                                                      | 171 |
| 1)    | Example of pattern for start and end of a program .....                                        | 171 |
| 2)    | Example of program for OD-machining (turning,<br>chamfering, cut-off, product receiving) ..... | 172 |
| 3)    | Example of program for a face-drilling operation .....                                         | 175 |
| 4)    | Example of program for forward product extraction .....                                        | 176 |
| 5)    | Example of program for a cross-drilling operation .....                                        | 177 |
| 6)    | Example of program for a 2-sur-face<br>flat-machining operation with an ehd mill .....         | 178 |
| 7)    | Example of program for a face-tapping operation .....                                          | 179 |
| 8)    | Example of program for a cross-tapping operation .....                                         | 180 |
| 9)    | Example of program for a cut-off and<br>receiving operation .....                              | 182 |
| 10)   | Example of program for a back-end-drilling operation ....                                      | 184 |
| 11)   | Example of program for a back-end-tapping operation ....                                       | 185 |
| 12)   | Example of program for a back-end-<br>threadcutting operation .....                            | 187 |
| 5-8-3 | Additional machining-program examples .....                                                    | 189 |
| 1)    | Example #1 .....                                                                               | 189 |
| 2)    | Example #2 .....                                                                               | 196 |

|                                                                |     |
|----------------------------------------------------------------|-----|
| 3) Example #3 .....                                            | 206 |
| 4) Example #4 .....                                            | 212 |
| 5-9 Reference for machining condition .....                    | 219 |
| 5-9-1 Reference for selecting the cutting speed .....          | 219 |
| 5-9-2 Thread cutting count table .....                         | 220 |
| 5-9-3 Incomplete thread length when thereading .....           | 221 |
| 5-9-4 Feed conditions .....                                    | 222 |
| 5-9-5 Cutting conditions .....                                 | 224 |
| SECTION 6: APPENDIX .....                                      | 226 |
| 6-1 Piping diagram .....                                       | 226 |
| 6-2 Measurement of dilution ratio of soluble cutting oil ..... | 227 |