

Table of Contents

Preface

| | |
|--|-------|
| Scope and Audience | xxiii |
| SVEEeight Plus GPS Manual Organization | xxiv |
| Reader Feedback | xxiv |
| Other Information | xxv |
| World Wide Web (WWW) Site | xxv |
| File Transfer Protocol (FTP) Site | xxv |
| Technical Assistance. | xxv |
| Document Conventions. | xxv |
| Notes, Tips, Cautions, and Warnings. | xxvi |

1 Using the SVEEeight Plus GPS Receiver

| | |
|---|------|
| 1.1 SVEEeight Plus GPS Overview. | 1-2 |
| 1.1.1 Interface Protocols. | 1-3 |
| TSIP | 1-3 |
| TAIP. | 1-3 |
| NMEA 0183. | 1-3 |
| DGPS | 1-4 |
| 1.2 GPS Receiver. | 1-5 |
| 1.2.1 SVEEeight Plus GPS Serial Port Interface. | 1-6 |
| 1.3 Antenna. | 1-7 |
| 1.4 Power. | 1-9 |
| 1.5 Hardware Setup. | 1-10 |
| 1.6 Running the TSIPMonitor32 Interface Program | 1-12 |

2 Hardware Integration

| | |
|--------------------------------|-----|
| 2.1 Power Requirement. | 2-2 |
| 2.2 Pulse Per Second | 2-3 |
| 2.3 Mounting | 2-3 |

3 Software Interface

| | | |
|-------|--|------|
| 3.1 | Start-up | 3-1 |
| 3.2 | Software Tool Kits | 3-1 |
| 3.3 | Communicating with the SVeeEight Plus GPS. | 3-2 |
| 3.4 | Protocol Summary | 3-4 |
| 3.4.1 | TSIP Data Output | 3-4 |
| 3.4.2 | TAIP Data Output | 3-5 |
| 3.4.3 | NMEA 0183 Data Output | 3-5 |
| 3.5 | Timing Applications | 3-6 |
| 3.5.1 | Week Number Roll Over | 3-6 |
| 3.6 | Differential GPS | 3-7 |
| 3.7 | Configuring the SVeeEight Plus GPS Protocols | 3-8 |
| 3.7.1 | Reconfiguring PORT2. | 3-8 |
| 3.7.2 | Entering the Configuration | 3-9 |
| 3.7.3 | Saving the Configuration | 3-11 |
| 3.7.4 | Returning to the Factory Settings | 3-11 |

4 Operation and Performance

| | | |
|-------|--|-----|
| 4.1 | GPS Satellite Message | 4-1 |
| 4.2 | Satellite Acquisition and Time to First Fix. | 4-2 |
| 4.2.1 | Cold-Start | 4-2 |
| 4.2.2 | Warm Start. | 4-2 |
| 4.2.3 | Garage Search Strategy | 4-3 |
| 4.2.4 | Hot Start | 4-3 |
| 4.3 | Satellite Mask Settings | 4-4 |
| 4.3.1 | Elevation Mask | 4-4 |
| 4.3.2 | SNR Mask | 4-5 |
| 4.3.3 | DOP Mask. | 4-5 |
| 4.3.4 | PDOP Switch | 4-5 |
| 4.4 | Standard Operating Modes | 4-6 |
| 4.4.1 | Fix Modes | 4-6 |
| | 2D Manual. | 4-6 |
| | 3D Manual. | 4-6 |
| | 2D/3D Automatic | 4-6 |
| 4.5 | Differential GPS Operating Modes. | 4-7 |
| 4.5.1 | DGPS On | 4-7 |
| 4.5.2 | DGPS Off | 4-7 |
| 4.5.3 | DGPS Automatic | 4-7 |
| 4.5.4 | Differential GPS Operation | 4-7 |

| | | |
|-------|---------------------------------------|------|
| 4.6 | Position Accuracy | 4-8 |
| 4.6.1 | Selective Availability (SA) | 4-8 |
| 4.6.2 | Differential GPS (DGPS) | 4-8 |
| 4.7 | Coordinate Systems. | 4-9 |
| 4.7.1 | TSIP Coordinate Systems | 4-9 |
| 4.7.2 | NMEA 0183 | 4-10 |
| 4.7.3 | TAIP | 4-10 |
| 4.8 | Performance Characteristics | 4-11 |
| 4.8.1 | Update Rate | 4-11 |
| 4.8.2 | Dynamic Limits | 4-11 |
| 4.8.3 | Re-Acquisition. | 4-11 |
| 4.9 | GPS Timing. | 4-12 |
| 4.9.1 | Serial Time Output | 4-12 |
| 4.9.2 | Timing Pulse Output (PPS) | 4-13 |
| 4.10 | System Architecture | 4-14 |

A Trimble Standard Interface Protocol

| | | |
|--------|--|------|
| A.1 | Interface Scope | A-1 |
| A.2 | Automatic Output Packets | A-2 |
| A.3 | Customizing Receiver Operations | A-3 |
| A.4 | Automatic Position and Velocity Reports | A-3 |
| A.5 | Initialization Packets to Speed Start-up | A-3 |
| A.6 | Packets Output at Power-Up | A-4 |
| A.7 | Differential GPS Packets | A-4 |
| A.8 | Timing Packets | A-4 |
| A.9 | Satellite Data Packets. | A-5 |
| A.10 | Background Packets | A-5 |
| A.11 | Backwards Incompatibility of SVeeEight Plus GPS Packets. | A-6 |
| A.12 | Recommended TSIP Packets. | A-6 |
| A.13 | Command Packets Sent to the Receiver | A-8 |
| A.14 | Report Packets Sent by the GPS Receiver to the User | A-11 |
| A.15 | Key Setup Parameters or Packet BB | A-13 |
| A.15.1 | Set Fix Mode | A-14 |
| A.15.2 | Dynamics Code | A-14 |
| A.15.3 | Elevation Mask | A-15 |
| A.15.4 | Signal Level Mask. | A-15 |
| A.15.5 | DOP Mask and Switch | A-16 |
| A.15.6 | Set DGPS Mode | A-16 |
| A.16 | Packet Structure | A-17 |

| | | |
|---------|--|------|
| A.17 | Packet Descriptions | A-18 |
| A.17.1 | Report Packet 0x13 - Packet Received | A-18 |
| A.17.2 | Command Packet 0x1D - Clear Oscillator Offset | A-18 |
| A.17.3 | Command Packet 0x1E - Clear Battery Backup, then Reset | A-18 |
| A.17.4 | Command Packet 0x1F - Request Software Versions | A-18 |
| A.17.5 | Command Packet 0x20 - Request Almanac | A-19 |
| A.17.6 | Command Packet 0x21 - Request Current Time | A-19 |
| A.17.7 | Command Packet 0x22 - Position Fix Mode Select | A-19 |
| A.17.8 | Command Packet 0x23 - Initial Position (XYZ Cartesian ECEF) | A-19 |
| A.17.9 | Command Packet 0x24 - Request GPS Receiver Position Fix Mode | A-20 |
| A.17.10 | Command Packet 0x25 - Initiate Soft Reset & Self Test | A-20 |
| A.17.11 | Command Packet 0x26 - Request Health | A-20 |
| A.17.12 | Command Packet 0x27 - Request Signal Levels | A-20 |
| A.17.13 | Command Packet 0x28 - Request GPS Systems Message | A-20 |
| A.17.14 | Command Packet 0x29 - Request Almanac Health Page | A-20 |
| A.17.15 | Command Packet 0x2A - Altitude for 2D Mode | A-21 |
| A.17.16 | Command Packet 0x2B - Initial Position (Latitude, Longitude, Altitude) | A-21 |
| A.17.17 | Command Packet 0x2C - Set/Request Operating Parameters | A-22 |
| A.17.18 | Command Packet 0x2D - Request Oscillator Offset | A-23 |
| A.17.19 | Command Packet 0x2E - Set GPS Time | A-23 |
| A.17.20 | Command Packet 0x2F - Request UTC Parameters. | A-23 |
| A.17.21 | Command Packet 0x31 - Accurate Initial Position (XYZ Cartesian ECEF) | A-23 |
| A.17.22 | Command Packet 0x32 - Accurate Initial Position, (Latitude, Longitude, Altitude) | A-24 |
| A.17.23 | Command Packet 0x35 - Set/Request I/O Options | A-25 |
| A.17.24 | Command Packet 0x37 - Request Status and Values of Last Position and Velocity | A-27 |
| A.17.25 | Command Packet 0x38 - Request/Load Satellite System Data | A-27 |
| A.17.26 | Command Packet 0x39 - Set/Request Satellite Disable or Ignore Health. | A-28 |
| A.17.27 | Command Packet 0x3A - Request Last Raw Measurement. | A-28 |
| A.17.28 | Command Packet 0x3B - Request Current Status of Satellite Ephemeris Data | A-29 |
| A.17.29 | Command Packet 0x3C - Request Current Satellite Tracking Status | A-29 |
| A.17.30 | Command / Report Packet 0x3D - Primary Port Configuration. | A-30 |
| A.17.31 | Report Packet 0x40 - Almanac Data Page. | A-32 |
| A.17.32 | Report Packet 0x41 - GPS Time. | A-33 |
| A.17.33 | Report Packet 0x42 - Single-Precision Position Fix, XYZ ECEF | A-34 |
| A.17.34 | Report Packet 0x43 - Velocity Fix, XYZ ECEF. | A-34 |
| A.17.35 | Report Packet 0x45 - Software Version Information | A-35 |
| A.17.36 | Report Packet 0x46 - Health of Receiver | A-36 |
| A.17.37 | Report Packet 0x47 - Signal Levels for all Satellites | A-37 |

| | | |
|---------|---|------|
| A.17.38 | Report Packet 0x48 - GPS System Message | A-37 |
| A.17.39 | Report Packet 0x49 - Almanac Health Page | A-38 |
| A.17.40 | Report Packet 0x4A - 20 Byte Format | A-38 |
| A.17.41 | Report Packet 0x4A - 9 Byte Format | A-39 |
| | Reference Altitude. | A-39 |
| | Altitude Flag. | A-39 |
| A.17.42 | Report Packet 0x4B - Machine/Code ID and Additional Status | A-40 |
| A.17.43 | Report Packet 0x4C - Report Operating Parameters | A-41 |
| A.17.44 | Report Packet 0x4D - Oscillator Offset | A-41 |
| A.17.45 | Report Packet 0x4E - Response to Set GPS Time. | A-42 |
| A.17.46 | Report Packet 0x4F - UTC Parameters | A-42 |
| A.17.47 | Report Packet 0x55 - I/O Options | A-43 |
| A.17.48 | Report Packet 0x56 - Velocity Fix, East-North-Up (ENU) | A-44 |
| A.17.49 | Report Packet 0x57 - Information About Last Computed Fix | A-44 |
| A.17.50 | Report Packet 0x58 - Satellite System Data/Acknowledge from Receiver . . | A-45 |
| A.17.51 | Report Packet 0x59 - Status of Satellite Disable or Ignore Health | A-49 |
| A.17.52 | Report Packet 0x5A - Raw Measurement Data | A-50 |
| A.17.53 | Report Packet 0x5B - Satellite Ephemeris Status | A-51 |
| A.17.54 | Report Packet 0x5C - Satellite Tracking Status | A-52 |
| A.17.55 | Command Packet 0x60 - Type 1 Differential GPS Corrections. | A-53 |
| A.17.56 | Command Packet 0x61 - Set Differential GPS Corrections. | A-54 |
| A.17.57 | Command Packet 0x62 - Request/Set Differential Position Fix Mode | A-54 |
| A.17.58 | Command Packet 0x65 - Request Differential Correction Status. | A-54 |
| A.17.59 | Report Packet 0x6D - All-In-View Satellite Selection | A-55 |
| A.17.60 | Command Packet 0x6E - Set or Request Synchronized Measurement Parameters | A-56 |
| | Enable / Disable Synchronized Measurements | A-56 |
| | Output Level. | A-56 |
| A.17.61 | Report Packet 0x6E - Synchronized Measurements. | A-57 |
| A.17.62 | Report Packet 0x6F, Subcode 1 | A-58 |
| A.17.63 | Command Packet 0x70 - Filter Control | A-60 |
| A.17.64 | Report Packet 0x70 | A-60 |
| A.17.65 | Command Packet 0x71 - Set/Request/Disable Position Filter | A-61 |
| A.17.66 | Command Packet 0x73 - Set/Request/Disable Altitude Filter | A-62 |
| A.17.67 | Report Packet 0x74 - Altitude Filter Parameters | A-63 |
| A.17.68 | Command Packet 0x75 | A-63 |
| A.17.69 | Report Packet 0x76 | A-63 |
| A.17.70 | Command Packet 0x77 - Set/Request Maximum Age of Differential Corrections. | A-63 |
| A.17.71 | Report Packet 0x78 - Maximum Age of Differential Corrections | A-64 |

| | | |
|---------|--|------|
| A.17.72 | Command Packet 0x7A | A-64 |
| A.17.73 | Report Packet 0x7B | A-64 |
| A.17.74 | Report Packet 0x82 - Differential Position Fix Mode. | A-65 |
| A.17.75 | Report Packet 0x83 - Double-Precision XYZ Position Fix and Bias Information. | A-65 |
| A.17.76 | Report Packet 0x84 - Double-Precision LLA Position Fix and Bias Information. | A-66 |
| A.17.77 | Report Packet 0x85 - Differential Corrections Status. | A-66 |
| A.17.78 | Packets 0x8E and 0x8F - Superpacket | A-66 |
| A.17.79 | Command Packet 0xBB - Navigation Configuration | A-67 |
| A.17.80 | Command Packet 0xBC - Protocol Configuration | A-68 |
| A.18 | TSIP Superpackets | A-70 |
| A.18.1 | Command Packet 0x8E-03 - Set / Request Auxiliary Configuration | A-70 |
| A.18.2 | Report Packet 0x8F-03 - Request Auxiliary Port Configuration | A-71 |
| A.18.3 | Command Packet 0x8E-15 - Set/Request Datum | A-72 |
| A.18.4 | Report Packet 0x8F-15 - Current Datum Values | A-73 |
| A.18.5 | Report Packet 0x8F-17 - UTM Single Precision Output | A-74 |
| A.18.6 | Report Packet 0x8F-18 - UTM Double Precision Output. | A-75 |
| A.18.7 | Command Packet 0x8E-19 - Enable / Disable UTM Output | A-76 |
| A.18.8 | Report Packet 0x8F-19 UTM Status | A-76 |
| A.18.9 | Command Packet 0x8E-20 - Request Last Fix with Extra Information. | A-77 |
| A.18.10 | Report Packet 0x8F-20 - Last Fix with Extra Information (binary fixed point) | A-78 |
| A.18.11 | Command Packet 0x8E-23 - Compact Super Packet | A-80 |
| A.18.12 | Report Packet 0x8F-23 - Compact Super Packet | A-81 |
| A.18.13 | Command Packet 0x8E-26 - SEEPROM Storage | A-82 |
| A.18.14 | Report Packet 0x8F-26 - SEEPROM Storage Status | A-82 |
| A.18.15 | Command Packet 0x8E-40 - TAIP Configuration. | A-83 |
| A.18.16 | Report Packet 0x8F-40 - TAIP Configuration. | A-83 |
| A.19 | Datums | A-84 |

B TSIP Toolkit User's Guide

| | | |
|-------|--------------------------|-----|
| B.1 | TSIPMonitor32 | B-2 |
| B.1.1 | Delta Position | B-3 |
| B.1.2 | File Storage | B-3 |

C Trimble ASCII Interface Protocol (TAIP)

| | | |
|-------|----------------------------------|-----|
| C.1 | Message Format | C-3 |
| C.1.1 | Start of a New Message | C-3 |
| C.1.2 | Message Qualifier | C-3 |

| | | |
|-------|--|------|
| C.1.3 | Message Identifier | C-4 |
| C.1.4 | Data String. | C-4 |
| C.1.5 | Vehicle ID | C-4 |
| C.1.6 | Checksum | C-4 |
| | Example | C-4 |
| C.1.7 | Message Delimiter. | C-4 |
| C.2 | Sample PV Message | C-5 |
| C.3 | Time and Distance Reporting. | C-6 |
| | C.3.1 Example | C-7 |
| C.4 | Latitude and Longitude Conversion | C-8 |
| | C.4.1 Example | C-8 |
| C.5 | Message Data Strings. | C-9 |
| C.6 | AL Altitude/Up Velocity | C-10 |
| C.7 | AM Alarm | C-10 |
| C.8 | AP Auxiliary Port Characteristics | C-11 |
| | C.8.1 Example | C-11 |
| C.9 | CP Compact Position Solution | C-12 |
| C.10 | DC Differential Corrections | C-13 |
| C.11 | DD Delta Differential Corrections | C-14 |
| C.12 | ID Identification Number. | C-15 |
| | C.12.1 Example | C-15 |
| C.13 | IP Initial Position | C-16 |
| | C.13.1 Example | C-16 |
| C.14 | LN Long Navigation Message | C-17 |
| C.15 | PR Protocol. | C-18 |
| C.16 | PT Port Characteristic | C-19 |
| C.17 | PV Position/Velocity Solution | C-20 |
| C.18 | RM Reporting Mode | C-21 |
| | C.18.1 Example | C-21 |
| C.19 | RT Reset Mode | C-22 |
| C.20 | ST Status | C-23 |
| C.21 | TM Time/Date | C-25 |
| C.22 | VR Version Number | C-26 |
| C.23 | X1 Extended Status | C-26 |
| C.24 | Communication Using TAIP | C-27 |
| | C.24.1 Query for Single Sentence. | C-27 |
| | C.24.2 Scheduled Reporting Frequency Interval | C-27 |
| | C.24.3 The Response to Query or Scheduled Report | C-27 |
| | C.24.4 The Set Qualifier | C-28 |

C.24.5 Sample Communication Session C-29

D GPSSK User's Guide (TAIP)

D.1 The GPSSK Files D-1
D.2 TAIP.C Source File D-2
D.3 GPSSK Start-up D-2
D.4 On-line Help D-2
D.5 Connecting the GPS Receiver D-3

E NMEA 0183

E.1 The NMEA 0183 Communication Interface E-1
E.2 NMEA 0183 Message Format E-2
E.3 NMEA 0183 Message Options E-3
E.4 NMEA 0183 Message Formats. E-4
 E.4.1 GGA - GPS Fix Data E-4
 E.4.2 GLL - Geographic Position - Latitude/Longitude E-4
 E.4.3 GSA - GPS DOP and Active Satellites E-5
 E.4.4 GSV - GPS Satellites in View E-6
 E.4.5 RMC - Recommended Minimum Specific GPS/Transit Data. E-7
 E.4.6 VTG - Track Made Good and Ground Speed E-7
 E.4.7 ZDA - Time & Date E-8
E.5 Exception Behavior. E-9
 E.5.1 Power-up with No BBRAM E-9
 E.5.2 Power-up with BBRAM E-9
 E.5.3 Interruption of GPS Signal E-9

F SVeeEight Plus GPS Specifications and Mechanical Drawings

Glossary

Index