# BE-50U

## GNSS Receiver

## Datasheet

Revision: 5.12

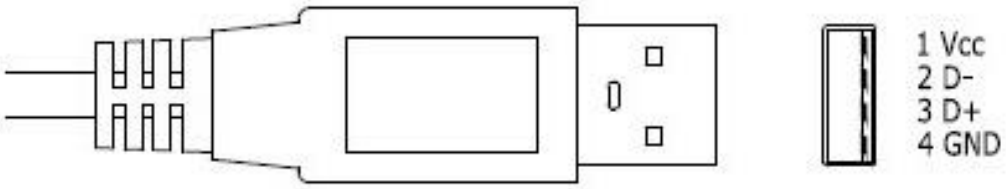
Date:2025.7

## Features:

| Item | Description | |
|---|---|---|
| Electrical Characteristic | Chip | M10050 |
| | Receiver type | GPS L1 C/A, QZSS L1 C/A/S,BDS B1I/B1C, Galileo E1B/C,SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN |
| | Default position system | GPS, BDS, GALILEO |
| | Augmentation system | SBAS, QZSS |
| | Channel | N/A |
| Sensitivity | Tracking & Navigation | -166dBm |
| | Reacquisition | -160dBm |
| | Cold start | -148dBm |
| | Hot Start | -160dBm |
| Accuracy | Horizontal position | 2.0m CEP |
| | Velocity | 0.05m/s |
| | Dynamic heading | 0.3 deg |
| | Time pulse | RMS 30ns |
| | | 99% 60ns |
| Acquisition | Cold start | 27s |
| | Hot start | 1s |
| | Aided start | 1s |
| Data Output | Baud rate | 4800bps - 921600bps, default 115200bps |
| | Level | PL2303SA chip TTL to USB driver, USB level |
| | Protocol | NMEA,UBX |
| | NMEA messages | RMC,VTG,GGA,GSA,GSV,GLL |
| | Update rate | 0.25Hz-18Hz,default 1Hz |
| | FLASH | With FLASH, the configuration can be changed, and the power will not be lost |
| | Frequency of time pulse signal | Configurable from 0.25 Hz to 10 MHz, the default period is 1s, and the high level lasts for 100ms |
| Operational Limits | Altitude | 80,000m |
| | Velocity | 500m/s |
| | Dynamics | <4g |
| Power Consumption | Voltage | DC 3.6V-5.5V, typical: 5.0V |
| | Current | 30mA/5.0V |
| Mechanical Specifications | Dimension | Φ56.7mm*18mm |
| | Weight | 70g |
| | Connector | USB 2.0 Male interface |
| | Cable Length | 2m |
| | Fixed | Magnetic bottom |
| Temperature | Operating | -40 ℃ ~ +85 ℃ |

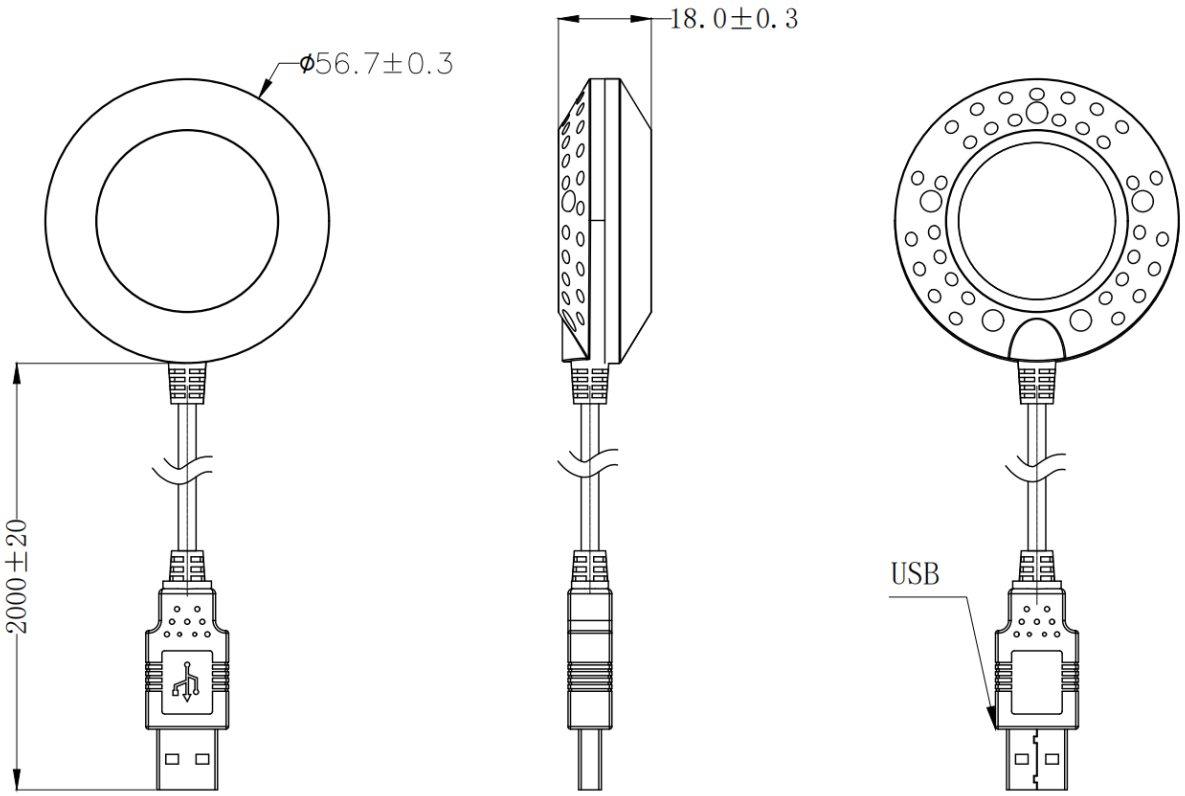
| | | |
|---|---|---|
| | Storage | -40 ℃ ~ +105 ℃ |

## Pin Description:



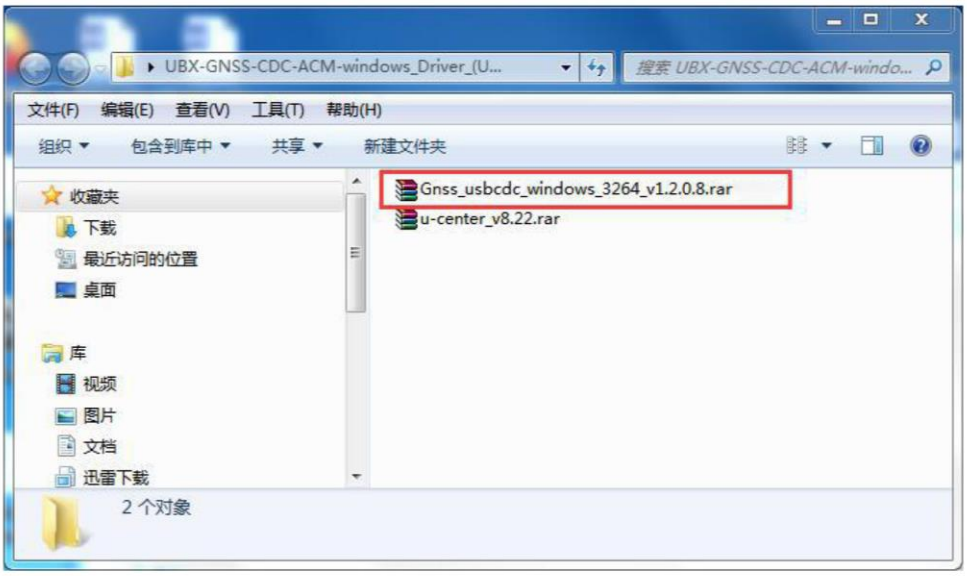

| PIN | Name | I/O | Description |
|---|---|---|---|
| 1 | VCC | I | DC 3.6 V-5.5V supply input,Typical: 5.0V |
| 2 | D- | O | USB D- |
| 3 | D+ | I | USB D+ |
| 4 | GND | G | Ground |

## Structural diagram:



## Driver installation:

The GPS receiver need to install the driver, in order to connect to the data communications. Support Windows, Linux, CE and many other systems. The following is the Windows driver installation:





# Data output protocol

Joint Mode Protocol Header - GN
GPS Mode Protocol Header-GP
GLONASS Mode Protocol Header-GL
Beidou mode protocol header - GB or BD

## Unlocated：

$GNRMC,,V,,,,,,,,,N,V*37
$GNVTG,,,,,,,,,N*2E
$GNGGA,,,,,,0,00,99.99,,,,,,*56
$GNGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99,1*33
$GNGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99,3*31
$GNGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99,4*36
$GNGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99,5*37
$GPGSV,1,1,00,0*65
$GAGSV,1,1,00,0*74
$GBGSV,1,1,00,0*77
$GQGSV,1,1,00,0*64
$GNGLL,,,,,,V,N*7A

## Positioned：

$GNRMC,054411.00,A,2243.08151,N,11401.10827,E,0.008,,230423,,,A,V*1E
$GNVTG,,T,,M,0.008,N,0.016,K,A*32
$GNGGA,054411.00,2243.08151,N,11401.10827,E,1,12,0.56,93.2,M,-2.7,M,,*64
$GNGSA,A,3,30,03,14,06,07,17,01,19,,,,,1.15,0.56,1.00,1*0D
$GNGSA,A,3,30,13,15,34,27,02,,,,,,,1.15,0.56,1.00,3*01
$GNGSA,A,3,27,28,30,01,02,03,37,38,40,,,,1.15,0.56,1.00,4*04
$GNGSA,A,3,02,07,03,04,,,,,,,,,1.15,0.56,1.00,5*00
$GPGSV,3,1,12,01,27,034,37,03,44,087,39,06,38,241,42,07,15,180,35,1*64
$GPGSV,3,2,12,14,78,359,45,17,43,333,38,19,28,303,39,30,34,212,39,1*6C
$GPGSV,3,3,12,39,29,252,33,40,20,257,40,41,46,237,44,50,60,149,39,1*65
$GPGSV,1,1,01,11,00,228,,0*5C
$GAGSV,2,1,06,02,30,136,38,13,23,238,40,15,68,289,42,27,37,324,30,7*7E
$GAGSV,2,2,06,30,83,091,42,34,41,026,41,7*70
$GBGSV,3,1,11,01,47,123,36,02,46,234,37,03,63,189,38,04,,,31,1*49
$GBGSV,3,2,11,05,,,34,27,52,351,44,28,24,046,37,30,31,283,40,1*46
$GBGSV,3,3,11,37,43,178,40,38,70,172,40,40,57,034,39,1*48
$GQGSV,1,1,04,02,63,125,42,03,59,044,39,04,38,131,38,07,60,149,36,1*6C
$GNGLL,2243.08151,N,11401.10827,E,054411.00,A,A*71

$xxGGA,time,lat,NS,lon,EW,quality,numSV,HDOP,alt,altUnit,sep,sepUnit,diffAge,diffStation*cs<CR><LF>
Example:
$GPGGA,092725.00,4717.11399,N,00833.91590,E,1,08,1.01,499.6,M,48.0,M,,*5B

| Field No. | Name | Unit | Format | Example | Description |
|---|---|---|---|---|---|
| 0 | xxGGA | - | string | $GPGGA | GGA Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | time | - | hhmmss.ss | 092725.00 | UTC time, see note on UTC representation |
| 2 | lat | - | ddmm.mmmmm | 4717.11399 | Latitude (degrees & minutes), see format description |
| 3 | NS | - | character | N | North/South indicator |
| 4 | lon | - | dddmm.mmmmm | 00833.91590 | Longitude (degrees & minutes), see format description |
| 5 | EW | - | character | E | East/West indicator |
| 6 | quality | - | digit | 1 | Quality indicator for position fix, see position fix flags description Flags in NMEA 4.10 and above |
| 7 | numSV | - | numeric | 08 | Number of satellites used (range: 0-12) |
| 8 | HDOP | - | numeric | 1.01 | Horizontal Dilution of Precision |
| 9 | alt | m | numeric | 499.6 | Altitude above mean sea level |
| Field No. | Name | Unit | Format | Example | Description |
| 10 | altUnit | - | character | M | Altitude units: M (meters, fixed field) |
| 11 | sep | m | numeric | 48.0 | Geoid separation: difference between ellipsoid and mean sea level |
| 12 | sepUnit | - | character | M | Geoid separation units: M (meters, fixed field) |
| 13 | diffAge | s | numeric | - | Age of differential corrections (null when DGPS is not used) |
| 14 | diffStation | - | numeric | - | ID of station providing differential corrections (null when DGPS is not used) |
| 15 | cs | - | hexadecimal | *5B | Checksum |
| 16 | <CR><LF> | - | character | - | Carriage return and line feed |

$xxGLL,lat,NS,lon,EW,time,status,posMode*cs<CR><LF>
Example:

$GPGLL,4717.11364,N,00833.91565,E,092321.00,A,A*60

| Field No. | Name | Unit | Format | Example | Description |
|---|---|---|---|---|---|
| 0 | xxGLL | - | string | $GPGLL | GLL Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | lat | - | ddmm.mmmmm | 4717.11364 | Latitude (degrees & minutes), see format description |
| 2 | NS | - | character | N | North/South indicator |

| | | | | | |
|---|---|---|---|---|---|
| 3 | lon | - | dddmm.mmmmm | 00833.91565 | Longitude (degrees & minutes), see format description |
| 4 | EW | - | character | E | East/West indicator |
| 5 | time | - | hhmmss.ss | 092321.00 | UTC time, see note on UTC representation |
| 6 | status | - | character | A | Data validity status, see position fix flags description |
| 7 | posMode | - | character | A | Positioning mode, see position fix flags description (only available in NMEA 2.3 and later) |
| Field No. | Name | Unit | Format | Example | Description |
| 8 | cs | - | hexadecimal | *60 | Checksum |
| 9 | <CR><LF> | - | character | - | Carriage return and line feed |

$xxGSA,opMode,navMode{,svid},PDOP,HDOP,VDOP,systemId*cs<CR><LF>

Example:

$GPGSA,A,3,23,29,07,08,09,18,26,28,,,,,1.94,1.18,1.54,1*0D

| Field No. | Name | Unit | Format | Example | Description |
|---|---|---|---|---|---|
| 0 | xxGSA | - | string | $GPGSA | GSA Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | opMode | - | character | A | Operation mode:<br>M = Manually set to operate in 2D or 3D mode<br>A = Automatically switching between 2D or 3D mode |
| 2 | navMode | - | digit | 3 | Navigation mode, see position fix flags description |
| Start of repeated block (12 times) | | | | | |
| 3 + 1*N | svid | - | numeric | 29 | Satellite number |
| End of repeated block | | | | | |
| 15 | PDOP | - | numeric | 1.94 | Position dilution of precision |
| 16 | HDOP | - | numeric | 1.18 | Horizontal dilution of precision |
| 17 | VDOP | - | numeric | 1.54 | Vertical dilution of precision |
| 18 | systemId | - | numeric | 1 | NMEA defined GNSS System ID, see Signal Identifiers table (only available in NMEA 4.10 and later) |
| 19 | cs | - | hexadecimal | *0D | Checksum |
| 20 | <CR><LF> | - | character | - | Carriage return and line feed |

$xxGSV,numMsg,msgNum,numSV{,svid,elv,az,cno},signalId*cs<CR><LF>

Example:

$GPGSV,3,1,09,09,,,17,10,,,40,12,,,49,13,,,35,1*6F
$GPGSV,3,2,09,15,,,44,17,,,45,19,,,44,24,,,50,1*64
$GPGSV,3,3,09,25,,,40,1*6E
$GPGSV,1,1,03,12,,,42,24,,,47,32,,,37,5*66
$GAGSV,1,1,00,2*76

| Field No. | Name | Unit | Format | Example | Description |
|---|---|---|---|---|---|
| 0 | xxGSV | - | string | $GPGSV | GSV Message ID (xx = GSV Talker ID, see NMEA Talker IDs table). Talker ID GN shall not be used |
| 1 | numMsg | - | digit | 3 | Number of messages, total number of GSV messages being output (range: 1-9) |
| 2 | msgNum | - | digit | 1 | Number of this message (range: 1-numMsg) |
| 3 | numSV | - | numeric | 10 | Number of known satellites in view regarding both the talker ID and the signalId |
| Start of repeated block (1..4 times) | | | | | |
| 4 + 4*N | svid | - | numeric | 23 | Satellite ID |
| 5 + 4*N | elv | deg | numeric | 38 | Elevation (range: 0-90) |
| 6 + 4*N | az | deg | numeric | 230 | Azimuth (range: 0-359) |
| 7 + 4*N | cno | dB Hz | numeric | 44 | Signal strength (C/N0, range: 0-99), null when not tracking |
| End of repeated block | | | | | |
| Field No. | Name | Unit | Format | Example | Description |
| 5.. 16 | signalId | - | numeric | 0 | NMEA defined GNSS Signal ID, see Signal Identifiers table (only available in NMEA 4.10 and later) |
| 6.. 16 | cs | - | hexadecimal | *7F | Checksum |
| 7.. 16 | <CR><LF> | - | character | - | Carriage return and line feed |

$xxRMC,time,status,lat,NS,lon,EW,spd,cog,date,mv,mvEW,posMode,navStatus*cs<CR><LF>
Example:

$GPRMC,083559.00,A,4717.11437,N,00833.91522,E,0.004,77.52,091202,,,A,V*57

| Field No. | Name | Unit | Format | Example | Description |
|---|---|---|---|---|---|
| 0 | xxRMC | - | string | $GPRMC | RMC Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | time | - | hhmmss.ss | 083559.00 | UTC time, see note on UTC representation |

| | | | | | |
|---|---|---|---|---|---|
| 2 | status | - | character | A | Data validity status, see position fix flags description |
| 3 | lat | - | ddmm.mmmmm | 4717.11437 | Latitude (degrees & minutes), see format description |
| 4 | NS | - | character | N | North/South indicator |
| 5 | lon | - | dddmm.mmmmm | 00833.91522 | Longitude (degrees & minutes), see format description |
| 6 | EW | - | character | E | East/West indicator |
| 7 | spd | knots | numeric | 0.004 | Speed over ground |
| 8 | cog | degrees | numeric | 77.52 | Course over ground |
| Field No. | Name | Unit | Format | Example | Description |
| 9 | date | - | ddmmyy | 091202 | Date in day, month, year format, see note on UTC representation |
| 10 | mv | degrees | numeric | - | Magnetic variation value. Only supported in ADR 4.10 and later |
| 11 | mvEW | - | character | - | Magnetic variation E/W indicator. Only supported in ADR 4.10 and later |
| 12 | posMode | - | character | A | Mode Indicator, see position fix flags description (only available in NMEA 2.3 and later) |
| 13 | navStatus | - | character | V | Navigational status indicator: V (Equipment is not providing navigational status information, fixed field, only available in NMEA 4.10 and later) |
| 14 | cs | - | hexadecimal | *57 | Checksum |
| 15 | <CR><LF> | - | character | - | Carriage return and line feed |

$xxVTG,cogt,cogtUnit,cogm,cogmUnit,sogn,sognUnit,sogk,sogkUnit,posMode*cs<CR><LF>

Example:

$GPVTG,77.52,T,,M,0.004,N,0.008,K,A*06

| Field No. | Name | Unit | Format | Example | Description |
|---|---|---|---|---|---|
| 0 | xxVTG | - | string | $GPVTG | VTG Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | cogt | degrees | numeric | 77.52 | Course over ground (true) |
| 2 | cogtUnit | - | character | T | Course over ground units: T (degrees true, fixed field) |

| | | | | | |
|---|---|---|---|---|---|
| 3 | cogm | degrees | numeric | - | Course over ground (magnetic). Only supported in ADR 4.10 and above |
| 4 | cogmUnit | - | character | M | Course over ground units: M (degrees magnetic, fixed field) |
| 5 | sogn | knots | numeric | 0.004 | Speed over ground |
| 6 | sognUnit | - | character | N | Speed over ground units: N (knots, fixed field) |
| Field No. | Name | Unit | Format | Example | Description |
| 7 | sogk | km/h | numeric | 0.008 | Speed over ground |
| 8 | sogkUnit | - | character | K | Speed over ground units: K (kilometers per hour, fixed field) |
| 9 | posMode | - | character | A | Mode Indicator, see position fix flags description (only available in NMEA 2.3 and later) |
| 10 | cs | - | hexadecimal | *06 | Checksum |
| 11 | <CR><LF> | - | character | - | Carriage return and line feed |

## Flags in NMEA 4.10 and above

| NMEA Message Field | GLL, RMC status | GGA quality | GLL, VTG posMode | RMC, GNS posMode |
|---|---|---|---|---|
| No position fix (at power-up, after losing satellite lock) | V | 0 | N | N |
| GNSS fix, but user limits exceeded | V | 0 | N | N |
| Dead reckoning fix, but user limits exceeded | V | 6 | E | E |
| Dead reckoning fix | A | 6 | E | E |
| RTK float | A | 5 | D | F |
| RTK fixed | A | 4 | D | R |
| 2D GNSS fix | A | 1 / 2 | A / D | A / D |
| 3D GNSS fix | A | 1 / 2 | A / D | A / D |
| Combined GNSS/dead reckoning fix | A | 1 / 2 | A / D | A / D |
| | See below (1) | See below(2) | See below(3) | See below(3) |

(1) Possible values for status: V = Data invalid, A = Data valid

(2) Possible values for quality: 0 = No fix, 1 = Autonomous GNSS fix, 2 = Differential GNSS fix, 4 =RTK fixed, 5 = RTK float, 6 = Estimated/Dead reckoning fix

**(3)** Possible values for posMode: N = No fix, E = Estimated/Dead reckoning fix, A = Autonomous GNSS fix, D = Differential GNSS fix, F = RTK float, R = RTK fixed

## FCC Warning Statement

This product has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This product generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this product does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna of the radio/TV.

-- Increase the separation between the equipment and receiver(radio/TV).

-- Connect the equipment into an outlet on a circuit different from that to which the receiver(radio/TV) is connected.

-- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1)This device may not cause harmful interference.

(2)This device must accept any interference received, including interference that may cause undesired operation.