

产品规格书

GNSS 接收机

BT-920

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一、产品介绍



BT-920 是一款内置 ZED-F9P 模块和四星多频天线的接收机，该接收机具有高精度厘米级 RTK 定位、天线高增益、小型化、高灵敏度、多系统兼容及高可靠性等特点，可有效满足用户的使用需求。

- 1、内置 ZED-F9P 高精度 RTK 厘米级定位模块，内置 GNSS 四星多频天线；
- 2、采用多馈点设计和完全对称天线结构，具有非常稳定的相位中心，降低天线对测量误差；
- 3、增益高，驻波比低，对低仰角信号接收效果明显，在遮挡较严重的场合能正常收星；
- 4、配备抗多径扼流板，具有防浪涌设计，能有效抑制带外强干扰信号，确保天线的可靠性；
- 5、采用防紫外线 PC 材料设计，兼具美观的同时确保天线外壳长时间户外使用不变色，具备 IP67 防水等级、耐高温、防晒防紫外线。

二、应用领域

此接收机可以接收 GPS L1/L2 GLONASS L1/L2 BDS B1/B2 GALILEO E1/E5b 频率，支持 RTK 差分定位，达到厘米级。满足目前 GNSS 测量设备对多系统兼容和高精度用户的需要，广泛应用于大地测绘、航道测绘、精准农业及海洋测量等领域，也可根据应用条件选择应用于军事领域。

三、主要技术参数

模块参数 Module Specifications

芯片特性	芯片	ZED-F9P 模块
	频率	GPS L1/L2, GLONASS G1/G2, BDS B1/B2, GALILEO E1/E5b, QZSS L1/L2
	工作模式	GPS+GLONASS+BDS+GALILEO+QZSS 联合定位。
	通道	184 搜索通道
灵敏度	跟踪	-167dBm
	重捕	-160dBm

	冷启动	-148dBm
	热启动	-157dBm
精度	RTK 水平精度	RTK 0.01 m + 1 ppm CEP
	RTK 垂直精度	RTK 0.01 m + 1 ppm CEP
	单点定位水平精度	1.5m CEP
	单点定位垂直精度	1.5m CEP
	速度精度	0.05m/s
	航向角精度	0.4 deg, 天线基线长度 1 米情况下
	动态航向角精度	0.3 deg
	1PPS 时间精度	RMS 30ns
99% 60ns		
启动时间	冷启动	24s
	热启动	2s
	重新捕获	1s
收敛时间	收敛时间	≤10s
输出数据	波特率	4800bps - 921600bps, 默认 38400bps
	输出电平	TTL 电平
	输出协议	NMEA, UBX, RTCM 3.3, 默认 NMEA 协议
	NMEA 语句	RMC, VTG, GGA, GSA, GSV, GLL
	更新频率	0.25Hz-20Hz, 默认 1Hz
	FLASH	4M FLASH, 可以更改配置, 断电不丢失
	秒脉冲	0.25 Hz to 10 MHz 可配置, 默认周期 1s, 高电平持续 100ns
	载波相位输出	支持, 输出 RAWX 语句
工作限制	高度	≤50,000m

	速度	$\leq 500\text{m/s}$
	重力加速度	$\leq 4\text{g}$
天线参数 Antenna Specifications		
频率范围 Frequency Range (MHz)		GPS L1/L2 GLONASS L1/L2 BDS B1/B2 GALILEO E1/E5b
增益 Gain (dBi)		< 5.5
天线轴比 Antenna AR (dB)		≤ 3.0
相位中心误差 Phase center error (mm)		± 2
极化方式 Polarization		右旋圆极化 Right-hand circular polarization
端口阻抗 Port Impedance		50Ω
LNA 参数 Electrical Specifications		
LNA 增益 Gain (dB)		40 ± 2
噪声系数 Noise figure (dB)		≤ 1.8
输出电压驻波比 VSWR		≤ 2.0
电源参数 Power Characteristics		
工作电压 Operating voltage (V)		$3.6\text{V}-6.0\text{V}$
工作电流 Operating current		$\leq 200\text{mA}$
指示灯特性 LED Characteristics		
PWR 灯		上电红灯常亮，表示有电源输入
RTK 灯		移动端未进入 RTK 模式，灯不亮；进入 RTK Float 模式，蓝灯闪烁；进入 RTK Fixed 模式，蓝灯常亮。基准站端不管任何状态都不亮。
结构特性 Structural Characteristics		
接头型号 Connector type		GX12-4 航空头公头
天线尺寸 Antenna size (mm)		$\Phi 160*66.5$
重量 Weight(g)		≤ 600

工作环境 Working Environment

工作温度 Operating temperature (°C)	-40 - +70
存储温度 Storage temperature (°C)	-55 - +85
防水等级 Waterproof grade	IP67

四、引脚定义



接口	序号	名称	I/O	描述	特性
GX12-4 航空头	1	VCC	I	主电源，直流输入。DC 3.6V-6.0V； 推荐 5.0V	电源引脚
	2	RX	I	UART 通讯数据输入接口,TTL 电平	输入引脚
	3	TX	O	UART 通讯数据输出接口,TTL 电平	输出引脚
	4	GND	G	接地	接地引脚

说明:

1. 该接收机支持 GPS L1C/A L2C, GLONASS L1OF L2OF, GALILEO E1B/C E5b, BDS B1I/B2I。
2. RX 可用于输入指令，给 GPS 更改波特率，频率，输出语句等参数。
3. 该接收机支持厘米级高精度 RTK 差分定位。
4. 该接收机可以做为基站，也可以作为移动站。
5. 如果用作基站，只需要通过指令进行配置成基站模式。基站用途是负责通过无线数传电台将 RTCM 数据以无线传输方式发送给移动站。
6. 如果用作移动站，可直接用作移动站，不需要任何配置。移动站先通过无线数传电台接收端接收到主机站的 RTCM 数据，然后计算，可以进入 RTK 差分定位模式，精度可以达厘米级定位。
7. 模块默认的波特率是 38400bps，如果频率调高，波特率相应调高，否则数据量太大传输不过

来。另外频率建议不要超过 5HZ。

8. 移动站的 RTK 灯, 未进入 RTK 模式, 灯不亮; 进入 RTK Float 模式, 蓝灯闪烁; 进入 RTK Fixed 模式, 蓝灯常亮。主机站的 RTK 灯任何时候都将不亮。

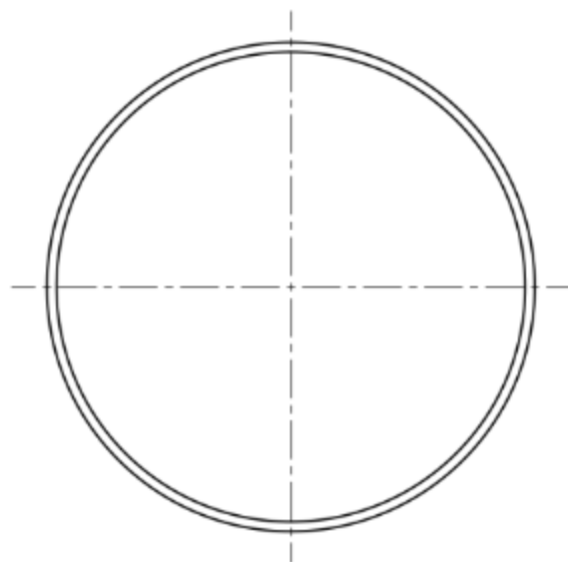
9. 支持定制开发。

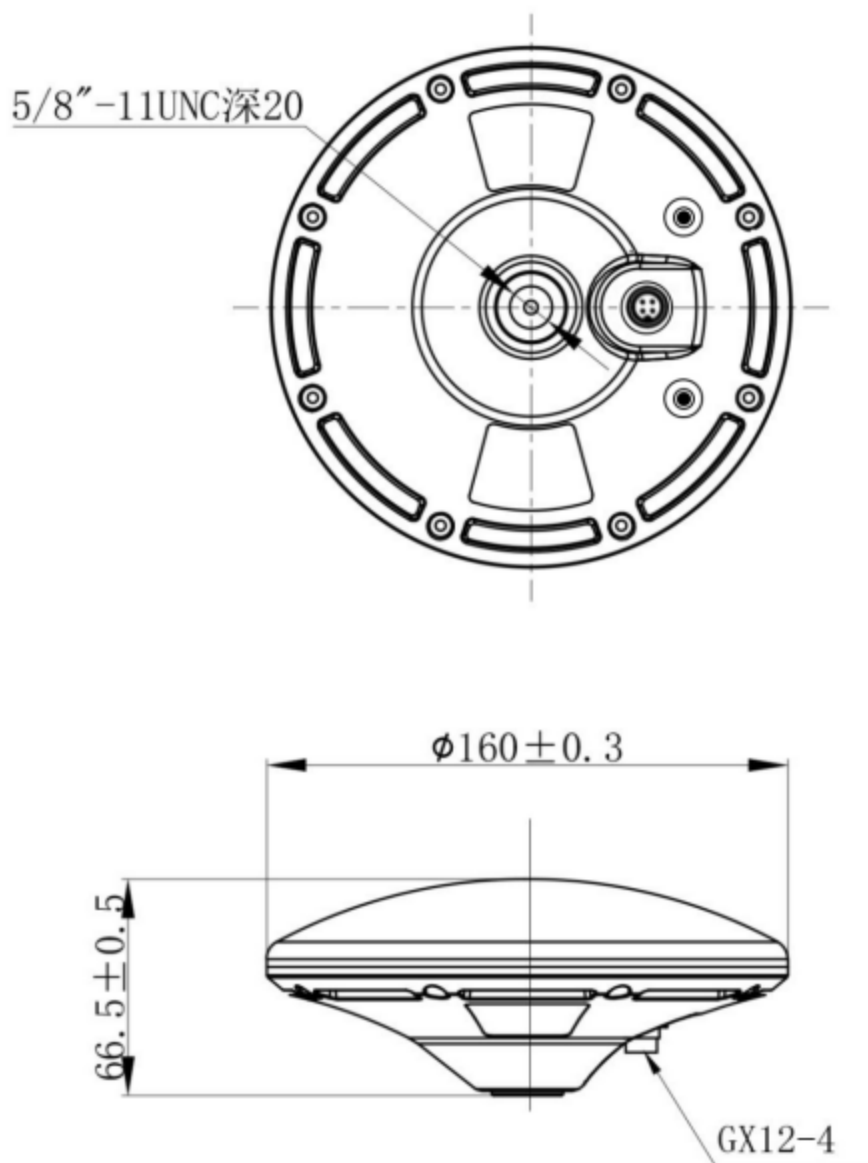
五、配置指令

Cold start	B5 62 06 04 04 00 FF FF 02 00 0E 61
Warm start	B5 62 06 04 04 00 01 00 02 00 11 6C
Hot start	B5 62 06 04 04 00 00 00 02 00 10 68
Revert to default configuration	B5 62 06 09 0D 00 FF FF 00 00 00 00 00 00 FF FF 00 00 17 2F AE
Save configuration	B5 62 06 09 0D 00 00 00 00 00 FF FF 00 00 00 00 00 00 17 31 BF
Baud rate 4800bps	B5 62 06 00 14 00 01 00 00 00 D0 08 00 00 C0 12 00 00 07 00 03 00 00 00 00 00 CF E4 B5 62 06 00 01 00 01 08 22
Baud rate 9600bps	B5 62 06 00 14 00 01 00 00 00 D0 08 00 00 80 25 0 00 03 00 03 00 00 00 00 00 9E 95 B5 62 06 00 01 00 01 08 22
Baud rate 38400bps	B5 62 06 00 14 00 01 00 00 00 D0 08 00 00 00 96 00 00 03 00 03 00 00 00 00 00 8F 70 B5 62 06 00 01 00 01 08 22
Baud rate 115200bps	B5 62 06 00 14 00 01 00 00 00 D0 08 00 00 00 C2 01 00 03 00 03 00 00 00 00 00 BC 5E B5 62 06 00 01 00 01 08 22
NMEA update rate 1Hz	B5 62 06 08 06 00 E8 03 01 00 01 00 01 39
NMEA update rate 2Hz	B5 62 06 08 06 00 F4 01 01 00 01 00 0B 77
NMEA update rate 4Hz	B5 62 06 08 06 00 FA 00 01 00 01 00 10 96
NMEA update rate 5Hz	B5 62 06 08 06 00 C8 00 01 00 01 00 DE 6A B5 62 06 08 00 00 0E 30
NMEA update rate 10Hz	B5 62 06 08 06 00 64 00 01 00 01 00 7A 12 B5 62 06 08 00 00 0E 30
Close GGA OutPut	B5 62 06 01 03 00 F0 00 00 FA 0F
Close GLL OutPut	B5 62 06 01 03 00 F0 01 00 FB 11
Close GSA OutPut	B5 62 06 01 03 00 F0 02 00 FC 13
Close GSV OutPut	B5 62 06 01 03 00 F0 03 00 FD 15
Close RMC OutPut	B5 62 06 01 03 00 F0 04 00 FE 17

Close VTG OutPut	B5 62 06 01 03 00 F0 05 00 FF 19
Open GGA OutPut	B5 62 06 01 03 00 F0 00 01 FB 10
Open GLL OutPut	B5 62 06 01 03 00 F0 01 01 FC 12
Open GSA OutPut	B5 62 06 01 03 00 F0 02 01 FD 14
Open GSV OutPut	B5 62 06 01 03 00 F0 03 01 FE 16
Open RMC OutPut	B5 62 06 01 03 00 F0 04 01 FF 18
Open VTG OutPut	B5 62 06 01 03 00 F0 05 01 00 1A
GSV 5S 输出一次	B5 62 06 01 08 00 F0 03 00 05 00 00 00 00 07 51
单条 RMC 输出	B5 62 06 01 03 00 F0 01 00 FB 11 B5 62 06 01 03 00 F0 02 00 FC 13 B5 62 06 01 03 00 F0 03 00 FD 15 B5 62 06 01 03 00 F0 05 00 FF 19 B5 62 06 01 03 00 F0 00 00 FA 0F
设置为基站	B5 62 06 8A 19 00 00 05 00 00 01 00 03 20 01 10 00 03 40 3C 00 00 00 11 00 03 40 50 C3 00 00 C9 1D B5 62 06 8A 13 00 00 05 00 00 01 00 74 10 00 02 00 74 10 00 04 00 74 10 01 3C B7 B5 62 06 8A 22 00 00 05 00 00 BE 02 91 20 01 CD 02 91 20 01 D2 02 91 20 01 19 03 91 20 01 D7 02 91 20 01 04 03 91 20 01 42 9B
以上配置指令要求 HEX 格式发送，配置完毕要进行保存到模块的 FLASH 里面。保存指令： B5 62 06 09 0D 00 00 00 00 00 FF FF 00 00 00 00 00 00 17 31 BF	

六、产品尺寸图





七、输出协议

联合模式协议头-GN
 GPS 模式协议头-GP
 GLONASS 模式协议头-GL
 北斗模式协议头-GB 或 BD

输出实例：

```
$GNRMC,090020.00,A,2240.8406477,N,11402.7075007,E,0.005,,140520,,A,V*16
$GNVTG,,T,,M,0.005,N,0.009,K,A*31
$GNGGA,090020.00,2240.8406477,N,11402.7075007,E,1,12,0.48,75.358,M,-2.521,M,,*6D
$GNGSA,A,3,02,06,09,17,19,28,04,03,,,,,0.99,0.48,0.87,1*0C
$GNGSA,A,3,73,74,70,75,69,85,,,,,0.99,0.48,0.87,2*01
$GNGSA,A,3,27,13,26,01,08,21,,,,,0.99,0.48,0.87,3*09
```



```

$GNGSA,A,3,28,07,08,10,13,27,30,,,,,0.99,0.48,0.87,4*07
$GPGSV,3,1,10,02,29,277,42,03,14,039,35,04,12,085,36,06,50,309,46,1*64
$GPGSV,3,2,10,09,19,119,37,17,55,035,46,19,50,357,46,23,,41,1*50
$GPGSV,3,3,10,24,00,288,,28,57,171,46,1*6C
$GPGSV,3,1,09,02,29,277,,03,14,039,31,04,12,085,38,06,50,309,46,6*67
$GPGSV,3,2,09,09,19,119,40,17,55,035,45,19,50,357,,24,00,288,,6*6E
$GPGSV,3,3,09,28,57,171,,6*55
$GLGSV,2,1,08,68,02,027,33,69,37,063,50,70,41,146,43,73,15,191,34,1*79
$GLGSV,2,2,08,74,36,228,44,75,29,298,47,84,29,034,20,85,28,327,47,1*77
$GLGSV,3,1,09,68,02,027,33,69,37,063,47,70,41,146,,73,15,191,40,3*79
$GLGSV,3,2,09,74,36,228,,75,29,298,46,84,29,034,37,85,28,327,44,3*71
$GLGSV,3,3,09,3*73
$GAGSV,2,1,07,01,26,310,40,08,30,091,42,13,45,016,46,14,18,100,37,7*7E
$GAGSV,2,2,07,21,55,249,46,26,36,302,43,27,30,180,40,7*46
$GAGSV,2,1,07,01,26,310,41,08,30,091,45,13,45,016,50,14,18,100,44,2*7E
$GAGSV,2,2,07,21,55,249,49,26,36,302,46,27,30,180,44,2*4D
$GBGSV,2,1,07,07,56,176,44,08,55,345,43,10,71,235,44,13,52,299,45,1*7E
$GBGSV,2,2,07,27,50,001,48,28,30,070,44,30,19,306,42,1*4A
$GBGSV,2,1,07,07,56,176,,08,55,345,,10,71,235,,13,52,299,,*49
$GBGSV,2,2,07,27,50,001,,28,30,070,,30,19,306,,*71
$GNGLL,2240.8406477,N,11402.7075007,E,090020.00,A,A*72
    
```

\$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. mmmm	4717.11399	Latitude (degrees & minutes), see format description
3	NS	-	character	N	North/South indicator
4	lon	-	dddmm. mmmm	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. mmmm	4717.11364	Latitude (degrees & minutes), see format description
2	NS	-	character	N	North/South indicator
3	lon	-	dddmm. mmmm	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
8	cs	-	hexadecimal	*60	Checksum
9	<CR><LF>	-	character	-	Carriage return and line feed

0	xxGSA	-	string	\$GPGSA	GSA Message ID (xx = current Talker ID, see NMEA Talker IDs table)
1	opMode	-	character	A	Operation mode: M = Manually set to operate in 2D or 3D mode 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. mmmm	4717.11437	Latitude (degrees & minutes), see format description
4	NS	-	character	N	North/South indicator
5	lon	-	dddmm. mmmm	00833.91522	Longitude (degrees & minutes), see format description
6	EW	-	character	E	East/West indicator
7	spd	kno ts	numeric	0.004	Speed over ground
8	cog	deg ree s	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	deg ree s	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