

SKM89 规格书/Datasheet

L1+L5 GNSS G-Mouse

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1 产品简介/General Description

Skylab SKM89 系列采用 GNSS 模块和 GNSS 天线一体化设计，自带备用电源;支持 L1+L5 双频定位方式，支持 GPS、BDS、GLONASS、Galileo、QZSS、SABS 等多系统定位。与 L1 单频定位相比，L1+L5 双频定位能有效消除电离层误差，定位精度更高，定位时间更短，系统稳定性更高。

Skylab SKM89 series adopts the integrated design of GNSS module and GNSS antenna, with on-board backup power supply; The module supports L1+L5 dual frequency positioning mode and supports GPS, BDS, GLONASS, Galileo, QZSS and SABS multi system positioning. Compared with L1 single frequency positioning, L1+L5 dual frequency positioning can effectively eliminate ionospheric errors, with higher positioning accuracy, shorter positioning time and higher system stability.

该模块具有灵敏度高(-164dbm)、抗干扰能力强的特点。可以在茂密的森林和高密度的城市建筑中保持定位。

The module has the characteristics of high sensitivity (-164dbm) and excellent anti-interference ability. It can maintain positioning in dense forests and high-density urban buildings.

该模块性能优异，成本低廉，能满足专业定位和个人消费需求的严格要求，包括车载、便携设备等产品的定位要求。

The module has excellent performance and low cost, and can meet the strict requirements of professional positioning and personal consumption needs, including the positioning requirements of products such as vehicle mounted and portable devices..

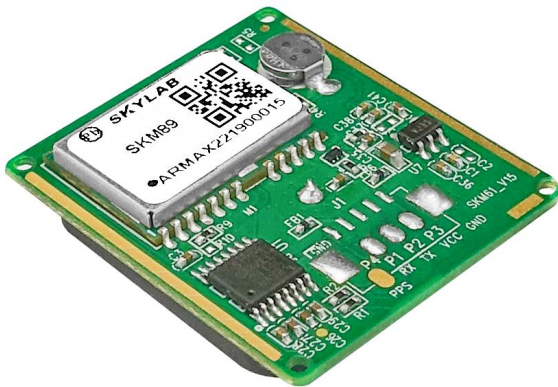


Figure 1: SKM89 Top View

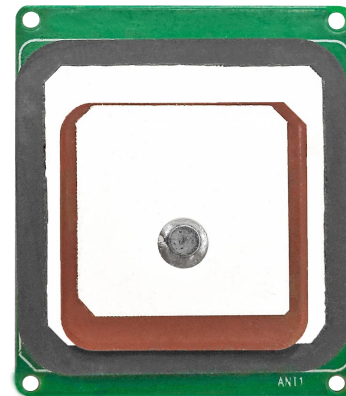


Figure 1: SKM89 bottom View

2 典型应用/Applications

- ◆ 汽车导航/ Car navigation
- ◆ 个人导航设备 Personal navigation equipment
- ◆ 汽车安全系统 Automobile security system
- ◆ 车载监控 Vehicle monitoring
- ◆ IRNSS 应用/ IRNSS application

3 典型应用/Features

- ◆ L1+L5 双频段, L1 支持 GPS、glo、gal、BDS、QZSS、SBAS 等系统/ L1+L5 dual band, L1 supports GPS, glo, gal, BDS, QZSS, SBAS systems
- ◆ L5 支持 GPS、gal、BDS 和 QZSS/ L5 supports GPS, gal, BDS and QZSS
- ◆ 支持 SBAS (WAAS, EGNOS, MSAs, Gagan)/ Support SBAS (WAAS, EGNOS, MSAs, Gagan)
- ◆ 支持 RTCM (v2.3 和 v3.3)/ Support RTCM (v2.3 and v3.3)
- ◆ 支持 agps: EPO, easy, NVRAM, hotstill/ Support agps: EPO, easy, NVRAM, hotstill
- ◆ 支持省电模式: 休眠模式、RTC 模式、周期模式、GLP、ULP/ Support power saving mode: sleep mode, RTC mode, periodic mode, GLP, ULP
- ◆ 支持 PPS 定时, 精度±15ns, PPS 与 NMEA 相关联/ Support PPS timing, with accuracy of ± 15ns. PPS is associated with NMEA
- ◆ 最多可跟踪 75 颗 L1 卫星和 60 颗 L5 卫星/ Up to 75 L1 satellites and 60 L5 satellites can be tracked
- ◆ 极快 TTFF: 冷启动小于 28s(带 glo 的 cttff 为 24s), 热启动时间小于 1s/ Extremely fast TTFF: cold start is less than 28s (cttff is 24s with glo); Hot start less than 1s
- ◆ 工业级标准/ Industrial standards
- ◆ 在微弱信号下具有良好的定位精度和定位效果/ Good positioning accuracy and position effectiveness under weak signal
- ◆ 卓越的质量和可靠性/ Superior quality and reliability
- ◆ 符合 ROHS, FCC 和 CE 标准/ Comply with ROHS, FCC and CE standards

4 Pin Assignment

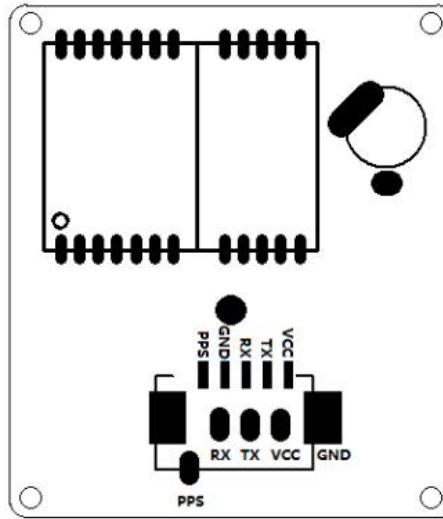


Figure 2: SKM89 Pin Package

5 引脚分配/ Pin Assignment

引脚序号/ Pin No.	引脚名称/ Pin name	I/O	描述/ Description	备注/ Remark
1	VCC	P	电源/ Module Power Supply	工作电源范围/ Operating range: 3.3V to 5.5V
2	TXD	O	串行数据输出/ UART Serial Data Output	不用则悬空/ Leave open if not used
3	RXD	I	串行数据输入/ UART Serial Data Input	Leave open if not used
4	GND	G	地/ Ground	
5	PPS	O	时间脉冲信号 I (100ms)/ Time pulse Signal (100ms)	Leave open if not used

6 接口配置/ Interfaces Configuration

UART

支持数据传输和固件升级。输入或输出信号类型为 LVTTTL 电平。默认波特率为 115200bps，最大波特率可设置为 921600bps。串口波特率由用户自行设置。

It supports data transmission and firmware upgrade. The input or output signal type is LVTTTL level. The default baud rate is 115200bps, and the maximum baud rate can be set to 921600bps. The serial port baud rate can be configured by the user.

UART 可以作为 RTCM 的输入输出接口。默认波特率为 115200，输出速率为 1Hz，且波特率和输出速率可调。

UART can be used as the input and output interface of RTCM. The default baud rate is 115200, the output rate is 1Hz, and the baud rate and output rate are adjustable.

PPS

二次脉冲(PPS): SKM89 提供了非常精确的时间脉冲 PPS 信号。PPS 信号可为外部系统提供定时服务。脉冲宽度可调，精度为每 24 小时 15ns。缺省情况下，每秒输出一个脉冲。

Second pulse (PPS): SKM89 provides a very accurate time pulse PPS signal. The PPS signal can provide time service for external systems. The pulse width is adjustable, and the accuracy is 15ns every 24h. By default, one pulse per second is output.

7 参数介绍/ Performance introduction

参数/ Parameter	说明/ Specification	
电源电压/ supply voltage	3.3~5.5V	
RF_IN	L1	GLONASS L1OF GPS L1CA QZSS L1CA SBAS L1 QZSS L1 SAIF Galileo E1(E1B+E1C) BDS B1I
	L5	GPS L5 QZSS L5 Galileo E5A BDS B2A
	SWR	≤1.5
灵敏度/Sensitivity	跟踪/ Tracking	-164dBm
	重捕获/ Re-Acquisition	-160dBm
	捕获/ Acquisition	-146dBm
精度/ Accuracy	定位/ Position	<1.7m CEP50 without SA(Open Sky)
	速率/ Velocity	0.1m/s without SA
	PPS	±15ns
捕获时间/ Acquisition Time	冷启动/ Cold Start	28s(Typical Open Sky)
	热启动/ Hot Start	1s
	重捕获/ Re-Acquisition	<1s
支持辅助 GPS/Assisted GPS support	EPO	
功耗/ Power Consumption	跟踪/ Tracking	58mA
	捕获/ Acquisition	53mA
数据刷新速率/ Navigation data update frequency	1~10Hz	Default 1Hz
运行限制/ Operational Limits	海拔/ Altitude	Max 18,000m
	速率/ Velocity	Max 515m/s
	加速度/ Acceleration	Less than 4g

8 电气特性/ Electrical Characteristics

绝对最大额定值/ Absolute Maximum Rating

参数/Parameter	符号/Symbol	最小值/Min	最大值/Max	单位/Units
电源/ Power Supply				
电源电压/Power Supply Volt.	VCC	-0.3	5.5	V
引脚输入/ Input Pins				
任何输入连接处的输入电压/ Input voltage on any input connection	V _{IO}	-0.5	2.94	V
人体模型 ESD 能力/ Human Body Model ESD capability			2000	V
环境/ Environment				
存储/ Storage Temperature	T _{stg}	-40	125	°C
湿度/ Humidity			95	%

注意: 绝对最大额定值仅为应力额定值, 在最大额定值处不保证功能运行。超过本表规定的应力范围可能会影响设备的可靠性或造成永久性的损坏。功能操作条件请参见如下操作条件表。

Note: Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

工作条件/ Operating Conditions

参数/ Parameter	符号/ Symbol	条件/ Condition	最小值 / Min	典型值 / Typ	最大值 / Max	单位/ Units
电源电压/ Power supply voltage	VCC		3.3	5	5.5	V
电源电压纹波/ Power supply voltage ripple	VCC_PP	VCC=5V			58	mV
电源电流,捕获/ Supply current, Acquisition	ICC	VCC=5V		40		mA
电源电流,跟踪/ Supply current, Tracking	ICC	VCC=5V		35		mA
输入高电平/ Input high voltage	V _{IH}		2		5.5	V

输入低电平/ Input low voltage	V_{IL}		-0.3		0.2VCC	V
输出高电平/ Output high voltage	V_{OH}		2.4		3.1	V
输出低电平/ Output low voltage	V_{OL}		-0.3		0.4	V
工作温度/ Operating temperature	T_{opr}		-40		85	°C

9 机械规范/ Mechanical Specification

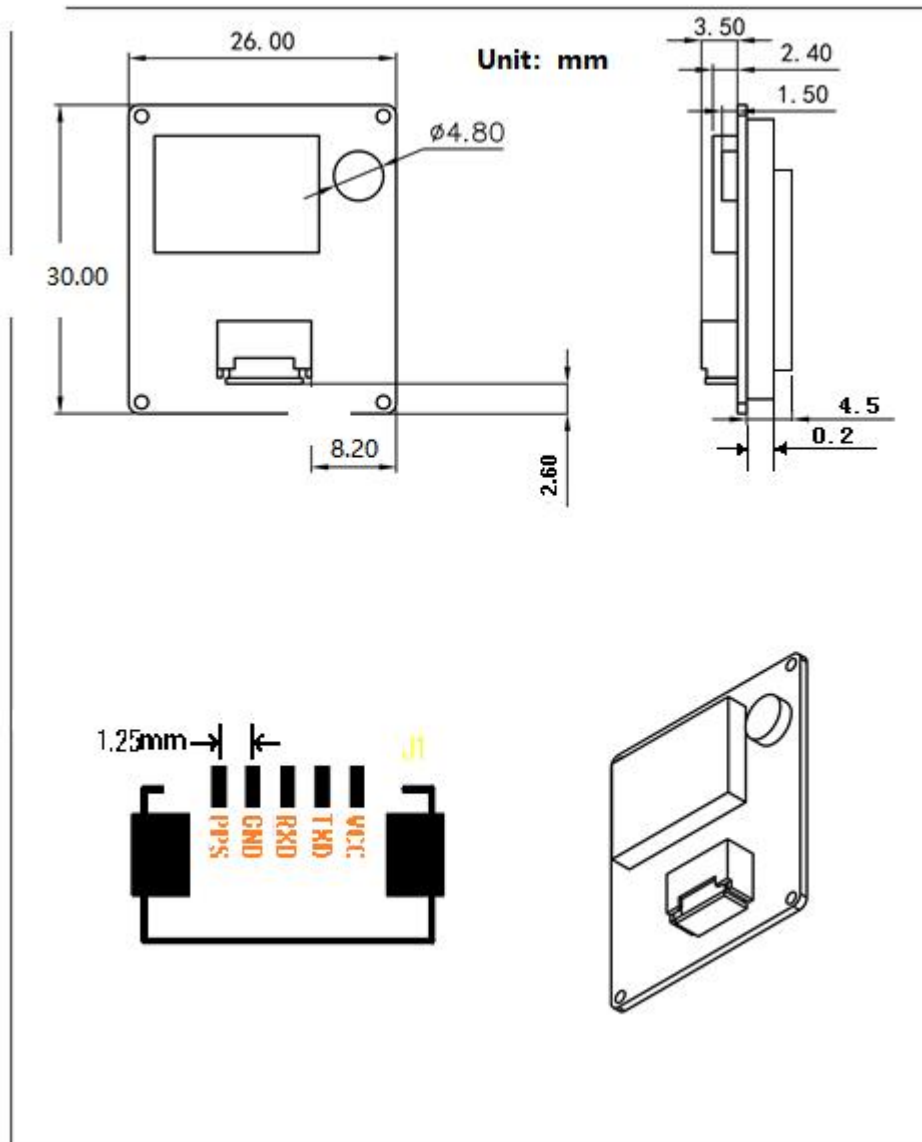


Figure 3: SKM89 Dimensions

10 软件协议/ Software Protocol

NMEA 0183 协议/ NMEA 0183 Protocol

NMEA 协议是一个基于 ascii 的协议，记录以\$和回车/换行开始。GPS 特定的消息都以\$GNxxx 开头，其中 xxx 是后面的消息数据的三个字母标识符。NMEA 消息有一个校验和，允许检测损坏的数据传输。

The NMEA protocol is an ASCII-based protocol, Records start with a \$ and with carriage return/line feed. GPS specific messages all start with \$GNxxx where xxx is a three-letter identifier of the message data that follows. NMEA messages have a checksum, which allows detection of corrupted data transfers.

Skylab SKM89 支持以下 NMEA-0183 消息:GGA, GSA, GSV, RMC VTG, ZDA。模块默认的 NMEA-0183 输出设置为 GGA, GSA, RMC, GSV, ZDA，波特率设置为 115200bps。

The Skylab SKM89 supports the following NMEA-0183 messages: GGA, GSA, GSV, RMC VTG, ZDA. The module default NMEA-0183 output is set up GGA、GSA、RMC、GSV , ZDA and default baud rate is set up 115200bps.

Table 1: NMEA-0183 输出语句/ NMEA-0183 Output Messages

NMEA 记录/ NMEA Record	描述/ Description	默认/ Default
GGA	定位数据信息/ Global positioning system fixed data	Y
GSA	当前卫星信息/ Global DOP and active satellites for GLONASS	Y
GSV	可见卫星信息/ GNSS satellites in view for GPS	Y
RMC	推荐定位信息/ Recommended minimum specific GNSS data	Y
VTG	地面速度信息/ Course over ground and ground speed	Y
ZDA	时间和日期信息/ Date and Time	Y

GGA -定位数据信息/ GGA-Global Positioning System Fixed Data

此语句包含了导航定位的位置、时间和质量。参考 RMC 中的定位状态、定位模式、定位日期、速度和正确航向。Fix Type、PDOP、VDOP 请参考 GSA。

This sentence contains the position, time and quality of the navigation fix. See RMC for Fix Status, Fix Mode, Fix Date, Speed, and True Course. See GSA for Fix Type, PDOP, and VDOP.

\$GNGGA,022326.000,2238.3443,N,11403.0962,E,1,22,0.72,104.0,M,-2.2,M,,*69

Table 2: GGA 语句格式/ GGA Data Format

名称/Name	示例/Example	单位/Unit	描述/Description
语句 ID/Message ID	\$GNGGA		GGA protocol header
UTC 定位/ UTC Position	022326.000		hhmmss.sss 时分秒格式
纬度/Latitude	2238.3443		ddmm.mmmm 度分格式
N / S 标志/ N/S indicator	N		N=北纬 S=南纬/ N=Northern latitude S=South latitude
经度/Longitude	11403.0962		dddmm.mmmm 度分格式
E/W 标志/ E/W Indicator	E		E=东经 W=西经/ E=East Longitude W=West Longitude
定位标志/Position Fix Indicator	1		见附表 2-1/ See Table 2-1
卫星使用/ Satellites Used	22		范围 0 到 12/ Range 0 to 12
HDOP	0.72		水平精度因子/ Horizontal Dilution of Precision
MSL Altitude	104.0	meters	高度(参照椭球面)/ Altitude (referenced to the Ellipsoid)
AltUnit	M	meters	Altitude Unit
GeoSep	-2.2	meters	Geoidal Separation
GeoSepUnit	M	meters	Geoidal Separation Unit
Age of Diff.Corr.	<Null>	second	不使用时为空字段/Null fields when it is not Used
Diff.Ref.Station ID	<Null>		不使用时为空字段/Null fields when it is not Used
校验和/ Checksum	*69		
EOL	<CR> <LF>		结束标志符/ End of message termination

Table 2-1: Position Fix Indicators

数值/Value	描述/Description
0	定位不可用或无效/ Fix not available or invalid
1	有效定位/ Fix valid
2	差分 GPS, 有效定位/ Differential GPS, fix valid

GSA -当前卫星信息/ GSA-GNSS DOP and Active Satellites

此条语句包含模块的选定工作模式，定位类型，已使用卫星的 PRN 信息及 PDOP, HDOP, VDOP 等信息。

This sentence contains the mode of operation, type of fix, PRNs of the satellites used in the solution as well as PDOP, HDOP and VDOP.

\$GNGSA,A,3,199,195,08,26,09,31,16,194,193,27,03,04,1.07,0.72,0.79,1*05

\$GNGSA,A,3,67,66,,,,,,,,,1.07,0.72,0.79,2*0E

\$GNGSA,A,3,,,,,,,,,1.07,0.72,0.79,3*0E

\$GNGSA,A,3,37,20,07,,,,,,,,,1.07,0.72,0.79,4*08

Table 3: GSA 语句格式/ GSA Data Format

名称/Name	示例/Example	单位/ Unit	描述/Description
语句 ID/ Statement ID	\$GPGSA		GSA 协议头/ GSA protocol header
模式 1/ Mode 1	A		See Table 3-2
模式 2/ Mode 2	3		See Table 3-1
已使用卫星 ID 信息/ ID of satellite used	199		第一信道的 Sv 信息/ Sv on Channel 1
已使用卫星 ID 信息/ ID of satellite used	195		第二信道的 Sv 信息/ Sv on Channel 2
...
已使用卫星 ID 信息/ ID of satellite used	<Null>		十二信道的 Sv 信息（未使用则为空）/ Sv on Channel 12 (Null fields when it is not Used)
PDOP	1.07		位置精度因子/Position Dilution of Precision
HDOP	0.72		水平精度因子/ Horizontal Dilution of Precision
VDOP	0.79		垂直精度因子/ Vertical Dilution of Precision
校验和/ Checksum	*05		
EOL	<CR> <LF>		结束标志符/ End of message termination

Table 3-1: 模式 2/ Mode 2

值/Value	描述/Description
1	未定位/ Fix not available
2	2D 定位/ 2D Fix
3	3D 定位/ 3D Fix

Table 3-2: 模式 1/ Mode 1

值/Value	描述/Description
M	手动选择 2D 或者 3D 模式/ Manual-forced to operate in 2D or 3D mode
A	自动选择 2D 或者 3D 模式/ Automatic-allowed to automatically switch 2D/3D

GSV -可见卫星信息/ GSV-GNSS Satellites in View

此语句包含可见卫星的 PRNs, 方位角和仰角等信息。

This sentence contains the PRNs, azimuth, elevation, and signal strength of all satellites in view.

\$GPGSV,4,1,13,27,78,149,46,199,60,149,39,04,59,289,43,194,56,045,44,1*64

\$GPGSV,4,2,13,195,54,108,43,16,50,008,43,08,45,203,42,26,33,038,40,1*5A

\$GPGSV,4,3,13,09,28,313,33,31,28,098,42,193,26,167,39,03,11,233,39,1*52

\$GPGSV,4,4,13,22,,,35,1*60

\$GPGSV,3,1,10,27,78,149,50,199,60,149,48,04,59,289,46,194,56,045,45,8*6C

\$GPGSV,3,2,10,195,54,108,46,08,45,203,48,26,33,038,36,09,28,313,31,8*54

\$GPGSV,3,3,10,193,26,167,44,03,11,233,43,8*55

\$GLGSV,1,1,02,66,38,231,37,67,31,297,33,1*7A

\$GAGSV,1,1,02,05,,,41,24,,,41,7*72

\$GAGSV,1,1,02,05,,,45,24,,,41,1*70

\$GBGSV,3,1,11,07,65,346,40,37,50,357,43,23,33,068,26,10,32,262,41,1*7A

\$GBGSV,3,2,11,20,28,264,35,01,,,42,02,,,36,16,,,42,1*48

\$GBGSV,3,3,11,03,,,40,05,,,28,32,,,38,1*74

\$GBGSV,1,1,04,37,50,357,41,23,33,068,45,20,28,264,37,32,,,41,4*44

Table 4: GSV 语句格式/ GSV Data Format

名称/Name	示例/Example	单位/ Unit	描述/Description
语句 ID/ Message ID	\$GPGSV		GSV 协议头/ GSV protocol header
信息数量/ Number of Message	4		本次 GSV 语句总数(范围 1 至 3)/ Total number of GSV sentences (Range 1 to 3)
信息号/ Message Number	1		本次 GSV 语句中的第几条(范围 1 至 3)/ Sentence number of the total (Range 1 to 3)

可见卫星信息/ Satellites in View	13		当前可见卫星总数/ Number of satellites in view
卫星 ID/ Satellite ID	27		信道 1/ Channel 1
仰角/Elevation	78	degrees	信道 1(范围 00 到 90)/ Channel 1(Range 00 to 90)
方位角/ Azimuth	149	degrees	信道 1(范围 000 到 359)/ Channel 1(Range 000 to 359)
信噪比/ SNR(C/NO)	46	dB-Hz	信道 1(范围 00 到 99,未使用则为空)/ Channel 1(Range 00 to 99, null when not tracking)
...			...
卫星 ID/ Satellite ID	194		信道 4/ Channel 4
仰角/Elevation	56	degrees	信道 4(范围 00 到 90)/ Channel 4(Range 00 to 90)
方位角/ Azimuth	045	degrees	信道 4(范围 000 到 359)/ Channel 4(Range 000 to 359)
信噪比/ SNR(C/NO)	44	dB-Hz	信道 4(范围 00 到 99,未使用则为空)/ Channel 4(Range 00 to 99, null when not tracking)
校验和/ Checksum	*64		
EOL	<CR> <LF>		结束标志符/ End of message termination

注：视所跟踪的卫星数目而定，可能需要多个 GSV 信息数据。

Note: Depending on the number of satellites tracked multiple messages of GSV data may be required.

RMC -推荐定位信息/ RMC-Recommended Minimum Specific GNSS Data

此语句包含推荐定位的卫星定位信息。参考 RMC 中的定位状态、定位模式、定位日期、速度和正确航向。

Fix Type、PDOP、VDOP 请参考 GSA。

This sentence contains the recommended minimum fix information. See GGA for Fix Quality, Sats Used, HDOP, Altitude, Geoidal Separation, and DGPS data. See GSA for Fix Type, PDOP and VDOP.

\$GNRMC,022326.000,A,2238.3443,N,11403.0962,E,0.01,169.33,120421,,,A,V*07

Table 5: RMC 数据格式/ RMC Data Format

名称/Name	示例/Example	单位/ Unit	描述/Description
语句 ID/ Message ID	\$GNRMC		RMC 协议头/ RMC protocol header
UTS 位置/ UTS Position	022326.000		hhmmss.sss 时分秒格式
状态/Status	A		A=data valid or V=data not valid
纬度/Latitude	2238.3443		ddmm.mmmm 度分格式

N/S 标志/ N/S Indicator	N		N=北纬 S=南纬/N=north or S=south
经度/Longitude	11403.0962		dddmm.mmmm 度分格式
E/W 标志/ E/W Indicator	E		E=东经 W=西经/E=east or W=west
对地速度/ Speed Over Ground	0.01	Knots	
对地航向/ Course Over Ground	169.33	Degrees	真航向/ True Course
UTC 日期/ Date(UTC)	120421		ddmmyy
磁偏角/ Magnetic variation	<Null>	Degrees	未使用则为空/ Null fields when it is not Used
磁偏角方位/Magnetic Variation Direction	<Null>		E=东经 W=西经 (未使用则为空) / E=east or W=west (Null fields when it is not Used)
定位模式/ Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
校验和/ Checksum	*07		
EOL	<CR> <LF>		结束标志符/ End of message termination

GLL-地理定位信息

包含纬度和经度信息。

\$GNGLL, 2238.3443,N, 11403.0962,E, 022326.000,A,A*4F

表 6: GLL 数据格式

名称	举例	单位	描述
Message ID	\$GNGLL		GLL protocol header
Latitude	2238.3443		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11403.0962		dddmm.mmmm
E/W Indicator	E		E=east or W=west
UTC Position	022326.000		hhmmss.sss
Fix Status	A		A=data valid or V=data not valid
Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
Checksum	*4F		
EOL	<CR> <LF>		End of message temination

VTG-地面速度信息/ VTG-Course Over Ground and Ground Speed

此语句包含了导航解决方案的航向和速度。

This sentence contains the course and speed of the navigation solution.

\$GNVTG,169.33,T,,M,0.01,N,0.02,K,A*2E

Table 6: VTG 语句格式/ VTG Data Format

名称/Name	示例/Example	单位/ Unit	名称/Name
语句 ID/Message ID	\$GPVTG		VTG 协议头/ VTG protocol header
Tcourse	169.33	度/ Degrees	真航向/ True Course
Reference	T		T = True
Mcourse	<Null>	度/ Degrees	Magnetic Course (Null fields when it is not Used)
Reference	M		M = Magnetic (Null fields when it is not Used)
Speed over ground	0.01	海里/ Knots	每小时海里数/ Nautical Miles per Hour
Units	N		Knots
Speed over ground	0.24	Km/hr	以公里每小时计算/ in Kilometers per Hour
Units	K		公里/小时/ Kilometer per hour
Mode	A		A=Autonomous, N=No fix, D=DGPS, E=DR
校验和/ Checksum	*23		
EOL	<CR> <LF>		结束标志符/ End of message termination

ZDA - 时间日期信息/ ZDA-Date and Time

此语句包含时间和日期信息

This sentence contains UTC date & time, and local time zone offset information.

\$GNZDA,022326.000,12,04,2021,,*49

Table 7: ZDA 数据格式/ ZDA Data Format

名称/Name	示例/Example	单位/ Unit	描述/Description
语句 ID/ Message ID	\$GPZDA		ZDA protocol header
UTC 时间/ UTC Time	022326.000		hhmmss.sss
日/Day	12		UTC time: day (01 ... 31) dd
月/ Month	04		UTC time: month (01 ... 12) mm

年/ Year	2021		UTC time: year (4 digit year) yyyy
偏移小时/ local zone hours	<Null>		本地时区偏移小时(不使用时为空字段)/ Local Time Zone Offset Hours (Null fields when it is not Used)
偏移分钟/ local zone minutes	<Null>		本地时区偏移分钟数(不使用时为空字段)/ Local Time Zone Offset Minutes (Null fields when it is not Used)
校验和/ Checksum	*49		
EOL	<CR> <LF>		结束标志符/ End of message termination

11 联系方式/ Contact Information

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