

SKM88 规格书/Datasheet

L1+L5 GNSS G-Mouse

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1 产品简介/General Description

SKM88 是一款高性能、多系统双频导航定位模块，可同时支持 GPS、北斗、GLONASS、Galileo、QZSS 等卫星接收模块。L1 + L5 双频定位，定位速度更快，精度更高，产品性能更可靠。

SKM88 is a high-performance, multi system dual frequency navigation and positioning module, which can support the satellite receiving modules of GPS, Beidou, GLONASS, Galileo and QZSS at the same time. L1 + L5 dual frequency positioning makes positioning faster, higher accuracy and more reliable product performance.

该模块凭借其优异的性能，可为车载、便携定位终端产品的制造提供高灵敏度、高精度、低成本的定位、导航等解决方案，满足专业定位的严格要求和个人消费需求。

With its excellent performance, the module can provide high-sensitivity, high-precision and low-cost positioning, navigation and other solutions for the manufacturing of vehicle mounted and portable positioning terminal products, and can meet the strict requirements of professional positioning and personal consumption needs.

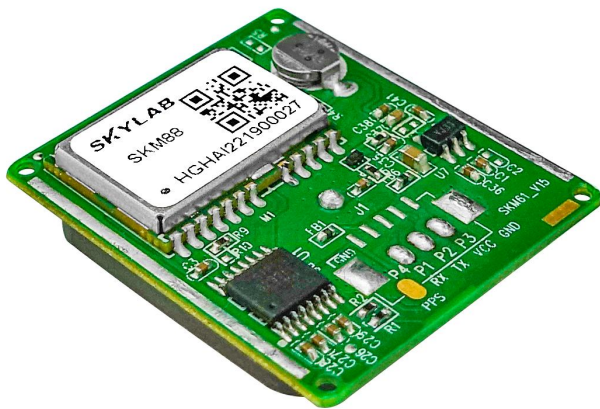


Figure 1: SKM88 正视图/SKM88 Top View

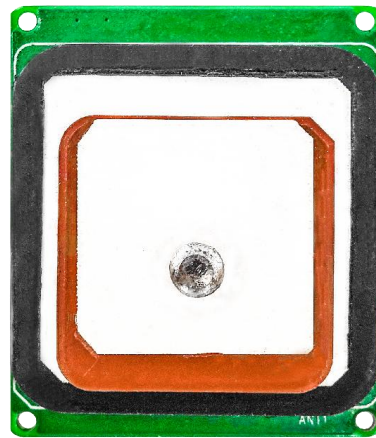


Figure 1: SKM88 底视图/SKM88 bottom View

2 典型应用/Applications

- ◆ 移动位置服务/ LBS (Location Based Service)
- ◆ 便携式导航装置/ PND (Portable Navigation Device)
- ◆ 车载导航系统/ Vehicle navigation system
- ◆ 汽车导航/ Car navigation

3 产品特点/Features

- ◆ 支持 L1+L5 双频/ L1+L5 dual band
- ◆ 支持北斗、GPS、GLONASS、伽利略、QZSS 和 SBAS 系统/Support BDS, GPS, GLONASS, Galileo, QZSS and SBAS systems
- ◆ 同步跟踪卫星数量达到 40 颗/ The number of simultaneous tracking satellites reaches 40
- ◆ 极快 TTFF:冷启动时间:<28s; 热启动时间:<1s/ Extremely fast TTFF: cold start:<28s; Hot start:<1s
- ◆ 支持 A-GPS/ Support A-GPS
- ◆ 工业级/ Industrial standards
- ◆ 符合 ROHS, FCC 和 CE/ Comply with ROHS, FCC and CE standards
- ◆ 获得最快的定位时间/ Get the fastest positioning time
- ◆ 微弱的信号下, 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
- ◆ 尺寸/ Size: 30* 26* 8mm

4 引脚分配/ Pin Assignment

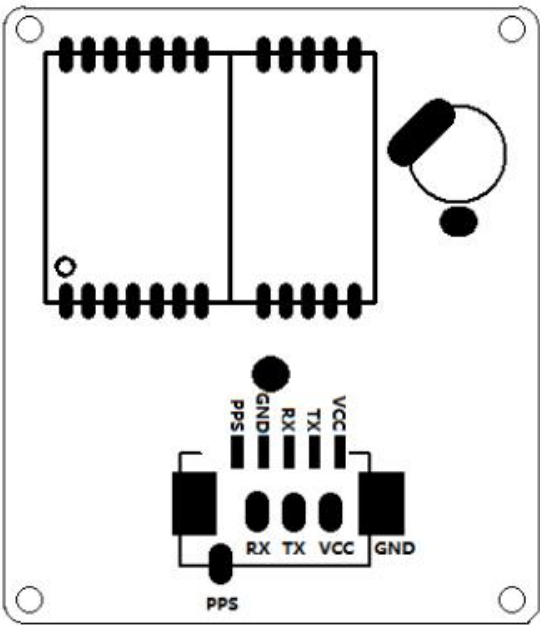


Figure 2: SKM88 Pin Package

5 引脚描述/ Pin Description

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	不用则悬空/ 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)	不用则悬空/ Leave open if not used

6 接口配置/ Interfaces Configuration

电源/ Power Supply

SKM88 需要调节功率。SKM88 系列输入电压 VCC 范围为 3.3V ~ 5.5V，电流要求大于 100mA。将解耦电容(10uF、1uF)放置在接口电源附近，既降低了电源噪声，又提高了电源的稳定性。

Regulated power for the SKM88 is required. SKM88 series input voltage VCC range is 3.3V ~ 5.5V, current requirement is greater than 100mA. Place decoupling capacitors (10uF and 1uF) close to the interface power supply. It can reduce the Noise from power supply and increase power stability.

主电源VCC电流根据处理器负载和卫星采集情况而变化。采集过程中最大VCC峰值电流约为45mA。

Main power supply VCC current varies according to the processor load and satellite acquisition. Maximum VCC peak current is about 45mA during acquisition.

UART 接口/ UART Ports

支持数据传输和固件升级。输入输出信号类型为 LVTTTL 电平。默认波特率为 115200bps，最大波特率可设置为 460800bps。串口波特率由用户自行设置。

It supports data transmission and firmware upgrade. The input/output signal type is LVTTTL level. The default baud rate is 115200bps, and the maximum baud rate can be set to 460800bps. The serial port baud rate can be configured by the user.

PPS

二次脉冲信号(PPS): SKM88 提供了非常精确的时间脉冲 PPS 信号。PPS 信号可以为外部系统提供定时功能。脉冲宽度可调，精度为 20ns。缺省情况下，每秒输出一个脉冲。

Second pulse signal (PPS): SKM88 provides a very accurate time pulse PPS signal. The PPS signal can provide timing function for external systems. The pulse width is adjustable with an accuracy of

20ns. By default, one pulse is output per second.

7 参数介绍/ Performance introduction

参数/ Parameter	说明/ Specification	
电源电压/ power supply voltage	3.3~5.5V	
RF_IN	频率/ Frequency	GPS/QZSS :L1CA, L1C,L5 GLONASS: L1 BeiDou: B1C,B1I,B2a GALILEO: E1,E5 SBAS: WAAS, EGNOS, MSAS, GAGAN, SDCM (L1)
	SWR	≤1.5
	输入阻抗/ Input impedance	50Ω±10%
	天线增益/ Antenna gain	0~32dBm
灵敏度/ Sensitivity	跟踪/ Tracking	-162dBm
	捕获/ Acquisition	-148dBm
精度/ Accuracy	定位/ Position	<1.5m CEP50 without SA(Open Sky)
	速率/ Velocity	0.1m/s without SA
捕获时间/ Acquisition Time	冷启动/ Cold Start	28s(Typical Open Sky)
	温启动/ Warm Start	1s
	热启动/ Hot Start	<1s
	重捕获/ Re-Acquisition	
支持辅助 GPS/ Assisted GPS support	EPO	
功耗/ Power Consumption	跟踪/ Tracking	57mA
	捕获/ Acquisition	53mA
Navigation data update frequency	Max 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

绝对最大定额值/ 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	-0.5	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	VIO	-0.5	5.5	V
人体模型 ESD 能力/ Human Body Model ESD capability	RF_IN		2000	V
环境/ Environment				
存储/ Storage Temperature	Tstg	-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			30	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}		0.67*V _{CC}		V _{CC}	V
输入低电平/ Input low voltage	V _{IL}		0		0.2*V _{CC}	V
输出高电平/ Output high voltage	V _{OH}		2.64			V
输出低电平/ Output low voltage	V _{OL}				0.4	V
工作温度/ Operating temperature	Topr		-40		85	°C

9 机械规范/ Mechanical Specification

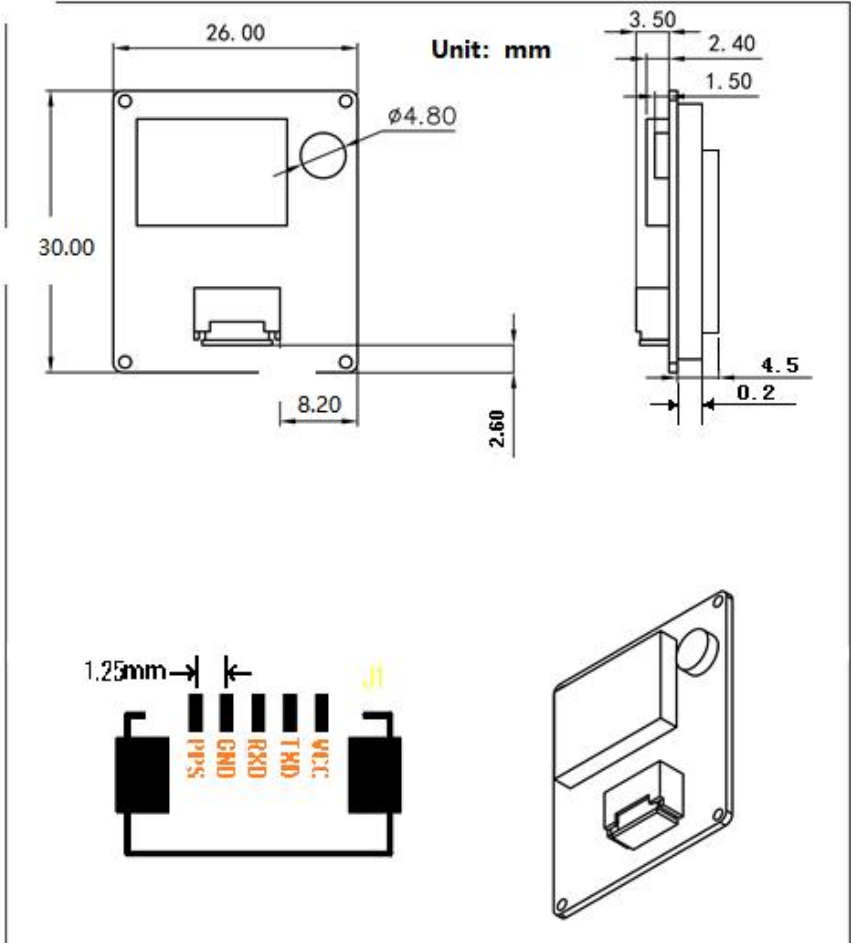


Figure 3: SKM88 Dimensions

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 SKM88 支持以下 NMEA-0183 消息:GGA, GSA, GSV, RMC, TXT, 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 SKM88 supports the following NMEA-0183 messages: GGA, GSA, GSV, RMC, TXT, 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
TXT	天线检测信息/ Antenna detection information	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,031301.000,2238.34517,N,11403.09467,E,2,14,1.14,100.3,M,-2.2,M,,0000*6B

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	031301.000		hhmmss.sss 时分秒格式
纬度/Latitude	2238.34517		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	11403.09467		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	2		见附表 2-1/ See Table 2-1
卫星使用/ Satellites Used	14		范围 0 到 12/ Range 0 to 12
HDOP	1.14		水平精度因子/ Horizontal Dilution of Precision
MSL Altitude	100.3	M	高度(参照椭球面)/ Altitude (referenced to the Ellipsoid)
AltUnit	M	M	Altitude Unit
GeoSep	-2.2	M	Geoidal Separation
GeoSepUnit	M	M	Geoidal Separation Unit
Age of Diff.Corr.	<Null>	S	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	*6B		
EOL	<CR> <LF>		结束标志符/ End of message termination

Table 2-1: 定位标志/ 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.

\$GPGSA,A,3,08,195,194,16,,,,,,,,,2.44,1.14,2.16,1*12

\$GLGSA,A,3,82,79,,,,,,,,,2.44,1.14,2.16,2*07

\$GAGSA,A,3,,,,,,,,,,2.44,1.14,2.16,3*0F

\$BDGSA,A,3,235,209,207,226,239,240,244,245,,,,,2.44,1.14,2.16,4*0B

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	08		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	2.44		位置精度因子/Position Dilution of Precision

HDOP	1.14		水平精度因子/ Horizontal Dilution of Precision
VDOP	2.16		垂直精度因子/ Vertical Dilution of Precision
校验和/ Checksum	1*12		
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,5,1,17,8,77,317,41,658,77,317,40,195,63,81,35,845,63,81,34*7C

\$GPGSV,5,2,17,50,59,149,31,199,59,149,28,849,59,149,29,194,58,58,44*76

\$GPGSV,5,3,17,844,58,58,35,53,55,222,23,41,46,238,26,4,41,214,33*4E

\$GPGSV,5,4,17,654,41,214,20,9,40,263,32,659,40,263,18,21,35,160,33*40

\$GPGSV,5,5,17,16,26,52,29*70

\$GLGSV,1,1,04,83,65,157,17,82,51,43,45,79,24,87,36,81,6,26,*6D

\$GAGSV,1,1,01,333,54,103,15*6D

\$BDGSV,5,1,18,235,69,56,43,885,69,56,40,209,64,226,28,207,57,2,44*67

\$BDGSV,5,2,18,226,56,355,47,876,56,355,38,239,52,206,31,889,52,206,25*65

\$BDGSV,5,3,18,240,51,331,48,890,51,331,43,216,50,193,27,894,50,206,25*66

\$BDGSV,5,4,18,206,46,185,23,245,42,90,36,895,42,90,29,212,24,209,27*6B

\$BDGSV,5,5,18,238,21,167,29,888,21,167,23*6A

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	5		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	17		当前可见卫星总数/ Number of satellites in view
卫星 ID/ Satellite ID	8		信道 1/ Channel 1
仰角/Elevation	77	degrees	信道 1(范围 00 到 90)/ Channel 1(Range 00 to 90)
方位角/ Azimuth	317	degrees	信道 1(范围 000 到 359)/ Channel 1(Range 000 to 359)
信噪比/ SNR(C/NO)	41	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	845		信道 4/ Channel 4
仰角/Elevation	63	degrees	信道 4(范围 00 到 90)/ Channel 4(Range 00 to 90)
方位角/ Azimuth	81	degrees	信道 4(范围 000 到 359)/ Channel 4(Range 000 to 359)
信噪比/ SNR(C/NO)	34	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	*7C		
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,031301.000,A,2238.34517,N,11403.09467,E,0.000,350.36,230421,,D*44

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	031301.000		hhmmss.sss 时分秒格式
状态/Status	A		A=data valid or V=data not valid
纬度/Latitude	2238.34517		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	11403.09467		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	0.000	Knots	
对地航向/ Course Over Ground	350.36	Degrees	真航向/ True Course
UTC 日期/ Date(UTC)	230421		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	D		A=autonomous, N = No fix, D=DGPS, E=DR
校验和/ Checksum	*44		
EOL	<CR> <LF>		结束标志符/ End of message termination

TXT -天线检测信息/ TXT-Antenna detection information

此语句包含天线状态信息。

This sentence contains antenna status information.

\$GNTXT,01,01,01,ANT_OPEN*40

Table 6 TXT 语句格式/TXT Data Format

名称/Name	示例/Example	单位/ Unit
语句 ID/Message ID	\$GNTXT	TXT protocol header
NumField1	01	
NumField2	01	
NumField3	01	
ANTCode	ANT_OPEN	See Table 6-1
校验和/ Checksum	*40	
EOL	<CR> <LF>	End of message termination

Table 6-1 Mode

值/Value	描述/Description
ANT_OPEN	天线断路/ Antenna open circuit
ANT_OK	天线状态 OK/ Antenna status OK
ANT_Short	天线短路/ Antenna short circuit

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,025956.000,23,04,2021,00,00*41

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	025956.000		hhmmss.sss
日/Day	23		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	00		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/	00		本地时区偏移分钟数(不使用时为空字段)/ Local Time

local zone minutes			Zone Offset Minutes (Null fields when it is not Used)
校验和/ Checksum	*4C		
EOL	<CR> <LF>		结束标志符/ End of message termination

11 联系方式/ Contact Information

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