

# SKM2102CR-40MXT

## 规格书/Datasheet

### L1 BDS3 GNSS G-Mouse

系列型号/Serial model No.: SKM2102CR-40M3T

SKM2102CR-40M5T

SKM2102CR-40M8T

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## 1 产品简介/Product introduction

SKYLAB SKM2102CR 具有嵌入式 GNSS 天线，可以在最严格的应用程序中实现高性能导航，甚至在严酷的 GNSS 可见环境中也能实现可靠的定位。它是基于单片架构的高性能 GNSS 单芯片，-162dBm 跟踪灵敏度将定位覆盖扩展到城市峡谷和茂密的树叶环境中。标准连接插头的设计是与其他电子设备进行通信的最简单、最方便的解决方案。

The SKYLAB SKM2102CR has an embedded GNSS antenna, which enables high performance navigation in the most stringent applications and reliable positioning even in harsh GNSS visibility environments. It is a high-performance GNSS single chip based on a monolithic architecture with a -165dbm tracking sensitivity that extends positioning coverage into urban canyons and dense leafy environments. The standard connector plug is designed to be the simplest and most convenient solution for communicating with other electronic devices.



Figure 1: SKM2102CR-40MXT Top View

## 2 典型应用/Applications

- ◆ LBS（基于位置的服务）/LBS (Location-based Services)
- ◆ PND（便携式导航设备）/PND (Portable Navigation Equipment)
- ◆ 车载导航系统 /Car Navigation System

## 3 产品特点/Features

- ◆ 支持 BDS3、GPS、GLONASS、Galileo、QZSS、SBAS 系统/ Supports BDS3, GPS, GLONASS,

Galileo, QZSS and SBAS systems

- ◆ 超高灵敏度/Ultra high sensitivity: -162dBm
- ◆ NMEA 协议（默认波特率：115200 bps）/NMEA protocol (default baud rate: 115200 BPS)
- ◆ 内部备用电池/Internal spare battery
- ◆ 嵌入式陶瓷天线 25 x 25 x 4.0mm 及 35 x35 x4.0mm/ Embedded ceramic antenna 25 x 25

x4.0mm and 35 x35 x4.0mm

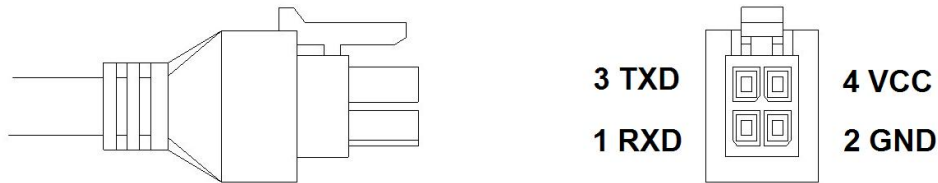
◆ 弱信号下较好的定位精度和位置有效性/Better positioning accuracy and position validity are maintained under weak signal

- ◆ 工作温度范围/Operating temperature range: -40~85℃
- ◆ 符合 ROHS, CE, FCC 标准/Compliance with ROHS, CE, FCC standards
- ◆ 尺寸/ Size: 50.7\* 48.5\* 18.5mm

## 4 型号说明/Model Code



## 5 接口定义/Interface definition



### RS232

1 RXD  
2 GND  
3 TXD  
4 VCC

### TTL Level

1 RXD  
2 GND  
3 TXD  
4 VCC

#### Note:

RXD: Serial Data Input To SKM2102

TXD: Serial Data Output From SKM2102

图 2: SKM2102CR-40MXT 接口定义

## 6 接口描述/Interface description

电源: SKM2102CR 系列输入电压 VCC 范围为 3.5 V~ 5.5V, 电流要求大于 100mA。靠近接口电源的地方请放置去耦电容 (10uF 和 1uF)。

Power supply: SKM2102CR series input voltage VCC range is 3.5 V~ 5.5V, current requirement is greater than 100mA. Place decoupling capacitors (10uF and 1uF) close to the interface power supply.

UART 端口: SKM2102CR 系列支持一个完整的双工系列通道 UART。

UART port: The SKM2102CR series supports a complete duplex series channel UART.

RS232 电平: SKM2102CR 系列使用单芯片 RS232 到 UART bridge, 它是 3.3V 驱动的 EIA / TIA-232 和 V.28/V.24。

RS232 level: The SKM2102CR series uses a single-chip RS232 to UART bridge, which is 3.3V driven EIA/TIA-232 and V.28/V.24.

| 序号/NO.                                            | 名称/Name | 输入/输出 Input/Output | 描述/Describe             | 备注/Remark        |
|---------------------------------------------------|---------|--------------------|-------------------------|------------------|
| <b>Micro-Fit 3.0 连接器/ Micro-fit 3.0 connector</b> |         |                    |                         |                  |
| 1                                                 | RXD     | I                  | UART Serial Data Input  | RS232 电平         |
| 2                                                 | GND     | G                  | Power Ground            | Reference Ground |
| 3                                                 | TXD     | O                  | UART Serial Data Output | RS232 电平         |
| 4                                                 | VCC     | P                  | Power Supply            | VCC:3.5V~5.5V    |

## 7 性能介绍/Performance introduction

| 项目/ Items                           | 参数/Parameter                                                                                                    |                                                                                    |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 接收类型/Type of receipt                | GNSS                                                                                                            |                                                                                    |
| 灵敏度/Sensitivity                     | 跟踪/Tracking<br>捕获/Acquisition                                                                                   | -162dBm<br>-148dBm                                                                 |
| 精度/Accuracy                         | 定位精度/ Position                                                                                                  | GNSS Open-Sky   CEP<2.5m<br>SBAS Open-Sky   CEP<2.0m<br>D-GNSS Open-Sky   CEP<1.0m |
|                                     | 漂移速度/Velocity                                                                                                   | GNSS   0.1m/s<br>SBAS   0.05m/s<br>D-GNSS 0.05m/s                                  |
| 定位时间/Acquisition Time               | 冷启动/Cold Start                                                                                                  | ≤28s                                                                               |
|                                     | 热启动/Hot Start                                                                                                   | <1s                                                                                |
|                                     | 重捕获/Re-Acquisition                                                                                              | ≤1s                                                                                |
| NMEA 输出频率/<br>NMEA output frequency |                                                                                                                 | 1Hz                                                                                |
| 使用范围/<br>Operational Limits         | 速度 Velocity                                                                                                     | Max 515m/s                                                                         |
|                                     | 加速度/Acceleration                                                                                                | <4g                                                                                |
| 天线指标/Antenna design                 |                                                                                                                 |                                                                                    |
| 外型尺寸/External dimension             | 25 x 25 x 4.0mm 或 35 x35 x4.0mm                                                                                 |                                                                                    |
| 频点/Frequency point                  | GPS/QZSS :L1C/A<br>GLONASS: L1<br>BeiDou: B1I,B1C<br>GALILEO: E1<br>SBAS: L1C/A(WAAS, EGNOS, MSAS, GAGAN, SDCM) |                                                                                    |
| 阻抗/Impedance                        | 50Ω±10%                                                                                                         |                                                                                    |
| 轴比/Axial ratio                      | 3 dB max                                                                                                        |                                                                                    |
|                                     |                                                                                                                 |                                                                                    |
| 极化/Polarization                     | 右极化(RHCP) /Right polarization (RHCP)                                                                            |                                                                                    |
| 机械特性/Mechanical characteristics     |                                                                                                                 |                                                                                    |
| 尺寸/Size                             | 50.7* 48.5 * 18.5mm                                                                                             |                                                                                    |
| 电源功耗/Power Consumption              |                                                                                                                 |                                                                                    |
| 电压/Voltage                          | 3.5V~5.5V                                                                                                       |                                                                                    |
| 电流/Electric current                 | 53mA(typical)                                                                                                   |                                                                                    |

| 工作环境/Operating environment       |                        |
|----------------------------------|------------------------|
| 工作温度范围/<br>Operating temperature | -40 ~ +85 °C （不包括备份电池） |
| 存储温度/<br>storage temperature     | -40 ~ +105 °C          |
| 湿度/ Humidity                     | ≦95%                   |

## 8 模块尺寸/Module size

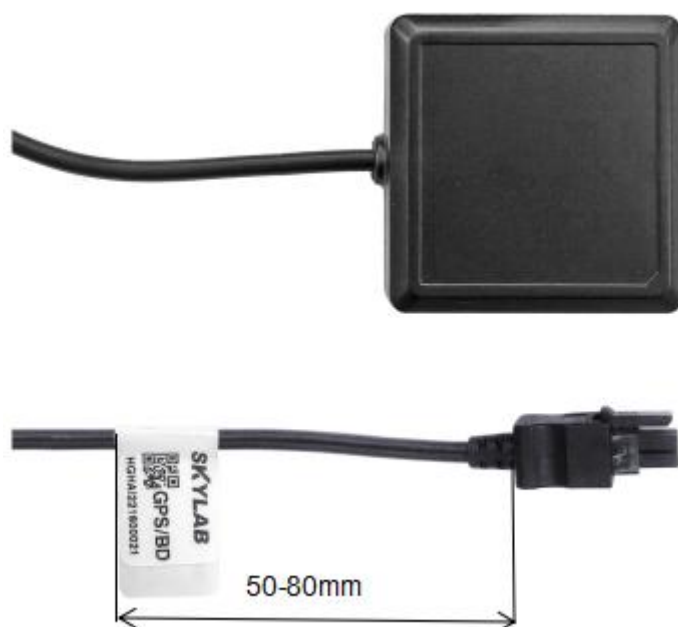


图 3 SKM2102CR-40MXT Log 标签

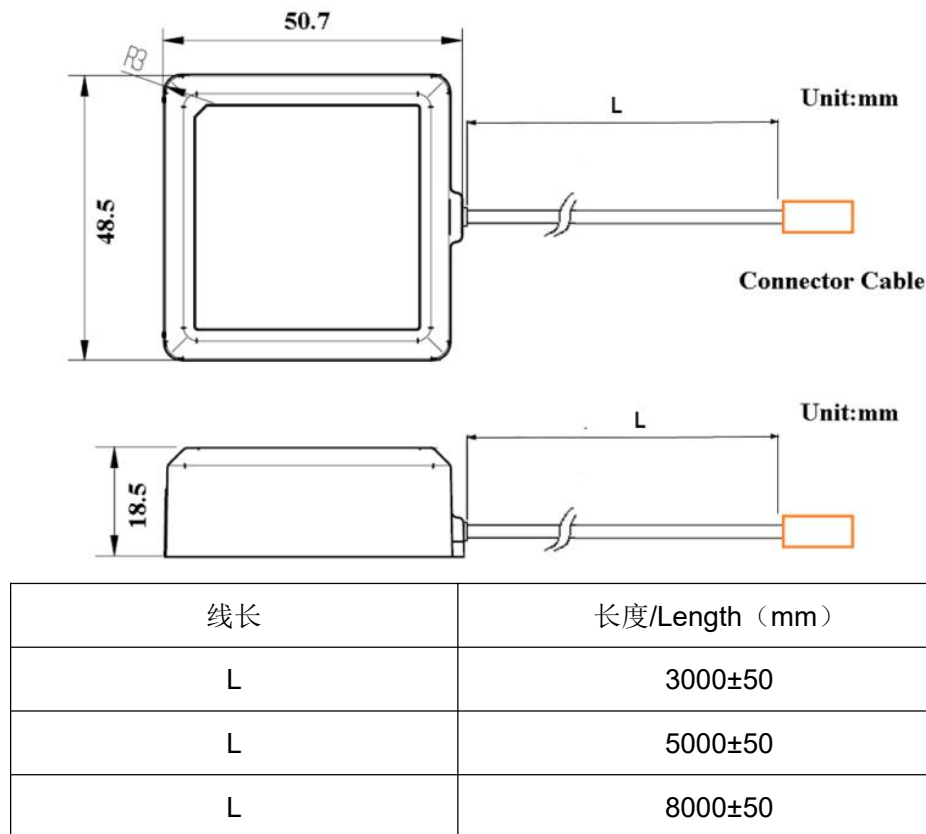


图 4: SKM2102CR-40MXT 尺寸

## 9 应用配置/Application configuration

### 9.1 NMEA-0183 协议/NMEA 0183 Protocol

NMEA 协议是一种基于代码的协议，记录以\$开始，并带有回车/换行。GNSS 特定的消息都以\$GNxxx 开始，其中 xxx 是一个三字母的消息数据标识符。NMEA 消息有一个校验和，它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. GNSS 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 SKM2102CR 支持以下 NMEA-0183 消息：GGA、GSA、GSV、RMC、ZDA、TXT。默认的 NMEA-0183 输出设置为 GGA、GSA、GSV、RMC、ZDA、TXT 和默认的波特率，设置为 115200bps。The Skylab SKM2102CR supports the following NMEA-0183 messages: GGA, GSA, GSV, RMC, ZDA, TXT. The module default NMEA-0183 output is set up GGA、GSA、RMC、GSV , and default baud rate is set up 115200bps.

表 1: NMEA-0183 输出消息/NMEA-0183 Output Messages

| NMEA 记录/NMEA Record | 描述/Description                                                          | 默认/Default |
|---------------------|-------------------------------------------------------------------------|------------|
| GNGGA               | 定位数据信息/ Global positioning system fixed data                            | Y          |
| GNGSA               | 当前卫星信息/ GNSS DOP and active satellites                                  | Y          |
| GPGSV               | 可见卫星信息/ GNSS satellites in view for GPS                                 | Y          |
| GNRMC               | 推荐定位信息/<br>Recommended minimum specific GNSS data                       | Y          |
| GNZDA               | 时间和日期信息/ Date and Time                                                  | Y          |
| TXT                 | 天线检测硬件功能输出信息/<br>Antenna detection hardware function output information | Y          |

表 2: 标识符助记码/Identifier mnemonic code

| 标识符/Identifier | 数据类型/Data type            |
|----------------|---------------------------|
| BD             | 北斗模式/ Beidou Model        |
| GP             | GPS 模式/ GPS Model         |
| GL             | GLONASS 模式/ GLONASS Model |
| GA             | GALILEO 模式/ GALILEO Model |
| GN             | 多模模式/ Dual-mode Model     |

## 9.2 GGA-位置信息/GGA- Location information

包含导航定位的位置、时间和精度因子。

Contains the location, time, and precision factor of navigation positioning.

\$GNGGA,040529.000,2238.3501,N,11403.1008,E,1,15,1.33,50.8,M,-2.2,M,,\*5F

表 2: GGA 数据格式/GGA Data Format

| 名称/Name       | 举例/Example | 单位/Units | 描述/Description      |
|---------------|------------|----------|---------------------|
| Message ID    | \$GNGGA    |          | GGA protocol header |
| UTC Position  | 040529.000 |          | hhmmss.sss          |
| Latitude      | 2238.3501  |          | ddmm.mmmm           |
| N/S indicator | N          |          | N=north or S=south  |
| Longitude     | 11403.1008 |          | dddmm.mmmm          |

|                        |           |        |                                        |
|------------------------|-----------|--------|----------------------------------------|
| E/W Indicator          | E         |        | E=east or W=west                       |
| Position Fix Indicator | 1         |        | See Table 2-1                          |
| Satellites Used        | 15        |        | Range 0 to 12                          |
| HDOP                   | 1.33      |        | Horizontal Dilution of Precision       |
| MSL Altitude           | 50.8      | meters | 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 | Null fields when it is not Used        |
| Diff.Ref.Station ID    | <Null>    |        | Null fields when it is not Used        |
| Checksum               | *5F       |        |                                        |
| EOL                    | <CR> <LF> |        | End of message termination             |

表 2-1: 位置固定指标/ Position Fix Indicators

| Value | 描述/Description               |
|-------|------------------------------|
| 0     | Fix not available or invalid |
| 1     | fix valid                    |
| 2     | Differential GPS, fix valid  |

### 9.3 GSA-GNSS 正在使用的卫星信息/GSA- GNSS satellites in using

包含卫星的 PRN，以及 PDOP、HDOP 和 VDOP。

PRN of the satellites used in the solution as well as PDOP, HDOP and VDOP.

\$GNGSA,A,3,194,01,21,07,195,09,,,,,,,,,1.62,1.33,0.93,1\*02

\$GNGSA,A,3,79,,,,,,,,,,,,,1.62,1.33,0.93,2\*02

\$GNGSA,A,3,,,,,,,,,,,,,1.62,1.33,0.93,3\*0D

\$GNGSA,A,3,07,10,24,,,,,,,,,,,,,1.62,1.33,0.93,4\*0A

表 3: GSA 数据格式/GSA Data Format

| 名称/Name | 举例/Example | 单位/Units | 描述/Description      |
|---------|------------|----------|---------------------|
| Message | \$GNGSA    |          | GSA protocol header |
| Mode 1  | A          |          | See Table --2       |

|                      |           |  |                                                    |
|----------------------|-----------|--|----------------------------------------------------|
| Mode 2               | 3         |  | See Table --1                                      |
| ID of satellite used | 194       |  | Sv on Channel 1                                    |
| ID of satellite used | 01        |  | Sv on Channel 2                                    |
| ...                  | ...       |  | ...                                                |
| ID of satellite used | <Null>    |  | Sv on Channel 12 (Null fields when it is not Used) |
| PDOP                 | 1.62      |  | Position Dilution of Precision                     |
| HDOP                 | 1.33      |  | Horizontal Dilution of Precision                   |
| VDOP                 | 0.93      |  | Vertical Dilution of Precision                     |
| Checksum             | *02       |  |                                                    |
| EOL                  | <CR> <LF> |  | End of message termination                         |

表 3-1: 模式 2/ Mode 2

| Value | 描述/Description    |
|-------|-------------------|
| 1     | Fix not available |
| 2     | 2D Fix            |
| 3     | 3D Fix            |

表 3-2: 模式 1/Mode 1

| Value | 描述/Description                                  |
|-------|-------------------------------------------------|
| M     | Manual-forced to operate in 2D or 3D mode       |
| A     | Automatic-allowed to automatically switch 2D/3D |

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

包含了所有可见卫星的 PRN、方位、仰角和信号强度。

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

\$GPGSV,2,1,07,07,74,271,19,01,67,151,25,21,66,073,42,194,65,088,39,1\*5E

\$GPGSV,2,2,07,195,63,052,44,09,15,212,27,16,07,098,29,1\*6F

\$GPGSV,2,1,05,01,67,151,32,194,65,088,33,195,63,052,38,09,15,212,20,8\*6A

\$GPGSV,2,2,05,30,,,27,8\*6E

\$GLGSV,1,1,01,79,61,018,29,1\*42

\$GAGSV,1,1,01,21,,,42,7\*77

\$GAGSV,1,1,01,21,,,32,1\*76

\$GBGSV,2,1,05,07,59,023,39,24,56,329,42,10,52,334,36,08,49,160,24,1\*78

\$GBGSV,2,2,05,09,37,216,22,1\*4B

\$GBGSV,1,1,01,24,56,329,28,4\*45

表 4: GSV 数据格式/ GSV Data Format

| 名称/Name            | 举例/Example | 单位/Units | 描述/Description                                    |
|--------------------|------------|----------|---------------------------------------------------|
| Message ID         | \$GPGSV    |          | GSV protocol header                               |
| Number of Message  | 2          |          | Total number of GSV sentences (Range 1 to 3)      |
| Message Number     | 1          |          | Sentence number of the total (Range 1 to 3)       |
| Satellites in View | 07         |          | Number of satellites in view                      |
| Satellite ID       | 07         |          | Channel 1                                         |
| Elevation          | 74         | degrees  | Channel 1(Range 00 to 90)                         |
| Azinmuth           | 271        | degrees  | Channel 1(Range 000 to 359)                       |
| SNR(C/NO)          | 19         | dB-Hz    | Channel 1(Range 00 to 99, null when not tracking) |
| ...                |            |          | ...                                               |
| Satellite ID       | 194        |          | Channel 4                                         |
| Elevation          | 65         | degrees  | Channel 4(Range 00 to 90)                         |
| Azimuth            | 088        | degrees  | Channel 4(Range 000 to 359)                       |
| SNR(C/NO)          | 39         | dB-Hz    | Channel 4(Range 00 to 99, null when not tracking) |
| Checksum           | *5E        |          |                                                   |
| EOL                | <CR> <LF>  |          | End of message termination                        |

根据跟踪的卫星数量，可能需要使用 GSV 数据的多个消息。

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

## 9.5 RMC-推荐的最小定位信息/RMC-Recommended Minimum locating information

包含推荐的最小定位信息。

This sentence contains the recommended minimum locating information.

\$GNRMC,040529.000,A,2238.3501,N,11403.1008,E,0.14,59.79,070521,,,A,V\*34

表 5: RMC 数据格式/ RMC Data Format

| 名称/Name                      | 举例/Example | 单位/Units | 描述/Description                                     |
|------------------------------|------------|----------|----------------------------------------------------|
| Message ID                   | \$GNRMC    |          | RMC protocol header                                |
| UTS Position                 | 040529.000 |          | hhmmss.sss                                         |
| Status                       | A          |          | A=data valid or V=data not valid                   |
| Latitude                     | 2238.3501  |          | ddmm.mmmm                                          |
| N/S Indicator                | N          |          | N=north or S=south                                 |
| Longitude                    | 11403.1008 |          | dddmm.mmmm                                         |
| E/W Indicator                | E          |          | E=east or W=west                                   |
| Speed Over Ground            | 0.14       | Knots    |                                                    |
| Course Over Ground           | 59.79      | Degrees  | True Course                                        |
| Date(UTC)                    | 070521     |          | ddmmyy                                             |
| Magnetic variation           | <Null>     | Degrees  | Null fields when it is not Used                    |
| Magnetic Variation Direction | <Null>     |          | E=east or W=west (Null fields when it is not Used) |
| Fix Mode                     | A          |          | A=autonomous, N = No fix, D=DGPS, E=DR             |
| Checksum                     | *34        |          |                                                    |
| EOL                          | <CR> <LF>  |          | End of message termination                         |

## 9.6 ZDA-时间和日期信息/ZDA-Date and Time

包含 UTC 日期和时间信息。

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

\$GNZDA,040529.000,07,05,2021,,\*41

表 6: ZDA 数据格式/ZDA Data Format

| 名称/Name    | 举例/Example | 单位/Units | 描述/Description                     |
|------------|------------|----------|------------------------------------|
| Message ID | \$GNZDA    |          | ZDA protocol header                |
| UTC Time   | 040529.000 |          | hhmmss.sss                         |
| Day        | 07         |          | UTC time: day (01 ... 31) dd       |
| Month      | 05         |          | UTC time: month (01 ... 12) mm     |
| Year       | 2021       |          | UTC time: year (4 digit year) yyyy |

|                    |           |  |                                                                  |
|--------------------|-----------|--|------------------------------------------------------------------|
| local zone hours   | <null>    |  | Local Time Zone Offset Hours (Null fields when it is not Used)   |
| local zone minutes | <null>    |  | Local Time Zone Offset Minutes (Null fields when it is not Used) |
| Checksum           | *41       |  |                                                                  |
| EOL                | <CR> <LF> |  | End of message termination                                       |

## 9.9 CMD 列表（TBD）/CMD List（TBD）

表 9：CMD 列表/CMD List

| CMD 命令/CMD command                                                     | CMD Example:                                    |
|------------------------------------------------------------------------|-------------------------------------------------|
| 热启动/Hot start                                                          | F1 D9 06 40 01 00 03 4A 24                      |
| 温启动/Warm start                                                         | F1 D9 06 40 01 00 02 49 23                      |
| 冷启动/Cold start                                                         | F1 D9 06 40 01 00 01 48 22                      |
| 恢复出厂设置/<br>Restore factory settings                                    | F1 D9 06 09 08 00 02 00 00 00 FF FF FF FF 15 01 |
| 只搜索 GPS 卫星/<br>Search GPS satellites only                              | F1 D9 06 0C 04 00 01 03 00 00 1A A9             |
| 只搜索北斗卫星<br>/Search BDS satellites only                                 | F1 D9 06 0C 04 00 04 C0 00 00 DA EC             |
| 搜索 GPS 和北斗卫星/Search GPS and BDS<br>satellites                          | F1 D9 06 0C 04 00 05 C3 00 00 DE F9             |
| 搜索 GPS 和 Galileo 卫星/Search GPS and<br>Galileo satellites               | F1 D9 06 0C 04 00 11 03 10 00 3A 09             |
| 搜索 GPS 和 BDS 及 Galileo 卫星/Search GPS<br>and BDS and Galileo satellites | F1 D9 06 0C 04 00 15 C3 10 00 FE 59             |
| 版本查询/ Version Query                                                    | F1 D9 0A 04 00 00 0E 34                         |
| 保存配置/ Save Configuration                                               | F1 D9 06 09 08 00 00 00 00 00 2F 00 00 00 46 B7 |

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