MC25 GNSS

Protocol Specification

GSM/GPRS/GNSS Module Series

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About the Document

History

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1 Introduction

MC25 is multi-purpose module which integrates a high performance GNSS engine and a quad-band GSM/GPRS engine. The GNSS engine is a single receiver integrating GPS, BeiDou and GLONASS systems. It supports multiple positioning and navigation systems including autonomous GPS, BeiDou, SBAS and QZSS*. With the embedded GNSS function, MC25 can help customers get accurate coordinates, high-precision time, etc., and thus is ideal for use in wearable devices, vehicle and personnel tracking, and more fields.

This document describes the software aspects of MC25 module. It supports NMEA 0183 standard commands, and also can be controlled and configured via NMEA packet.

NOTE

"*" means under development.

1.1. Differences between Two Application Modes

The internal GSM and GNSS engines of MC25 can work as a whole unit (**All-in-one** solution) or work relatively independently (**Stand-alone** solution) according to customers' demands.

In **All-in-one** solution, MC25 works as a whole unit. The GNSS part can be regarded as a peripheral of the GSM part. This allows for convenient communication between GSM and GNSS parts, such as AT command sending for GNSS control.

In **Stand-alone** solution, GSM and GNSS parts work independently, and thus have to be controlled separately.

When working in **All-in-one** or **Stand-alone** solution, there are some differences for MC25 to acquire NMEA output data, or send GNSS command. The details are listed below.

Table 1: Differences between All-in-one Solution and Stand-alone Solution

Item	All-in-one	Stand-alone
NMEA Output Data Acquisition	Acquire via sending **AT+QGNSSRD** command	Acquire directly
ASCII Command Sending	Send via **AT+QGNSSCMD** command	Send directly
HEX Command Sending	Send via **AT+QGNSSCMD** command	Send directly

NOTE

AT commands are effective only when the module is in **All-in-one** solution.

2 Standard NMEA Packet Protocol

MC25 supports standard NMEA 0183 messages, and the following tables show the structure of these messages.

2.1. --RMC

RMC-Recommended Minimum Position Data (including position, velocity and time).

Example: $GNRMC,085152.00,A,3150.78499,N,11711.90193,E,0.176,,221018,,,A,V*1E<CR><LF> $GPRMC,090853.00,A,3150.78462,N,11711.89851,E,0.071,,221018,,,A,V*01<CR><LF> $GLRMC,095332.00,A,3150.76852,N,11711.91845,E,0.111,,221018,,,A,V*1E<CR><LF> $BDRMC,095703.00,A,3150.77667,N,11711.93068,E,0.518,,221018,,,A,V*14<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
--RMC	Message ID
UTC Time	Time in format 'hhmmss.ss'
Data Valid	'V'=Invalid 'A'=Valid
Latitude	Latitude in format 'ddmm.mmmmm' (degrees and minutes)
N/S	'N'=North 'S'=South
Longitude	Longitude in format 'dddmm.mmmmm' (degrees and minutes)
E/W	'E'=East 'W'=West
Speed	Speed over ground in knots
COG	Course over ground in degree
Date	Date in format 'ddmmyy'

Magnetic Variation	Magnetic variation in degree, not being output
E/W	Magnetic variation E/W indicator, not being output
Positioning Mode	'N'=No fix 'A'=Autonomous GNSS fix 'D'=Differential GNSS fix
Navigation State	"V"=Navigational status not valid
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each NMEA message ends with 'CR' and 'LF'

NOTE

For more details about talker ID, please refer to ***Table 8***.

2.2. --VTG

VTG-Track Made Good and Ground Speed.

Example:
$GNVTG,,T,,M,0.054,N,0.101,K,A*3C<CR><LF>
$GPVTG,,T,,M,0.071,N,0.132,K,A*25<CR><LF>
$GLVTG,,T,,M,0.111,N,0.206,K,A*3A<CR><LF>
$BDVTG,,T,,M,0.518,N,0.959,K,A*3B<CR><LF>

Field	Description
$	Each NMEA message starts with '$'
--VTG	Message ID
COG (T)	Course over ground (true) in degree
T	Fixed field, true
COG(M)	Course over ground (magnetic), not being output
M	Fixed field, magnetic
Speed	Speed over ground in knots

N	Fixed field, knots
Speed	Speed over ground in km/h
K	Fixed field, km/h
Positioning Mode	'N'=No fix 'A'=Autonomous GNSS fix 'D'=Differential GNSS fix
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each NMEA message ends with 'CR' and 'LF'

NOTE

For more details about talker ID, please refer to ***Table 8***.

2.3. --GGA

GGA-Global Positioning System Fix Data, is the essential fix data which provides 3D location and accuracy data.

Example:
$GNGGA,094324.00,3150.77559,N,11711.92539,E,1,07,2.10,52.9,M,-2.2,M,,*60<CR><LF>
$GPGGA,090853.00,3150.78462,N,11711.89851,E,1,05,1.86,115.3,M,-2.2,M,,*48<CR><LF>
$GLGGA,095332.00,3150.76852,N,11711.91845,E,1,04,5.85,65.7,M,-2.2,M,,*64<CR><LF>
$BDGGA,095703.00,3150.77667,N,11711.93068,E,1,04,3.31,57.8,M,-2.2,M,,*64<CR><LF>

Field	Description
$	Each NMEA message starts with '$'
--GGA	Message ID
UTC Time	Time in format 'hhmmss.ss'
Latitude	Latitude in format 'ddmm.mmmmm' (degrees and minutes)
N/S	'N'=North 'S'=South
Longitude	Longitude in format 'dddmm.mmmmm' (degrees and minutes)

E/W	‘E’=East ‘W’=West
Fix Status	‘0’=Invalid ‘1’=GNSS fix ‘2’=DGPS fix ‘6’=Estimated (dead reckoning) Mode
Number of SV	Number of satellites being used (0~26)
HDOP	Horizontal dilution of precision
Altitude	Altitude in meters according to WGS84 ellipsoid
M	Fixed field, meter
Geoid Separation	Height of Geoid (means sea level) above WGS84 ellipsoid, meter
M	Fixed field, meter
DGPS Age	Age of DGPS data in seconds, empty if DGPS is not used
DGPS Station ID	DGPS station ID, empty if DGPS is not used
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each NMEA message ends with ‘CR’ and ‘LF’

NOTE

For more details about talker ID, please refer to ***Table 8***.

2.4. --GSA

GSA-GNSS DOP and Active Satellites, which provides details on the fix and includes the number of satellites being used in the current solution and the DOP.

Example:
$GNGSA,A,3,12,15,24,25,,,,,,,,2.68,1.45,2.25,1*0E<CR><LF>
$GNGSA,A,3,70,80,69,71,,,,,,,,3.03,2.10,2.18,2*0C<CR><LF>
$GNGSA,A,3,06,01,04,,,,,,,,,3.03,2.10,2.18,4*0F<CR><LF>
$GPGSA,A,3,24,20,10,32,21,,,,,,,,3.92,1.86,3.45,1*1D<CR><LF>
$GLGSA,A,3,70,80,69,71,,,,,,,,,7.20,5.85,4.20,2*0D<CR><LF>

$BDGSA,A,3,01,04,06,09,,,,,,,,,6.42,3.31,5.50,4*00<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
--GSA	Message ID
Mode	Auto selection of 2D or 3D fix 'M'=Manual, forced to switch 2D/3D mode 'A'=Allowed to automatically switch 2D/3D mode
Fix Status	'1'=No fix '2'=2D fix '3'=3D fix
Satellite Used 1	Satellite used on channel 1
Satellite Used 2	Satellite used on channel 2
Satellite Used 3	Satellite used on channel 3
Satellite Used 4	Satellite used on channel 4
Satellite Used 5	Satellite used on channel 5
Satellite Used 6	Satellite used on channel 6
Satellite Used 7	Satellite used on channel 7
Satellite Used 8	Satellite used on channel 8
Satellite Used 9	Satellite used on channel 9
Satellite Used 10	Satellite used on channel 10
Satellite Used 11	Satellite used on channel 11
Satellite Used 12	Satellite used on channel 12
PDOP	Position dilution of precision
HDOP	Horizontal dilution of precision
VDOP	Vertical dilution of precision
GNSS System ID	1 = GPS 2 = GLONASS 4 = BeiDou
*	End character of data field

Checksum	Hexadecimal checksum
<CR><LF>	Each NMEA message ends with ‘CR’ and ‘LF’

NOTE

For more details about talker ID, please refer to ***Table 8***.

2.5. --GSV

GSV-GNSS Satellites in View. One GSV sentence can only provide data for at most 4 satellites, so several sentences might be required for full information. Since GSV includes satellites that are not used as part of the solution, GSV sentence contains more satellites than GGA does.

Example:
$GPGSV,3,1,09,10,49,322,30,12,29,119,16,14,10,272,09,15,31,068,,0*66<CR><LF>
$GPGSV,3,2,09,20,80,322,27,21,35,216,30,24,52,044,18,25,19,159,13,0*6A<CR><LF>
$GPGSV,3,3,09,32,26,285,29,0*5D<CR><LF>
$GLGSV,1,1,04,69,20,109,40,70,60,046,43,71,33,331,50,80,55,041,46,0*75<CR><LF>
$BDGSV,1,1,03,01,44,142,40,04,31,120,41,06,65,022,43,0*47<CR><LF>

Field	Description
$	Each NMEA message starts with ‘$’
--GSV	Message ID
Number of Message	Number of messages, total number of GPGSV messages being output (1~4)
Sequence Number	Sequence number of this entry (1~4)
Satellites in View	Total satellites in view
Satellite ID 1	Satellite ID
Elevation 1	Elevation in degree (0~90)
Azimuth 1	Azimuth in degree (0~359)
SNR 1	Signal to noise ration in dB-Hz (0~99), empty if not tracking
Satellite ID 2	Satellite ID
Elevation 2	Elevation in degree (0~90)

Azimuth 2	Azimuth in degree (0~359)
SNR 2	Signal to noise ration in dB-Hz (0~99), empty if not tracking
Satellite ID 3	Satellite ID
Elevation 3	Elevation in degree (0~90)
Azimuth 3	Azimuth in degree (0~359)
SNR 3	Signal to noise ration in dB-Hz (0~99), empty if not tracking
Satellite ID 4	Satellite ID
Elevation 4	Elevation in degree (0~90)
Azimuth 4	Azimuth in degree (0~359)
SNR 4	Signal to noise ration in dB-Hz (0~99), empty if not tracking
Signal ID	0 = All channel
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each NMEA message ends with ‘CR’ and ‘LF’

NOTE

For more details about talker ID, please refer to ***Table 8***.

2.6. --GLL

GLL-Geographic Latitude and Longitude, which contains position information, time of position fix and status.

Example:
$GNGLL,3150.77559,N,11711.92539,E,094324.00,A,A*72<CR><LF>
$GPGLL,3150.78462,N,11711.89851,E,090853.00,A,A*6C<CR><LF>
$GLGLL,3150.76847,N,11711.91841,E,095331.00,A,A*77<CR><LF>
$BDGLL,3150.77668,N,11711.93041,E,095702.00,A,A*76<CR><LF>

Field	Description

$	Each NMEA message starts with '$'
--GLL	Message ID
Latitude	Latitude in format 'ddmm.mmmmm' (degrees and minutes)
N/S	'N'=North 'S'=South
Longitude	Longitude in format 'dddmm.mmmmm' (degrees and minutes)
E/W	'E'=East 'W'=West
UTC Time	Time in format 'hhmmss.ss'
Data Valid	'V'=Invalid 'A'=Valid
Positioning Mode	'N'=No fix 'A'=Autonomous GNSS fix 'D'=Differential GNSS fix
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each NMEA message ends with 'CR' and 'LF'

NOTE

For more details about talker ID, please refer to ***Table 8***.

3 GNSS AT Commands

The commands below are used to control or configure the internal GNSS engine of MC25. These commands are effective only in **All-in-one** solution.

Table 2: Overview of GNSS AT Commands for MC25

Command	Description
AT+QGNSSC	GNSS module power control
AT+QGNSSRD	Read GNSS navigation information
AT+QGNSSCMD	Send commands to GNSS module
AT+QGNSSTS	Get time synchronization status for GNSS module

3.1. AT+QGNSSC GNSS Module Power Control

The command is used to control the power supply of GNSS module.

AT+QGNSSC GNSS Module Power Control	
Test Command **AT+QGNSSC=?**	Response **+QGNSSC:** (list of supported **<mode>**s) **OK**
Read Command **AT+QGNSSC?**	Response **+QGNSSC: <mode>** **OK**
Write Command **AT+QGNSSC=<mode>**	Response **OK** If there is any error, response: **+CME ERROR: <err>**

Parameter

<mode>	0	Power off GNSS module
	1	Power on GNSS module

NOTE

In **Stand-alone** solution, the power supply of GNSS is controlled by an external circuit rather than GPS_VCC_EN pin. In such case, **AT+QGNSSC** command cannot be used and thus can be ignored.

Example

```
AT+QGNSSC?                  //Query GNSS power status
+QGNSSC: 0                  //GNSS powered off

OK
AT+QGNSSC=1                 //Power on GNSS
OK
```

3.2. AT+QGNSSRD Read GNSS Navigation Information

The command is used to read the GNSS navigation information.

AT+QGNSSRD Read GNSS Navigation Information	
Test Command **AT+QGNSSRD=?**	Response **+QGNSSRD:** (list of supported **<item>**s) **OK**
Read Command **AT+QGNSSRD?**	Response **+QGNSSRD:** (information of all supported **<item>**s) **OK**
Write Command **AT+QGNSSRD=<item>**	Response **+QGNSSRD:** (information of **<item>**) **OK** If there is any error, response: **+CME ERROR: <err>**

Parameter

<item>	"NMEA/GGA": Get GGA sentence "NMEA/GLL": Get GLL sentence "NMEA/GSA": Get GSA sentence "NMEA/GSV": Get GSV sentence "NMEA/RMC": Get RMC sentence "NMEA/VTG": Get VTG sentence

NOTE

The command can only be executed 3 seconds after GNSS is powered on, otherwise **+CME ERROR: 7103** will be returned.

Example

```
AT+QGNSSRD?                          //Inquire GNSS NMEA sentence.
+QGNSSRD: $GNRMC,034035.000,A,3150.8617,N,11711.9038,E,3.02,183.45,240516,,,A*75
$GNVTG,183.45,T,,M,3.02,N,5.59,K,A*20
$GNGGA,034035.000,3150.8617,N,11711.9038,E,1,4,1.50,40.9,M,0.0,M,,*44
$GPGSA,A,3,26,21,,,,,,,,,,,1.75,1.50,0.91*0A
$GLGSA,A,3,82,70,,,,,,,,,,,1.75,1.50,0.91*1C
$GPGSV,3,1,12,16,67,308,,26,58,021,16,23,40,307,,31,40,088,*7F
$GPGSV,3,2,12,08,17,199,,09,14,320,,21,10,086,14,14,10,153,*73
$GPGSV,3,3,12,22,09,226,,193,06,165,,32,03,154,,29,01,034,*45
$GLGSV,3,1,09,81,44,073,,79,40,041,,82,38,145,15,80,36,323,*66
$GLGSV,3,2,09,70,30,290,16,69,26,225,,78,12,078,,88,09,027,*64
$GLGSV,3,3,09,71,05,334,*5B
$GNGLL,3150.8617,N,11711.9038,E,034035.000,A,A*4C

OK
AT+QGNSSRD="NMEA/RMC"                //Inquire RMC information.
+QGNSSRD: $GNRMC,034036.000,A,3150.8612,N,11711.9045,E,2.74,178.00,240516,,,A*7C

OK
AT+QGNSSRD="NMEA/GSA"                //Inquire GSA information.
+QGNSSRD: $GPGSA,A,3,26,21,,,,,,,,,,,1.76,1.50,0.91*09
$GLGSA,A,3,82,70,,,,,,,,,,,1.75,1.50,0.91*1C

OK
```

3.3. AT+QGNSSCMD Send Commands to GNSS Module

The command is used to send commands to GNSS module, which allows customers to optionally use some functions to meet application demands.

AT+QGNSSCMD Send Commands to GNSS Module	
Test Command **AT+QGNSSCMD=?**	Response **+QGNSSCMD: (0,1),"cmdString"** **OK**
Write Command **AT+QGNSSCMD=<cmdType>,<cmdString>**	Response **OK** If there is any error, response: **+CME ERROR: <err>**

Parameter

<cmdType>	0	NMEA style command
	1	Hex style command
<cmdString>	Command string	

NOTE

The command can only be executed 3 seconds after GNSS is powered on, otherwise it will not be able to reach GNSS.

3.4. AT+QGNSSTS Get Time Synchronization Status for GNSS Module

The command is used to get time synchronization status for GNSS module.

AT+QGNSSTS Get Time Synchronization Status for GNSS Module	
Test Command **AT+QGNSSTS=?**	Response **+QGNSSTS: <status>** **OK**
Read Command **AT+QGNSSTS?**	Response **+QGNSSTS: <status>** **OK**

Parameter

<status>	0	Time is not synchronized
	1	Time is synchronized successfully

NOTE

The time synchronization status queried by **AT+QGNSSTS?** will be updated in either of the following cases:

- The time is synchronized via NITZ.
- GNSS gets fixed in **All-in-one** solution.

Example

```
AT+QGNSSTS=?                //Test command
+QGNSSTS: (0,1)

OK
AT+QGNSSTS?                 //Read time synchronization status
+QGNSSTS: 1                 //Time is synchronized successfully

OK
```

4 NMEA Packet Protocols

This chapter introduces the NMEA packet protocols, which are a set of extension messages of standard NMEA packet protocols. These messages are used to control and configure the internal GNSS engine of MC25. The following tables show the structure of NMEA packet.

4.1. Packet Type: DFT

This message is used to restore default settings.

Data Field: $CCDFT,Mode,*Checksum Example: $CCDFT,0,*66<CR><LF> Response: None.	
Field	**Description**
$	Each NMEA message starts with '$'
CCDFT	Restore default settings message
Mode	The mode of restore '0' = Restore all settings to default
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each NMEA message ends with 'CR' and 'LF'

4.2. Packet Type: SIR

This message is used to set work and start mode.

Data Field: $CCSIR,Type,Mode*Checksum Example: $CCSIR,3,1*4A<CR><LF> Response: None.	
Field	**Description**
$	Each NMEA message starts with '$'
CCSIR	Set work and startup mode message
Type	Work type '1' = BeiDou '2' = GPS '3' = BeiDou+GPS '4' = GLONASS '5' = BeiDou+GLONASS '6' = GPS+GLONASS
Mode	Start mode '0' = Auto mode '1' = Cold start '2' = Warm start '3' = Hot start
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each NMEA message ends with 'CR' and 'LF'

5 Hexadecimal Packet Protocols

This chapter introduces the hexadecimal packet protocols, which are a set of extension messages of standard NMEA packet protocols. These messages are used to control and configure the internal GNSS engine of MC25. The following table shows the structure of hexadecimal packet, which is sent through AT commands.

5.1. Hexadecimal Packet Structure

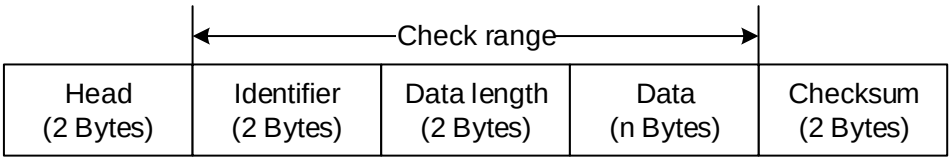
5.1.1. Data Type

All multibyte data is saved and transferred in little endian mode. The data type is defined in following table.

Table 3: Data Type

Name	Type	Byte	Code
I8S	signed char	1	Complemental code
I8U	unsigned char	1	
I16S	signed short	2	
I16U	unsigned short	2	
I32S	signed int	4	
I32U	unsigned int	4	
F32	single precision float	4	IEEE 754
F64	double precision float	8	
B8	bit field	1	
B16	bit field	2	
B32	bit field	4	
CH	Char	1	

5.1.2. Data Frame Basic Structure



5.1.3. Head

The head includes 2-byte HEX values (0x23 and 0x3E), and the values are fixed.

5.1.4. Identifier

The identifier includes 2-byte HEX values (Type and Function codes). For details, please refer to ***Chapter 5.2***, ***5.3***, ***5.4*** and ***5.5***.

5.1.5. Data Length

The data length is the number of data bytes.

5.1.6. Data

The data is specifically defined by identifier.

5.1.7. Checksum

The checksum is calculated by FletCher16. The check range includes identifier, data length and data. The reference code of FletCher16 is as follows:

```
I16U FletCher16(const I8U* pbuf, I16U len)
{
    I16U cs1,cs2;
    cs1= cs2= 0;
    while(len --)
    {
        cs1 += *pbuf++;
        cs2 += cs1;
    }
    return (cs2 << 8) | (cs1 & 0xFF);
}
```

5.2. General Protocols (0x01)

5.2.1. ACK (0x01)

SDBP-PUB-ACK						
Description	Type: Output This is the response if the command is valid and executed successfully.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x01	0x01	2	See below	-

Data			
No.	**Type**	**Name**	**Description**
1	I8U	Type code of identifier	This is the type code (included in the identifier) of the command that has been sent.
2	I8U	Function code of identifier	This is the function code (included in the identifier) of the command that has been sent.

5.2.2. NACK (0x02)

SDBP-PUB-NACK						
Description	Type: Output This is the response if the command is invalid and executed failed.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x01	0x02	2	See below	-

Data			
No.	**Type**	**Name**	**Description**
1	I8U	Type code of identifier	This is the type code (included in the identifier) of the command that has been sent.
2	I8U	Function code of identifier	This is the function code (included in the identifier) of the command that has been sent.

5.3. Control Protocols (0x02)

5.3.1. RESET (0x01)

SDBP-CTL-RESET						
Description	Type: Input This command is used to restart the module. Module will response **SDBP-PUB-NACK** if the command is invalid.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x02	0x01	1	See below	-

Data		
No.	**Type**	**Name**	**Description**
1	I8U	The mode of start	0x01: Cold start 0x02: Warm start 0x03: Hot start

5.3.2. DEFAULT (0x02)

SDBP-CTL-DEFAULT						
Description	Type: Input This command is used to restore default settings. Module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x02	0x02	1	See below	-

Data			
No.	**Type**	**Name**	**Description**
1	B8	The bit of the default settings	0xFF: Restore all settings to default

5.3.3. STANDBY (0x04)

SDBP-CTL-STANDBY						
Description	Type: Input The standby mode is a low power mode, and this command is used to enter into this mode. After entering into the mode, the chip will turn off the main power automatically and stop working, and will be woken up with a level change (rising or falling) of the specific pin (UART1_RX). Waking up the chip is equivalent to resetting it. Module will enter into standby mode if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x02	0x04	1	See below	-

Data		
No.	**Type**	**Name**	**Description**
1	I8U	Enable control	0x01: Enter into standby mode Other values: Reserved and no response

5.4. Setting Protocols (0x03)

5.4.1. GNSS (0x11)

SDBP-CFG-GNSS						
Description	Type: Input/Output This command is used to configure GNSS mode. Module will response **SDBP-PUB-NACK** if the command is invalid. Module will response **SDBP-PUB-ACK** if the command is valid, executed successfully, and RF does not need to be reconfigured. Module will be restarted and not respond if RF needs to be reconfigured. When GPS system is selected, the SBAS system is automatically turned on; when SBAS is not required, the SBAS control command needs to be sent to turn off the system.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x03	0x11	2	See below	-

Data			
No.	**Type**	**Name**	**Description**

1	I8U	GNSS mode	1: BeiDou 2: GPS 3: BeiDou+GPS (SBAS is turned on) 4: GLONASS 5: BeiDou+GLONASS 6: GPS+GLONASS
2	I8U	Auto-save	1: Save to backup area Other values: not saved, and restore default values after power-on

5.4.2. QZSS (0x12)*

SDBP-CFG-QZSS						
Description	Type: Input This command is used to turn on/off QZSS. Module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**. QZSS system must be used simultaneously with the GPS system. If GPS is turned off, QZSS is automatically turned off; after GPS is turned on, QZSS is turned on or off using control commands as needed.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x03	0x12	2	See below	-

Data			
No.	**Type**	**Name**	**Description**
1	I8U	QZSS switch	0: Turn off QZSS 1: Turn on QZSS
2	I8U	Auto-save	1: Save to backup area Other values: not saved, and restore default values after power-on

NOTE

"*" means under development.

5.4.3. SBAS (0x13)

SDBP-CFG-SBAS

Description

Type: Input

This command is used to turn on/off SBAS.

Module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**.

QZSS* system must be used simultaneously with the GPS system. If GPS is turned off, QZSS* is automatically turned off; after GPS is turned on, SBAS is automatically turned on, and will be turned off using control commands as needed.

Structure

Head		Identifier		Data Length	Data	Checksum
0x23	0x3E	0x03	0x13	2	See below	-

Data

No.	Type	Name	Description
1	I8U	SBAS switch	0: Turn off SBAS 1: Turn on SBAS
2	I8U	Auto-save	1: Save to backup area. Other values: not saved, and restore default values after power-on

NOTE

"*" means under development.

5.4.4. UART (0x21)

SDBP-CFG-UART

Description

Type: Input

This command is used to configure UART.

Module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**.

Default settings (UART1):

- Baudrate: 9600bps
- Data bit: 8bits
- Stop bit: 1bit
- Parity bit: None

Structure	Head		Identifier		Data Length	Data	Checksum
	0x23	0x3E	0x03	0x21	6	See below	-

Data			
No.	**Type**	**Name**	**Description**
1	I8U	UART port	1: UART1 2: UART2*
2	I8U	Baud rate	1: 4800 2: 9600 3: 19200 4: 38400 5: 57600 6: 115200 7: 230400
3	I8U	None	Reserved
4	I8U	None	Reserved
5	I8U	None	Reserved
6	I8U	Auto-save	1: Save to backup area Other values: not saved, and restore default values after power-on

NOTES

1. This system does not support the modification of data bits, stop bits, and parity bits.
2. "*" means under development.

5.4.5. DYNAMIC (0x31)

SDBP-CFG-DYNAMIC	
Description	Type: Input This command is used to configure motion mode. Module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**. When the mode changes, the module automatically restarts. 1. Adaptive mode: maximum speed 340m/s, maximum altitude 15000m, maximum acceleration 2g. 2. Static mode: maximum speed 5m/s, maximum altitude 15000m. 3. Walking mode: maximum speed 10m/s, maximum altitude 15000m.

	4. Automotive mode: maximum speed 150m/s, maximum altitude 15000m. 5. Ship mode: maximum speed 50m/s, maximum altitude 1000m.

Structure	Head		Identifier		Data Length	Data	Checksum
	0x23	0x3E	0x03	0x31	2	See below	-

Data

No	Type	Name	Description
1	I8U	Motion mode	1: Adaptive 2: Static 3: Walking 4: Automotive 5: Ship
2	I8U	Auto-save	1: Save to backup area Other values: not saved, and restore default values after power-on

NOTES

1. Adaptive mode covers static, walking, and automotive modes. If ship mode is used, it must be configured independently.
2. Set the correct mode according to the corresponding usage, which can effectively improve positioning precision.

5.4.6. FIX (0x32)

SDBP-CFG-FIX

Description	Type: Input This command is used to configure fix mode. Module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**.

Structure	Head		Identifier		Data Length	Data	Checksum
	0x23	0x3E	0x03	0x32	11	See below	-

Data

No.	Type	Name	Scale	Unit	Description
1	I8U	Fix mode	-	-	1: 2D mode 2: 3D mode 3: 2D/3D automatic switching

					mode
2	I8U	First fix mode	-	-	Only for 2D/3D automatic switching mode 0: 2D mode 1: 3D mode
3	I32S	Reference altitude	10^{-2}	m	Only for 2D mode Default: 0m
4	I32U	Reference altitude precision	10^{-4}	m	Variance, only for 2D mode Default: 0.0m
5	I8U	Auto-save	-	-	1: Save to backup area Other values: not saved, and restore default values after power-on

5.4.7. SV (0x33)

SDBP-CFG-SV

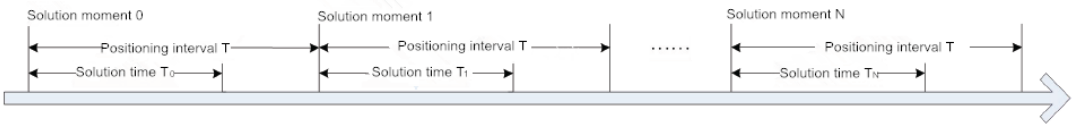
Description	Type: Input This command is used to configure the satellite selected for positioning. The module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**.

Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x03	0x33	4	See below	-

Data

No.	Type	Name	Ratio	Unit	Description
1	I8U	The maximum quantity of satellites participating in the positioning solution	-	-	4 ≤ Satellite quantity ≤ 20 Default: 20
2	I8U	Minimum satellite elevation angle participating in positioning solution	-	Degree	0 ≤ Elevation angle ≤ 90 Default: 5
3	I8U	Minimum signal strength (C/N0) participating in positioning solution	-	dB/Hz	0 ≤ Signal strength ≤ 54 Default: 5
4	I8U	Auto-save	-	-	1: Save to backup area. Other values: not saved, restore default vales after power-on

5.4.8. INTERVAL (0x35)

SDBP-CFG-INTERVAL	
Description	Type: Input This command is used to configure positioning interval. The module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**. The continuous positioning and navigation process is shown in the figure below.  When the solution time T_N required for the solution moment N is greater than positioning time interval T, system automatically cancels the solution process from positioning moment T_{N+1} to the positioning moment T_{N+X} until the process is completed, and then the solution of positioning moment T_{N+X+1} is started. Therefore, when the positioning time interval T is short (the positioning frequency is high) and the solution time is long (the amount of calculation is large, and the number of elements participating in the solution is too large), the navigation output interval does not match the set positioning interval. If the navigation output interval is required to match the positioning interval, the appropriate positioning interval T or solution time needs to be adjusted (use **SDBP-CFG-GNSS** command to reduce the satellite system used, and use **SDBP-CFG-SV** command to reduce the number of satellites used for positioning solution).

Structure	Head		Identifier		Data Length	Data	Checksum
	0x23	0x3E	0x03	0x35	3	See below	-

Data

No.	Type	Name	Ratio	Unit	Description
1	I16U	Positioning interval	-	ms	100 ≤ Interval ≤ 60000; An integer multiple of 100; Default: 1000
2	I8U	Auto-save	-		1: Save to backup area. Other values: not saved, restore default vales after power-on

5.4.9. PPS (0x41)

SDBP-CFG-PPS						
Description	Type: Input This command is used to configure PPS. Module will response **SDBP-PUB-ACK** if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**. Default settings (PPS0): PPS0: Switch = 1; Output Mode = 1; Pulse Polarity = 0; Period = 1000; Pulse Width = 100; Offset = 0.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x03	0x41	18	See below	-

Data

No.	Type	Name	Ratio	Unit	Description
1	I8U	Serial number	-	-	0: PPS0
2	I8U	Switch	-	-	0: Turn off PPS 1: Turn on PPS
3	I8U	Output mode	-	-	0: Output after power-on 1: Output after fix
4	I8U	Pulse polarity	-	-	0: Negative 1: Positive
5	I8U	GNSS time standard [1)]	-	-	0: UTC 1: BeiDou 2: GPS 3: GLONASS
6	I32U	Period	-	ms	≥ 10ms
7	I32U	Pulse width	-	ms	
8	I32S	Offset	-	ns	
9	I8U	Auto-save	-	-	1: Save to backup area. Other values: not saved, and restore default values after power-on

NOTE

1) The firmware version of MC25 does not support the adjustment of GNSS time standard, which is fixed to UTC.

5.4.10. NMEA (0x51)

SDBP-CFG-NMEA						
Description	Type: Input This command is used to configure NMEA active output statement. Module will response **SDBP-PUB-ACK** if the command is valid and executed successfully otherwise response **SDBP-PUB-NACK**.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x03	0x51	4	See below	-

Data			
No.	**Type**	**Name**	**Description**
1	I8U	Sentence ID	0x01: ZDA 0x02: DTM 0x03: RMC 0x04: GGA 0x05: GSA 0x06: GSV 0x07: VTG 0x08: GNS 0x09: GLL 0x0A: GRS 0x0B: GST 0x0C: GBS 0x0D: TXT
2	I8U	Output port	1: UART1 2: UART2*
3	I8U	Output frequency	0: Turn off the output. 1~N: Integer multiple of the positioning frequency. Example: 2 means positioning twice and output once.
4	I8U	Auto-save	1: Save to backup area Other values: not saved, and restore default values after power-on.

NOTE

"*" means under development.

5.5. Query Protocols (0x05)

5.5.1. GNSS (0x02)

SDBP-QUE-GNSS						
Description	Type: Input This command is used to query GNSS configuration information. Module will response the queried result if the command is valid and executed successfully, otherwise response **SDBP-PUB-NACK**.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x05	0x02	0	-	-

SDBP-QUE-GNSS						
Description	Type: Output This is the GNSS configuration information queried.					
Structure	**Head**		**Identifier**		**Data Length**	**Data**	**Checksum**
	0x23	0x3E	0x05	0x02	3	See below	-

Data			
No.	**Type**	**Name**	**Description**
1	B8	BeiDou state	BIT[0]: 0: Turn off BeiDou; 1: Turn on BeiDou BIT[1~7]: Reserved
2	B8	GPS state	BIT[0]: 0: Turn off GPS; 1: Turn on GPS BIT[1]: 0: Turn off SBAS; 1: Turn on SBAS BIT[2]: 0: Turn off QZSS*; 1: Turn on QZSS* BIT[3~7]: Reserved
3	B8	GLONASS state	BIT[0]: 0: Turn off GLONASS; 1: Turn on GLONASS BIT[1~7]: Reserved

NOTE

"*" means under development.

6 Default Configurations

Table 4: Default Configurations

Item	Default
NMEA Port Baud Rate	9600bps
Datum	WGS84
Rate of Position Fixing	1Hz
DGPS Mode	SBAS
SBAS	Enabled
NMEA Output Messages	RMC, GGA, GSA, GSV, VTG and GLL

7 Appendix A References

Table 5: Related Document

SN	Document Name	Remark
[1]	Quectel_MC25_Hardware_Design	MC25 Hardware Design

Table 6: Terms and Abbreviations

Abbreviation	Description
AGPS	Assisted Global Positioning System
CS	Commercial Sample
DGPS	Differential Global Positioning System
GGA	NMEA: Global Positioning System Fix Data
GLL	NMEA: Geographic Latitude and Longitude
GLONASS	GLObalnaya NAvigatsionnaya Sputnikovaya Sistema, the Russian Global Navigation Satellite System
GNSS	Global Navigation Satellite System
BeiDou	Chinese Satellite Navigation System
GPS	Global Positioning System
GSA	NMEA: GNSS DOP and Active Satellites
GSV	NMEA: GNSS Satellites in View
HDOP	Horizontal Dilution of Precision
MP	Mass Production
NMEA	National Marine Electronics Association
NITZ	Network Identity and Time Zone

PDOP	Position Dilution of Precision
QZSS	Quasi-Zenith Satellite System
RMC	NMEA: Recommended Minimum Position Data
SBAS	Satellite-Based Augmentation System
UTC	Universal Time Coordinated
VDOP	Vertical Dilution of Precision
VTG	NMEA: Track Made Good and Ground Speed
WAAS	Wide Area Augmentation System

Table 7: Structure of NMEA Message

Filed	Length (Bytes)	Description
$	1	Each NMEA message starts with '$'
Talker ID	1~2	Talker IDs can be 'GP', 'GN', 'BD' and 'GL' when the message ID is RMC, VTG, GLL ,GGA and GSA; Talker IDs can be 'GP', 'GL' and 'BD' when the message ID is GSV.
NMEA Message ID	3	NMEA message ID.
Data Field	Variable, and depends on the NMEA message type	Data fields, delimited by comma ','.
*	1	End character of data field.
Checksum	2	A hexadecimal number calculated by exclusive OR of all characters between '$' and '*'.
<CR><LF>	2	Each NMEA message ends with 'CR' and 'LF'.

NOTE

The default output messages of MC25 are as following six sentences: RMC, VTG, GGA, GSA, GSV and GLL.

Table 8: Talker ID Display in Different GNSS System (for NMEA 0183 4.10 Version)

Talker ID	GPS Only	BeiDou Only	GLONASS Only	GPS+ GLONASS	GPS+ BeiDou	GLONASS+ BeiDou
GGA	GP	BD	GL	GN	GN	GN
RMC	GP	BD	GL	GN	GN	GN
GLL	GP	BD	GL	GN	GN	GN
VTG	GP	BD	GL	GN	GN	GN
GSA	GP	BD	GL	GN	GN	GN
GSV	GP	BD	GL	GP+GL	GP+BD	GL+BD