TOSUN

TM2101 Product Manual

Version：V1.0 | English

tosunai.com

Why Is a GPS-to-CAN Device Necessary?

- Data Integration Simplification and Efficient Transmission

In modern vehicles and automation systems, the use of GPS and IMU sensors has become increasingly common. However, these devices often communicate through separate interfaces, such as serial ports or dedicated data lines. This not only complicates system integration but also introduces additional potential points of failure.

By integrating GPS and IMU data into CAN messages, GPS-to-CAN devices significantly simplify the communication between these sensors and in-vehicle systems. CAN bus technology is already well-established in vehicles, offering excellent noise immunity and long transmission distances, ensuring reliable data propagation. Building on this foundation, data is transmitted in a standardized format, enhancing both system integration and communication efficiency.

- Wide System Compatibility

Most modern vehicle systems (such as engine control units, braking systems, and vehicle body electronic system, etc.) widely adopt the CAN bus as a communication standard. As a result, utilizing GPS-to-CAN devices allows seamless integration with existing vehicle infrastructure, avoiding the complexity of interface compatibility issues.

By offering CAN interface directly, GPS and IMU data can flow more freely between various vehicle systems, providing consistent and real-time data support to different functional areas. This enhances the overall coordination and efficiency of the vehicle's systems.

- Cost Reduction and Simplified Maintenance

In the past, integrating multiple sensors required complex wiring systems or multiple communication modules, significantly increasing system costs and maintenance efforts. By utilizing GPS-to-CAN devices, these additional hardware requirements are greatly reduced, leading to lower production and maintenance costs.

Additionally, due to the widespread use and standardization of the CAN bus, devices that transmit data through this interface are also more intuitive and easier to diagnose and repair when system failures occur.

- Enhancing Overall System Performance

Accurate positional and motion attitude data are critical for many vehicle functions.

GPS-to-CAN devices provide high-precision and real-time data, enabling vehicles to perform navigation and control tasks with greater accuracy.

In autonomous driving applications, this data precision enhances capabilities such as path planning, lane keeping, and obstacle avoidance, significantly improving the safety and comfort of the vehicle.

What Can the TM2101 Do?

- Convert GPS and IMU data to CAN format
- Adapt to different baud rates in CAN/CAN FD networks
- Customize message IDs and reporting intervals
- Support configuration of basic information for one CAN interface
- Support configuration of various NMEA sentence types
- ...

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1. About this User Manual

1.1 Warranty

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2.TM2101

2.1 Overview

The TM2101, developed by TOSUN, is a device that converts data collected from GPS and IMU modules into CAN/CAN FD bus data. Combining advanced GPS positioning technology with high-precision gyroscopes, it is designed for accurate positioning and dynamic perception. The device provides real-time, precise location information and attitude sensing, periodically transmitting GPS signals along with acceleration and angular velocity data to a host computer through its communication interface. It is widely used in navigation, motion tracking, drone control, autonomous driving, and other fields. With its ease of use and powerful functionality, TM2101 enables users to deploy it quickly and effectively.

The TM2101 supports 12V DC power supply through an adapter or Phoenix terminal and is equipped with one CAN/CAN FD port. Users can customize communication methods, GPS module parameters, IMU measurement range, and reporting intervals. It features two modes: "Configuration Mode" and "User Mode", which can be switched via a button.

In "Configuration Mode", users configure the device using the TOSUN TSMaster software via a host computer. This mode allows CAN port settings, GPS information, and IMU data configuration through CAN/CAN FD message transmission. In "User Mode", the device can periodically upload GPS and IMU data in CAN message format according to the configuration settings. With the corresponding database, users can easily parse the transmitted data.

2.2 Features

- ✓ CAN channel baud rate adjustable from 125Kbps to 1Mbps
- ✓ CAN FD channel baud rate adjustable from 125Kbps to 8Mbps
- ✓ Supports self-defined IDs and DBC file generation
- ✓ Configurable GPS and IMU data reporting types (DLC=8/DLC=15, STD/EXT)
- ✓ Customizable message reporting intervals
- ✓ Supports multiple GPS satellite systems (BD, GPS, GLONASS)
- ✓ Equipped with gyroscope and accelerometer (IMU) and capable of outputting acceleration and angular velocity data

2.3 Technical Data

✓ Device Parameters

Channel	1 * CAN FD
Communication Interface	Config Mode: CAN Normal Mode: CAN/CAN FD (user configuration)
Driver	Driverless design for Windows system, offering excellent system compatibility
Software	TSMaster
Terminal Resistor	Built-in 120-ohm terminal resistor, with the resistance value configurable through software
Power Supply	Power adapter/phoenix terminal DC power supply (9-32V)
Power Consumption	1W
Case Material	Metal
Dimension	Approx. 80*113*97mm
Weight	Approx. 110.2g (without packaging) /Approx. 405g (with packaging and accessories)
Operating Temperature	-40℃～80℃
Operating Humidity	10% ～ 90% (non-condensing)
Operating Environment	Keep away from corrosive gases

✓ GPS Parameters

Channel	50
Position Update Rate	1Hz (default), maximum 10Hz
Position Accuracy	<1.5m (CEP50)
Speed Accuracy	<0.1m/s (1σ)

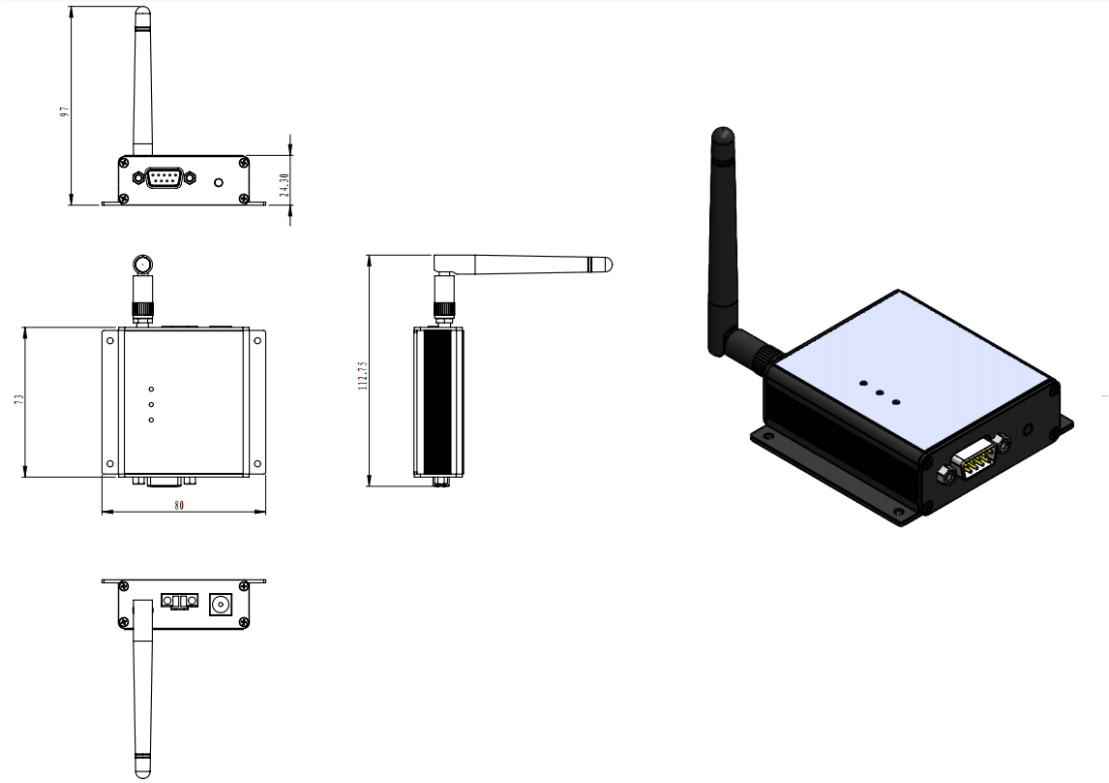
✓ IMU Parameters

Resolution	16bit
Acceleration Range	±3 g, ± 6 g, ±12 g, ±24g
Angular Velocity Range	±125°/s, ±250°/s, ±500°/s, ±1000°/s, ±2000°/s

2.6 Electrical Data

Parameter		Test Condition	Minimum Value	Typical Value	Maximum Value	Unit
Operating Voltage	External DC power supply	CAN transmission	9	12	32	V
Operating Current	External DC power supply	CAN transmission	--	0.062	--	A
Power Consumption	External DC power supply	CAN transmission	--	0.8	--	W
CAN Interface	Bus pin voltage resistance	CANH、CAHL	-58	--	+58	V
	Isolation withstand voltage	Leakage current less than 1mA	2500	--	--	VDC

2.5 Mechanical Data



2.6 Scope of Delivery

✓ Main device: TM2101

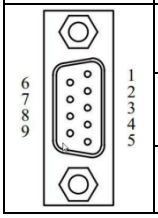
✓ 12V2A power adapter

✓ GPS Antenna

2.7 Hardware Interface

- Power adapter DC power supply port
- Phoenix terminal DC power supply port
- GPS signal reception port
- Config configuration port
- DB9 male:

DB9 Pin	PIN	Definition

	Number	
	PIN2	CAN FD_Low
	PIN3	CAN FD_GND
	PIN7	CAN FD_High

2.8 LED

✓ Diagram of LED indicator:

✓ Description of indicator:

Indicator	Definition
GPS	Indicator for GPS
Config	Indicator for configuration
CAN/CAN FD	Indicator for CAN/CAN FD channel

✓ Description of LED color:

Indicator	Description
GPS	Red and green dual-color. Behavior depends on the antenna status:

	Off in configuration mode. In user mode, the green light stays on when the antenna works normally, the red light flashes if the antenna is not connected, and the red light stays on if the antenna is short-circuited.
Config	Green single-color. Stays on in configuration mode. Not operational in user mode.
CAN/CAN FD	Red and green dual-color. The green light flashes when frames are detected on the bus, while the red light flashes when error frames are detected.

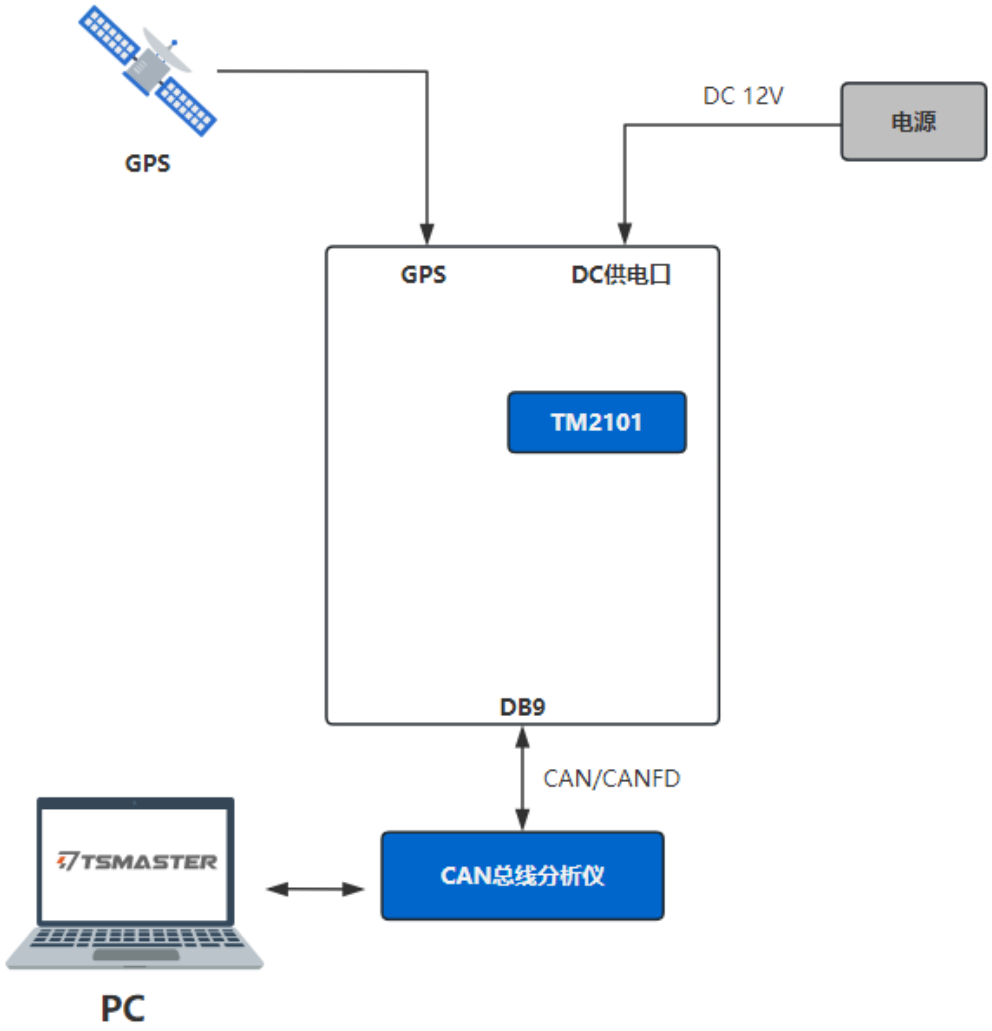
2.9 Optional Accessories

N/A

3. Quick Start

3.1 System Connection

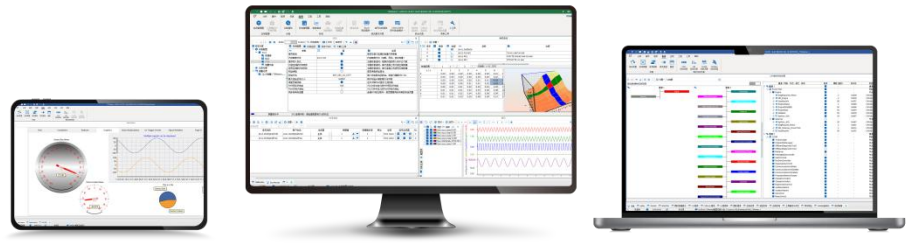
The TM2101 has a power adapter interface, a phoenix terminal power interface, and a CAN/CAN FD interface (DB9). When in use, it is necessary to connect an additional CAN/CAN FD bus analyzer tool via the DB9 interface, and the bus tool should be connected to a computer. Additionally, the corresponding GPS antenna needs to be connected.



3.2 Driver Installation

All TOSUN hardware adopts a driverless design, offering excellent system compatibility.

3.3 Software Overview



TSMaster is a powerful and comprehensive tool that can connect, configure, and control all TOSUN hardware tools and devices, enabling functions such as automotive bus embedded code generation, monitoring, simulation, development, UDS diagnostics, CCP/XCP calibration, ECU flashing, I/O control, test measurement, and so on.

TSMaster supports Matlab Simulink co-simulation and CarSim dynamic model ECU algorithm simulation testing (soft real-time HIL). It provides users with a series of convenient functions and editors, allowing them to directly execute ECU code within TSMaster and supports C script and Python script editing. At the same time, TSMaster also offers a mini-program function, enabling users to customize the simulation test panel, test process, test logic, and even the entire test system, and automatically generate reports. The code written by users based on TSMaster is hardware-independent, and can be easily shared, referenced, and used on different hardware platforms.

TSMaster supports multiple commonly used bus tool brands, including Vector, Kvaser, PEAK, IXXAT, as well as mainstream instruments in the market (such as oscilloscopes, waveform generators, and digital multimeters) and boards (such as AI, DI, DO, etc.). Its design concept is to perfectly integrate with the test system to achieve joint simulation and testing of multiple hardware and multiple channels. This enables TSMaster to meet the PV/DV test verification needs for various automotive electronic components and assemblies, as well as the inspection requirements for the production line.

3.4 Software Installation

TSMaster software download link:

https://www.tosunai.com/downloads

If the link is not accessible, you can contact the corresponding sales personnel or visit the official TOSUN website to obtain the software. Meanwhile, you can scan the QR code to follow the TOSUN official account to get the download link.

After the installation，you can see the following software on the PC.

3.5 Functional Module

3.5.1 Full-mode Positioning and Navigation Module

TM2101 supports multiple satellite navigation systems, including BeiDou (identifier BD), GPS (identifier GP), GLONASS (identifier GL), etc. When outputting signals, the satellite system identifier will be included. It can simultaneously receive satellite signals from the above satellite navigation systems to achieve combined positioning. In this case, the output signal identifier will be GN (multi-mode satellite). The output signals will be formatted as NMEA sentences according to the NMEA standard, which are used to transmit time, location information, and other data. Users can select the satellite system and choose whether to output each type of sentence.

The NMEA sentences used by this product are as follows:

NMEA Sentence	Standard Message
GGA	Receiver positioning data
GLL	Geographic location - latitude/longitude
GSA	Accuracy factor (DOP) and active satellites
GSV	Visible satellites
RMC	Recommended minimum specific navigation data
VTG	Ground speed and course over ground
ZDA	Time and date
DHV	Receiver speed information
GST	Statistical information on receiver pseudorange errors

3.5.2 Gyroscope and Accelerometer

The accelerometer has a maximum measurement range of ±24g, and the gyroscope has a maximum measurement range of ±2000°/s. Users can control the measurement range to obtain

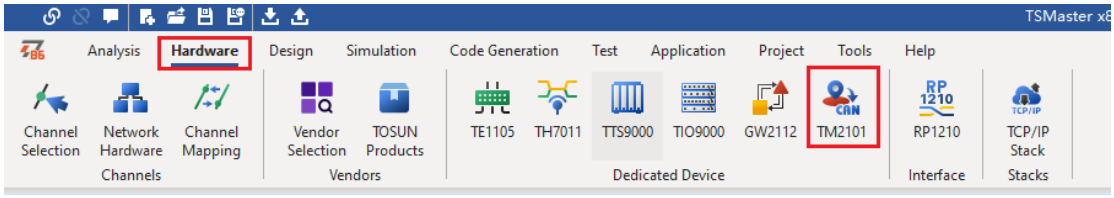
more accurate data.

3.6 Fundamental Usage

3.6.1 Basic Introduction

◆ How to Open

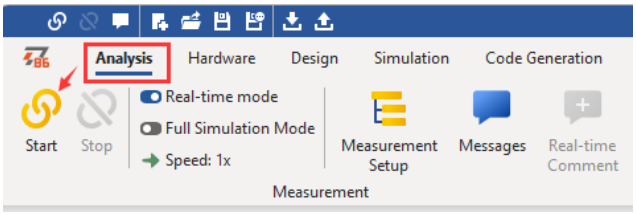
Update the TSMaster software to a version later than November 2024. As shown in the figure below, click "Hardware"->"TM2101" in sequence to open the host computer software.



◆ Interface Description

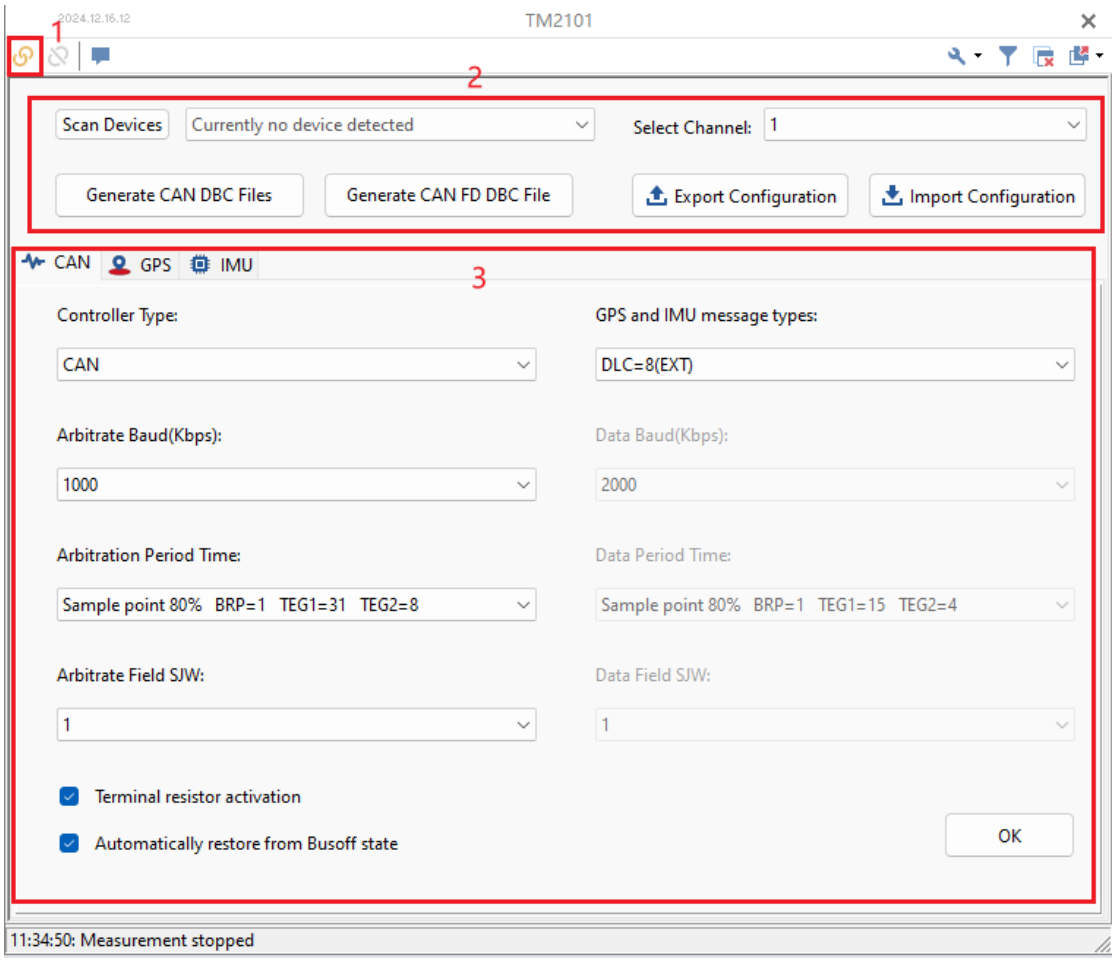
As shown in the figure below, the host computer interface can be roughly divided into three parts:

Part 1: Equivalent to "Start" under "Analysis" in the TSMaster software.



Part 2: Refer to the detailed introduction in subsequent chapters.

Part 3: Configurable for CAN/CAN FD, GPS, and IMU. Detailed explanations can be found in subsequent chapters.



◆ How to Switch Device Modes

As shown in the figure below, there is a button on the right side of the DB9 interface. This button allows switching between "Configuration Mode" and "User Mode".

Steps for operation:

(1) Switch to "Configuration Mode": Power off the device first, while the device is powered off, press and hold the mode switch button, then power on the device. The "Config" indicator will light up green continuously, indicating that the device is in Configuration Mode. Users can now configure the device using the host computer.

(2) Switch to "User Mode": Do nothing (release the mode switch button) and directly power on the device. The "GPS" indicator will light up or blink depending on the status, and the "CAN/CAN FD" channel indicator will flash red or green based on the situation.

◆ Factory Default Configuration

(1) Configuration Mode:

The GPS and IMU are inactive. The CAN controller is set to extended frame, with a sampling point of 80% and a baud rate of 1000 Kbps.

(2) User Mode:

Module	Parameter	Default Value
GPS	Control NMEA sentences	GGA, RMC
	Positioning satellite system	BDS
	GPS data reporting interval	1000ms
	GPS data reporting ID	0x18000464
IMU	Acceleration range	±24g
	Angular velocity range	±2000°/s
	IMU data reporting interval	1000ms
	IMU data reporting ID	0x18000463
CAN	CAN controller	bxCAN (EXT)
	Arbitration phase baud rate	1000Kbps
	Arbitration phase bit timing	Sampling point: 80% Pre-sample time: 31 Post-sample time: 8
	Arbitration phase sync jump width	1
	Data phase baud rate	Disable
	Data phase bit timing	Disable
	Data phase sync jump width	Disable
	Terminal resistor activation	Activated
	Auto-recovery from Busoff	Enabled
	GPS and IMU message type	DLC=8(EXT)

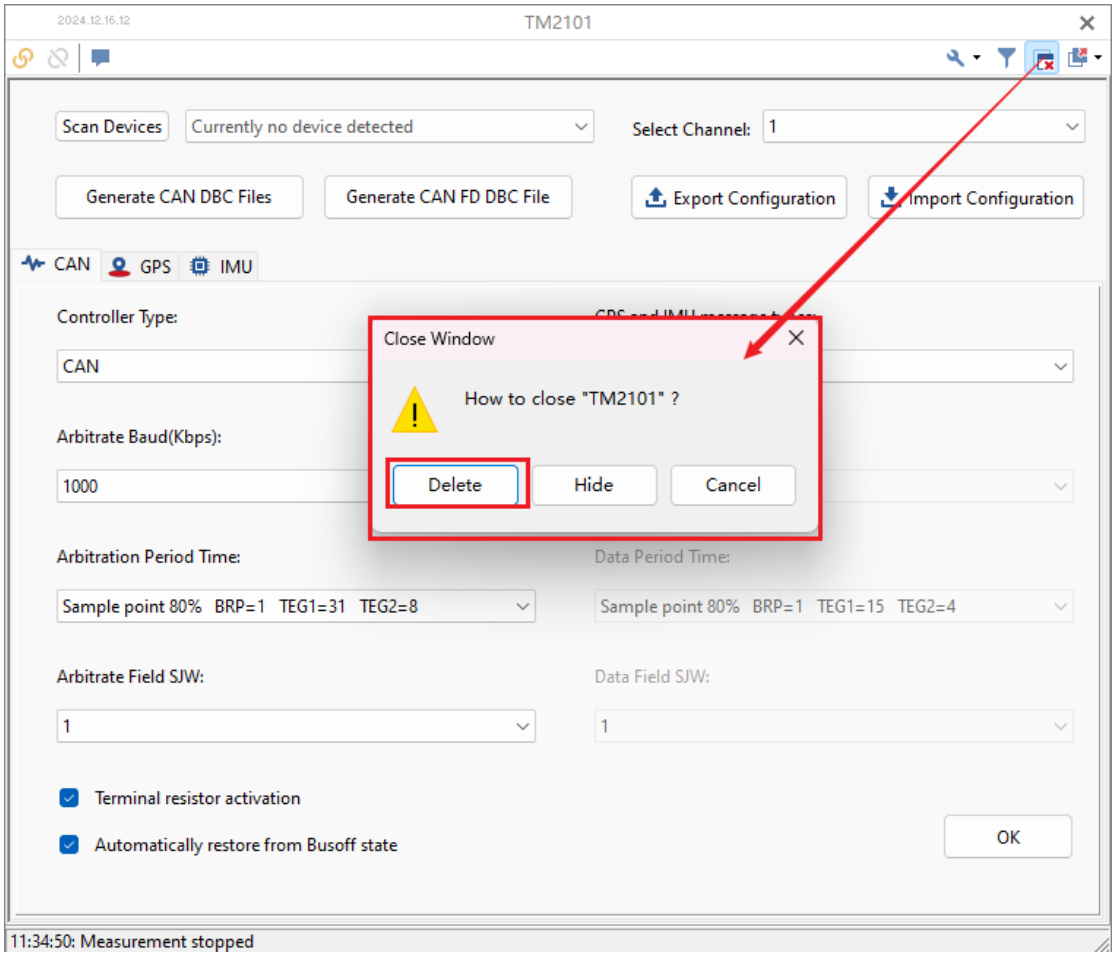
The data segment parameters are invalid when the controller is selected as "bxCAN".

◆ How to Restore Default Configuration

The data displayed when the interface is first opened is the default configuration.

If the configuration data has been modified, how to restore it to the default configuration?

As shown in the figure below, click the "close the current window" button in the top right corner of the host computer interface. Then, in the pop-up window, click the "Delete" button. After that, reopen the window, and it will display the initial default configuration.



◆ Configuration Mode

When the mode switch button is pressed while the device is powered on, it enters configuration mode.

In configuration mode, the GPS and IMU modules are inactive, and the device does not actively transmit any messages. It only receives configuration messages from the host computer.

After receiving the information, the device will write it into memory. The configuration messages include three types: GPS, IMU, and CAN. These messages carry the working parameters for the corresponding modules in user mode, and they only take effect in user mode.

CAN configuration message: Configures user mode CAN parameters, including controller type (CAN/CAN FD), arbitration and data segment baud rates, bit timing, synchronization jump width, whether to automatically recover from BUSOFF, and the types of GPS and IMU messages (Device sends messages with ID 0x08000462, receives messages with ID 0x00000462).

GPS configuration message: Configures supported satellite systems, NMEA message types, reporting period, and data reporting message ID (default 0x18000464).

IMU Module and Communication Settings: Configures acceleration range, angular velocity range, reporting period, and data reporting message ID (default 0x18000463).

- User Mode

When the device powers up without pressing the mode-switching button, the device enters user mode.

In this mode, the working parameters for CAN, GPS, and IMU are determined by the configuration mode. Upon power-up, the device reads the configuration parameters from memory and proceeds with initialization. Once initialization is complete, the system begins operation and periodically uploads messages.

The GPS module supports receiving messages from three satellite systems: GPS, BDS, and GLONASS. Each satellite system transmits messages consisting of 12 sentences in NMEA format (note: only 9 sentences are actually available). Users can configure the device to switch between satellite systems and select the sentences to receive.

◆ Precautions

(1) Ensure proper wiring before powering on the device. Do not reverse the power connection.

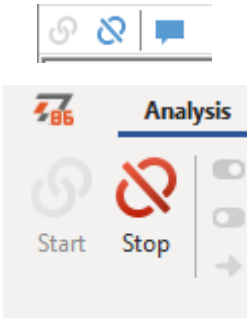
(2) Ensure the antenna is properly connected during operation to maintain GPS accuracy.

(3) Operate the device outdoors and ensure there are no obstructions from buildings to maintain GPS accuracy.

3.6.2 Detailed Introduction

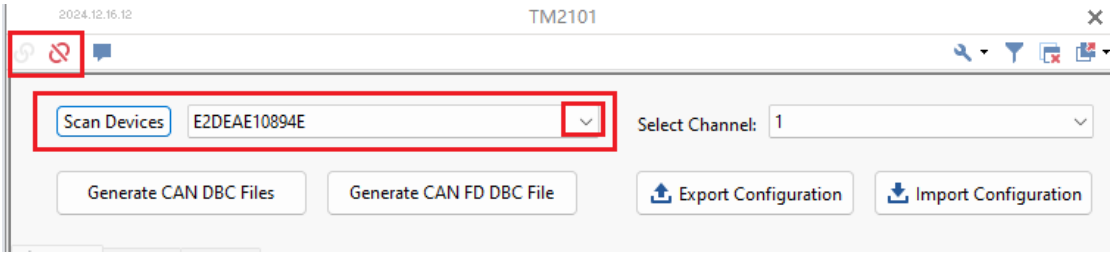
◆ Device Connection

(1) Click the "Start" button, either from the top menu of the TSMaster software or the upper-left corner of the host computer interface.



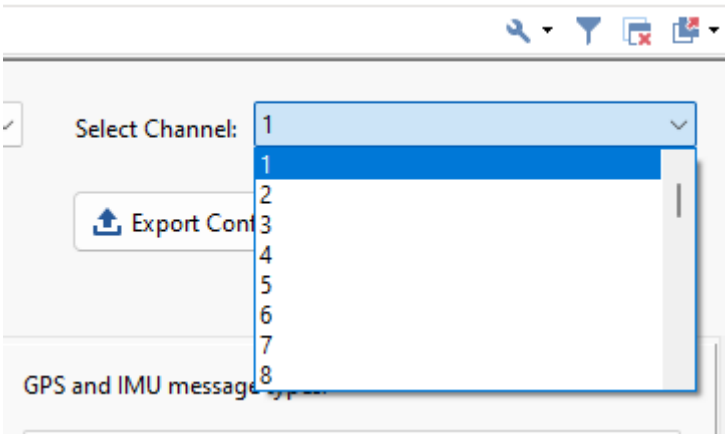
(2) Click “Scan Devices” and select the corresponding device.

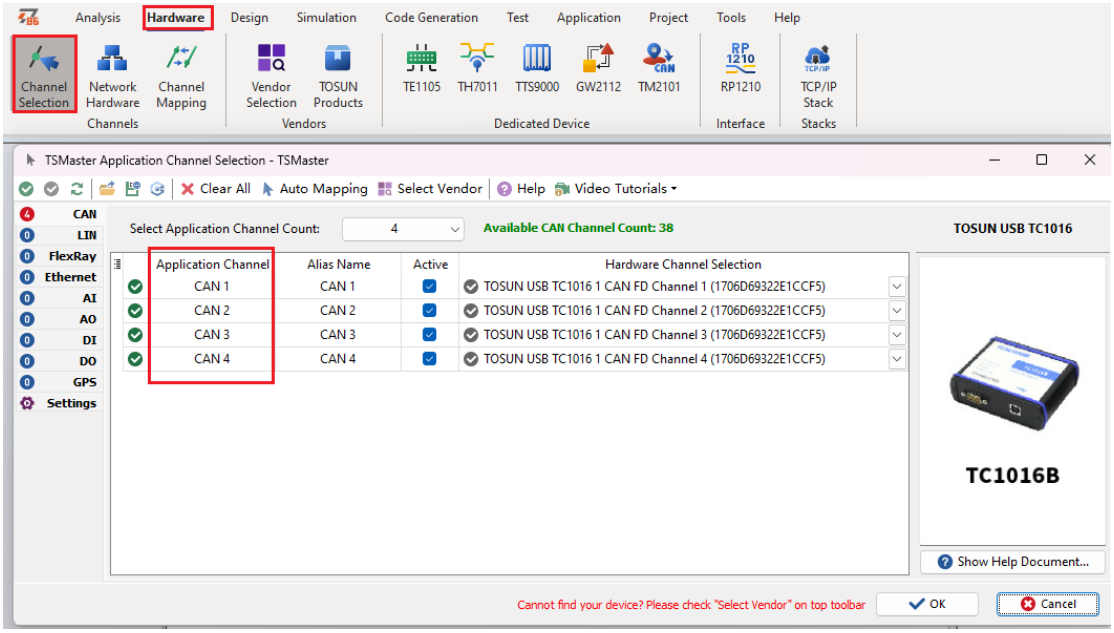
(Note: If multiple devices are connected, multiple scanned device serial numbers will be displayed.)



◆ Channel Selection

The channel here corresponds to the "Application Channel" under "Hardware" -> "Channel Selection" in the TSMaster software. You can select the corresponding channel number according to the need.

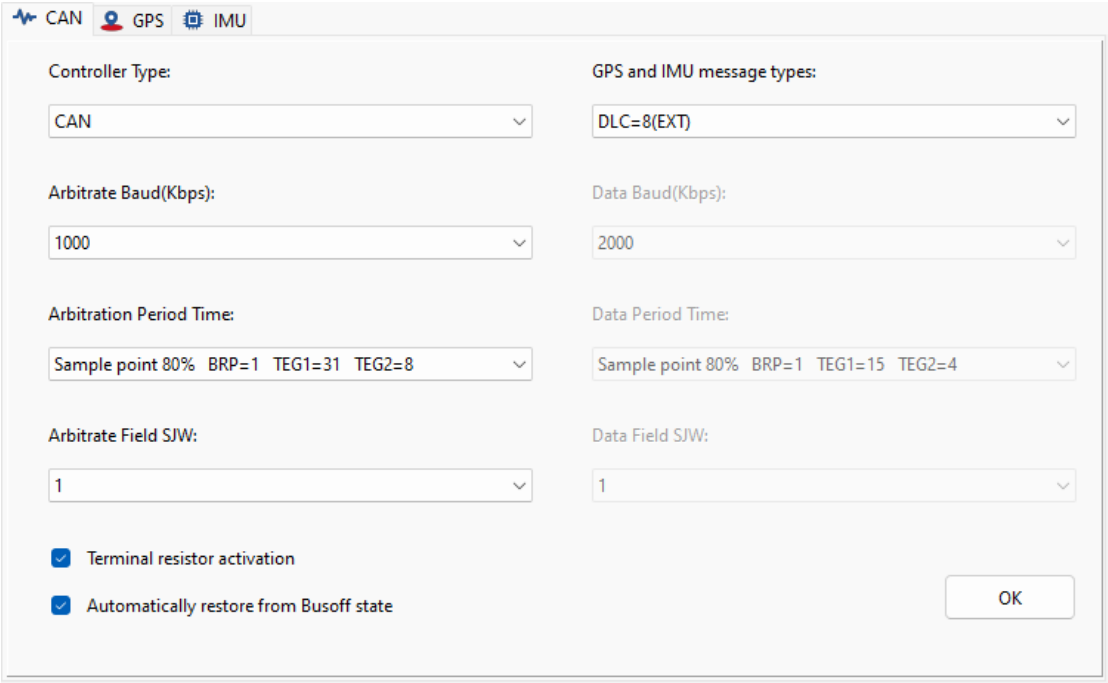




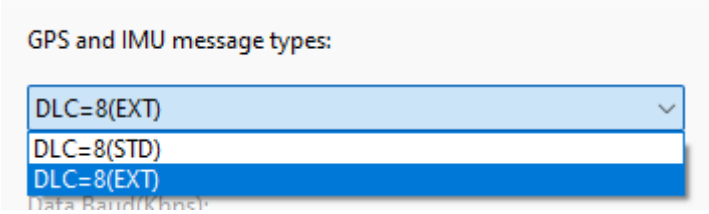
◆ CAN Configuration

(Note: The "OK" buttons for the three different configuration items—CAN, GPS, and IMU—are independent of each other. This means that if modifications are made to all three configurations, you must click the "OK" button separately on each respective configuration page. In total, you need to click at least three times.)

(1) Classic CAN:



The configurable message types are as follows:

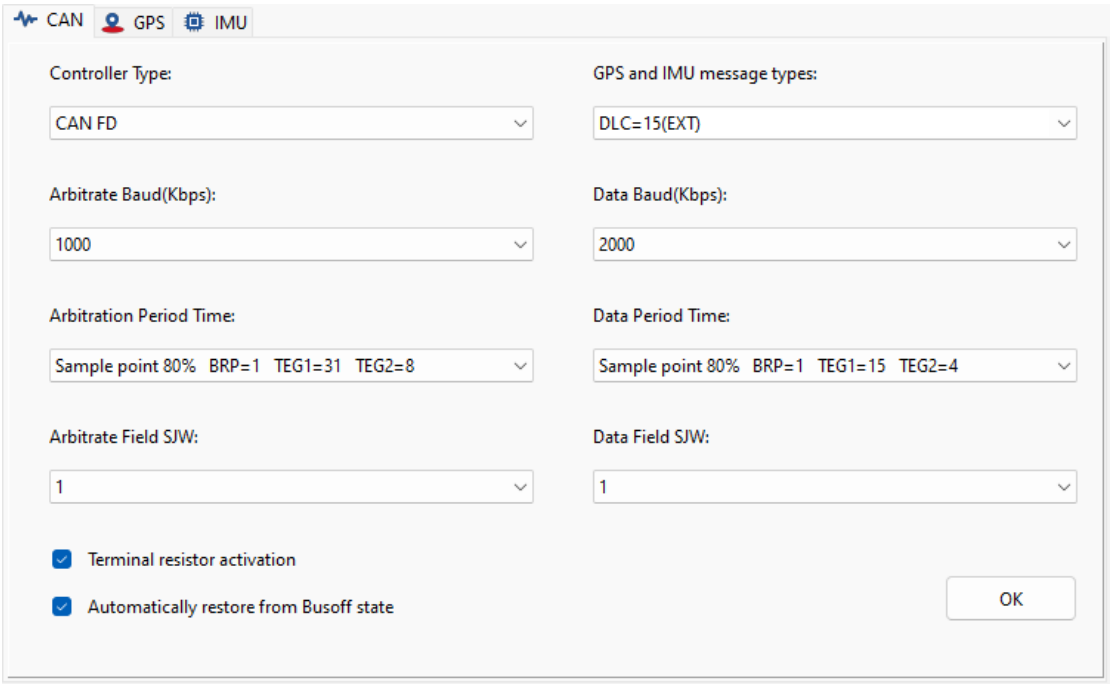


It is important to note that there are standard frames and extended frames. The ID length of standard frames and extended frames is different, which affects the ID configuration in the subsequent GPS and IMU settings. Please configure the ID according to the rules.

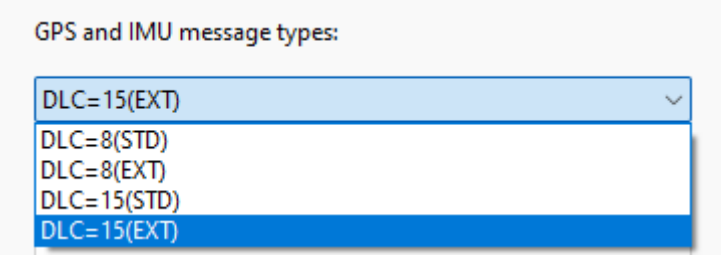
Additionally, the arbitrate baud (Kbps), arbitration period time, and arbitrate field synchronization jump width can be configured.

Users can also configure the “terminal resistor activation”, and “Automatically restore from Busoff state”.

(2) CAN FD:



CAN FD adds two new configurable message types on top of classic CAN. Similarly, it is important to distinguish between standard frames and extended frames.



For CAN FD, on top of classic CAN, it can also configure the data baud (Kbps), data period time, and data field synchronization jump width.

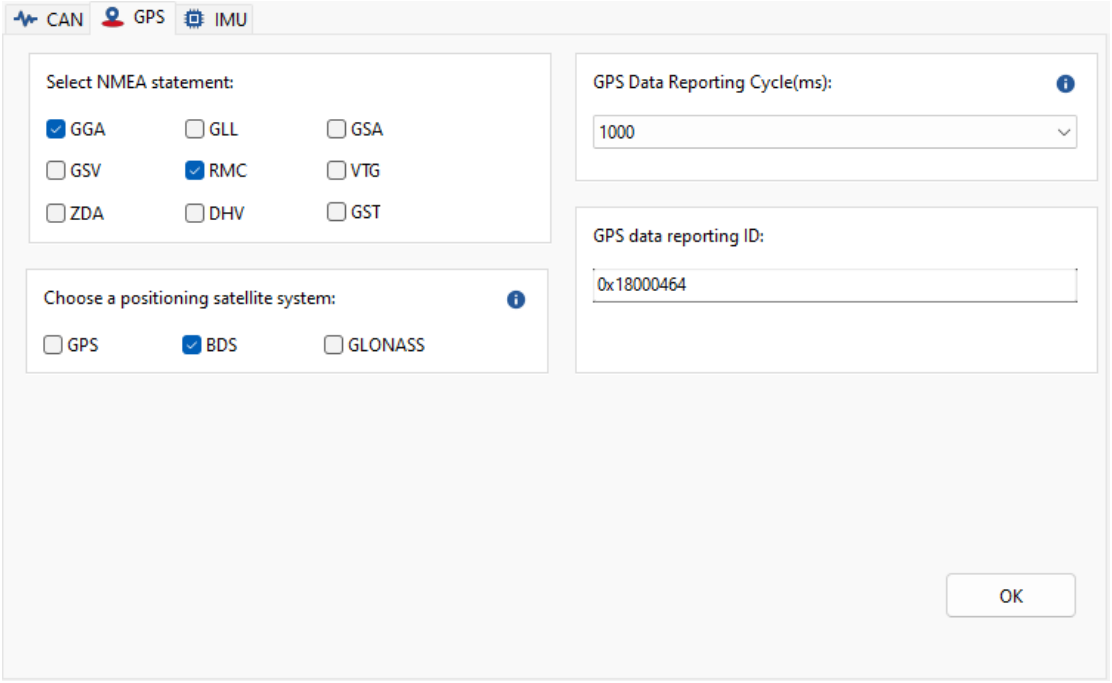
◆ GPS Configuration

(1) Select NMEA Sentences: The GPS module includes 9 types of sentences. Once enabled, it will periodically report the selected sentence. By default, GGA and RMC are enabled.

(2) Select Satellite Positioning System: The GPS module can receive messages from three satellite systems: Global Positioning System (GPS), BeiDou Navigation Satellite System (BDS), and Global Navigation Satellite System (GLONASS). By default, it receives messages from BDS.

(3) GPS Data Reporting Interval: The default reporting interval is 1 second.

(4) GPS Data Reporting ID: The CAN identifier used for GPS messages is set to 0x18000464 by default. This value must not be the same as the IMU reporting ID.



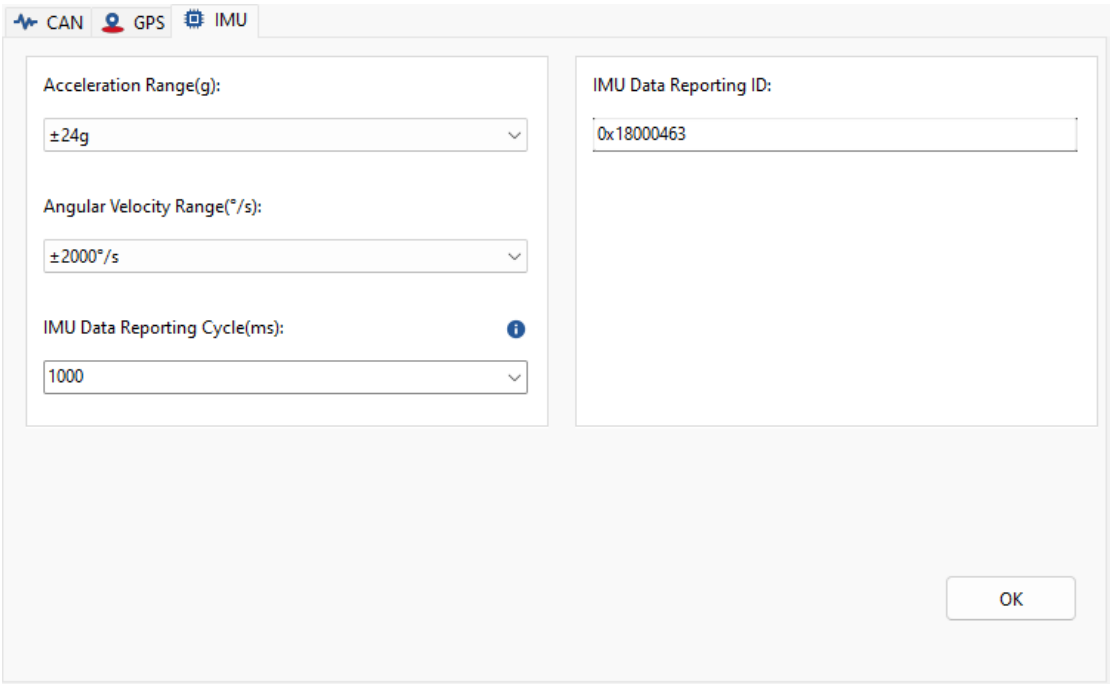
◆ IMU Configuration

(1) Acceleration Range: The range of variation for the accelerometer, with a default of ±24g.

(2) Angular Velocity Range: The range of variation for the gyroscope, with a default of ±2000°/s.

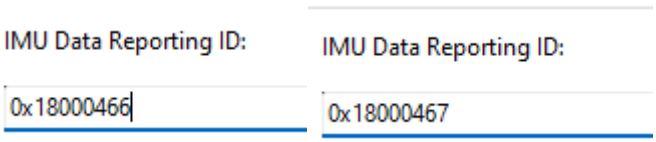
(3) IMU Data Reporting Interval: The default reporting interval is 1 second.

(4) IMU Data Reporting ID: The CAN identifier used for IMU messages, set to 0x18000463 by default. This value must not be the same as the GPS data reporting ID.

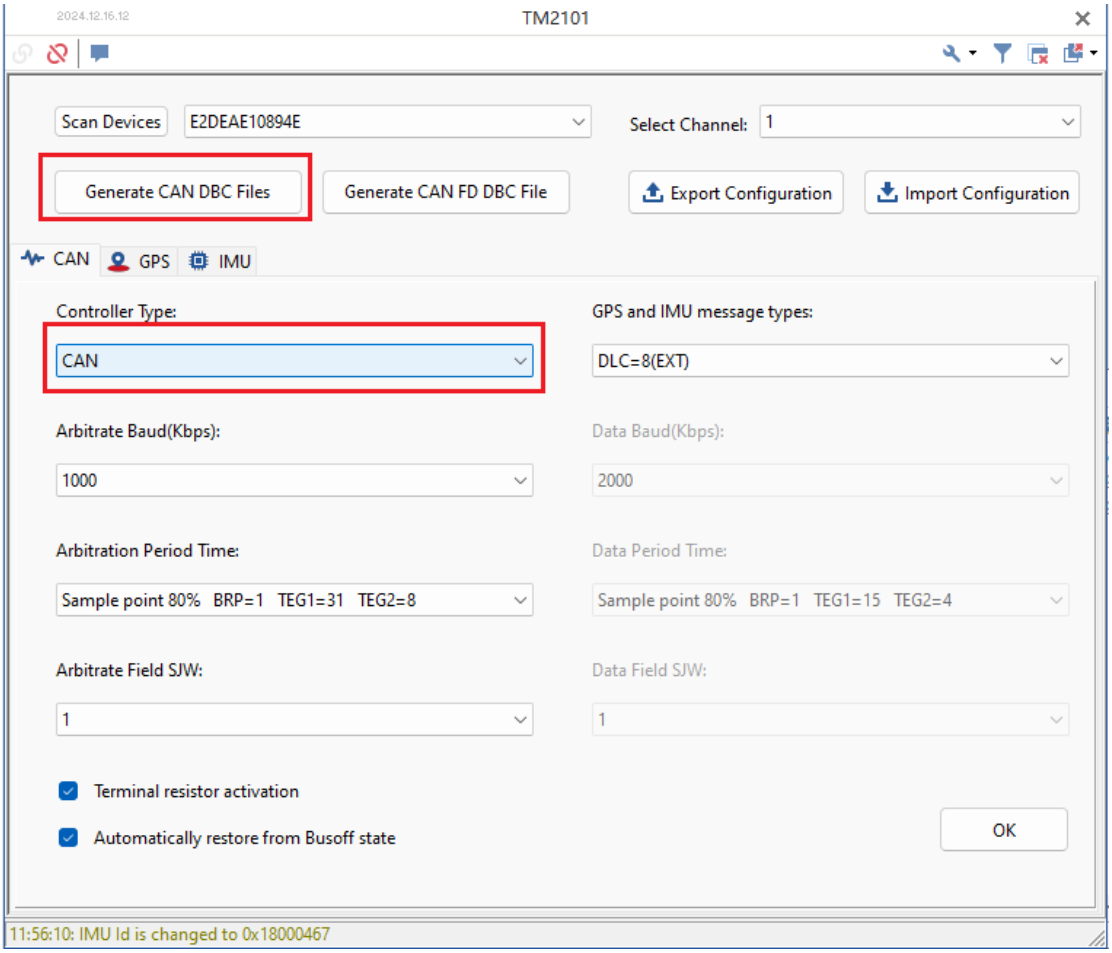


◆ Generate/Load DBC File

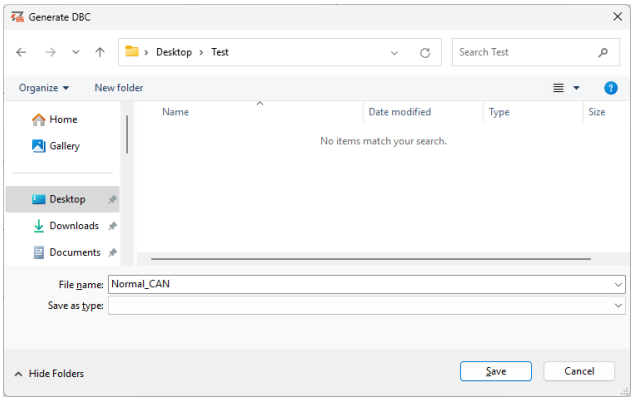
Generating a DBC file is intended for updating the data reporting ID settings modified in the GPS and IMU configurations. If the reporting ID is changed during GPS or IMU configuration, a new DBC file must be generated to synchronize the message IDs.



(1) Generate Classic CAN DBC File: This applies to controllers using classic CAN——"bxCAN". If mixed with CAN FD messages, it may cause incoming messages from the lower machine to fail to be parsed.



Click the “Generate CAN DBC Files” button, and select a save path to store the DBC file:



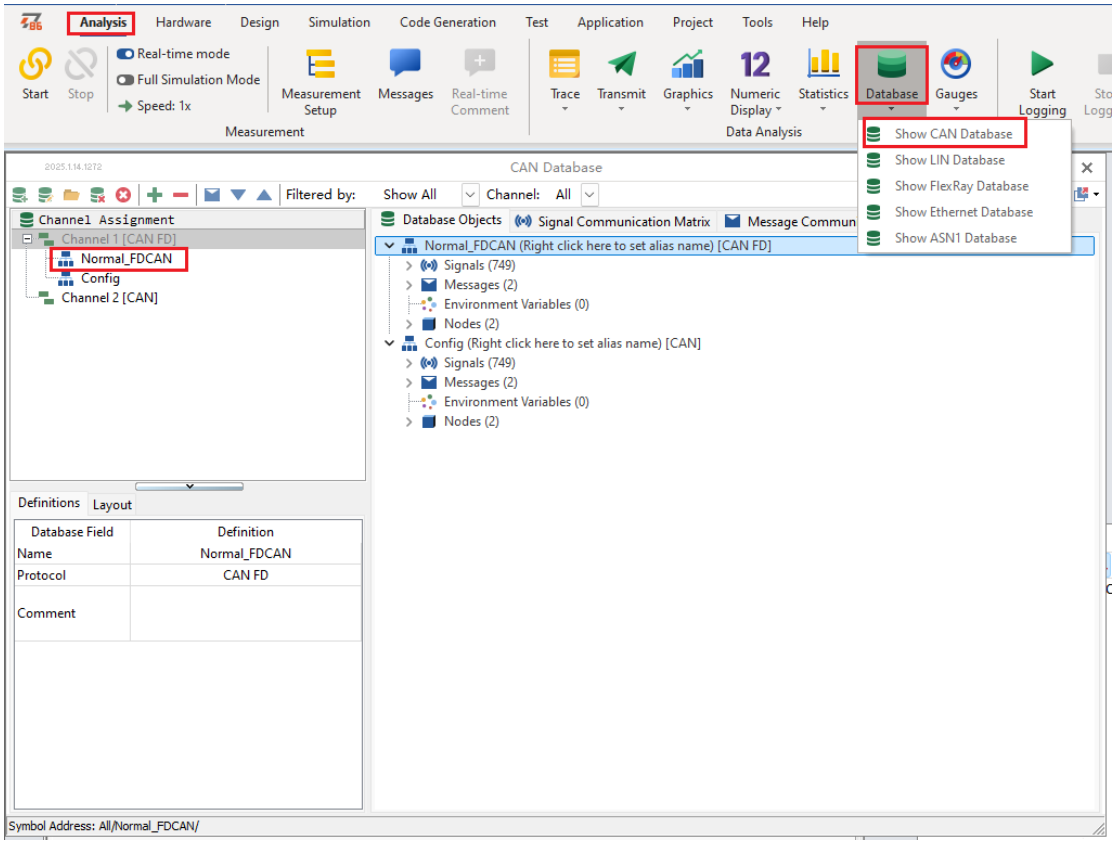
(2) Similarly, “Generate CAN FD DBC File” is specific for CAN FD, and here it will not be described in details.

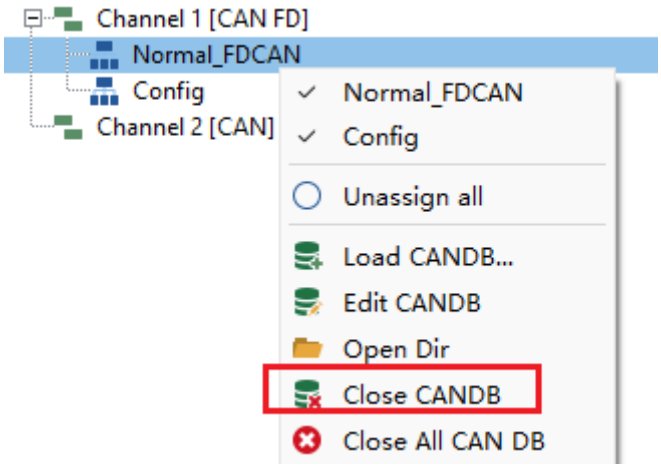
(3) How to Import the Newly Generated DBC File:

Open the database in the TSMaster software, close all DBC databases except for "Config", and then drag and drop the prepared DBC file into the software.

(Note: To avoid ID conflicts, it is recommended to use only one type of DBC file at a time,

either classic CAN or CAN FD.)

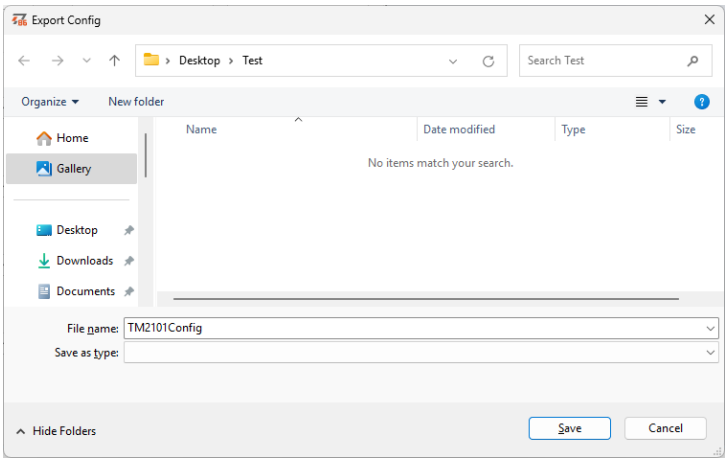




◆ Export and Import Configuration

(1) Click "Export Configuration": This will save the current configurations of CAN, GPS, and

IMU from the host computer panel into a JSON file.



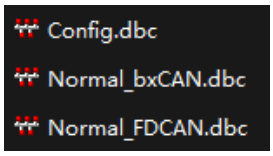
A window will pop up upon successful export. Click "OK" to close the window.

(2) Click "Import Configuration": Select the previously exported configuration JSON file. If the import is successful, a window will pop up. Click "OK" to close it.

4 Message Parsing

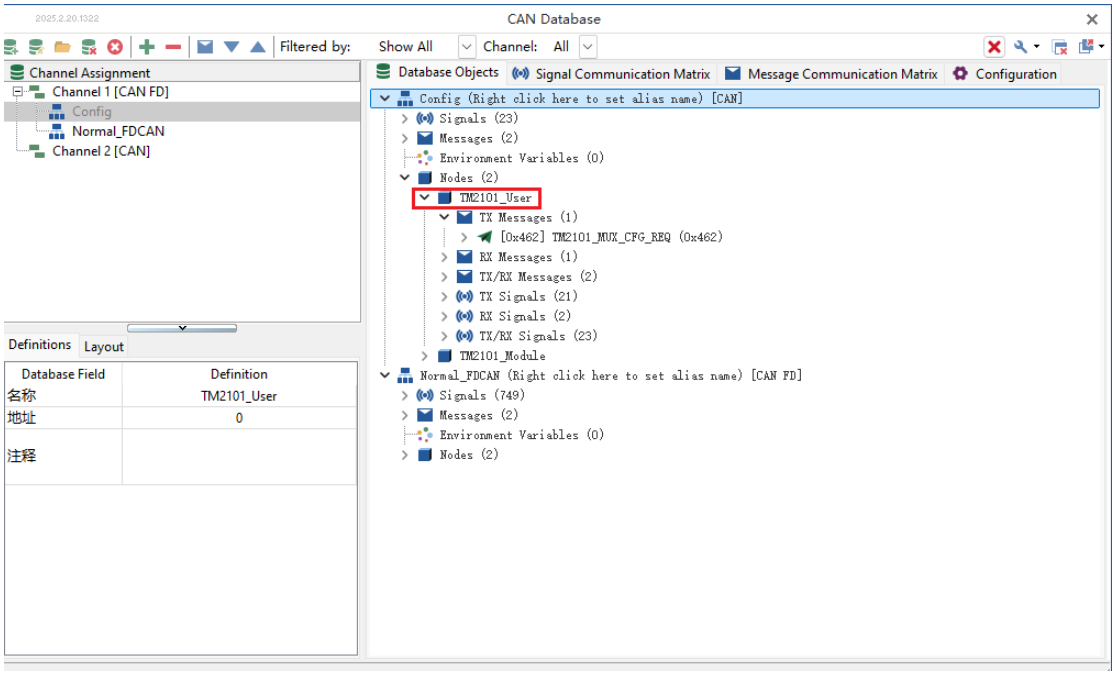
4.1 DBC File Description

The device provides DBC files, including Config.dbc for configuration, Normal_bxCAN.dbc for user mode CAN interface, and Normal_FDCAN.dbc for user mode CAN FD interface.



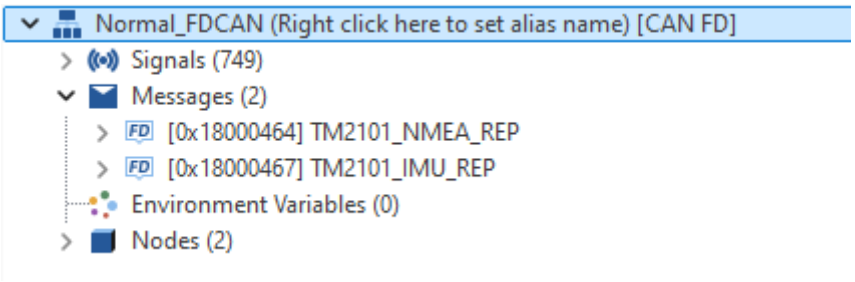
◆ Configuration Mode

The DBC file for configuration includes user nodes and device nodes. To transmit GPS parameters, IMU parameters, and CAN channel parameters to the device and receive responses from the device, users only need to use the transmit messages of the user node. If the configuration is successful, the first byte of the returned message will be 0x00. If the configuration fails, the first byte of the returned message will be 0x0A.



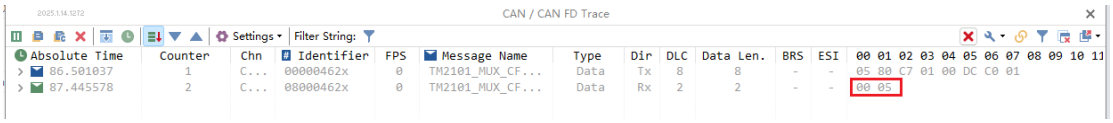
◆ User Mode

The DBC file for user mode includes both user nodes and device nodes. The device sends GPS messages and IMU messages to the user node, and then parses them.

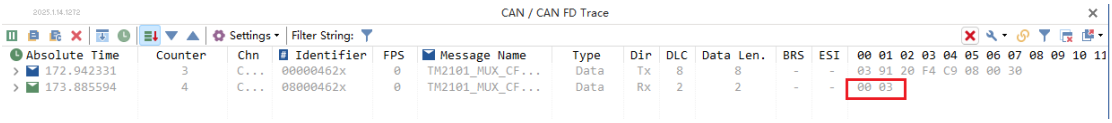


◆ Example of Configuration Mode

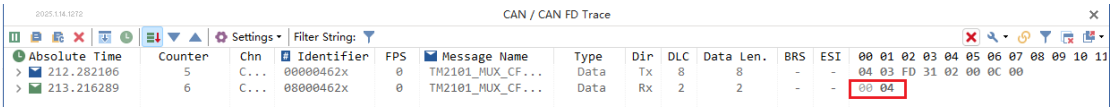
(1) CAN Configuration Success: The returned message data segment is 0x00, 0x05.



(2) GPS Configuration Success: The returned message data segment is 0x00, 0x03.

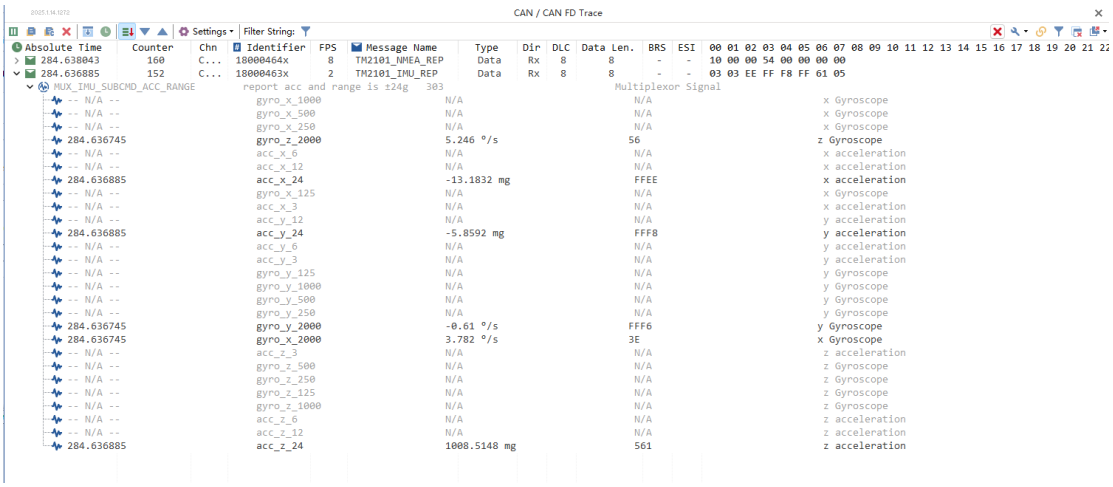


(3) IMU Configuration Success: The returned message data segment is 0x00, 0x04.



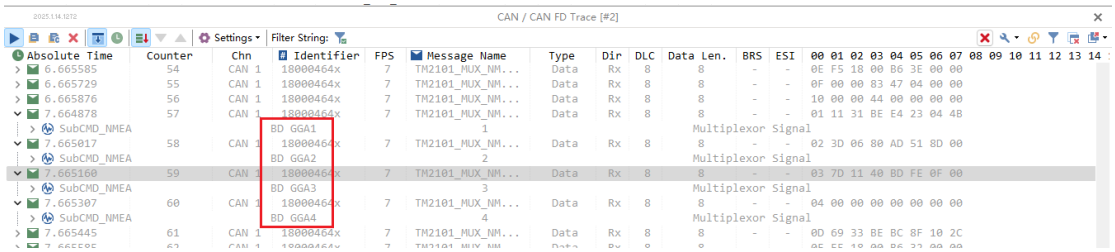
◆ Example of User Mode

(1) IMU data message:



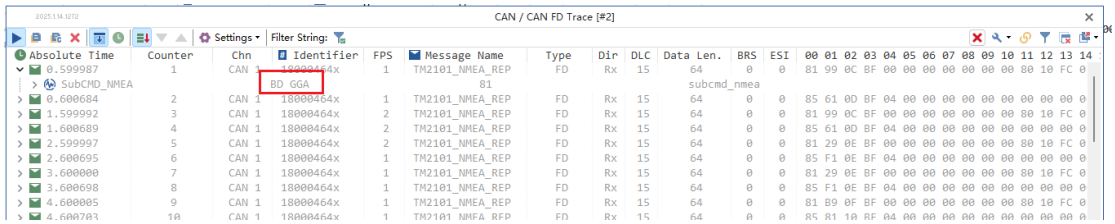
(2) GPS data message (CAN):

Taking the GGA sentence as an example, since the CAN message data segment length is limited and cannot accommodate the entire sentence content, in the classic CAN message mode, a single GGA sentence will be split into four parts (the number of splits may vary for different sentences, as detailed in section 4.3 Description of GPS Sentence to CAN), as shown in the following figure:



(3) GPS data message (CAN FD):

Similarly, taking the GGA sentence as an example, we already know that in a CAN message, the GGA sentence is split into four parts due to length limitations. However, in CAN FD, a single message is sufficient to accommodate the entire GGA sentence.



4.2 Description of IMU Data to CAN

(Note: CMD refers to the last two hexadecimal digits of the message ID).

◆ IMU Acceleration

CMD: 0x63 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	acc_range	acc_x		acc_y		acc_z	

Parameter Description	SubCMD: U8 0x03 acc_range: U8 0 = ±3g 1 = ±6g 2 = ±12g 3 = ±24g acc_x / acc_y / acc_z: S16 Acceleration value

◆ IMU Angular Acceleration

CMD: 0x63 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	gyro_range	gyro_x		gyro_y		gyro_z	
Parameter Description	SubCMD: U8 0x04 gyro_range: U8 0 = ±2000°/s 1 = ±1000°/s 2 = ±500°/s 3 = ±250°/s 4 = ±125°/s gyro_x / gyro_y / gyro_z: S16 Angular velocity value							

4.3 Description of GPS Sentence to CAN

(Note: CMD refers to the last two hexadecimal digits of the message ID).

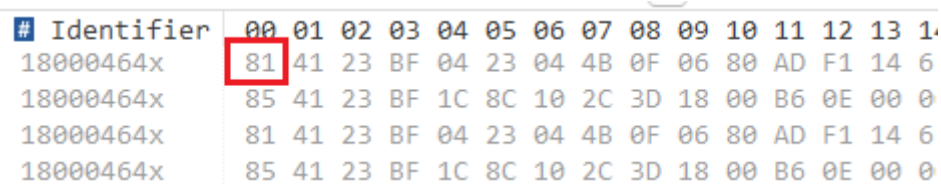
The format of all the following messages is CAN message. In CAN FD, all NMEA signals are combined into a single message. Only the GGA sentence provides a CAN FD message example, and the other sentences are similar.

(Reference document: "CASIC Multimode Satellite Navigation Receiver Protocol Specification.pdf" can be searched and downloaded online.)

4.3.1 GPS SubCMD Overview

Non-FD message numbers: 0x01 - 0x80, and FD message numbers: 0x81 - 0xC0.

The message numbers correspond to the first byte of the message data segment.



# Identifier	00	01	02	03	04	05	06	07	08	09	10	11	12	13	1
18000464x	81	41	23	BF	04	23	04	4B	0F	06	80	AD	F1	14	6
18000464x	85	41	23	BF	1C	8C	10	2C	3D	18	00	B6	0E	00	0
18000464x	81	41	23	BF	04	23	04	4B	0F	06	80	AD	F1	14	6
18000464x	85	41	23	BF	1C	8C	10	2C	3D	18	00	B6	0E	00	0

Number	Name	Description
0x00	MUX_REP_RESERVED	Reserved
0x01	REP_NMEA_BDGGA_1	BeiDou GGA Sentence 1
0x02	REP_NMEA_BDGGA_2	BeiDou GGA Sentence 2
0x03	REP_NMEA_BDGGA_3	BeiDou GGA Sentence 3
0x04	REP_NMEA_BDGGA_4	BeiDou GGA Sentence 4
0x05	REP_NMEA_BDGLL_1	BeiDou GLL Sentence 1
0x06	REP_NMEA_BDGLL_2	BeiDou GLL Sentence 2
0x07	REP_NMEA_BDGSA_1	BeiDou GSA Sentence 1

0x08	REP_NMEA_BDGSA_2	BeiDou GSA Sentence 2
0x09	REP_NMEA_BDGSA_3	BeiDou GSA Sentence 3
0x0A	REP_NMEA_BDGSV_1	BeiDou GSV Sentence 1
0x0B	REP_NMEA_BDGSV_2	BeiDou GSV Sentence 2
0x0C	REP_NMEA_BDGSV_3	BeiDou GSV Sentence 3
0x0D	REP_NMEA_BDRMC_1	BeiDou RMC Sentence 1
0x0E	REP_NMEA_BDRMC_2	BeiDou RMC Sentence 2
0x0F	REP_NMEA_BDRMC_3	BeiDou RMC Sentence 3
0x10	REP_NMEA_BDRMC_4	BeiDou RMC Sentence 4
0x11	REP_NMEA_BDVTG_1	BeiDou VTG Sentence 1
0x12	REP_NMEA_BDVTG_2	BeiDou VTG Sentence 2
0x13	REP_NMEA_BDZDA_1	BeiDou ZDA Sentence 1
0x14	REP_NMEA_BDANT_1	BeiDou ANT Sentence 1
0x15	REP_NMEA_BDDHV_1	BeiDou DHV Sentence 1
0x16	REP_NMEA_BDDHV_2	BeiDou DHV Sentence 2
0x17	REP_NMEA_BDLPS_1	BeiDou LPS Sentence 1
0x18	REP_NMEA_BDLPS_2	BeiDou LPS Sentence 2
0x19	REP_NMEA_BDUTC_1	BeiDou UTC Sentence 1
0x1A	REP_NMEA_BDUTC_2	BeiDou UTC Sentence 2
0x1B	REP_NMEA_BDUTC_3	BeiDou UTC Sentence 3
0x1C	REP_NMEA_BDGST_1	BeiDou GST Sentence 1
0x21	REP_NMEA_GPGGA_1	GPS GGA Sentence 1
...	...	
0x40	...	...
0x41	REP_NMEA_GLGGA_1	GLONASS GGA Sentence 1
...	...	...
0x60	...	...
0x61	REP_NMEA_GNGGA_1	Multi-satellite Combined GGA Sentence 1
...	...	...
0x80	MUX_REP_RESERVED	Reserved
0x81	REP_NMEA_BDGGA_FD	BeiDou GGA Sentence (FD frame)
0x82	REP_NMEA_BDGLL_FD	BeiDou GLL Sentence (FD frame)
0x83	REP_NMEA_BDGSA_FD	BeiDou GSA Sentence (FD frame)

0x84	REP_NMEA_BDGSV_FD	BeiDou GSV Sentence (FD frame)
0x85	REP_NMEA_BDRMC_FD	BeiDou RMC Sentence (FD frame)
0x86	REP_NMEA_BDVTG_FD	BeiDou VTG Sentence (FD frame)
0x87	REP_NMEA_BDZDA_FD	BeiDou ZDA Sentence (FD frame)
0x88	REP_NMEA_BDDHV_FD	BeiDou DHV Sentence (FD frame)
0x89	REP_NMEA_BDGST_FD	BeiDou GST Sentence (FD frame)
...	...	...
0x90	MUX_REP_RESERVED	Reserved
0x91	REP_NMEA_GPGGA_FD	GPS GGA Sentence (FD frame)
0x92	REP_NMEA_GPGLL_FD	GPS GLL Sentence (FD frame)
0x93	REP_NMEA_GPGSA_FD	GPS GSA Sentence (FD frame)
0x94	REP_NMEA_GPGSV_FD	GPS GSV Sentence (FD frame)
0x95	REP_NMEA_GPRMC_FD	GPS RMC Sentence (FD frame)
0x96	REP_NMEA_GPVTG_FD	GPS VTG Sentence (FD frame)
0x97	REP_NMEA_GPZDA_FD	GPS ZDA Sentence (FD frame)
0x98	REP_NMEA_GPDHV_FD	GPS DHV Sentence (FD frame)
0x99	REP_NMEA_GPGST_FD	GPS GST Sentence (FD frame)
...	...	...
0xA0	MUX_REP_RESERVED	Reserved
0xA1	REP_NMEA_GLGGA_FD	GLONASS GGA Sentence (FD frame)
0xA2	REP_NMEA_GLGLL_FD	GLONASS GLL Sentence (FD frame)
0xA3	REP_NMEA_GLGSA_FD	GLONASS GSA Sentence (FD frame)
0xA4	REP_NMEA_GLGSV_FD	GLONASS GSV Sentence (FD frame)
0xA5	REP_NMEA_GLRMC_FD	GLONASS RMC Sentence (FD frame)
0xA6	REP_NMEA_GLVTG_FD	GLONASS VTG Sentence (FD frame)
0xA7	REP_NMEA_GLZDA_FD	GLONASS ZDA Sentence (FD frame)
0xA8	REP_NMEA_GLDHV_FD	GLONASS DHV Sentence (FD frame)
0xA9	REP_NMEA_GLGST_FD	GLONASS GST Sentence (FD frame)
...	...	...
0xB0	MUX_REP_RESERVED	Reserved
0xB1	REP_NMEA_GNGGA_FD	Multi-satellite Combined GGA Sentence (FD frame)
0xB2	REP_NMEA_GNGLL_FD	Multi-satellite Combined GLL Sentence (FD frame)

0xB3	REP_NMEA_GNGSA_FD	Multi-satellite Combined GSA Sentence (FD frame)
0xB4	REP_NMEA_GNGSV_FD	Multi-satellite Combined GSV Sentence (FD frame)
0xB5	REP_NMEA_GNRMC_FD	Multi-satellite Combined RMC Sentence (FD frame)
0xB6	REP_NMEA_GNVTG_FD	Multi-satellite Combined VTG Sentence (FD frame)
0xB7	REP_NMEA_GNZDA_FD	Multi-satellite Combined ZDA Sentence (FD frame)
0xB8	REP_NMEA_GNDHV_FD	Multi-satellite Combined DHV Sentence (FD frame)
0xB9	REP_NMEA_GNGST_FD	Multi-satellite Combined GST Sentence (FD frame)
...	...	...
0xC0	MUX_REP_RESERVED	Reserved

4.3.2 GGA Message

◆ CAN GGA Sentence

(1) CAN GGA Sentence 1:

	GGA Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	UTCtime_Flag /UTCtime /Lat_Flag /Lat /uLa_Flag /uLat						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x01: REP_NMEA_BDGGA_1 Beidou GGA sentence 1 0x21: REP_NMEA_GPGGA_1 GPS GGA sentence 1 0x41: REP_NMEA_GLGGA_1 GLONASS GGA sentence 1							

	0x61: REP_NMEA_GNGGA_1 Multi-satellite combined GGA sentence 1 UTCtime_Flag: U1, 0=invalid 1=valid UTCtime: U25, Factor = 0.01, Offset = 0, Min=0, Max=235959.99, Unit=UTC time Lat_Flag: U1, 0=invalid 1=valid Lat: U27, Factor = 0.0001, Offset = 0, Min=0, Max=13421.7727, Unit=latitude uLa_Flag: U1, 0=invalid 1=valid uLat: U1, Factor = 1, Offset = 0, Min=0, Max=1, Unit=latitude direction

(2) CAN GGA Sentence 2:

	GGA Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Lon_Flag / Lon / uLon_Flag / uLon / FS_Flag / FS / numSv_Flag / numSv / HDOP_Flag / HDOP						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x02: REP_NMEA_BDGGA_2 Beidou GGA sentence 2 0x22: REP_NMEA_GPGGA_2 GPS GGA sentence 2 0x42: REP_NMEA_GLGGA_2 GLONASS GGA sentence 2 0x62: REP_NMEA_GNGGA_2 Multi-satellite combined GGA sentence 2 Lon_Flag: U1, 0=invalid 1=valid Lon: U28, Factor = 0.0001, Offset = 0, Min=0, Max=26843.5455, Unit=longitude uLon_Flag: U1, 0=invalid 1=valid uLon: U1, Factor = 1, Offset = 0, Min=0, Max=1, Unit=longitude direction FS_Flag: U1, 0=invalid 1=valid FS: U4, Factor = 1, Offset = 0, Min=0, Max=8, Unit=positioning quality numSv_Flag: U1, 0=invalid 1=valid numSv: U5, Factor = 1, Offset = 0, Min=0, Max=8, Unit=number of							

	satellites HDOP_Flag: U1, 0=invalid 1=valid HDOP: U10, Factor = 0.1, Offset = 0, Min=0, Max=102.3, Unit= horizontal accuracy factor

(3) CAN GGA Sentence 3:

	GGA Sentence 3							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	msl_Flag / msl/ sep_Flag / sep/ diffAge_Flag / diffAge						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x03: REP_NMEA_BDGGA_3 Beidou GGA sentence 3 0x23: REP_NMEA_GPGGA_3 GPS GGA sentence 3 0x43: REP_NMEA_GLGGA_3 GLONASS GGA sentence 3 0x63: REP_NMEA_GNGGA_3 Multi-satellite combined GGA sentence 3 msl_Flag: U1, 0=invalid 1=valid msl: S21, Factor = 0.01, Offset = 0, Min=-10485.76, Max=10485.75, Unit=Altitude sep_Flag: U1, 0=invalid 1=valid sep: S21, Factor = 0.01, Offset = 0, Min=-10485.76, Max=10485.75, Unit= geoid height relative to the ellipsoid diffAge_Flag: U1, 0=invalid 1=valid diffAge: U9, Factor = 1, Offset = 0, Min=0, Max=511, Unit=age of differential correction data							

(4) CAN GGA Sentence 4:

	GGA Sentence 4							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	diffSta_Flag / diffSta						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the							

	satellite system and NMEA sentence. 0x04: REP_NMEA_BDGGA_4 Beidou GGA sentence 4 0x24: REP_NMEA_GPGGA_4 GPS GGA sentence 4 0x44: REP_NMEA_GLGGA_4 GLONASS GGA sentence 4 0x64: REP_NMEA_GNGGA_4 Multi-satellite combined GGA sentence 4 diffSta_Flag: U1, 0=invalid 1=valid diffSta: U10 Factor = 1, Offset = 0, Min=0, Max=1023, Unit=S The ID of the differential reference station

◆ CAN FD GGA Sentence

	GGA Sentence							
CMD: 0x64 (Default)	B0	B1	.....	B30	B31	.....	B62	B63
Report	SubCMD	UTCtime_Flag /UTCtime /Lat_Flag /Lat /uLa_Flag /uLat/Lon_Flag / Lon / uLon_Flag / uLon / FS_Flag / FS / numSv_Flag / numSv / HDOP_Flag / HDOP/msl_Flag / msl/ sep_Flag / sep/ diffAge_Flag / diffAge/diffSta_Flag / diffSta						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x81: REP_NMEA_BDGGA_FD Beidou GGA sentence (FD) 0x91: REP_NMEA_GPGGA_FD GPS GGA sentence (FD) 0xA1: REP_NMEA_GLGGA_FD GLONASS GGA sentence (FD) 0xB1: REP_NMEA_GNGGA_FD Multi-satellite combined GGA sentence (FD)							

4.3.3 GLL Message

◆ CAN GLL Sentence

(1) GLL Sentence 1:

	GLL Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	UTCtime_Flag /UTCtime /Lat_Flag /Lat /uLa_Flag /uLat						
Parameter	SubCMD: U8							

Description	The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x05: REP_NMEA_BDGLL_1 Beidou GLL sentence 1 0x25: REP_NMEA_GPGLL_1 GPS GLL sentence 1 0x45: REP_NMEA_GLGLL_1 GLONASS GLL sentence 1 0x65: REP_NMEA_GNGLL_1 Multi-satellite combined GLL sentence 1 UTCtime_Flag: U1, 0=invalid 1=valid UTCtime: U25, Factor = 0.01, Offset = 0, Min=0, Max=235959.99, Unit=UTC time Lat_Flag: U1, 0=invalid 1=valid Lat: U27, Factor = 0.0001, Offset = 0, Min=0, Max=13421.7727, Unit=latitude uLa_Flag: U1, 0=invalid 1=valid uLat: U1, Factor = 1, Offset = 0, Min=0, Max=1, Unit=latitude direction

(2) GLL Sentence 2:

	GLL Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Lon_Flag / Lon / uLon_Flag / uLon / valid_Flag / valid/ Mode_Flag / Mode						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x06: REP_NMEA_BDGLL_2 Beidou GLL sentence 2 0x26: REP_NMEA_GPGLL_2 GPS GLL sentence 2 0x46: REP_NMEA_GLGLL_2 GLONASS GLL sentence 2 0x66: REP_NMEA_GNGLL_2 Multi-satellite combined GLL sentence 2 Lon_Flag: U1, 0=invalid 1=valid Lon: U28, Factor = 0.0001, Offset = 0, Min=0, Max=26843.5455, Unit=longitude uLon_Flag: U1, 0=invalid 1=valid uLon: U1, Factor = 1, Offset = 0, Min=0, Max=1, Unit=longitude							

	direction valid_Flag: U1, 0=invalid 1 = valid valid: U1, 0=invalid, 1=valid, Unit=data validity Mode_Flag: U1, 0=invalid 1=valid Mode: U3, Factor = 1, Offset= 0, Min=0, Max=4, Unit=positioning mode

◆ CAN FD GLL Sentence

Omitted.

4.3.4 GSA Message

◆ CAN GSA Sentence

(1) GSA Sentence 1:

	GSA Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Smode_Flag / Smode / FS_Flag / FS / Svid1_Flag / Svid1/ Svid2_Flag / Svid2/ Svid3_Flag / Svid3/ Svid4_Flag / Svid4/ Svid5_Flag / Svid5/						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x07: REP_NMEA_BDGSA_1 Beidou GSA sentence 1 0x27: REP_NMEA_GPGSA_1 GPS GSA sentence 1 0x47: REP_NMEA_GLGSA_1 GLONASS GSA sentence 1 0x67: REP_NMEA_GNGSA_1 Multi-satellite combined GSA sentence 1 Smode_Flag: U1, 0=invalid 1=valid Smode: U1, Factor=1, Offset = 0, Min=0, Max=1, Unit=mode switch indicator FS_Flag: U1, 0=invalid 1=valid FS: U4, Factor = 1, Offset = 0, Min=0, Max=8, Unit=positioning quality Svid1_Flag: U1, 0=invalid 1=valid Svid1: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 1 Svid2_Flag: U1, 0=invalid 1=valid							

	Svid2: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 2 Svid3_Flag: U1, 0=invalid 1=valid Svid3: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 3 Svid4_Flag: U1, 0=invalid 1=valid Svid4: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 4 Svid5_Flag: U1, 0=invalid 1=valid Svid5: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 5

(2) GSA Sentence 2:

	GSA Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Svid6_Flag / Svid6/ Svid7_Flag / Svid7/ Svid8_Flag / Svid8/Svid9_Flag / Svid9Svid10_Flag / Svid10/ Svid11_Flag / Svid11						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x08: REP_NMEA_BDGSA_2 Beidou GLL sentence 2 0x28: REP_NMEA_GPGSA_2 GPS GSA sentence 2 0x48: REP_NMEA_GLGSA_2 GLONASS GSA sentence 2 0x68: REP_NMEA_GNGSA_2 Multi-satellite combined GSA sentence 2 Svid6_Flag: U1, 0=invalid 1=valid Svid6: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 6 Svid7_Flag: U1, 0=invalid 1=valid Svid7: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 7 Svid8_Flag: U1, 0=invalid 1=valid Svid8: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 8 Svid9_Flag: U1, 0=invalid 1=valid Svid9: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 9 Svid10_Flag: U1, 0=invalid 1=valid Svid10: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 10 Svid11_Flag: U1, 0=invalid 1=valid							

	Svid11: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 11

(3) GSA Sentence 3:

	GSA Sentence 3							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	/ Svid12_Flag / Svid12/ PDOP_Flag / PDOP/ HDOP_Flag / HDOP/ /VDOP_Flag / VDOP/ Systemid_Flag / Systemid						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x09: REP_NMEA_BDGSA_2 Beidou GLL sentence 2 0x29: REP_NMEA_GPGSA_2 GPS GSA sentence 2 0x49: REP_NMEA_GLGSA_2 GLONASS GSA sentence 2 0x69: REP_NMEA_GNGSA_2 Multi-satellite combined GSA sentence 2 Svid12_Flag: U1, 0=invalid 1=valid Svid12: U8, Factor = 1, Offset=0, Min=0, Max=255, Unit=satellite number 12 PDOP_Flag: U1, 0=invalid 1=valid PDOP: U10, Factor = 0.1, Offset = 0, Min=0, Max=102.3, Unit= position accuracy factor HDOP_Flag: U1, 0=invalid 1=valid HDOP: U10, Factor = 0.1, Offset = 0, Min=0, Max=102.3, Unit=horizontal accuracy factor VDOP_Flag: U1, 0=invalid 1=valid VDOP: U10, Factor = 0.1, Offset = 0, Min=0, Max=102.3, Unit= vertical accuracy factor Systemid_Flag: U1, 0=invalid 1=valid Systemid: U3, Factor = 1, Offset =0, Min=0, Max=4, Unit=GNSS system ID							

◆ CAN FD GSA Sentence

Omitted.

4.3.5 GSV Message

◆ CAN GSV Sentence

(1) GSV Sentence 1:

	GSV Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	numMsg_Flag / numMsg/ msgNo_Flag / msgNo/ numSv_Flag / numSv/ Svid1_Flag / Svid1 / Ele1_Flag / Ele1/ Az1_Flag / Az1/ Cno1_Flag / Cno1/ Svid2_Flag / Svid2						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x0A: REP_NMEA_BDGSV_1 Beidou GSV Sentence 1 0x2A: REP_NMEA_GPGSV_1 GPS GSV Sentence 1 0x4A: REP_NMEA_GLGSV_1 GLONASS GSV Sentence 1 0x6A: REP_NMEA_GNGSV_1 Multi-satellite combined GSV Sentence 1 numMsg_Flag: U1, 0=invalid 1=valid numMsg: U3, Factor=1, Offset=0, Min=0, Max=4, Unit= total number of sentences msgNO_Flag: U1, 0=invalid 1=valid msgNO: U3, Factor =1, Offset=0, Min=0, Max=4, Unit=current sentence number numSv_Flag: U1, 0=invalid 1=valid numSv: U5, Factor=1, Offset=0, Min=0, Max=32, Unit=total number of visible satellites Svid1_Flag: U1, 0=invalid 1=valid Svid1: U5, Factor=1, Offset=0, Min=0, Max=32, Unit=satellite number 1 Ele1_Flag: U1, 0=invalid 1=valid Ele1: U7, Factor =1, Offset=0, Min=0, Max=127, Unit=elevation angle Az1_Flag: U1, 0=invalid, 1=valid Az1: U9, Factor=1, Offset=0, Min=0, Max=359, Unit=azimuth angle Cno1_Flag: U1, 0=invalid 1=valid Cno1: U7, Factor=1, Offset=0, Min=0, Max=127, Unit=carrier-to-noise ratio Svid2_Flag: U1, 0=invalid 1=valid							

	Svid2: U5, Factor=1, Offset=0, Min=0, Max=32, Unit=satellite number 2

(2) GSV Sentence 2:

	GSV Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Ele2_Flag / Ele2/ Az2_Flag / Az2/ Cno2_Flag / Cno2/ / Svid3_Flag / Svid3 / Ele3_Flag / Ele3/ Az3_Flag / Az3						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x0B: REP_NMEA_BDGSV_1 Beidou GSV sentence 1 0x2B: REP_NMEA_GPGSV_1 GPS GSV sentence 1 0x4B: REP_NMEA_GLGSV_1 GLONASS GSV sentence 1 0x6B: REP_NMEA_GNGSV_1 Multi-satellite combined GSV sentence 1 Ele2_Flag: U1, 0=invalid 1=valid Ele2: U7, Factor =1, Offset=0, Min=0, Max=127, Unit=elevation angle Az2_Flag: U1, 0=invalid, 1=valid Az2: U9, Factor=1, Offset=0, Min=0, Max=359, Unit=azimuth angle Cno2_Flag: U1, 0=invalid 1=valid Cno2: U7, Factor=1, Offset=0, Min=0, Max=127, Unit=carrier-to-noise ratio Svid3_Flag: U1, 0=invalid 1=valid Svid3: U5, Factor=1, Offset=0, Min=0, Max=32, Unit=satellite number 3 Ele3_Flag: U1, 0=invalid 1=valid Ele3: U7, Factor =1, Offset=0, Min=0, Max=127, Unit=elevation angle Az3_Flag: U1, 0=invalid, 1=valid Az3: U9, Factor=1, Offset=0, Min=0, Max=359, Unit=azimuth angle							

(3) GSV Sentence 3:

	GSV Sentence 3							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Cno_Flag3/Cno3/Svid4_Flag / Svid4/ Ele4_Flag / El4e/ Az4_Flag / A4z/ Cno4_Flag / Cno4/ Signalid_Flag / Signalid						
Parameter	SubCMD: U8							

Description	The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x0C: REP_NMEA_BDGSV_1 Beidou GSV sentence 1 0x2C: REP_NMEA_GPGSV_1 GPS GSV sentence 1 0x4C: REP_NMEA_GLGSV_1 GLONASS GSV sentence 1 0x6C: REP_NMEA_GNGSV_1 Multi-satellite combined GSV sentence 1 Cno3_Flag: U1, 0=invalid 1=valid Cno3: U7, Factor=1, Offset=0, Min=0, Max=127, Unit=carrier-to-noise ratio Svid4_Flag: U1, 0=invalid 1=valid Svid4: U5, Factor=1, Offset=0, Min=0, Max=32, Unit= satellite number 4 Ele4_Flag: U1, 0=invalid 1=valid Ele4: U7, Factor =1, Offset=0, Min=0, Max=127, Unit=elevation angle Az4_Flag: U1, 0=invalid, 1=valid Az4: U9, Factor=1, Offset=0, Min=0, Max=359, Unit=azimuth angle Cno4_Flag: U1, 0=invalid 1=valid Cno4: U7, Factor=1, Offset=0, Min=0, Max=127, Unit=carrier-to-noise ratio Signalid_Flag: U1, 0=invalid, 1=valid Signalid: U3, Factor=1, Offset=0, Min=0, Max=4, Unit=GNSS signal ID

◆ CAN FD GSV Sentence

Omitted.

4.3.6 RMC Message

◆ CAN RMC Sentence

(1) RMC Sentence 1:

	RMC Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	UTCtime_Flag /UTCtime /Status_Flag /Status/Lat_Flag /Lat						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x0D: REP_NMEA_BDRMC_1 Beidou RMC sentence 1 0x2D: REP_NMEA_GPRMC_1 GPS RMC sentence 1							

	0x4D: REP_NMEA_GLRMC_1 GLONASS RMC sentence 1 0x6D: REP_NMEA_GNRMC_1 Multi-satellite combined RMC sentence 1 UTCtime_Flag: U1, 0=invalid 1=valid UTCtime: U25, Factor = 0.01, Offset = 0, Min=0, Max=235959.99, Unit=UTC time Status_Flag: U1, 0=invalid, 1=valid Status: U1, Factor=1, Offset=0, Min=0, Max=1, Unit=position validity flag Lat_Flag: U1, 0=invalid 1=valid Lat: U27, Factor = 0.0001, Offset = 0, Min=0, Max=13421.7727, Unit= latitude

(2) RMC Sentence 2:

	RMC Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	uLat_Flag /uLat/Lon_Flag / Lon / uLon_Flag / uLon / Spd_Flag / Spd						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x0E: REP_NMEA_BDRMC_2 Beidou RMC sentence 2 0x2E: REP_NMEA_GPRMC_2 GPS RMC sentence 2 0x4E: REP_NMEA_GLRMC_2 GLONASS RMC sentence 2 0x6E: REP_NMEA_GNRMC_2 Multi-satellite combined RMC sentence 2 uLat_Flag: U1, 0=invalid 1=valid uLat: U1, Factor = 1, Offset = 0, Min=0, Max=1, Unit=latitude direction Lon_Flag: U1, 0=invalid 1=valid Lon: U28, Factor = 0.0001, Offset = 0, Min=0, Max=26843.5455, Unit=longitude uLon_Flag: U1, 0=invalid 1=valid uLon: U1, Factor = 1, Offset = 0, Min=0, Max=1, Unit=longitude direction Spd_Flag: U1, 0=invalid 1=valid Spd: U15, Factor=0.01, Offset=0, Min=0, Max=327.67, Unit=ground speed							

(3) RMC Sentence 3:

	RMC Sentence 3							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Cog_Flag / Cog/ Data_Flag / Data						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x0F: REP_NMEA_BDRMC_3 Beidou RMC sentence 3 0x2F: REP_NMEA_GPRMC_3 GPS RMC sentence 3 0x4F: REP_NMEA_GLRMC_3 GLONASS RMC sentence 3 0x6F: REP_NMEA_GNRMC_3 Multi-satellite combined RMC sentence 3 Cog_Flag: U1, 0=invalid 1=valid Cog: U15, Factor=0.01, Offset=0, Min=0.Max=327.67, Unit=true course over ground Date_Flag: U1, 0=invalid 1=valid Date: U25, Factor=1, Offset=0, Min=0, Max=33554431, Unit=date (day, month, year)							

(4) RMC Sentence 4:

	RMC Sentence 4							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Mv_Flag / Mv/ Mve_Flag / Mve/ Mode_Flag / Mode/Navstatus_Flag / Navstatus/						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x10: REP_NMEA_BDRMC_4 Beidou RMC sentence 4 0x30: REP_NMEA_GPRMC_4 GPS RMC sentence 4 0x50: REP_NMEA_GLRMC_4 GLONASS RMC sentence 4 0x70: REP_NMEA_GNRMC_4 Multi-satellite combined RMC sentence 4 Mv_Flag: U1, 0=invalid 1=valid Mv: U15, Factor=0.01, Offset=0, Min=0, Max=327.67, Unit=magnetic							

	declination Mve_Flag: U1, 0=invalid 1=valid Mve: U1, Factor=1, Offset=0, Min=0, Max=1, Unit=magnetic declination direction Mode_Flag: U1, 0=invalid 1=valid Mode: U3, Factor = 1, Offset= 0, Min=0, Max=4, Unit=positioning mode Navstatus_Flag: U1, 0=invalid 1=valid Navstatus: U7, Factor =1, Offset=0, Min=0, Max=127, Unit=navigation status indicator

◆ CAN FD RMC Sentence

Omitted.

4.3.7 VTG Message

◆ CAN VTG Sentence

(1) VTG Sentence 1:

	VTG Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Cogt_Flag /Cogt/Cogm_Flag /Cogm/Sog_Flag /Sog						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x11: REP_NMEA_BDVTG_1 Beidou VTG sentence 1 0x31: REP_NMEA_GPVTG_1 GPS VTG sentence 1 0x51: REP_NMEA_GLVTG_1 GLONASS VTG sentence 1 0x71: REP_NMEA_GNVTG_1 Multi-satellite combined VTG sentence 1 Cogt_Flag: U1, 0=invalid 1=valid Cogt: U15, Factor=0.1, Offset=0, Min=0.Max=360.00, Unit=true course over ground (relative to true north) Cogm_Flag: U1, 0=invalid 1=valid Cogm: U15, Factor=0.1, Offset=0, Min=0.Max=360.00, Unit=magnetic course over ground (relative to magnetic north)							

	Sog_Flag: U1, 0=invalid 1=valid Sog: U15, Factor=0.01, Offset=0, Min=0, Max=327.67, Unit=ground speed

(2) VTG Sentence 2:

	VTG Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Kph_Flag / Kph/ Mode_Flag / Mode						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x12: REP_NMEA_BDVTG_2 Beidou VTG sentence 2 0x32: REP_NMEA_GPVTG_2 GPS VTG sentence 2 0x52: REP_NMEA_GLVTG_2 GLONASS VTG sentence 2 0x72: REP_NMEA_GNVTG_2 Multi-satellite combined VTG sentence 2 Kph_Flag: U1, 0=invalid 1=valid Kph: U15, Factor=0.01, Offset=0, Min=0, Max=327.67, Unit=horizontal speed Mode_Flag: U1, 0=invalid 1=valid Mode: U3, Factor = 1, Offset= 0, Min=0, Max=4, Unit=positioning mode							

◆ CAN FD VTG Sentence

Omitted.

4.3.8 ZDA Message

◆ CAN ZDA Sentence

(1) ZDA Sentence 1:

	ZDA Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	UTCtime_Flag /UTCtime /Day_Flag /Day/Month_Flag /Month/Year_Flag /Year						
Parameter	SubCMD: U8							

Description	The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x13: REP_NMEA_BDZDA_1 Beidou ZDA sentence 1 0x33: REP_NMEA_GPZDA_1 GPS ZDA sentence 1 0x53: REP_NMEA_GLZDA_1 GLONASS ZDA sentence 1 0x73: REP_NMEA_GNZDA_1 Multi-satellite combined ZDA sentence 1 UTCtime_Flag: U1, 0=invalid 1=valid UTCtime: U25, Factor = 0.01, Offset = 0, Min=0, Max=235959.99, Unit=UTC time Day_Flag: U1, 0=invalid 1=valid Day: U5, Factor=1, Offset=0, Min=0, Max=31, Unit=day Month_Flag: U1, 0=invalid 1=valid Month: U4, Factor=1, Offset=0, Min=0, Max=12, Unit=month Year_Flag: U1, 0=invalid 1=valid Year: U14, Factor=1, Offset=0, Min=0, Max=9999, Unit=year

◆ CAN FD ZDA Sentence

Omitted.

4.3.9 ANT Message

◆ CAN ANT Sentence

(1) ANT Sentence 1:

	ANT Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Xx_Flag / Xx / Yy_Flag / Yy / Info_Flag / Info						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x14: REP_NMEA_BDANT_1 Beidou ANT sentence 1 0x34: REP_NMEA_GPANT_1 GPS ANT sentence 1 0x54: REP_NMEA_GLANT_1 GLONASS ANT sentence 1 0x74: REP_NMEA_GNANT_1 Multi-satellite combined ANT sentence 1							

	Xx_Flag: U1, 0=invalid 1=valid Xx: U7, Factor = 1, Offset = 0, Min=0, Max=127, Unit=total number of message sentences Yy_Flag: U1, 0=invalid 1=valid Yy: U7, Factor = 1, Offset = 0, Min=0, Max=127, Unit=message number Info_Flag: U1, 0=invalid 1=valid Info: U2, Factor = 1, Offset = 0, Min=0, Max=3, Unit=antenna status

◆ CAN FD ANT sentence

Omitted.

4.3.10 DHV Message

◆ CAN DHV Sentence

(1) DHV Sentence 1:

	DHV Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	UTCtime_Flag /UTCtime /Speed3D_Flag /Speed3D/Spdx_Flag /Spdx/						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x15: REP_NMEA_BDDHV_1 Beidou DHV sentence 1 0x35: REP_NMEA_GPDHV_1 GPS DHV sentence 1 0x55: REP_NMEA_GLDHV_1 GLONASS DHV sentence 1 0x75: REP_NMEA_GNDHV_1 Multi-satellite combined DHV sentence 1 UTCtime_Flag: U1, 0=invalid 1=valid UTCtime: U25, Factor = 0.01, Offset = 0, Min=0, Max=235959.99, Unit=UTC time Speed3D_Flag: U1, 0=invalid 1=valid Speed3D: U8, Factor = 1, Offset = 0, Min=0, Max=255, Unit=receiver 3D speed Spdx_Flag: U1, 0=invalid 1=valid							

	Spdx: S15, Factor = 0.01, Offset = 0, Min=-163.84, Max=163.83, Unit= receiver speed in ECEF-X axis direction

(2) DHV Sentence 2:

	DHV Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Spdy_Flag /Spdy//Spdz_Flag /Spdz/Gdspd_Flag / Gdspd						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x16: REP_NMEA_BDDHV_2 Beidou DHV sentence 2 0x36: REP_NMEA_GPDHV_2 GPS DHV sentence 2 0x56: REP_NMEA_GLDHV_2 GLONASS DHV sentence 2 0x76: REP_NMEA_GNDHV_2 Multi-satellite combined DHV sentence 2 Spdy_Flag: U1, 0=invalid 1=valid Spdy: S15, Factor = 0.001, Offset = 0, Min=-163.84, Max=163.83, Unit=receiver speed in ECEF-Y axis direction Spdz_Flag: U1, 0=invalid 1=valid Spdz: S15, Factor = 0.001, Offset = 0, Min=-163.84, Max=163.83, Unit= receiver speed in ECEF-Z axis direction Gdspd_Flag: U1, 0=invalid 1=valid Gdspd: U8, Factor = 1, Offset = 0, Min=0, Max=255, Unit=Receiver speed in horizontal direction							

◆ CAN FD DHV Sentence

Omitted.

4.3.11 LPS Message

◆ CAN LPS Sentence

(1) LPS Sentence 1:

	LPS Sentence 1							
CMD:	B0	B1	B2	B3	B4	B5	B6	B7

0x64 (Default)								
Report	SubCMD	Xx_Flag /Xx/Yy_Flag /Yy/System_Flag /System/valid_Flag /valid/Utcls_Flag /Utcls/Utclsf_Flag /Utclsf						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x17: REP_NMEA_BDLPS_1 Beidou LPS sentence 1 0x37: REP_NMEA_GPLPS_1 GPS LPS sentence 1 0x57: REP_NMEA_GLLPS_1 GLONASS LPS sentence 1 0x77: REP_NMEA_GNLPS_1 Multi-satellite combined LPS sentence 1 Xx_Flag: U1, 0=invalid 1=valid Xx: U7, Factor = 1, Offset = 0, Min=0, Max=99, Unit=total number of message sentences Yy_Flag: U1, 0=invalid 1=valid Yy: U7, Factor = 1, Offset = 0, Min=0, Max=99, Unit=message number System_Flag: U1, 0=invalid 1=valid System: U1, Factor =1, Offset=0, Min=0, Max=1, Unit=system corresponding to leap second information valid_Flag: U1, 0=invalid 1=valid Valid: U2, Factor=1, Offset=0, Min=0, Max=3, Unit=leap second information validity flag Utcls_Flag: U1, 0=invalid 1=valid Utcls: U8, Factor=1, Offset=0, Min=-127, Max=127, Unit=leap second correction value Utclsf_Flag: U1, 0=invalid 1=valid Utclsf: U2, Factor=1, Offset=0, Min=0, Max=3, Unit=source of leap second information								

(2) LPS Sentence 2:

	LPS Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7

Report	SubCMD	Utctow_Flag / Utctow/ Utcwnt_Flag / Utcwnt/ Utcdn_Flag / Utcdn/ Utcwnf_Flag / Utcwnf/ Utca0_Flag / Utca0/ Utca1_Flag / Utca1/ leapdt_Flag / leapdt/ datelsf_Flag / datelsf/ lsfexp_Flag / lsfexp/ wnexp_Flag / wnexp/ Wnexpnum_Flag / Wnexpnum/
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x18: REP_NMEA_BDLPS_2 Beidou LPS sentence 2 0x38: REP_NMEA_GPLPS_2 GPS LPS sentence 2 0x58: REP_NMEA_GLLPS_2 GLONASS LPS sentence 2 0x78: REP_NMEA_GNLPS_2 Multi-satellite combined LPS sentence 2 Utctow_Flag: U1, 0=invalid 1=valid Utctow: U16, Factor=1, Offset=0, Min=0, Max=65535, Unit=UTC time week number Utcwnt_Flag: U1, 0=invalid 1=valid Utcwnt: U10, Factor=1, Offset=0, Min=0, Max=1023, Unit=current UTC week number Utcdn_Flag: U1, 0=invalid 1=valid Utcdn: U5, Factor=1, Offset=0, Min=0, Max=31, Unit=current UTC date Utcwnf_Flag: U1, 0=invalid 1=valid Utcwnf: U12, Factor=1, Offset=0, Min=0, Max=4095, Unit=future estimate of UTC week number Utca0_Flag: U1, 0=invalid 1=valid Utca0: U10, Factor=1, Offset=0, Min=0, Max=1023, Unit=current UTC week number Utca1_Flag: U1, 0=invalid 1=valid Utca1: U10, Factor=1, Offset=0, Min=0, Max=1023, Unit=current UTC week number leapdt_Flag: U1, 0=invalid 1=valid leapdt: U5, Factor=1, Offset=0, Min=0, Max=31, Unit=date of the leap second datelsf_Flag: U1, 0=invalid 1=valid datelsf: U10, Factor=1, Offset=0, Min=0, Max=1023, Unit=current UTC week number lsfexp_Flag: U1, 0=invalid 1=valid	

	lsfexp: U8, Factor=1, Offset=0, Min=-127, Max=127, Unit=current UTC week number wnexp_Flag: U1, 0=invalid 1=valid wnexp: U8, Factor=1, Offset=0, Min=-127, Max=127, Unit =current UTC week number Wnexpnum_Flag: U1, 0=invalid 1=valid wnexpnum: U10, Factor=1, Offset=0, Min=0, Max=1023, Unit =current UTC week number

◆ CAN FD LPS Sentence

Omitted.

4.3.12 UTC Message

◆ CAN UTC Sentence

(1) UTC Sentence 1:

	UTC Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	UTCtime_Flag /UTCtime/Lat_Flag /Lat/uLa_Flag /uLa						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x19: REP_NMEA_BDUTC_1 Beidou UTC sentence 1 0x39: REP_NMEA_GPUTC_1 GPS UTC sentence 1 0x59: REP_NMEA_GLUTC_1 GLONASS UTC sentence 1 0x79: REP_NMEA_GNUTC_1 Multi-satellite combined UTC sentence 1 UTCtime_Flag: U1, 0=invalid 1=valid UTCtime: U25, Factor = 0.01, Offset = 0, Min=0, Max=235959.99, Unit=UTC time Lat_Flag: U1, 0=invalid 1=valid Lat: U27, Factor = 0.0001, Offset = 0, Min=0, Max=8959.9999, Unit=latitude uLa_Flag: U1, 0=invalid 1=valid							

	uLat: U1, Factor = 1, Offset = 0, Min=0, Max=1, Unit=latitude direction

(2) UTC Sentence 2:

	UTC Sentence 2							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Lon_Flag / Lon/ uLon_Flag / uLon/ FS_Flag / FS/ numsv_Flag / numsv/ HDOP_Flag / HDOP/ Hgt_Flag / Hgt						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x1A: REP_NMEA_BDUTC_2 Beidou UTC sentence 2 0x3A: REP_NMEA_GPUTC_2 GPS UTC sentence 2 0x5A: REP_NMEA_GLUTC_2 GLONASS UTC sentence 2 0x7A: REP_NMEA_GNUTC_2 Multi-satellite combined UTC sentence 2 Lon_Flag: U1, 0=invalid 1=valid Lon: U28, Factor = 0.0001, Offset = 0, Min=0, Max=17959.9999, Unit=longitude uLon_Flag: U1, 0=invalid 1=valid uLon: U1, Factor = 1, Offset = 0, Min=0, Max=1, Unit=longitude direction FS_Flag: U1, 0=invalid 1=valid FS: U4, Factor = 1, Offset = 0, Min=0, Max=8, Unit=positioning quality numsv_Flag: U1, 0=invalid 1=valid numsv: U5, Factor = 1, Offset = 0, Min=0, Max=1, Unit=number of positioning satellites HDOP_Flag: U1, 0=invalid 1=valid HDOP: U10, Factor = 0.01, Offset = 0, Min=0.5, Max=99.9, Unit=horizontal accuracy factor Hgt_flag: U1, 0=invalid 1=valid Hgt: U7, Factor = 1, Offset = 0, Min=0, Max=127, Unit=height							

(3) UTC Sentence 3:

	UTC Sentence 3

CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	Data_Flag /Data/antsta_Flag /antsta/timesrc_Flag /timesrc/leapvalid_Flag /leapvalid/Utcls_Flag /Utcls/Utclsf_Flag /Utclsf/Leaptime_Flag /Leaptime						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x1B: REP_NMEA_BDUTC_1 Beidou UTC sentence 1 0x3B: REP_NMEA_GPUTC_1 GPS UTC sentence 1 0x5B: REP_NMEA_GLUTC_1 GLONASS UTC sentence 1 0x7B: REP_NMEA_GNUTC_1 Multi-satellite combined UTC sentence 1 Data_Flag: U1, 0=invalid 1=valid Data: U25, Factor=1, Offset=0, Min=0, Max=31129999, Unit=date (day, month, year) antsta_Flag: U1, 0=invalid 1=valid Antsta: U2, Factor=1, Offset=0, Min=0, Max=2, Unit=antenna status timesrc_Flag: U1, 0=invalid 1=valid timesrc: U1, Factor=1, Offset=0, Min=0, Max=1, Unit=current time source system leapvalid_Flag: U1, 0=invalid 1=valid leapvalid: U1, Factor=1, Offset=0, Min=0, Max=1, Unit= leap second correction validity flag utcls_Flag: U1, 0=invalid 1=valid utcls: U4, Factor=1, Offset=0, Min=0, Max=1, Unit=leap second correction value utclsf_Flag: U1, 0=invalid 1=valid utclsf: U4, Factor=1, Offset=0, Min=0, Max=1, Unit=predicted new leap second correction value Leaptime_Flag: U1, 0=invalid 1=valid Leaptime: U4, Factor=1, Offset=0, Min=0, Max=1, Unit=predicted leap second occurrence time							

- CAN FD UTC Sentence

  Omitted.

4.3.13 GST Message

◆ GST GLL Sentence

(1) GST Sentence 1:

	GST Sentence 1							
CMD: 0x64 (Default)	B0	B1	B2	B3	B4	B5	B6	B7
Report	SubCMD	UTCtime_Flag / UTCtime/ rms_Flag / rms/ stdlat_Flag / stdlat/ stdlon_Flag / stdlon / stdalt_Flag / stdalt						
Parameter Description	SubCMD: U8 The sub-command under this multiplexed command, used here to identify the satellite system and NMEA sentence. 0x1C: REP_NMEA_BDGST_1 Beidou GST sentence 1 0x3C: REP_NMEA_GPGST_1 GPS GST sentence 1 0x5C: REP_NMEA_GLGST_1 GLONASS GST sentence 1 0x7C: REP_NMEA_GNGST_1 Multi-satellite combined GST sentence 1 UTCtime_Flag: U1, 0=invalid 1=valid UTCtime: U25, Factor = 0.01, Offset = 0, Min=0, Max=235959.99, Unit=UTC time rms_Flag: U1, 0=invalid 1=valid rms: U4, Factor=1, Offset=0, Min=0, Max=1, Unit=RMS value of receiver pseudorange error standard deviation during positioning stdlat_Flag: U1, 0=invalid 1=valid stdlat: U4, Factor=1, Offset=0, Min=0, Max=15, Unit=standard deviation of latitude error of the receiver stdlon_Flag: U1, 0=invalid 1=valid stdlon: U4, Factor=1, Offset=0, Min=0, Max=15, Unit=standard deviation of longitude error of the receiver stdalt_Flag: U1, 0=invalid 1=valid stdalt: U4, Factor=1, Offset=0, Min=0, Max=15, Unit=standard deviation of altitude error of the receiver							

◆ CAN FD GST Sentence

Omitted.

5. Inspection and Maintenance

The main electrical components of the TM2101 product are semiconductor components. Although the equipment has a long service life, they may also accelerate aging and significantly reduce their service life under an incorrect environment. Therefore, during the use of the equipment, periodic inspection should be carried out to ensure that the use environment maintains the required conditions.

It is recommended to conduct inspections at least once every 6 months to 1 year. Under improper environmental, more frequent inspections should be conducted. As shown in the table below, if you encounter problems during maintenance, please read the following content to find the possible causes of the problem. If the problem still cannot be solved, please contact Shanghai TOSUN Technology Ltd.

Item	Inspection	Standard	Action
Power Supply	Inspect for voltage fluctuations at the power supply end	Power supply port +12V DC	Use a voltage meter to check the power input end. Take necessary actions to keep the voltage fluctuations within the acceptable range.
Surrounding Environment	Check the ambient temperature of the surrounding environment. (Including the internal temperature of enclosed environments)	-40℃~+80℃	Use a thermometer to check the temperature and ensure that the ambient temperature within in the acceptable range.
	Check the ambient	The relative	Use a hygrometer to check

	humidity. (Including the internal humidity of enclosed environments)	humidity must be within the range of 10% to 90%	the humidity and ensure that the ambient humidity within the acceptable range.
	Check for the accumulation of dust, powder, salt, and metal shavings	No accumulation	Clean and protect the equipment.
	Check for any contact with water, oil, or chemical sprays on the equipment	No contact	Clean and protect the equipment if necessary.
	Check for the presence of corrosive or flammable gases in the equipment area	No presence	Inspect by the smell, or using a sensor.
	Check for levels of vibration and shock	Vibration and shock are within the acceptable range	Install padding or other shock-absorbing devices if necessary.
	Check for noise sources near the equipment	No significant noise source	Isolate the equipment from noise sources or protect the equipment.
Wiring Installation	Check the crimped connectors in the external wiring	Ensure enough space between the connectors	Visually inspect and adjust if necessary.
	Check for damage in the external wiring	No damage	Visually inspect and replace the wiring if necessary.

TOSUN

Engineer Everything !

Software

Support CAN(FD)/LIN/FlexRay/SOME/IP and DoIP

UDS diagnostics/ECU flashing/CCP/XCP calibration

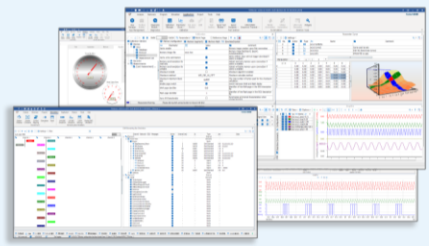
Embedded code generation/Application builder

Encrypted release/Logging and bus replay

Graphical programming/Residual bus simulation

C and Python scripting

Bus monitoring/Transmiting/Automated testing



TSMASTER

Hardware

1/2/4/8/12-channel CAN FD/CAN to USB/PCIe device

1/2/6-channel LIN to USB/PCIe device

Multi channel FlexRay/CAN FD to USB/PCIe device

Multi channel automotive Ethernet/CAN FD to USB/PCIe device

Automotive Ethernet media conversion device (T1 to Tx)

Multi-channel CAN FD/Ethernet/LIN datalogger

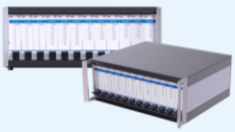
TTS test systems

-CAN FD/CAN/FlexRay/LIN communication boards

-Relay and fault injection boards

-Resistors for sensor simulation

-Digital I/O, Analog I/O boards available



CAN CAN FD LIN FlexRay OPEN ALLIANCE

Solutions

- Bus Conformance
- Network Automation Testing System
- Charging Testing System
- EMB Calibration Testing Equipment
- Information Security Solutions
- Steer-by-Wire Chassis Testing Solutions
- EOL Testing Equipment
- Motor Performance
- Durability Testing Solutions
- FCT

About TOSUN

The core product, TSMaster, is a comprehensive tool for automotive R&D, testing, production, and after-sales. It integrates essential functions with hardware support to streamline processes and ensure precision, making it ideal for automotive professionals.

International Organization

ASAM CiA

Quality Assurance

ISO9001:2015

CE Certification

CE

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