GCAN-402 Dual-Channel CAN Acquisition and Storage System

1. Function Introduction

1.1 Functional Overview

GCAN-402 CAN bus data storage module is a module specifically designed for storing CAN bus data. This module integrates two standard CAN bus interfaces, enabling real-time storage of CAN bus data by connecting the module to the CAN bus.

The module uses a TF memory card to store data from the bus in real time, enabling offline real-time storage. After storage is complete, the user simply needs to return the TF card and use dedicated software to restore the stored data to the actual bus data, facilitating analysis.

This module is suitable for systems requiring CAN bus historical data acquisition and pre- and post-fault message analysis. It can be widely used in systems with large data volumes and difficult-to-troubleshoot faults, such as those in automobiles, rail vehicles, and industrial control, facilitating data playback.

1.2 Performance Characteristics

● High-speed 32-bit industrial-grade processor;
● Use an external power supply (9~30V DC);
● Power supply current: 50mA, 24V DC;
● Integrated with 2 standard CAN bus interfaces, using OPEN4 terminal blocks;
● The CAN bus supports CAN2.0A and CAN2.0B frame formats and conforms to the ISO/DIS 11898 standard;
● The CAN bus communication baud rate can be configured between 20Kbps and 1Mbps via a DIP switch;
● The CAN bus interface is electrically isolated, and the isolation module insulation voltage is 2500V DC;
● Maximum received data rate: 8000 fps/second;
● CAN data is timestamped with an accuracy of 0.1ms;
● The maximum supported memory card size is 128GB;
● Operating temperature range: -40℃ to +85℃;
● Electrostatic discharge immunity level: Contact discharge ±4KV, air discharge ±8KV;
● Electrical Fast Transient/Bulk Immunity Class: ±2KV;
● Surge immunity rating: Power interface ±1KV. CAN bus interface ±4KV;
● Operating humidity range: 5%~95%RH, no condensation;

2. Equipment Installation

2.1 Equipment Dimensions

The equipment's external dimensions are: (length, including terminals) 102mm * (width) 63mm * (height) 23mm, as shown in Figure 2.1.

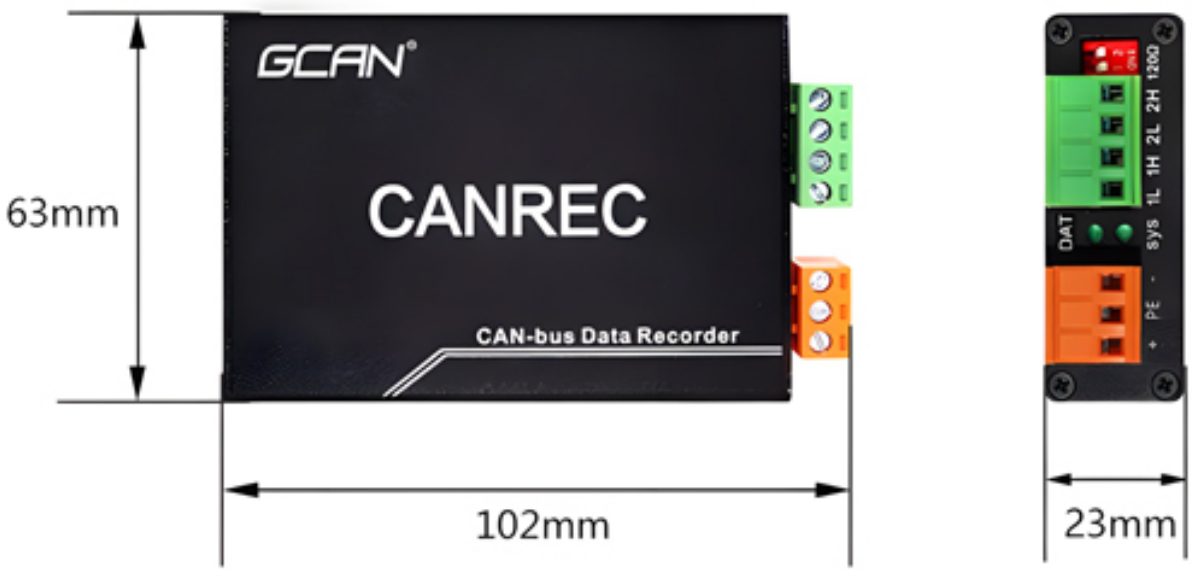


Figure 2.1 External dimensions of the GCAN-402 module

2.2 Interface Definition and Functions

The GCAN-402 module integrates one 9-30V DC power interface and two standard CAN-bus interfaces. The GCAN-402 module adopts an external power supply method, and the power interface is brought out by a 3-pin pluggable terminal block (orange). The location of its power interface and CAN-bus interface is shown in Figure 2.2, and the power interface definition is shown in Table 2.1.

Figure 2.2 Location of power interface and CAN-bus interface

引脚（由左至右）	端口	名称	功能
1	电源	+	9-30V 直流电源输入正
2		PE	屏蔽接外壳
3		-	9-30V 直流电源输入负

Table 2.1 GCAN-402 Module Power Interface Definition

The GCAN-402 module's CAN-bus interface is provided by a single 4-pin pluggable terminal block (green), which can be used to connect two CAN-bus networks or devices with CAN-bus interfaces. Its CAN-bus interface definition is shown in Table 2.2.

引脚（由左至右）	端口	名称	功能
1	CAN	1L	CAN1_L 信号线（CAN 低）
2		1H	CAN1_H 信号线（CAN 高）
3		2L	CAN2_L 信号线（CAN 低）
4		2H	CAN2_H 信号线（CAN 高）
	拨码开关	终端电阻	终端电阻，详见 3.4 章

Table 2.2 CAN-bus signal allocation of GCAN-402 module

3. Equipment Use

The GCAN-402 supports two configuration modes: one is to configure the system time, baud rate, and filtering functions through Guangcheng Technology's dedicated configuration software, and the other is to adjust the baud rate of the CAN terminal using an external hardware baud rate switch.

3.1 Software Configuration

Users can configure the GCAN-402 module parameters via USB interface and CANREC-config software to meet the needs of practical applications. GCAN-402 module configuration includes system time, baud rate, data format, filtering, etc. Before normal use, the GCAN-402's storage parameters need to be pre-configured; otherwise, the GCAN-402 will execute the parameters from the last successfully configured configuration.

3.1.1 Software Connection

Users need to connect to the configuration software using a USB cable to the USB port shown in Figure 3.6, and then locate the serial port number in Device Manager, as shown in Figure 3.1.

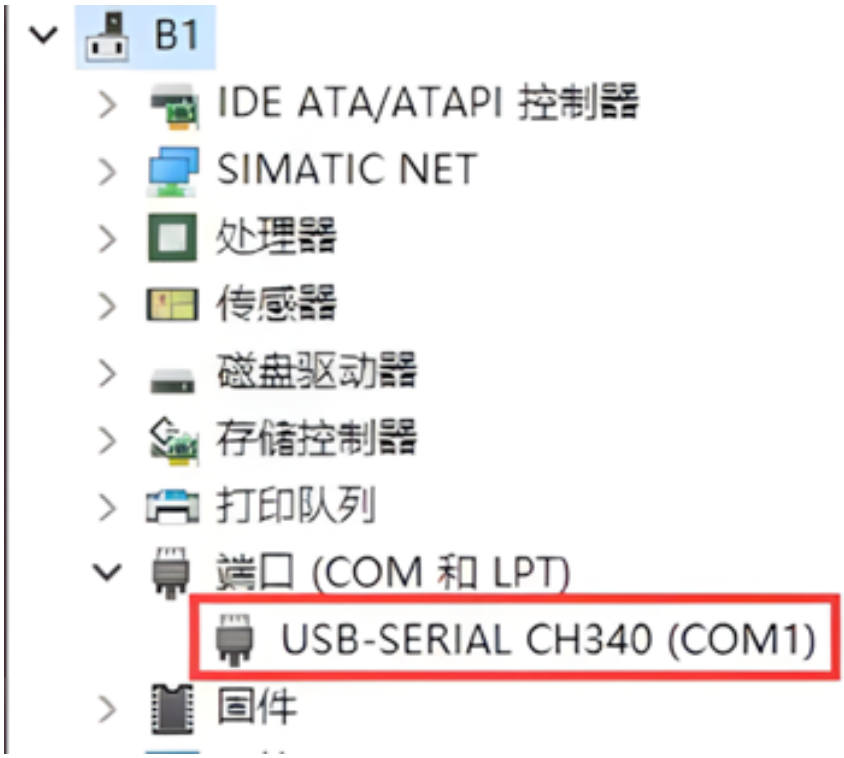


Figure 3.1 Device Manager Interface

After the GCAN-402 module is successfully connected to the PC via the serial port, open the "CANREC-config" software to configure the module. The software interface is shown in Figure 3.2.

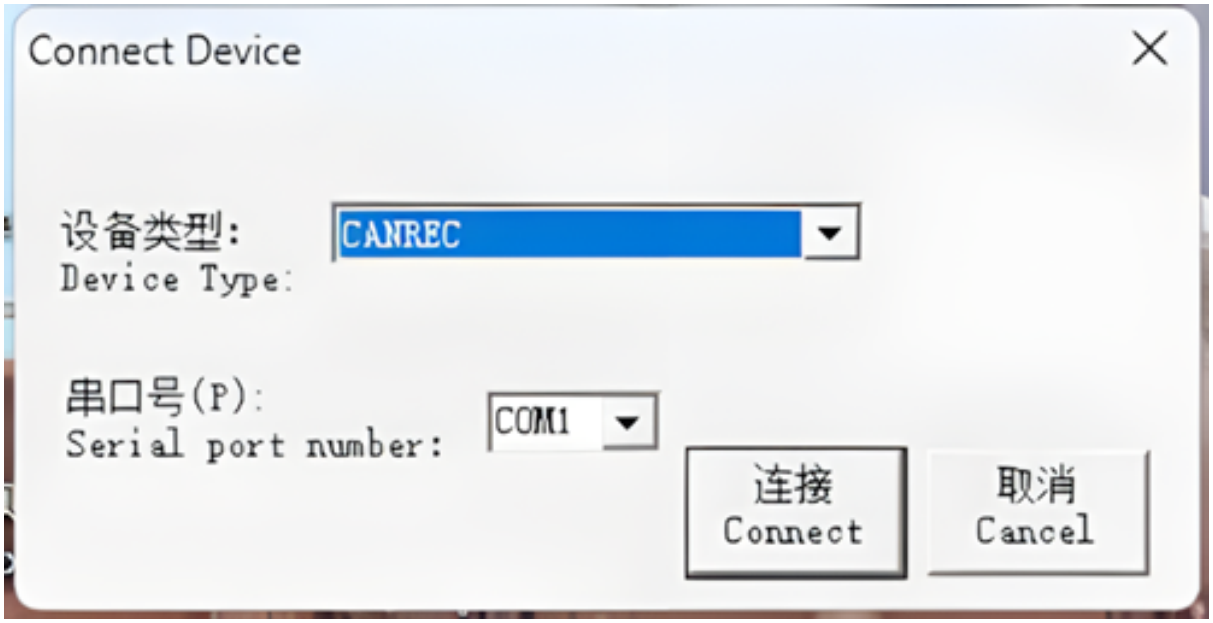


Figure 3.2 CANREC-config software main interface

After entering the software, select the serial port number to connect to the GCAN-402 and click "Connect Device" to establish a connection. If the user does not know the serial port number, they can check it in the PC's Device Manager. After clicking "Connect", a message "Parameters read successfully" will pop up, indicating that the module's current configuration has been read.

3.1.2 Configure system time

The CAN bus data storage unit integrates a system clock. The accurate system clock and file system allow the module to store and manage data daily. Specifically, a new folder is created each day according to the date, and the data for that day is automatically stored in the corresponding folder. The module creates a new file every minute in the current day's folder, saving the data received in that minute to the corresponding file.

If the module's factory time is inaccurate, the user needs to manually calibrate the system time. The system time interface is shown in Figure 3.3. The system time can be read by

clicking the "Read Time" button. The parameter before "Set Time" can be modified to "NT=XXX". For example, sending "NT=20190626094616" will change the system time to 09:46:16 on June 26, 2019. Click "Set Time".

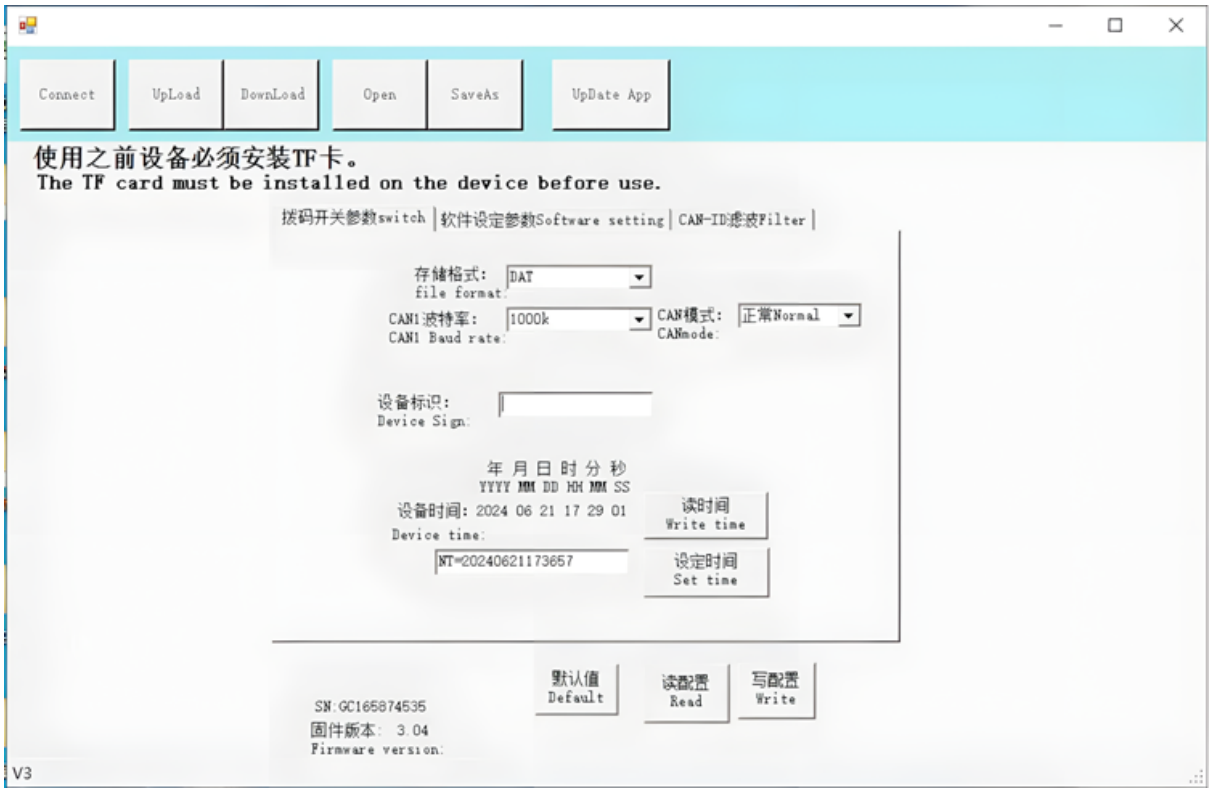
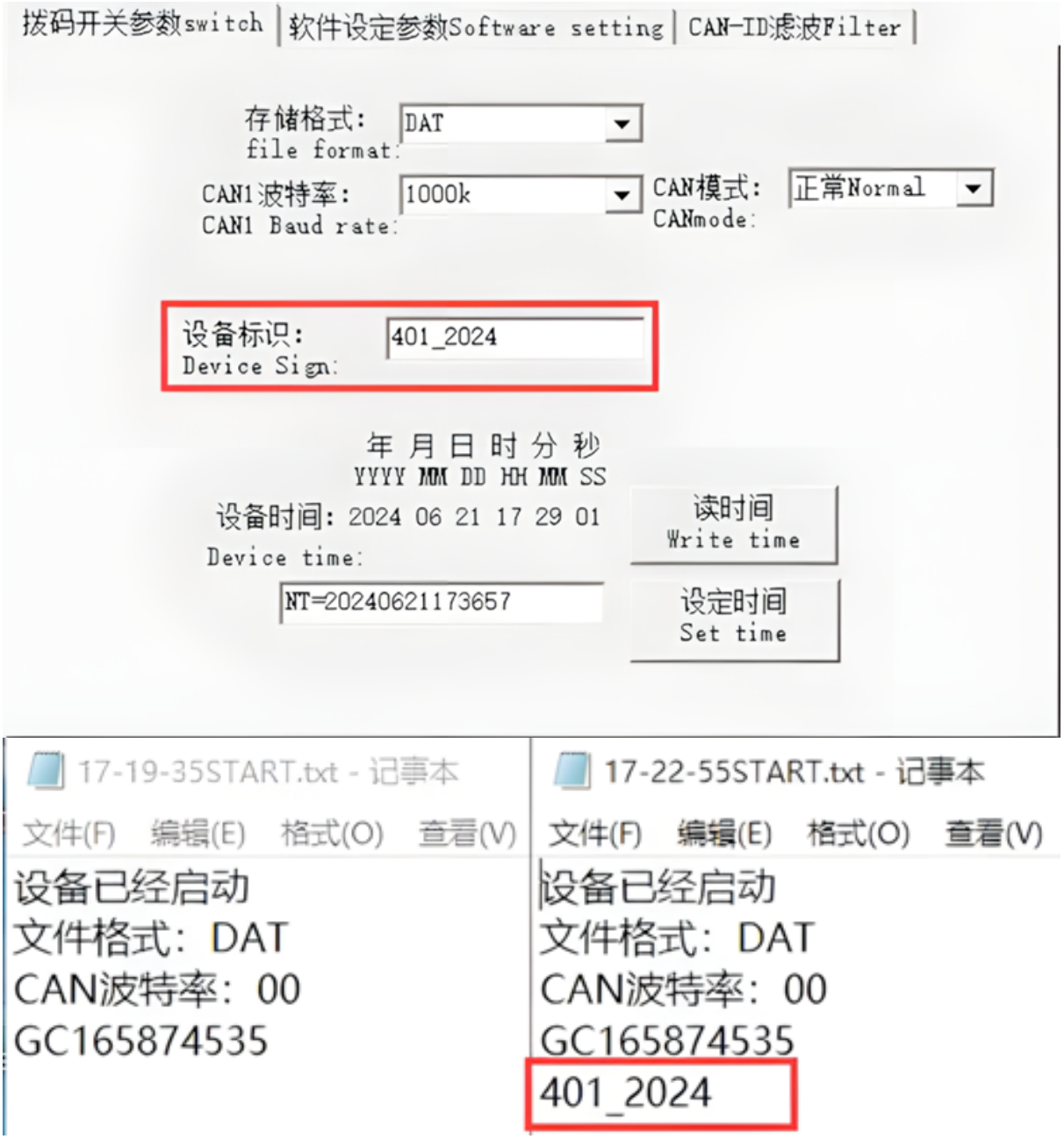


Figure 3.3 DIP switch parameter settings

CAN Mode: Here you can select Normal mode or Silent mode. For normal use, you should select the default Normal mode. Silent mode is suitable for listening to the bus without interfering with it, but data cannot be sent. In this mode, the device does not act as a CAN bus node and does not send acknowledgment or clock signals.

Device Identifier: Add a corresponding identifier to the generated START file to distinguish different devices:



3.1.3 Software Configuration Parameters

The software configuration parameter interface is shown in Figure 3.4. Users can read the parameters set by the device's DIP switches through the interface shown in Figure 3.3. The GCAN-402 module supports a full range of baud rates from 20k to 1000k. The CAN bus data storage supports four data saving formats: binary files (.DAT), text files (.TXT), Vector software-importable files (.ASC), and batch files (.CAN). By default, GCAN-402 creates a new file every minute and saves the data received in that minute to the corresponding file. The data saving time of a single file can be modified by changing the

recording duration of a single file.

Please note: It is recommended to save .DAT format files at a rate of one file per minute to avoid data corruption and loss; after checking "Use software to set parameters", the software configuration shall prevail, and the device hardware DIP switch shall be set to the digital side.

Figure 3.4 Software configuration parameter settings

3.1.4 CAN-ID Filtering

The CAN-ID filtering interface is shown in Figure 3.5. To enable filtering, you must first check "Filter Enable," and then set the filtering parameters. First, select the mode: Extended Frame Filtering or Standard Frame Filtering. After selecting, set the start ID and end ID. Frame IDs between these two IDs can be saved normally. After setting, click "Add" to add it to the filter list. If you don't need a certain filtering parameter, select it and click "Delete."

After setting the filter parameters, you need to make sure that "Filter Enable" is checked for the filtering to take effect; otherwise, the filtering function will not be enabled.

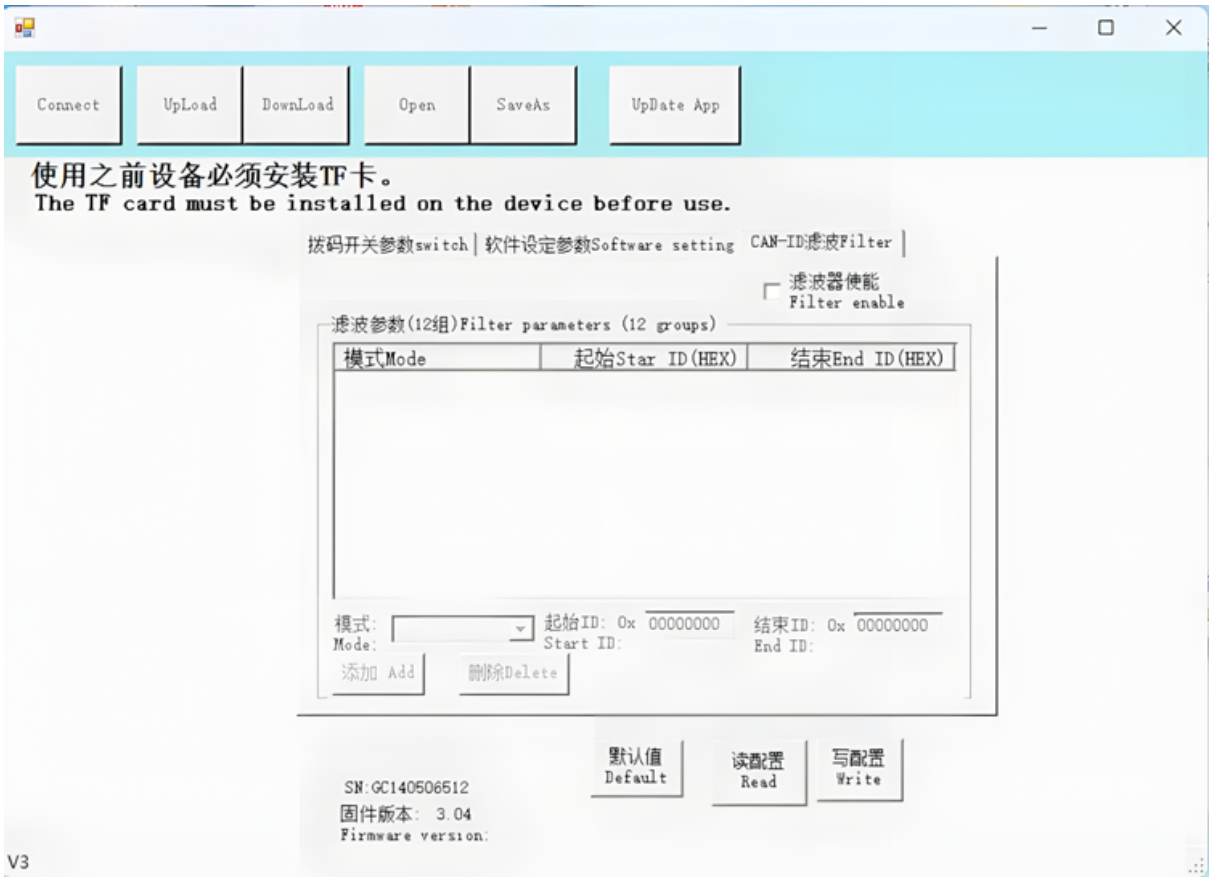


Figure 3.5 CAN-ID Filter Settings

3.1.5 Saving Parameters

After the user has configured the GCAN-402 module, they can click "Write Configuration" to download the module parameters (by switching the DIP switch to the digital side).

After the parameters are downloaded, the module needs to be powered on again for the new configuration to take effect.

Please note: Clicking "Default" will restore all configuration settings to their default state. The default working mode is that software configuration is invalid and there is no filtering.

3.2 Hardware Configuration

Before using the CAN bus data storage module, users generally need to configure the CAN bus communication parameters or entrust our company to configure them at the factory.

3.2.1 Configure CAN bus baud rate

The CAN bus data storage module can support a set of commonly used baud rates between 20K and 1000K. The baud rate can be configured by operating the DIP switch on the side of the device. The position of the DIP switch is shown in Figure 3.6.

Figure 3.6 Side view of the CAN bus data storage module

Do not power on the system yet. The DIP switches "1, 2, 3, 4, 5" can be used to configure the baud rates for CAN1 and CAN2 respectively. Terminal 8 has a special definition and defaults to facing downwards; please do not set it arbitrarily. The default value for a downward-facing DIP switch is 0, and for an upward-facing switch it is 1. See Table 3.1 for details on each baud rate.

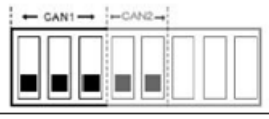
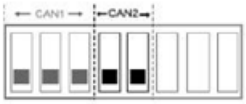
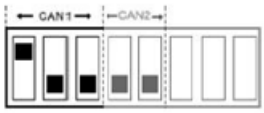
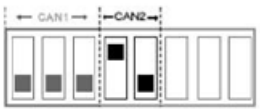
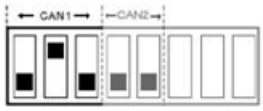
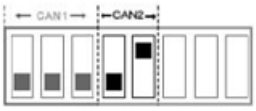
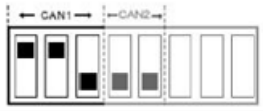
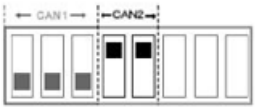
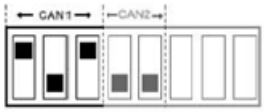
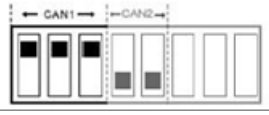
CAN1		CAN2	
1、2、3号拨码开关		4、5号拨码开关	
	1Mbps		1 Mbps
	500Kbps		500 Kbps
	250 Kbps		250 Kbps
	125 Kbps		125 Kbps
	100 Kbps		
	50 Kbps		
	40 Kbps		
	20 Kbps		

Table 3.1 Schematic diagram of baud rate DIP switch

3.2.2 Configure CAN bus terminating resistor

The CAN bus data storage has a standard 120Ω terminating resistor integrated inside the CAN bus, which can be selected for connection via a DIP switch.

3.3 Connection with CAN bus

The CAN bus data storage device can be connected to the CAN bus by connecting CAN_H to CAN_H and CAN_L to CAN_L to establish communication.

The CAN network uses a linear topology. The two furthest terminals on the bus require 120Ω terminating resistors. If the number of nodes is greater than two, intermediate nodes do not require 120Ω terminating resistors. For branch connections, the length should not exceed 3 meters. The CAN bus connection is shown in Figure 3.7.

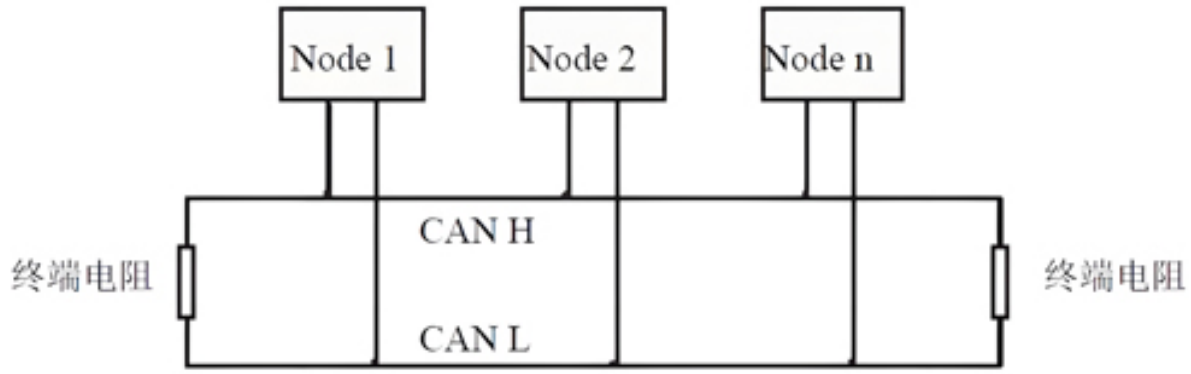


Figure 3.7 Topology of CAN network

Note: CAN cables can use ordinary twisted-pair cables or shielded twisted-pair cables. The theoretical maximum communication distance mainly depends on the bus baud rate; see Table 3.2 for the relationship between the maximum bus length and baud rate. If the communication distance exceeds 1 km, the cross-sectional area of the cable should be greater than Φ1.0 mm². The specific specifications should be determined according to the distance, and generally, the cable size should be increased appropriately as the distance increases.

波特率	总线长度
1 Mbit/s	25m
500 kbit/s	100m
250 kbit/s	250m
125 kbit/s	500m
50 kbit/s	1.0Km
20 kbit/s	2.5Km
10 kbit/s	5.0Km
5 kbit/s	13Km

Table 3.2 Baud Rate and Maximum Bus Length Reference Table

3.4 CAN bus terminating resistor

To enhance the reliability of CAN communication and eliminate interference from CAN bus terminal signal reflections, terminating resistors are typically added to the two furthest endpoints of the CAN bus network, as shown in Figure 3.8. The value of the terminating resistor is determined by the characteristic impedance of the transmission cable. For example, if the characteristic impedance of the twisted pair cable is 120Ω, then 120Ω terminating resistors should also be integrated at both endpoints of the bus.

The GCAN-402 series module has a standard 120Ω terminating resistor integrated inside the CAN channel. The resistor can be connected to the bus via a DIP switch: switch 1 controls the resistor corresponding to CAN1, and switch 2 controls the resistor corresponding to CAN2. Switching to the ON position will enable the resistor.

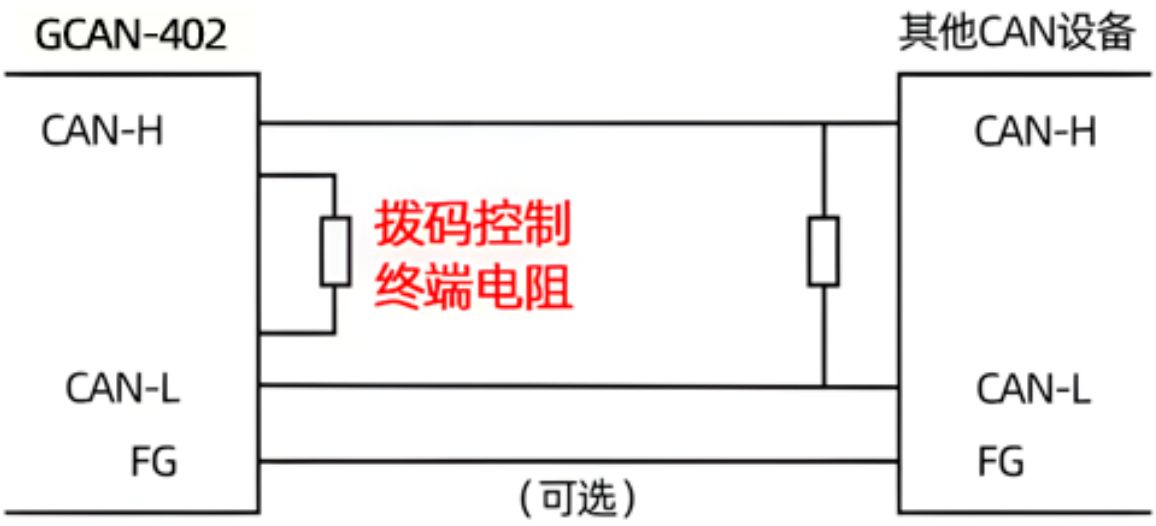


Figure 3.8 Connection of the CAN bus data storage module with other CAN node devices

3.5 System status indicator lights

The CAN bus data storage has one SYS indicator light to indicate the system operating status and one DAT indicator light to indicate CAN bus data transmission and TF card status. The specific functions of these two indicator lights are shown in Table 3.3, and the meanings of their various states are shown in Table 3.4.

指示灯	颜色	指示状态
SYS	绿	系统运行指示
DAT	绿	CAN通信状态指示和TF卡状态

Table 3.3 CAN Bus Data Memory Indicator Lights

After the CAN bus data storage is powered on, the system status indicator SYS flashes, indicating that the device has been powered on and the system initialization has been successful; otherwise, it indicates that there is a power failure in the system.

After the CAN bus data storage is powered on, if the DAT indicator light remains constantly on, it indicates that the TF card is in an abnormal state. Please check if the TF card is installed correctly, if it is being used properly, and if the format is exFAT. If the DAT indicator light illuminates and then immediately goes out, it indicates that the TF

card is in good condition and can store data normally. When CAN data is received, the DAT indicator light will flash at the same frequency as the data storage.

指示灯	状态	指示状态
SYS	不亮	系统故障
	常亮	系统初始化失败
	闪烁	系统初始化正常
DAT	点亮后熄灭	CAN总线无数据传输
	闪烁	CAN总线有数据传输
	点亮后常亮	TF卡状态异常
	点亮后慢闪	存储数据格式为Dat格式

Table 3.4 CAN Bus Data Memory Indicator Status

4. Storage Instructions

Please note: The CAN bus data storage supports TF memory cards with a maximum capacity of 128GB and a file system format of exFAT. If your TF card is not in this format, you need to reformat the memory card to exFAT format. Formatting the memory card will erase all data, so please operate with caution!

Please note: TF card storage is based on saving one frame of data per 1ms, with 24-hour continuous storage as an example. Data can be stored for approximately 24 days (32GTF card). Once full, previous files will be automatically overwritten.

The CAN bus data storage unit integrates a system clock. The accurate system clock and file system allow the module to store and manage data daily. Specifically, a new folder is created each day according to the date, and the data for that day is automatically stored in the corresponding folder. The module creates a new file every minute in the current day's folder and saves the data received in that minute to the corresponding file, as shown in Figure 4.1.

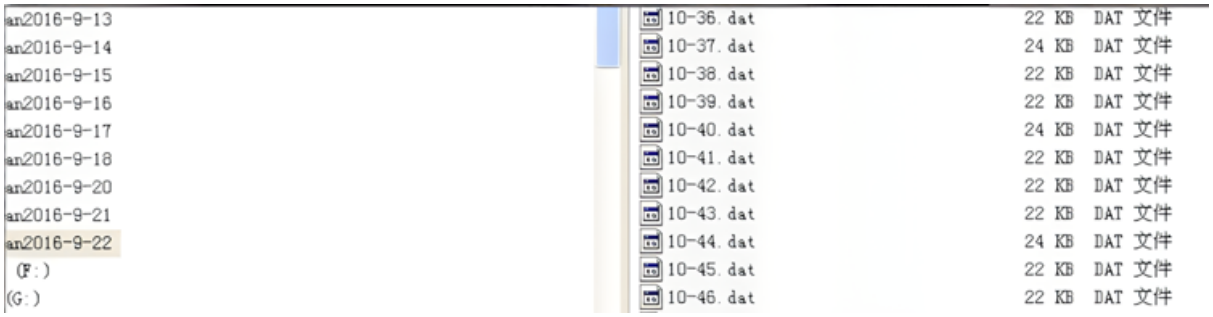


Figure 4.1 File saving format

The CAN bus data storage supports four data storage formats: binary files (.DAT), text files (.TXT), Vector software importable files (.ASC), and batch files (.CAN). These can be switched using the sixth and seventh switches in the 8-bit DIP switch, as shown in Figure 4.2.

Figure 4.2 File save type switch

Terminals 6 and 7 allow you to set the data storage file format. The default value is 1 for upward and 0 for downward.

6.7 拨码位置	存储格式
00	二进制文件 dat
01	文本文件 txt
10	Vector 软件可导入文件 asc
11	批处理文件 can

Please note: Only binary files are supported for conversion.

4.1 Example of saving binary files

The data content stored in the binary file is shown in Figure 4.3.

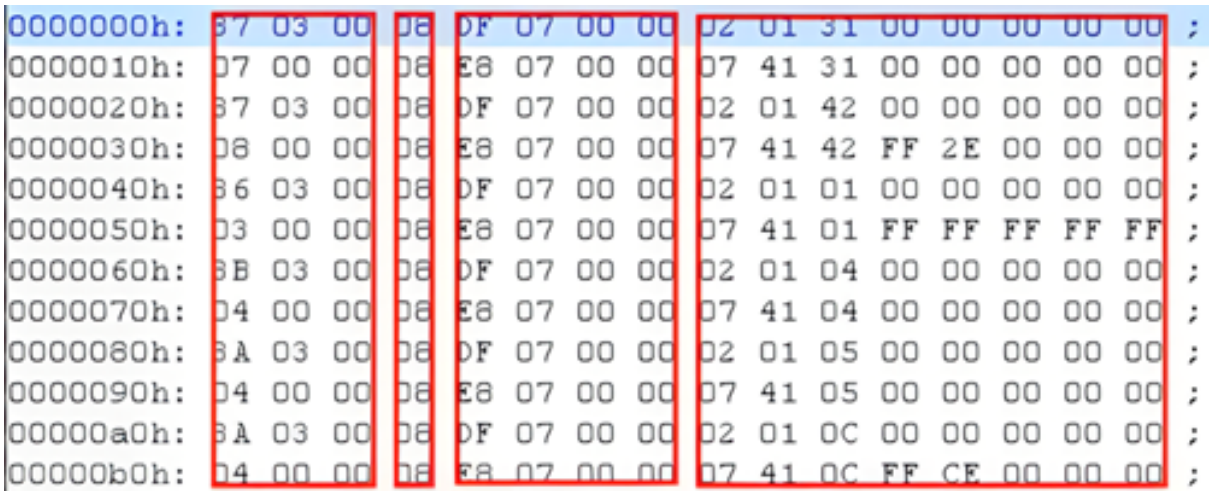


Figure 4.3 Binary file data saving format

When the user chooses to save as a binary file format, the specific data meanings are as follows:

The first three bytes: frame interval time, with a precision of 0.1ms. The third byte: 00 represents CAN1, 01 represents CAN2.

The fourth byte: Frame information

Bytes 5, 6, 7, and 8: Frame ID

From the ninth byte onwards: Frame data

Please note: Binary files support file merging and conversion; only .DAT format files support conversion. Users can batch merge saved binary files and convert them into text or Excel spreadsheet formats, as follows:

1. Open the CANRecToolsV1.5 software on the CD. The software interface is shown in Figure 4.4.

2. Click the "Browse" button at the top of the software, select the folder containing the files you want to merge, and click OK. At this point, all files in that folder will be loaded

into the software.

3. Select the files you want to merge and convert, and select the type of data to export (do not select files that only have timestamps and no data).

4. Click "Export Data", select the location to save the data and set the file name, then click "Save" to start the conversion.

5. Wait for the progress bar to complete, then click OK.

Figure 4.4 CANRecToolsV1.5 software interface

The converted data format is shown in Figure 4.5.

Date Time	Chanel	ID(HEX)	Type	Format	Len	Data
2019-01-16 09:22:09 628.4	0	0	0	0	8	00 01 02 03 04 05 06 07
2019-01-16 09:22:09 638.3	0	0	0	0	8	01 01 02 03 04 05 06 07
2019-01-16 09:22:09 648.3	0	0	0	0	8	02 01 02 03 04 05 06 07
2019-01-16 09:22:09 660.7	0	0	0	0	8	03 01 02 03 04 05 06 07
2019-01-16 09:22:09 668.1	0	0	0	0	8	04 01 02 03 04 05 06 07
2019-01-16 09:22:09 678.1	0	0	0	0	8	05 01 02 03 04 05 06 07
2019-01-16 09:22:09 688.0	0	0	0	0	8	06 01 02 03 04 05 06 07
2019-01-16 09:22:09 697.9	0	0	0	0	8	07 01 02 03 04 05 06 07
2019-01-16 09:22:09 707.9	0	0	0	0	8	08 01 02 03 04 05 06 07
2019-01-16 09:22:09 717.8	0	0	0	0	8	09 01 02 03 04 05 06 07
2019-01-16 09:22:09 727.8	0	0	0	0	8	0A 01 02 03 04 05 06 07
2019-01-16 09:22:09 737.7	0	0	0	0	8	0B 01 02 03 04 05 06 07
2019-01-16 09:22:09 747.6	0	0	0	0	8	0C 01 02 03 04 05 06 07
2019-01-16 09:22:09 757.6	0	0	0	0	8	0D 01 02 03 04 05 06 07
2019-01-16 09:22:09 767.5	0	0	0	0	8	0E 01 02 03 04 05 06 07
2019-01-16 09:22:09 777.4	0	0	0	0	8	0F 01 02 03 04 05 06 07
2019-01-16 09:22:09 787.4	0	0	0	0	8	10 01 02 03 04 05 06 07
2019-01-16 09:22:09 797.3	0	0	0	0	8	11 01 02 03 04 05 06 07
2019-01-16 09:22:09 807.2	0	0	0	0	8	12 01 02 03 04 05 06 07
2019-01-16 09:22:09 817.2	0	0	0	0	8	13 01 02 03 04 05 06 07
2019-01-16 09:22:09 827.1	0	0	0	0	8	14 01 02 03 04 05 06 07
2019-01-16 09:22:09 837.1	0	0	0	0	8	15 01 02 03 04 05 06 07
2019-01-16 09:22:09 847.0	0	0	0	0	8	16 01 02 03 04 05 06 07
2019-01-16 09:22:09 856.9	0	0	0	0	8	17 01 02 03 04 05 06 07
2019-01-16 09:22:09 866.9	0	0	0	0	8	18 01 02 03 04 05 06 07
2019-01-16 09:22:09 876.8	0	0	0	0	8	19 01 02 03 04 05 06 07
2019-01-16 09:22:09 886.7	0	0	0	0	8	1A 01 02 03 04 05 06 07
2019-01-16 09:22:09 896.7	0	0	0	0	8	1B 01 02 03 04 05 06 07
2019-01-16 09:22:09 906.6	0	0	0	0	8	1C 01 02 03 04 05 06 07
2019-01-16 09:22:09 916.6	0	0	0	0	8	1D 01 02 03 04 05 06 07
2019-01-16 09:22:09 926.5	0	0	0	0	8	1E 01 02 03 04 05 06 07
2019-01-16 09:22:09 936.4	0	0	0	0	8	1F 01 02 03 04 05 06 07
2019-01-16 09:22:09 946.4	0	0	0	0	8	20 01 02 03 04 05 06 07
2019-01-16 09:22:09 956.3	0	0	0	0	8	21 01 02 03 04 05 06 07

Figure 4.5 Data format after conversion by CANRecToolsV1.5 software

in:

DateTime indicates the time when the data was received, with a precision of 0.1ms.

Chanel indicates the channel number, with 0 representing channel one and 1 representing channel two.

ID represents the frame ID.

Type indicates the frame type: data frame 0, remote frame 1.

Format indicates the frame format: standard frame 0, extended frame 1.

Len represents the data length.

Data represents frame data.

4.2 Example of saving a text document

The data content saved in the text file is shown in Figure 4.6.

Figure 4.6 Text file data saving format

When the user chooses to save as a text file, the specific meaning of the data is as follows:

First column: Frame interval time, precision 0.1ms (6 characters)

Example: 0x000064 converted to decimal as 100 (unit: ms)

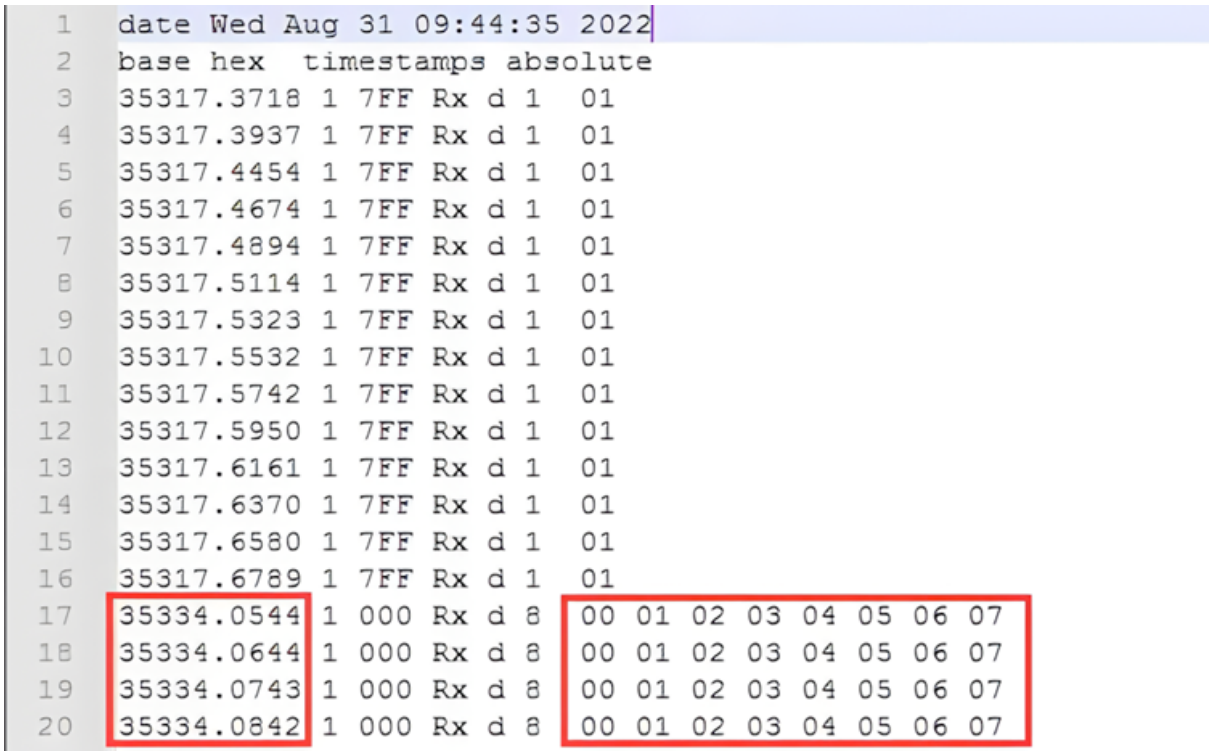
Second column: Frame information (2 characters)

Third column: Frame ID (8 characters)

After the fourth column: Frame data

4.3 Examples of importing and saving files in Vector software

The data content of the file (.ASC) that Vector software can import is shown in Figure 4.7.



```
date Wed Aug 31 09:44:35 2022
base hex  timestamps absolute
35317.3718 1 7FF Rx d 1  01
35317.3937 1 7FF Rx d 1  01
35317.4454 1 7FF Rx d 1  01
35317.4674 1 7FF Rx d 1  01
35317.4894 1 7FF Rx d 1  01
35317.5114 1 7FF Rx d 1  01
35317.5323 1 7FF Rx d 1  01
35317.5532 1 7FF Rx d 1  01
35317.5742 1 7FF Rx d 1  01
35317.5950 1 7FF Rx d 1  01
35317.6161 1 7FF Rx d 1  01
35317.6370 1 7FF Rx d 1  01
35317.6580 1 7FF Rx d 1  01
35317.6789 1 7FF Rx d 1  01
35334.0544 1 000 Rx d 8  00 01 02 03 04 05 06 07
35334.0644 1 000 Rx d 8  00 01 02 03 04 05 06 07
35334.0743 1 000 Rx d 8  00 01 02 03 04 05 06 07
35334.0842 1 000 Rx d 8  00 01 02 03 04 05 06 07
```

Figure 4.7 ASC file data saving format

When the user chooses to save the file as an ASCII file, the specific meaning of the data is as follows:

First column: Data time (absolute time of the day the data was received, calculated from 00:00:00, unit: seconds). Example: 35334.0544 represents 9:48:54 on the same day.

Second column: CAN channels, 1 represents CAN1, 2 represents CAN2.

Third column: CAN ID

Fourth column: Data type (default is Rx)

Fifth column: Frame type (d is a data frame, r is a remote frame)

Column 6: Frame Data Length

After the seventh column: Frame data

4.4 Example of saving batch files

The data content saved in the batch file is shown in Figure 4.8.

Figure 4.8 Batch file data saving format

When the user chooses to save as a batch file format, the specific data meanings are as follows:

First column: Frame interval time (unit: ms)

Second column: Standard frame 0, Extended frame 1

Third column: Data frame 0, Remote frame 1

Fourth column: Frame ID

After the fifth column: Frame data

4.5 File Merging

If you find that you have too many documents saved, you can use the batch file merging method to combine the data from all files into one file. The specific method is as follows:

Taking merging text files (.txt) as an example, create a new text document in the folder where you want to merge the files, and enter the following content in the document:

The file is named `copy*.txt merge_file.txt` (the final merged file is named `merged_file.txt`, and the name can be changed arbitrarily). See Figure 4.9.

(Other file formats are also supported for merging; simply change "txt" in the content to "ASC" or "CAN".)

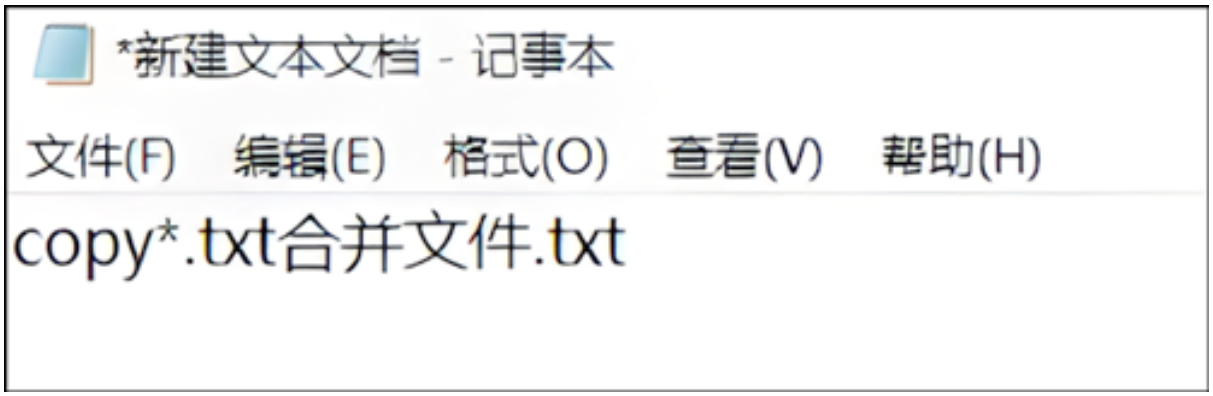


Figure 4.9 Document Illustration

After you finish typing, save the file, then close the file and change the file extension to .bat.

After double-clicking to run, you'll see a black window pop up briefly before closing.

Afterwards, you will see a new file in the folder: "Merge Files.txt". All the data has now been merged.

5. Technical Specifications

连接方式	
CAN	OPEN4接线端子
电源	OPEN3接线端子
TF卡支持	
TF卡	容量最高为128G，文件系统必须为exFAT
接口特点	
CAN协议	遵循ISO 11898标准，支持CAN2.0A/B
CAN波特率	20Kbit/s~1Mbit/s，通过拨码开关配置
电气隔离	2500V DC
CAN终端电阻	已集成，通过拨码开关选择是否接入
供电电源	
供电电压	+9~30V DC
供电电流	50mA，24V DC
环境试验	
工作温度	-40℃~+85℃
工作湿度	15%~90%RH，无凝露
EMC测试	EN 55024:2011-09 EN 55022:2011-12
防护等级	IP 20
基本信息	
外形尺寸	102mm *63mm *23mm
重量	130g