

CANFDBridge Smart

CAN(FD)-BUS Communication Products

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Product User Manual

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1. Functions

1.1 Overview

The CANFDBridge intelligent CANFD bridge is a high-performance CAN (FD) relay and CAN (FD) message conversion device. It can increase the load capacity of the bus and extend the communication distance, match CAN (FD) networks with different communication baud rates, and support the conversion of CAN and CANFD networks.

CANFDBridge, as a CAN (FD) intelligent bridge, supports the default conversion processing of CAN to CAN, CAN to CANFD, CANFD to CAN, CANFD to CANFD and other messages. In addition, it provides special conversion processing such as frame mapping, merging (several CAN messages form a CANFD message) and splitting (a CANFD message is split into several CAN messages). You can freely set the rules for forwarding and mapping, grouping and unpacking of CAN (FD) messages to meet your own application needs. After you connect the PC over the USB interface, use the CANFDBridge configuration tool to configure the baud rate and rules. Then you can use it offline easily.

1.2 Features

- ◆ Two completely electrically isolated CAN (FD) channels. You can choose whether the CAN controller is CAN or CANFD;
- ◆ Support both ends of CAN (FD) channel baud rate setting. Common baud rates can be set, and the baud rate can be customized;
- ◆ The baud rate range is 40k-5Mbps;
- ◆ Supports setting the 120-ohm terminal resistance switch at both ends of the CAN (FD) channel;
- ◆ Supports setting the receiving hardware filtering function of CAN (FD) channels at both ends. Each channel supports 64 standard/extended frame IDs. The filtering method is whitelist filtering, which minimizes the load of the CAN bus;
- ◆ When using USB to connect the device to the computer, you can enable the function of automatically reporting and recording the current error status and error count (sending and receiving error counts) of the CAN (FD) channels at both ends by using the CANFDBridge configuration tool. It can be used as a very practical CAN network status analyzer, which quickly determines the CAN communication quality;
- ◆ Supports CAN (FD) message forwarding, including three forwarding modes: (1) basic forwarding; (2) frame mapping; (3) grouping and unpacking. The forwarding function is mainly for received CAN(FD) frames. Before forwarding, the received frames are processed such as mapping, grouping and unpacking, and the processed frames are sent. **The processing priority is: grouping and unpacking > frame mapping > basic forwarding;**
- ◆ After forwarding fails, return the specified frame to tell the sender that the forwarding failed;
- ◆ In the case of relaying, the CAN single-channel standard frame rate can reach 6,000

frames/s, and the CANFD single-channel standard frame rate can reach 4,600 frames/s;

- ◆ When only the relay is used, the forwarding delay is about 40 us. When frame mapping and merging and splitting functions are used at the same time, the forwarding delay is about 50 us. The more frame mapping, merging and splitting rules, the greater the forwarding delay. The forwarding delay is also affected by the baud rate. When the baud rate value is small, such as 50 kbps, the forwarding delay is up to 60 us;
- ◆ The CAN-bus circuit adopts 2,500 V DC electrical isolation;
- ◆ Can be used in environments with safety and explosion-proof requirements;
- ◆ Operating temperature: -40°C to +85°C; Operating power: less than 2 W;

1.3 Typical Applications

- Coal mine telecommunication;
- Industrial site control;
- Remote monitoring and data collection;
- Electrical communication;

2. Hardware

2.1 Appearance and Installation Dimensions

Figure 2.1 and Figure 2.2 show the appearance and installation dimensions.



Figure 2.1 CANFDBridge appearance (without mounting ears)

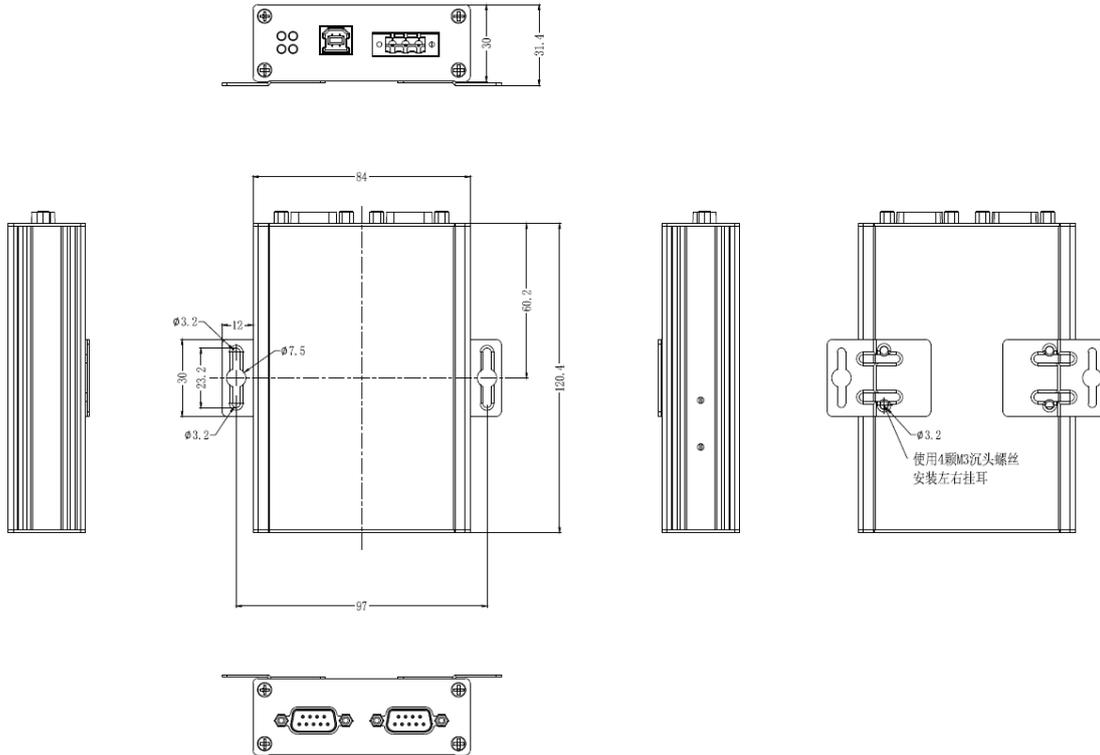


Figure 2.2 CANFDBridge installation dimensions

2.2 Power Supply and USB Interface

CANFDBridge has two power supply methods. The first is powered via USB and the second is powered via DC power. It can work with any power supply method. An external power supply and a USB cable are also possible, but it is recommended to use the USB power supply method when you configure the device, and DC power supply in other cases. The USB cable is type B (square port), and a USB cable is provided before delivery. Table 2.1 lists the pin definitions of the DC power interface.

Table 2.1 Interface description

Type	Schematic Diagram	Pin definitions	Pin description
OPEN3		1: GND	Power input negative
		2: EARTH	Ground
		3: 9V-48V	Power input positive

2.3 CAN(FD) Communication Interface

CANFDBridge has two CAN(FD)-bus interfaces. Table 2.2 lists the interface pin definitions.

Table 2.2 CAN interface definitions

Type	Schematic Diagram	Pin definitions	Pin description
DB9 socket		1: NC	Dangling
		2: CAN_L	CAN data transceiving differential inverted signal
		3, 6: CAN_GND	CAN isolated ground
		4, 8: NC	Dangling
		5: Shield	Shielding ground
		7: CAN_H	CAN data sending and receiving differential positive phase signal
		9: NC	Dangling
DB9 socket		1: NC	Dangling
		2: CAN_L	CAN data transceiving differential inverted signal
		3, 6: CAN_GND	CAN isolated ground
		4, 8: NC	Dangling
		5: Shield	Shielding ground
		7: CAN_H	CAN data sending and receiving differential positive phase signal
		9: NC	Dangling

2.4 Indicators

CANFDBridge has four red and green bi-color LEDs to indicate its operating status. Table 2.3 lists the functions.

Table 2.3 LED indicators

Indicator	STATUS	Indication status
SYS indicator	Green	Power on equipment
	Off	The device is not powered on
	Green flashing	Device running
USB indicator light	Off	USB cable not connected
	Always red	USB cable connected but driver not installed
	Green normally on	The USB driver has been installed, and the USB cable has been connected
	Green flashing	The USB is communicating with the device
	Flash in red	USB and device communication error

CANFD Channel indicator (Channel 0, Channel 1)	Green normally on	The CAN channel is idle
	Green flashing	The CAN channel is sending/receiving data
	Flash in red	CAN channel bus error

2.5 CAN Bus Connection

The physical layer mainly transmits inter-device signals, converts various information into transmittable physical signals (usually electrical or optical signals), and transmits these signals to other target devices. For this purpose, CAN-bus has made detailed regulations on signal levels, cables and connectors used for communication.

Two standards are released after CAN-bus was standardized by ISO, namely ISO11898-2 (125kbps-1Mbps high-speed communication standard) and ISO11898-3 (low-speed communication standard less than 125 kbps).

The CAN transceiver determines the bus level based on the voltage difference between the two cables. This transmission method is called differential transmission. There are only two possibilities for the level signal transmitted on the cable, namely the dominant level and the recessive level. The dominant level indicates logic 0, and the recessive level indicates logic 1. Table 2.4 lists the high-speed CAN electrical characteristics.

Table 2.4 CAN-BUS interface specifications

parameter		Minimum	Typical value	Maximum	Unit
Communication baud rate		5k		1M	bps
Number of nodes				110	pcs
Dominant level (logic 0)	CANH	2.75	3.5	4.5	V
	CANL	0.5	1.5	2.25	
Recessive level (logic 1)	CANH	2	2.5	3	
	CANL	2	2.5	3	
Differential level	Dominant (logic 0)	1.5	2	3.0	
	Recessive (logic 1)	-0.5	0	0.05	
Maximum withstand voltage of the bus pin		-18		18	
Instantaneous voltage of the bus		-100		+100	
Isolation voltage (DC)		2500			V

The CAN bus adopts balanced transmission. ISO11898-2 stipulates: In the high-speed CAN, a 120 ohm terminal resistor needs to be connected to the network terminal node to eliminate signal reflection on the bus and avoid signal distortion. Figure 2.3 shows the high-speed CAN network topology.

The device has a built-in 120 ohm terminal resistance, which can be configured to turn on or off by using the CANCfg configuration tool.

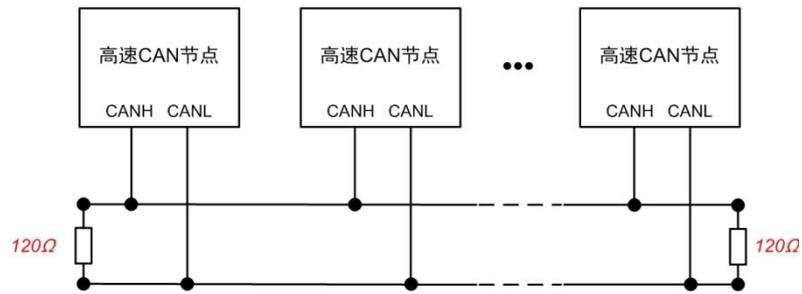


Figure 2.3 High-speed CAN topology

Note: The bus communication distance and communication rate are related to the field application and can be designed according to the actual application and related standards. The CAN-Bus cable can use ordinary twisted pair, shielded twisted pair or standard bus communication cable. In long-distance communication, the terminal resistance value needs to be selected according to the communication distance, cable impedance and number of nodes.

3. Driver and Configuration Tool Installation

After CANFDBridge is connected to the computer using the USB Type-B cable, use the CANCfg software to configure the parameters. Therefore, install CANFDBridge driver and CANCfg host computer software before using CANFDBridge. This document uses a computer running Windows 7 as an example to describe how to install the CANFDBridge driver and CANCfg host computer software and describe the operation of the CANCfg software.

3.1 Installing the Driver on Windows

First, connect the CANFDBridge device to the computer with a USB cable to ensure that the device is powered properly. Right-click [Computer] and choose [Properties] (as shown in Figure 3.1) to open the Device Manager. Before the driver is installed, the Device Manager is displayed, as shown in Figure 3.2. At this time, if the device manager does not display the message, check whether the USB cable is connected correctly, whether the USB port of the computer is disabled, and whether the device indicator USB is on.



Figure 3.1 Opening the computer device manager

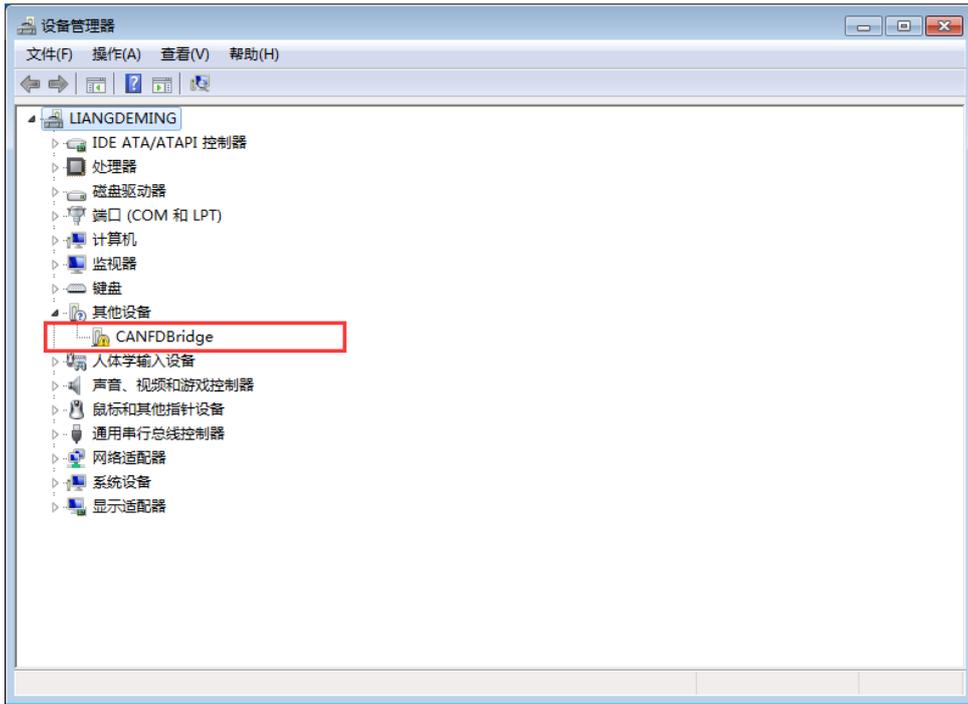


Figure 3.2 No driver installed

Right-click [CANFDBridge] and choose [Update Driver Software]. The update driver software interface appears, as shown in Figure 3.3.

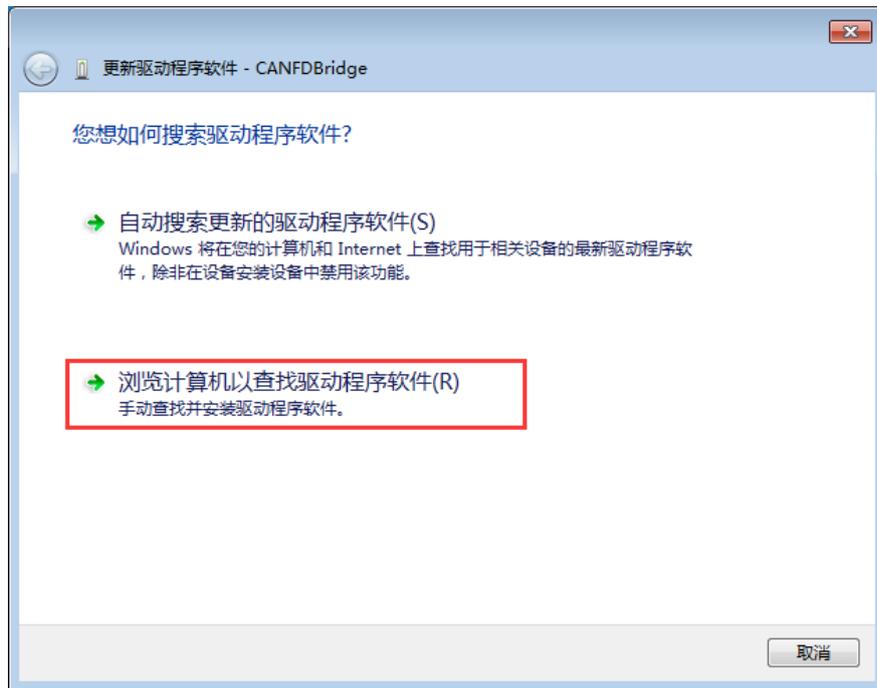


Figure 3.3 Updating the driver

As shown in Figure 3.4, in the pop-up interface, click [Browse], select the official CANFDBridge driver folder, click [Next], and wait until the driver is installed.

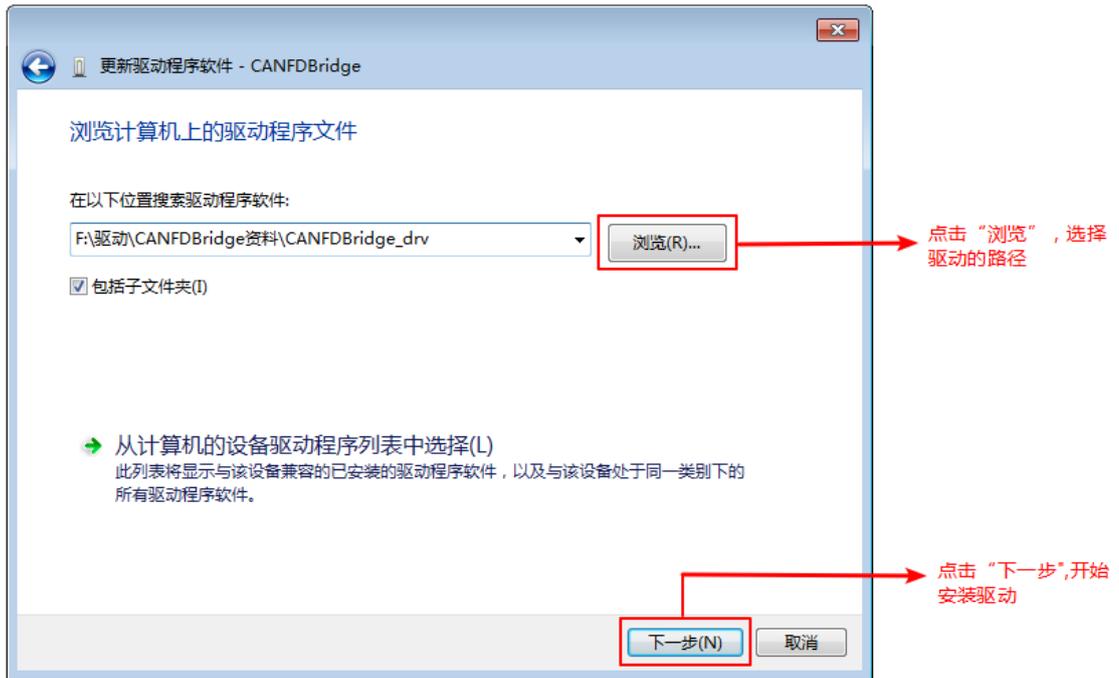


Figure 3.4 Installing the driver

After the installation is complete, the message "The driver file has been successfully updated" appears. Click the [Close] button to complete the installation, as shown in Figure 3. 5.

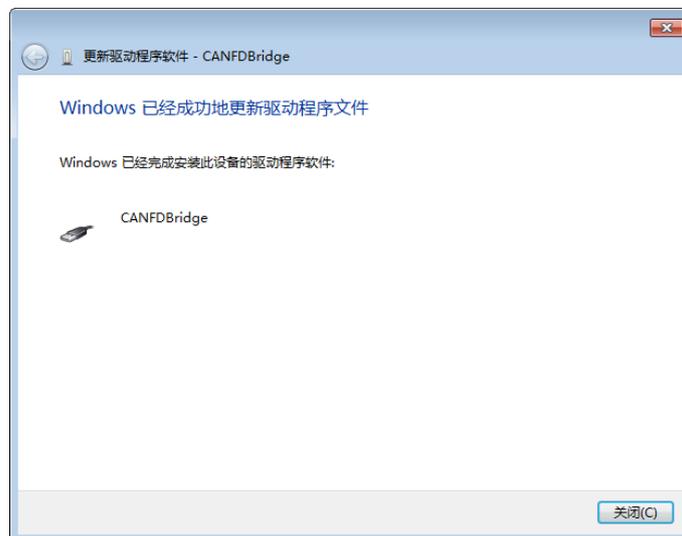
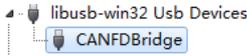


Figure 3.5 Driver installation complete

After driver installation,  is displayed in the device manager, which indicates that the driver is installed correctly, and the device USB indicator changes from red to green. At this time, the CANFDBridge and PC have been

connected, and the CANFDBridge can be configured by using the CANCfg host computer software.

3.2 Installing the Software CANCfg on the PC

CANCfg software is the company's CAN-Hub and CAN-Bridge equipment-specific configuration software running on the Windows platform. You can obtain and change the configuration parameters of the CANFDBridge device and upgrade the device firmware by using the CANCfg software.

3.2.1 Configuration Tool Installation Example

You can download the latest version of CANCfg software from the official website of ZLG Electronics www.zlg.cn by searching for "CAN networking equipment configuration tool". Double-click the unzipped CANCfgSetup.exe file. The welcome window appears, as shown in Figure 3.6. Click [Next] to install.

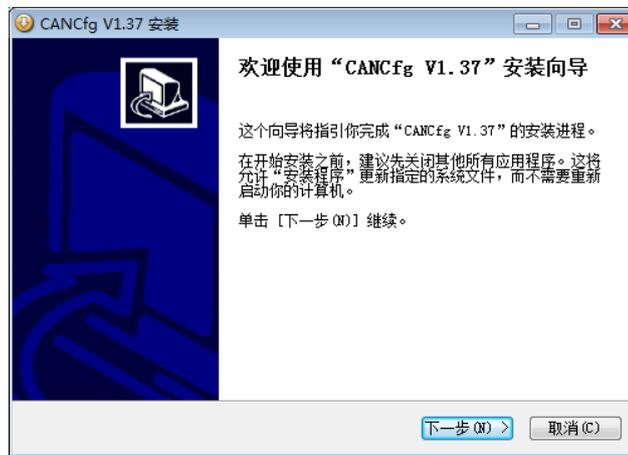


Figure 3.6 Welcome interface

The window shown in Figure 3.7 appears. The window asks for the installation path (The default installation path is C:\Program Files(x86)\CANCfg). To change the installation path, click [Browse].

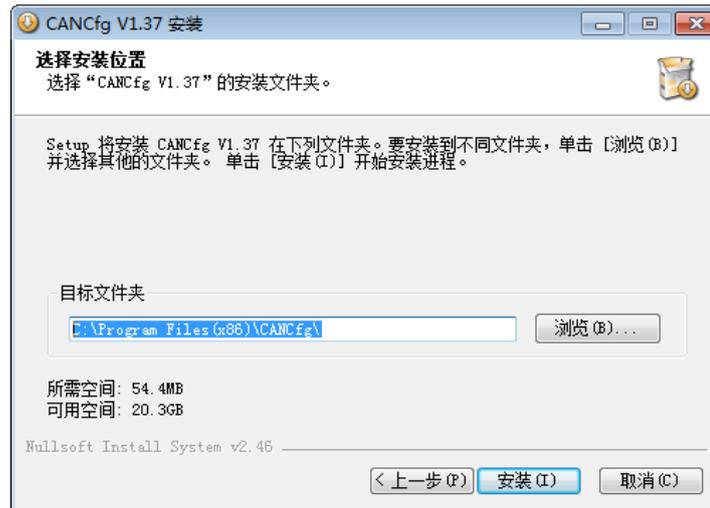


Figure 3.7 Selecting an installation path

Click [Install] to install the file in the installation path. After the installation is complete, the successful installation message as shown in Figure 3.8 will appear. Click [Finish] to exit the installation software.



Figure 3.8 Installation complete

4. Quick Instructions

This chapter describes the operation of the CANFDBridge device by using the CANCfg software to help you get familiar with the product.

4.1 Obtaining Basic Device Information

Double-click  to run the CANCfg software. Figure 4.1 shows the software interface.

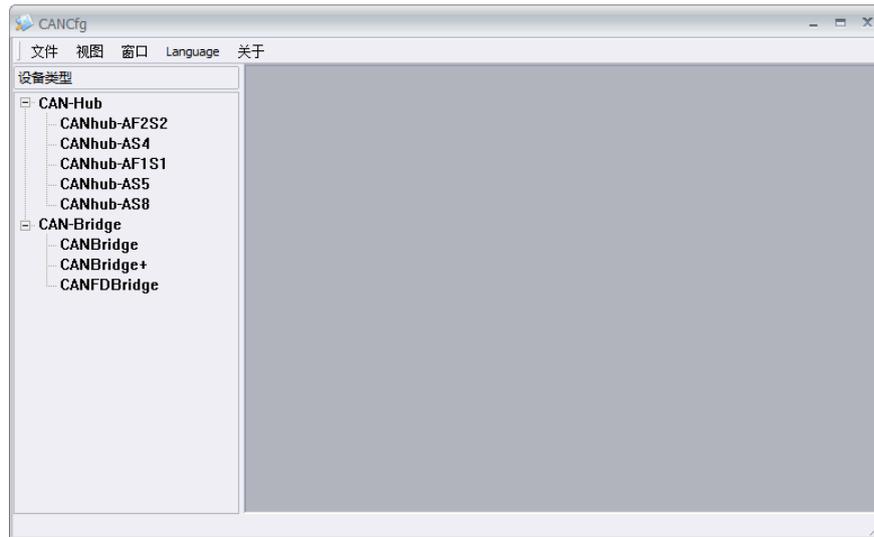


Figure 4.1 CANCfg running interface

Click the CANFDBridge in the left device type. The CANFDBridge configuration interface appears, as shown in Figure 4.2.

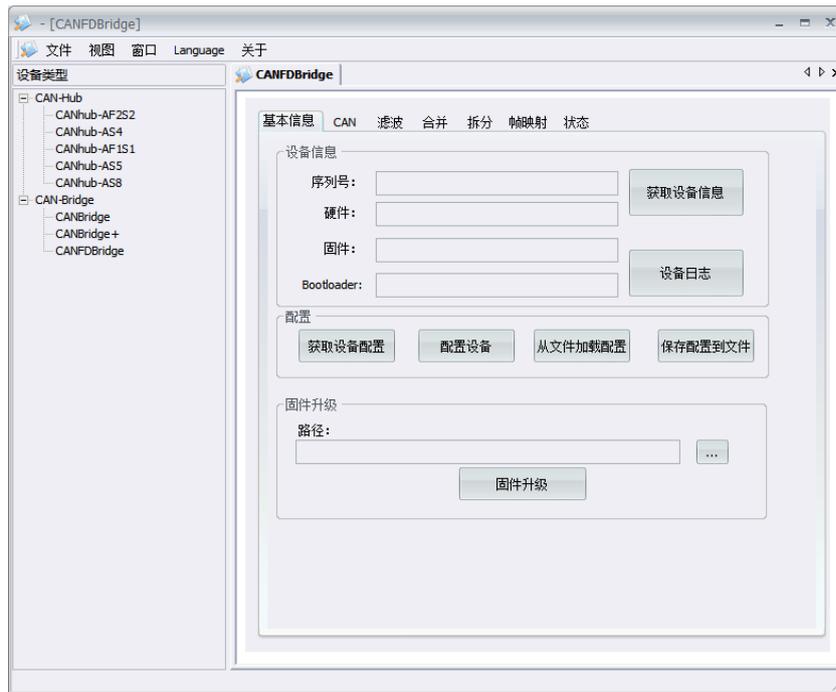


Figure 4.2 CANFDBridge basic information

After connecting the device, you can click  to get the device information. Figure 4.3 shows the information obtained by using the device this time. If the information cannot be obtained, the device may not be properly connected to the computer. Check whether the device USB indicator is solid red. If yes, the connection to the computer is abnormal, or the driver is not installed.

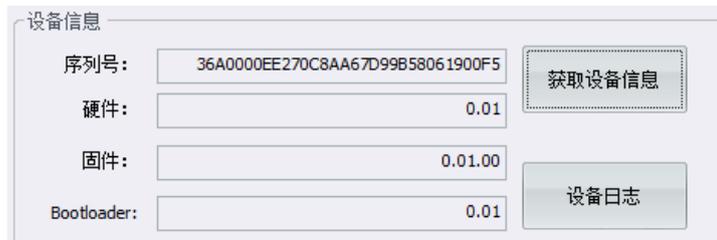


Figure 4.3 Obtaining the CANFDBridge device information

4.2 Managing Device Configurations

On the CANFDBridge basic information interface, the four buttons in the configuration part indicate:

[Get device configuration] means to obtain all configuration parameters of the device from the current device. Click this button to display the current device configurations, including the baud rate, filtering, relaying, fallback, frame mapping, merging and splitting.

[Configure device] means to write the configuration parameters in the window such as baud rate, filtering, relay, fallback, frame mapping, merging and splitting into the device. The configuration takes effect immediately after being written.

[Load configurations from files] Load configurations from the previously saved configuration file into the baud rate, filter, relay, failback, frame map, merge and split windows. To configure to a device, click the [Configure Device] button.

[Save configurations to files] Save the current baud rate, filtering, relay, failback, frame mapping, merging and splitting and other window parameters to a file, which facilitates next use or other devices.

4.3 Configuring Parameters

4.3.1 CAN

The CAN window is used to configure the two channel parameters of CANFDBridge, such as baud rate, CAN controller type, and termination resistance enable, as shown in Figure 4.4.



Figure 4.4 Baud rate

Each channel supports setting the controller type, as shown in Figure 4.5. When the selected type is CAN, only CAN messages can be sent and received. You can set the port controller type connected to the CAN bus to CAN to prevent CANFD messages from being forwarded to the CAN bus. When the selected type is CANFD, both CAN messages and CANFD messages can be sent and received.



Figure 4.5 Controller types

Each channel supports setting the CANFD protocol standard, as shown in Figure 4.6. Both ISO and Non-ISO standards are supported.



Figure 4.6 CANFD protocol

Each channel can choose to enable or disable the internal termination resistor. To enable the resistor, select 终端电阻; if this check box is not selected, the internal terminating resistor is disabled.

Each channel supports setting the baud rate. Figure 4.7 shows the setting interface. The baud rate option includes the arbitration domain baud rate and the data domain baud rate. For an ordinary CAN, the baud rate is determined by the arbitration domain baud rate, and the data domain baud rate is invalid. For CANFD, the data domain baud rate is valid only when acceleration is enabled. CAN bus baud rate. In addition to the standard baud rates recommended by CIA (75-83.5% sampling point, SJW = 2, 3) in the list, a "custom" option is also given. Select a custom baud rate, click [Calculator] to call the baud rate calculator to calculate the desired baud rate, copy the calculated baud rate, and enter the value in the custom baud rate box.

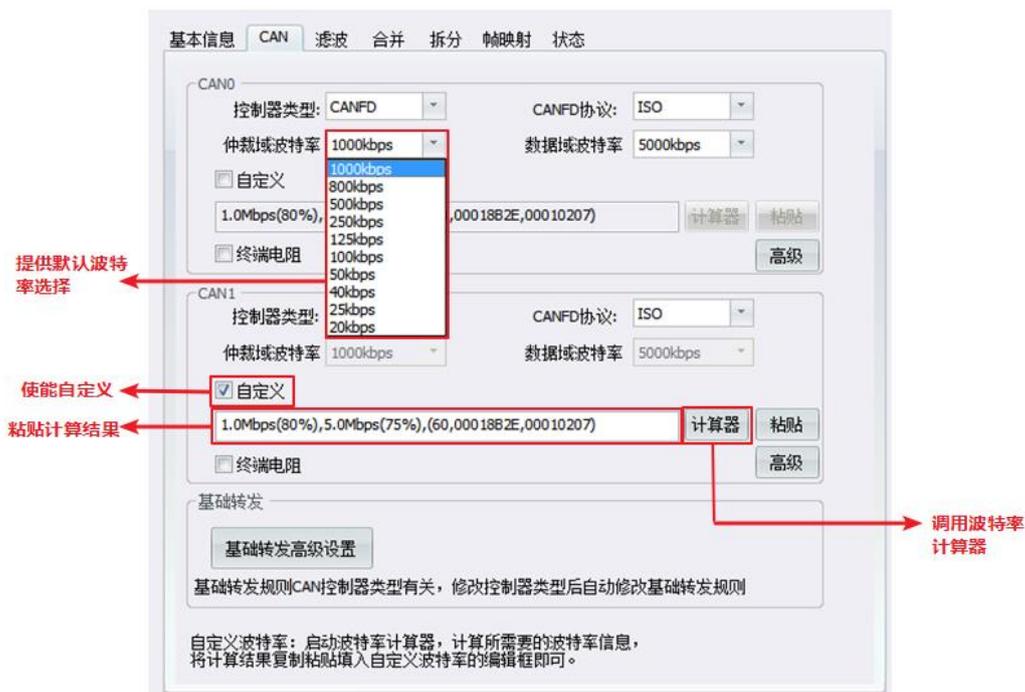


Figure 4.7 Baud rate settings

The baud rate calculator method is as follows:

1. As shown in Figure 4.8, set the arbitration domain baud in ①, select the appropriate synchronization jump width, and select the required baud rate. Enter a value manually if the drop-down list does not have your desired value;
2. Set the data domain baud rate in ②, select an appropriate synchronization jump width, and select the required baud rate. Enter a value manually if the drop-down

- list does not have your desired value;
- After setting, click the calculation button at ③ to list the calculation results of the corresponding baud rate for your choice;
 - Select the arbitration domain baud rate for the appropriate sampling point. If the value is selected, the blue background color appears, indicating that the value is selected, as shown in ④;
 - Select the data domain baud rate for the appropriate sampling point. If the value is selected, the blue background color appears, indicating that the value is selected, as shown in ⑤;
 - Click the copy button at ⑥ to copy the custom baud rate, and paste this value into the custom baud rate text box.



Figure 4.8 Using the baud rate calculator

Advanced settings are available for each channel. Click 高级 to display the advanced setting interface, as shown in Figure 4.9. In the advanced settings, set the channel forwarding mode and failback function.



Figure 4.9 Advanced settings

- Forwarding mode: Provides two options: FIFO mode and real-time mode. FIFO mode uses external RAM to provide larger buffer capacity, which can buffer 45,000 frames. The real-time mode uses the chip's internal RAM, which is smaller but faster.
- Failback setting: After this option is enabled, when CANFDBridge fails to forward, it will send a specified frame to inform the sender that the forwarding fails. Figure 4.10 shows the schematic diagram.

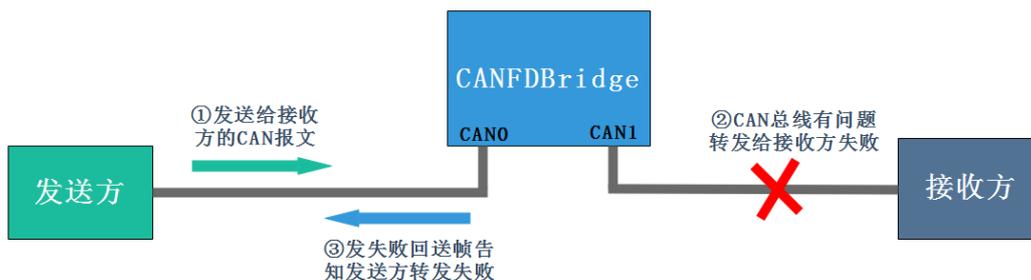


Figure 4.10 Failback

For the failback frame, you can set the frame ID, frame type (standard frame/extended frame), CAN data frame or CANFD data frame. The data length of the echo frame is fixed at 2 bytes. The first byte indicates the CAN0 channel error status, and the second byte indicates the CAN1 channel error status. The channel error states are defined as follows:

0x00: No bus error;

0x01: bus error active state;

0x02: Bus error passive state;

0x03: Bus closed;

4.3.2 Failback Example

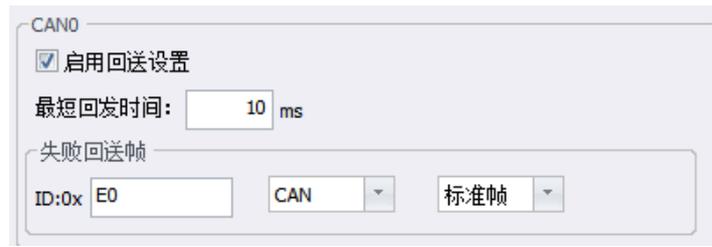


Figure 4.11 CAN0 channel failback setting

In this example, the CAN0 of USBCANFD-200U is connected to the CAN0 channel of CANFDBridge, and the CAN1 channel is not connected, causing a forwarding error on purpose. According to the configuration shown in Figure 4.11, CANFDBridge receives the CANFD message sent by USBCANFD-200U channel 0 on the CAN0 channel. An error occurred when CANFDBridge forwarded the message out of the CAN1 channel because CAN1 is not connected. As shown in Figure 4.12, channel 0 of USBCANFD-200U will receive a CAN standard data frame with ID 0xE0, and the second byte of data is 0x02, indicating that a bus passive error occurs when CAN1 channel forwards data.

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据
0x00000001	USBCANFD-200U	设备0	通道0	15:57:57.547	发送	标准帧	数据帧	CANFD加速	64	01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18 00 00 00 00 00 00 ...
0x000000E0	USBCANFD-200U	设备0	通道0	15:57:57.575	接收	标准帧	数据帧	CAN	2	00 02

Figure 4.12 CAN1 channel forwarding failed, error value 0x02

Each channel supports setting basic forwarding. CANFDBridge basic forwarding can realize CAN to CAN, CANFD to CANFD, CAN to CANFD, CANFD to CAN and other functions. The forwarding rules of the basic forwarding settings are the default forwarding rules. When the received packets do not conform to the rules of frame mapping, merging, and splitting, they are forwarded according to the basic forwarding rules. Basic forwarding provides default forwarding settings and restrictions on forwarding settings according to the CAN controller type, as shown in Table 4.1. If the default forwarding rules do not meet user requirements, users can manually select appropriate forwarding settings. Click

基础转发高级设置

to display the configuration interface, as shown in Figure 4.13.

Table 4.1 Default forwarding and forwarding restrictions

Receiver controller type	Sender controller type	Receive CAN to CAN	Receive CAN to CANFD	Receive CANFD to CAN	Receive CANFD to CANFD
CAN	CAN	Default settings	Disable settings	Disable settings	Disable settings
CAN	CANFD	User selectable settings	Default settings	Disable settings	Disable settings
CANFD	CAN	Default settings	Disable settings	Default settings	Disable

					settings
CANFD	CANFD	Default settings	User selectable settings	User selectable settings	Default settings



Figure 4.13 Basic forwarding settings

- Set converting CAN to CANFD or CAN (such as ① set to convert the received CAN to the CAN frame), and converting CANFD to CANFD or CAN (such as ② set to convert the received CANFD to the CAN frame);
- The frame data is not changed when CAN→CAN, CANFD→CANFD;
- If you choose converting CAN to CANFD, the forwarding rules are as follows (as shown in the configuration in ③):
 - When [Fill] is not selected, the number of the CAN messages and the number of the converted CANFD messages will remain the same.
 - After selecting [Padding], set the CANFD message data length DLC and set the padding data. The default padding is 0. After setting, when the CAN message data length is 8 bytes, the CANFD message will be filled to the preset CANFD message data length with padding data. When the CAN frame data length is 0-7, the padding is invalid. The length of the converted CANFD frame data is the same as the CAN frame data length;
 - Set whether the CANFD message is bit rate accelerated (BRS bit);
- If converting CANFD to CAN is selected, if the data length of the CANFD message is greater than 8 bytes, the CANFD message is truncated, and only the first 8 bytes are reserved for forwarding (the frame type remains unchanged).

4.3.3 Basic Forwarding Example

In the example, USBCANFD-200U is connected to CANFDBridge (CAN0 is connected to CAN0, CAN1 is connected to CAN1), and the sent CAN(FD) frame is compared with the CAN(FD) frame sent back after conversion by CANFDBridge.

1. Receive CAN to CAN

As shown in ① in Figure 4.13, set CAN0 to receive CAN-to-CAN without changing the frame data.

CANFDBridge has the ability of acceptance filtering in hardware. Selective reception of CAN (FD) messages can minimize the network burden from the network. When setting the acceptance filter, switch to the Filter Settings tab, as shown in Figure 4.19. Select the CAN channel to be set in [Channel]. Select [Enable Filter] to enable the acceptance filter function. The filtering mode of CANFDBridge is whitelist filtering. After filtering is enabled, only CAN (FD) messages within the ID range of each filtering item in the filtering table are received. **Note: If filtering is enabled, but there is no filtering item in the filtering table, all packets will be filtered at this time.** The maximum number of filter items for each channel is 64.

[Filter format] is single ID filter or a group ID filter. Single ID means that only one ID is set. At this time, only [Start Frame ID] is valid. The group ID means setting [Start Frame ID] and [End Frame ID] to determine an ID range. At this point, only IDs that meet this range will be accepted.

Example: As shown in Figure 4.19, the standard frame IDs for CAN0 channel acceptance are set to 0x08 and 0x12, the extended frame group IDs are 0x55 to 0x66, and the standard frame group IDs are 0x22 to 0x66. The CAN0 channel of CANFDBridge only receives standard frame CAN (FD) messages with IDs 0x08, 0x12, 0x22-0x66 and extended frame CAN (FD) messages with IDs 0x55-0x66.

The screenshot shows the 'Filter parameter settings' window for the CAN0 channel. The '通道' (Channel) is set to 'CAN0'. The '开启滤波' (Enable Filter) checkbox is checked. Below is a table with the following data:

索引	过滤格式	起始ID(HEX)	结束ID(HEX)
1	标准帧单ID	8	8
2	标准帧单ID	12	12
3	扩展帧组ID	55	66
4	标准帧组ID	22	66

Below the table, the '过滤格式' (Filter Format) is set to '标准帧组ID'. The '起始帧ID: 0x' (Start Frame ID) is set to '22' and the '结束帧ID: 0x' (End Frame ID) is set to '66'. At the bottom, there are buttons for '添加' (Add), '删除' (Delete), and '清空' (Clear).

Figure 4.19 Filter parameter settings

4.3.5 Frame Mapping

CANFDBridge can set the frame mapping function. Figure 4.20 shows the frame mapping interface. After the specified CAN (FD) frame is received, it is forwarded to the specified CAN (FD) frame for transmission. The specific functions of frame mapping are as follows:

- Each CAN channel supports 64 frame mappings;



Figure 4.21 Frame mapping settings

means to delete the currently selected mapping rule.

means to modify the currently selected mapping rule.

means to clear all mapping rules in the current table.

means to move the currently selected mapping rule up and down. The smaller the sequence number of the mapping rule, the higher the priority. That is, once a frame satisfies one mapping rule, it will not continue to check other mapping rules.

4.3.6 Frame Mapping Example

In the example, two CAN0 frame mappings are set, as shown in Figure 4.22. The first is that the CAN standard frame is mapped to the CANFD extended frame, and the data is mapped; the second is that the CAN standard frame is mapped to the CAN standard frame, and the data is not mapped.



Figure 4.22 Two frame mappings

1. Use data mapping

The configuration is shown in Figure 4.23. Map the CAN standard frame with ID 0x02, data 0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x07, 0x08 to ID 0x333, data 0x11, 0x22, 0x33, 0x44, 0x55, 0x66, 0x77, 0x88, CANFD extended frame of 0x99, 0x10, 0x11, 0x12. Figure 4.24 shows example results.

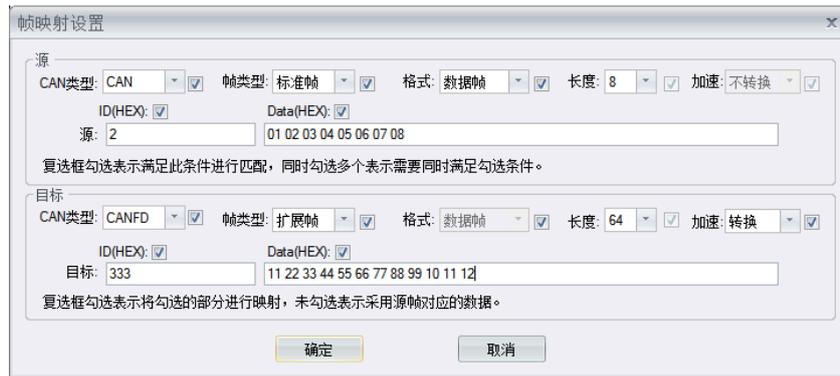


Figure 4.23 Using data mapping

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据
0x00000002	USBCANFD-200U	设备0	通道0	17:25:52.547	发送	标准帧	数据帧	CAN	8	01 02 03 04 05 06 07 08
0x00000333	USBCANFD-200U	设备0	通道1	17:25:55.867	接收	扩展帧	数据帧	CANFD加速	12	11 22 33 44 55 66 77 88 99 10 11 12

Figure 4.24 Example of using data mapping

2. Do not map data

As shown in Figure 4.25, if the red box is not selected, no comparison or modification will be made. Therefore, the CAN standard data frame whose ID is 0x01 is converted into a CAN standard data frame whose ID is 0x222, and the data content remains unchanged.

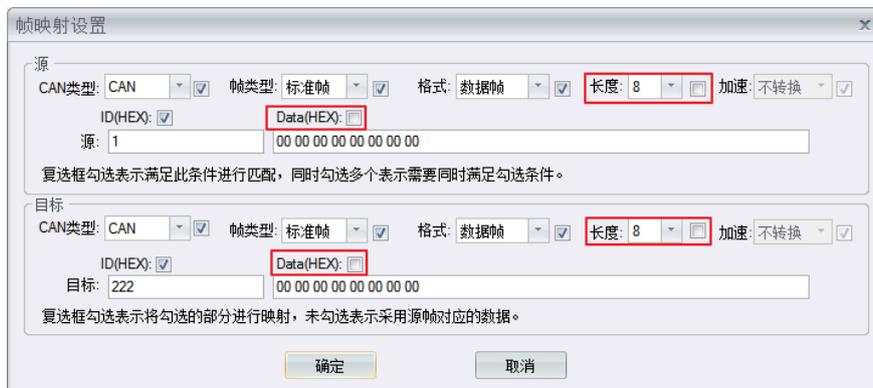


Figure 4.25 Unmapped data

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据
0x00000001	USBCANFD-200U	设备0	通道0	16:38:40.280	发送	标准帧	数据帧	CAN	8	00 11 22 33 44 55 66 77
0x00000222	USBCANFD-200U	设备0	通道1	16:38:40.289	接收	标准帧	数据帧	CAN	8	00 11 22 33 44 55 66 77

Figure 4.26 Example of unmapped data

4.3.7 Merging

The merge function is used to merge multiple CAN messages and convert them into CANFD messages, as follows:

- The device allows you to set a maximum of 64 merge rules. According to the

merging rules, the device merges the received CAN messages into corresponding CANFD frames based on the frame ID and frame type in sequence;

- The device caches the CAN messages that conform to the merging rules in a persistent manner, until it receives the CAN message with the same ID as the last CAN frame in the merging rule, and merges the previously cached CAN messages into a CANFD message and sends it out. That is, the condition for triggering merge forwarding is that the CAN message ID received by the corresponding port of the device is the same as the last CAN frame ID in a merge rule;
- All CAN frame IDs in the merge rule should not be repeated. The mapped CANFD frame ID can be repeated;
- In a merging rule, the data length of the target CANFD frame must be greater than or equal to the sum of the data lengths of all CAN frames;
- In a merging rule, if the sum of the data lengths of multiple CAN messages is less than the corresponding CANFD frame length, it can be padded to the preset CANFD length. The padding data is set by the user.

The combined interface layout and button functions are similar to frame mapping. The only difference is that after you click , the merge item setting window appears, as shown in Figure 4.27.

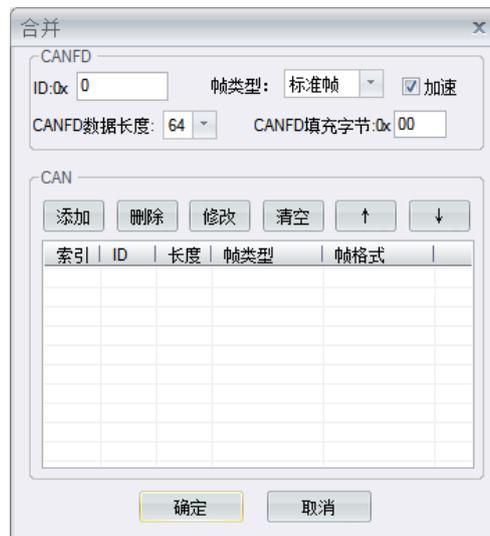


Figure 4.27 Merge item settings

The parameter in the CANFD box indicates the target CANFD to be merged. You can specify the frame ID, frame type, data length and padding bytes, and enable bit rate switching.

The table in the CAN box indicates the list of CANs to be merged. Click . The CAN setting window to be merged appears, as shown in Figure 4.28. After setting, you can add a CAN to be merged into the list. Combine a maximum of eight CAN messages into one CANFD message.



Figure 4.28 CAN settings to be merged

4.3.8 Merge Example

Figure 4.29 shows the settings. This setting enables CAN0 to combine three standard CAN frames with IDs 0x01, 0x02, and 0x03 with a data length of 8 into a CANFD standard frame with an ID of 0x123 and a data length of 24.



Figure 4.29 Combining three CAN settings

When CAN0 receives three CAN frames that conform to the grouping rules, they are merged into CANFD frames and sent out from CAN1. The data of the CANFD frame is formed by combining the data of three CAN frames.

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据
0x0000001	USBCANFD-200U	设备0	通道0	08:46:55.431	发送	标准帧	数据帧	CAN	8	01 02 03 04 05 06 07 08
0x0000002	USBCANFD-200U	设备0	通道0	08:46:55.431	发送	标准帧	数据帧	CAN	8	09 0A 0B 0C 0D 0E 0F 10
0x0000003	USBCANFD-200U	设备0	通道0	08:46:55.431	发送	标准帧	数据帧	CAN	8	11 12 13 14 15 16 17 18
0x0000123	USBCANFD-200U	设备0	通道1	08:46:55.433	接收	标准帧	数据帧	CANFD加速	24	01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18

Figure 4.30 Example of combining three CANs

When the last packet of the merging rule is received, the CAN frame will send the previously cached CAN frame into a CANFD frame, as shown in Figure 4.31. Upon

receiving the last CAN frame with ID 0x03, the combined CANFD frame is sent immediately. The first 16 bytes of data are the previously cached data.

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据
0x00000003	USBCANFD-200U	设备0	通道0	08:50:46.447	发送	标准帧	数据帧	CAN	8	11 12 13 14 15 16 17 18
0x00000123	USBCANFD-200U	设备0	通道1	08:50:46.449	接收	标准帧	数据帧	CANFD加速	24	01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18

Figure 4.31 Example of receiving only the last packet

Figure 4.32 shows the settings. Make CAN0 combine three standard CAN frames with IDs 0x10, 0x11, 0x12 with a data length of 8 into a CANFD standard frame with an ID of 0x234 and a data length of 64. The first 24 bytes of data are merged from the data of three CAN frames, and the last 40 bytes of data are auto-fill bytes 0xFF.



Figure 4.32 Total length of combined CAN less than CANFD

As shown in Figure 4.33, the CANFD frame data sent after the merge is automatically filled with data 0xFF starting from the 25th byte.

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据
0x00000010	USBCANFD-200U	设备0	通道0	08:49:33.718	发送	标准帧	数据帧	CAN	8	01 02 03 04 05 06 07 08
0x00000011	USBCANFD-200U	设备0	通道0	08:49:33.719	发送	标准帧	数据帧	CAN	8	09 0A 0B 0C 0D 0E 0F 10
0x00000012	USBCANFD-200U	设备0	通道0	08:49:33.719	发送	标准帧	数据帧	CAN	8	11 12 13 14 15 16 17 18
0x00000234	USBCANFD-200U	设备0	通道1	08:49:33.731	接收	标准帧	数据帧	CANFD加速	64	01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18 FF FF FF FF FF FF ...

Figure 4.33 Example of combined CAN total length less than CANFD

4.3.9 Split

The split function is used to split the CANFD message into multiple CAN messages for transmission. The device supports setting a maximum of 64 split rules. Each rule specifies the frame ID, frame type and frame length of the CANFD to be split. After receiving the corresponding CANFD message, it is split into multiple CAN messages based on the preset target frame ID and frame type. The specified split CANFD frame ID

should not be repeated. The CANFD frame data length must be greater than or equal to the sum of all CAN frame data lengths in the split rule.

Split interface layout and key functions are similar to merge. After you click , the split item setting window appears, as shown in Figure 4.34.



Figure 4.34 Split configuration items

The parameter items in the ANFD box indicate the source CANFD to be split. You can specify the frame ID, frame type, data length and padding bytes, and enable bit rate switching.

The table in the CAN box indicates the CAN list of the split target. Click to display the split target CAN setting window as shown in Figure 4.35. After setting, you can add a split target CAN to the list. A CANFD message can be split into a maximum of eight CAN messages.



Figure 4.35 CAN settings to be merged

4.3.10 Split Example

Set as shown in Figure 4.36. Split the CANFD standard frame whose ID is 0xF1 and whose length is 64 bytes into eight CAN standard frames whose data length is 8 bytes. The IDs are 0x00-0x07 respectively.



Figure 4.36 64-byte CANFD split into eight 8-byte CAN settings

As shown in Figure 4.37, when the CAN0 channel receives a CANFD standard frame with an ID of 0xF1 and a data length of 64, it will be split into 8 CAN standard frames according to the unpacking rules and sent from the CAN1 channel.

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据															
										全	全部	全部	全部	01	02	03	04	05	06	07	08	09	0A	0B	0C
0x000000F1	USBCANFD-200U	设备0	通道0	11:20:25.046	发送	标准帧	数据帧	CANFD加速	64	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10
0x00000000	USBCANFD-200U	设备0	通道1	11:20:28.052	接收	标准帧	数据帧	CAN	8	01	02	03	04	05	06	07	08								
0x00000001	USBCANFD-200U	设备0	通道1	11:20:28.052	接收	标准帧	数据帧	CAN	8	09	0A	0B	0C	0D	0E	0F	10								
0x00000002	USBCANFD-200U	设备0	通道1	11:20:28.052	接收	标准帧	数据帧	CAN	8	11	12	13	14	15	16	17	18								
0x00000003	USBCANFD-200U	设备0	通道1	11:20:28.052	接收	标准帧	数据帧	CAN	8	19	1A	1B	1C	1D	1E	1F	20								
0x00000004	USBCANFD-200U	设备0	通道1	11:20:28.052	接收	标准帧	数据帧	CAN	8	21	22	23	24	25	26	27	28								
0x00000005	USBCANFD-200U	设备0	通道1	11:20:28.052	接收	标准帧	数据帧	CAN	8	29	2A	2B	2C	2D	2E	2F	30								
0x00000006	USBCANFD-200U	设备0	通道1	11:20:28.052	接收	标准帧	数据帧	CAN	8	31	32	33	34	35	36	37	38								
0x00000007	USBCANFD-200U	设备0	通道1	11:20:28.052	接收	标准帧	数据帧	CAN	8	39	3A	3B	3C	3D	3E	3F	40								

Figure 4. Example of 3764-byte CANFD split into eight 8-byte CANs

Set as shown in Figure 4.38. Split the CANFD standard frame with ID 0xF2 and length of 24 bytes into 4 CAN standard frames with data length of 6 bytes. The IDs are 0x10~0x13 respectively.



Figure 4.38 24-byte CANFD split into 4 6-byte CAN settings

As shown in Figure 4.39, when the CAN0 channel receives a CANFD standard frame with an ID of 0xF2 and a data length of 24, it will be split into four CAN standard frames according to the unpacking rules and sent from the CAN1 channel.

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据
0x000000F2	USECANFD-200U	设备0	通道0	11:22:00.590	发送	标准帧	数据帧	CANFD加速	24	01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18
0x00000010	USECANFD-200U	设备0	通道1	11:22:00.593	接收	标准帧	数据帧	CAN	6	01 02 03 04 05 06
0x00000011	USECANFD-200U	设备0	通道1	11:22:00.593	接收	标准帧	数据帧	CAN	6	07 08 09 0A 0B 0C
0x00000012	USECANFD-200U	设备0	通道1	11:22:00.593	接收	标准帧	数据帧	CAN	6	0D 0E 0F 10 11 12
0x00000013	USECANFD-200U	设备0	通道1	11:22:00.593	接收	标准帧	数据帧	CAN	6	13 14 15 16 17 18

Figure 4. Example of 3924-byte CANFD split into 4 6-byte CANs

This setting splits the CANFD standard frame with ID 0xF3 and length 64 bytes into two CAN standard frames with data length of 8 bytes and a CAN standard frame with data length of 4 bytes. The IDs are 0x00-0x02 respectively. Only the first 20 bytes of data in the CANFD frame are split, and the excess data is discarded.



Figure 4.40 64-byte CANFD split into two 8-byte CAN settings

As shown in Figure 4.41, according to the unpacking rule, only the first 20 bytes of data are split, and the rest of the data is discarded.

帧ID	源设备类型	源设备	源通道	时间标识	方向	帧类型	帧格式	CAN类型	长度	数据
0x000000F3	USBCANFD-200U	设备0	通道0	11:25:37.950	发送	标准帧	数据帧	CANFD加速	64	01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F ...
0x00000000	USBCANFD-200U	设备0	通道1	11:25:37.970	接收	扩展帧	数据帧	CAN	8	01 02 03 04 05 06 07 08
0x00000001	USBCANFD-200U	设备0	通道1	11:25:37.970	接收	扩展帧	数据帧	CAN	8	09 0A 0B 0C 0D 0E 0F 10
0x00000002	USBCANFD-200U	设备0	通道1	11:25:37.970	接收	扩展帧	数据帧	CAN	4	11 12 13 14

Figure 4. Example of 4164-byte CANFD split into 2 8-byte CANs

4.4 Device Status Acquisition and Reporting

Figure 4.42 shows the status interface of the CANFDBridge configuration software. It provides two functions, namely, real-time acquisition of CAN channel error counts and automatic reporting of device error status. The two functions can be used to analyze the adaptation of the device on the network, and record the error conditions during use, which helps analyze the cause.



Figure 4.42 Status interface

4.4.1 Obtaining the Device CAN Interface Error Count

Click  shown in Figure 4.43 to read the receive error count and send error count of the CAN channel in real time. These error counts directly reflect the smoothness of the bus. When the received error value is greater than 127, the bus is almost paralyzed. When the error value is high (above 40), the bus communication is blocked seriously. At this time, adjust the baud rate value of the bridge or increase the number of bridges. When the bus communication is good, the error count can generally be maintained at 0. The send error count is similar to the receive error count.

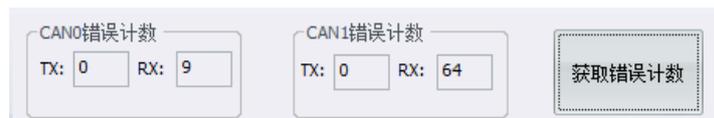
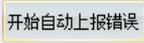


Figure 4.43 Obtaining the error count

4.4.2 Real-time reporting of device status

As shown in Figure 4.44, click  to enable automatic error reporting. At this time, if an error occurs in the device communication, the error will be automatically reported to the computer and recorded in the table. In the recording, it will record the error time (based on the computer time), channel number, error type, send error count, receive error count and continuous error count and other information. The information helps analyze the failure of communication.



The screenshot shows a software interface for reporting CAN errors. At the top, there are three buttons: '开始自动上报错误' (Start automatic error reporting), '停止自动上报错误' (Stop automatic error reporting), and '清空' (Clear). Below these buttons is a table with the following data:

索引	时间	通道	错误类型	发送错误	接收错误
0	9-17 11:30:46	1	总线错误:未知错误	0	100
1	9-17 11:30:46	1	总线告警	0	100
2	9-17 11:30:46	1	总线错误:未知错误	0	127
3	9-17 11:30:46	1	总线消极	0	255
4	9-17 11:30:46	1	总线错误:未知错误	0	255
5	9-17 11:30:46	1	总线错误:格式错误	0	255
6	9-17 11:30:46	1	总线错误:未知错误	0	255
7	9-17 11:30:46	1	总线错误:格式错误	0	255
8	9-17 11:30:46	1	总线错误:未知错误	0	255
9	9-17 11:30:46	1	总线错误:格式错误	0	255
10	9-17 11:30:46	1	总线错误:未知错误	0	255
11	9-17 11:30:46	1	总线错误:格式错误	0	255
12	9-17 11:30:46	1	总线错误:未知错误	0	255
13	9-17 11:30:46	1	总线错误:格式错误	0	255
14	9-17 11:30:46	1	总线错误:未知错误	0	255
15	9-17 11:30:46	1	总线错误:格式错误	0	255
16	9-17 11:30:46	1	总线错误:未知错误	0	255
17	9-17 11:30:46	1	总线错误:格式错误	0	255

Figure 4.44 Automatic reporting of CAN errors

5. Firmware Upgrade

To improve the device maintainability, CANFDBridge provides the IAP firmware upgrade function. CANCfg software facilitates CANFDBridge upgrades. The interface related to the upgrade function in the software is shown in the red box in Figure 5.1. Click

 to select the path of the firmware to be upgraded, and then click  to start the firmware upgrade. After the upgrade starts, a window as shown in Figure 5.2 will appear, showing the upgrade progress and status. During the upgrade, the USB indicator will flash rapidly. During the upgrade, do not power off the device or disconnect the USB cable; otherwise, the upgrade will fail. If the upgrade fails, the CANFDBridge device does not work properly, and the USB indicator keeps flashing. At this time, reconnect the device to the computer and perform a firmware upgrade.



Figure 5.1 Firmware upgrade

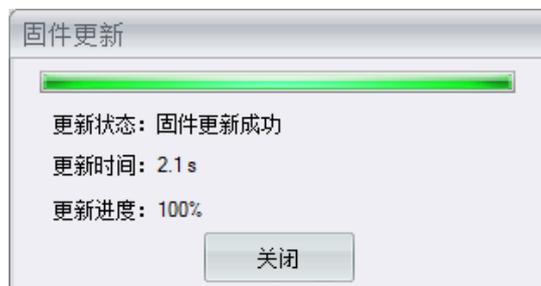


Figure 5.2 Firmware upgrade completed

6. Disclaimer

Based on the principle of providing better service for users, Guangzhou ZLG Electronics Co., Ltd. ("ZLG Electronics") will try to present detailed and accurate product information in this manual. However, due to the effectiveness of this manual within a particular period of time, ZLG Electronics does not guarantee the applicability of this document at any time. ZLG Electronics shall reserve the right to update this manual without prior notice. To get the latest version, please visit the official website of ZLG Electronics regularly or contact ZLG Electronics. Thank you!

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