User Manual

CANFDDTU-400EWGR User Manual

CANFD Bus Message Recording and Wireless Data Transmission Equipment

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Category	Contents
Keywords	CANFD-BUS, message recording, Ethernet, WiFi
Abstract	Product User Guide

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Revision History

Version	Date	Description
V1.1	2020/04/13	Created
V1.1	2022/09/29	Modify power supply scope and company template

Contents

1. Product Introduction

1.1 Product Overview

In CANFD bus troubleshooting, the biggest difficulty is occasional faults, which makes engineers or even CANFD experts unable to accurately identify the fault cause. For example, the pitch system of the wind turbine had a CANFD data transmission interruption in 72 hours; the dashboard of a new energy vehicle appeared "blank" once during a 10,000 km drive, but this fault could not reoccur; the high-speed train experienced an emergency deceleration due to abnormal CANFD communication during a 2,000 km journey. These occasional CANFD communication exceptions have troubled engineers like time bombs. If one CANFD bus data recorder is installed on an occasion prone to faults, it is equivalent to a "black box" to record CANFD data, which helps analyze the fault cause.

Guangzhou ZLG Electronics Co., Ltd., as a leading manufacturer of the domestic CANFD bus, has developed CANFDDTU series products for troubleshooting CANFD buses, which can record CANFD messages offline. The products can easily complete the message recording and on-site monitoring for applications such as vehicles, ships, elevators, wind turbines, and construction machinery.

CANFDDTU-400 series products are storage-type 4-channel CANFD bus data recorders, which can run independently from PC and store CANFD message data for a long time, which facilitates analysis and troubleshooting. The recorder can send the recorded data to a PC via an SD memory card on the Ethernet. After format conversion of the raw data, users can analyze and evaluate the recorded data offline by using CANFDoe, INCA, and CANFDScope.

1.2 Features

Table 1.1 Product features

CANFD channel	Number of channels: four user-configurable CANFD channels
	Interface type: high-speed CANFD
	Baud rate: any programmable value between 40 Kbps and 5 Mbps

	Maximum receive data flow: 4,000 frames/s(One way)
	Surge protection: 1 kV (Class B)
	Isolation voltage: 2,500 V
Standard Ethernet interface	100M/1000M adaptive
Vehicle Ethernet interface	Meet 100base-T1, OPEN Alliance BroadR-Reach specification
Wireless 4G transmission	Support Unicom, Telecom, Mobile 4G
Digital output	Two digital outputs
Digital input	Two digital inputs
LIN channel	Four independent LIN channels
Message recording and storage	Storage Capacity: supports SD memory cards of a maximum of 64 GB
	Storage mode: all storage, timing storage
	Full mode: rolling record, full stop
	Trigger mode: conditional trigger, external trigger
	Find and location: Manual time stamping
	Data export: supports multiple data formats, such as .frame, .csv, .txt, and .asc for software analysis
Real-time clock	Built-in rechargeable lithium battery
Software resources	Supports the general configuration function library, which helps users develop application programs with VC, VB, Delphi and C++ Builder
	Supports the configuration tool CANDTU
Power supply voltage	DC 9 - 36V
Power consumption	8.6W(Max)
Range of temperature	Operating temperature: -40°C to +85°C
	Storage temperature: -40°C to +85°C
External dimension	179 mm x 131.5 mm x 50.4 mm

1.3 Typical Applications

- High-speed train operation fault detection and troubleshooting
- Subway train operation fault detection and troubleshooting
- Train control system operation fault detection and troubleshooting
- Wind turbine CANFD communication fault detection
- Multi-channel CANFD communication recording and fault analysis for traditional vehicles and new energy vehicles
- Ship CANFD communication fault detection and troubleshooting
- Coal mine CANFD communication fault analysis
- Elevator operation fault detection and troubleshooting
- Construction machinery operation fault detection and troubleshooting
- Aerospace vehicles and ancillary equipment detection and troubleshooting

2. Product Specifications

2.1 Electrical Specifications

Table 2.1 Product features

Item	Conditions	Rating			Unit
		Minimum	Typical Value	Maximum	
Operating voltage	DC	9	24	36	V
Power consumption		4.2	5.1	8.6	W

2.2 Operating Temperature

Table 2.2 Operating temperature

Parameter Name	Rating			Unit
	Minimum	Typical Value	Maximum	
Operating temperature	-40	-	85	°C
Storage temperature	-40	-	85	°C

2.3 Protection Level

Warning:Operation of this equipment in a residential environment could cause radio interference.

Table 2.3 Protection level-electrostatic discharge immunity test (IEC61000-4-2)

Interface	Test Level	Test Voltage (kV)	Test Result	Remarks
Power supply	Level 4	6	Class A	Contact discharge
CANFD bus	Level 4	6	Class A	Contact discharge
Ethernet	Level 4	6	Class A	Contact discharge
Buttons, Indicators	Level 4	15	Class A	Air discharge

Table 2.4 Protection level-electrical fast transient pulse group immunity test (IEC61000-4-4)

Interface	Test Level	Test Voltage (kV)	Test Result	Remarks
Power supply	Level 3	2	Class A	Capacitive coupling
CANFD bus	Level 3	1	Class B	Capacitive coupling
Ethernet	Level 3	2	Class A	Capacitive coupling

Table 2.5 Protection level-surge (impact) test (IEC61000-4-5)

Interface	Test Level	Test Voltage (kV)	Test Result	Remarks
Power supply	Level 3	1	Class A	Line-line
	Level 3	2	Class A	Line-ground
CANFD bus	Level 3	1	Class B	Line-line
	Level 3	2	Class B	Line-ground
Ethernet	Level 3	1	Class A	Line-line
	Level 3	2	Class A	Line-ground

3. Mechanical Dimensions

The mechanical dimensions are shown in the following figure (unit: mm)

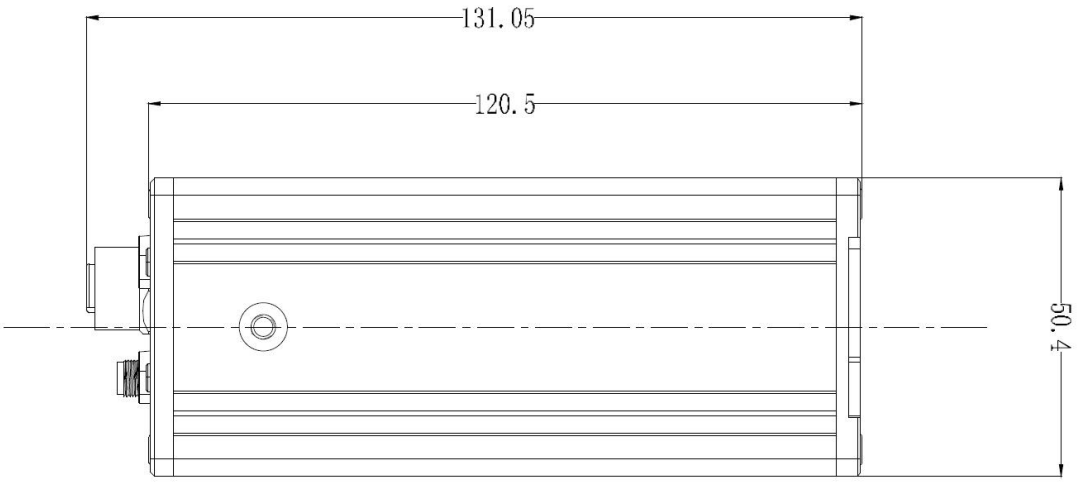


Figure 3.1 Host dimensions diagram 1

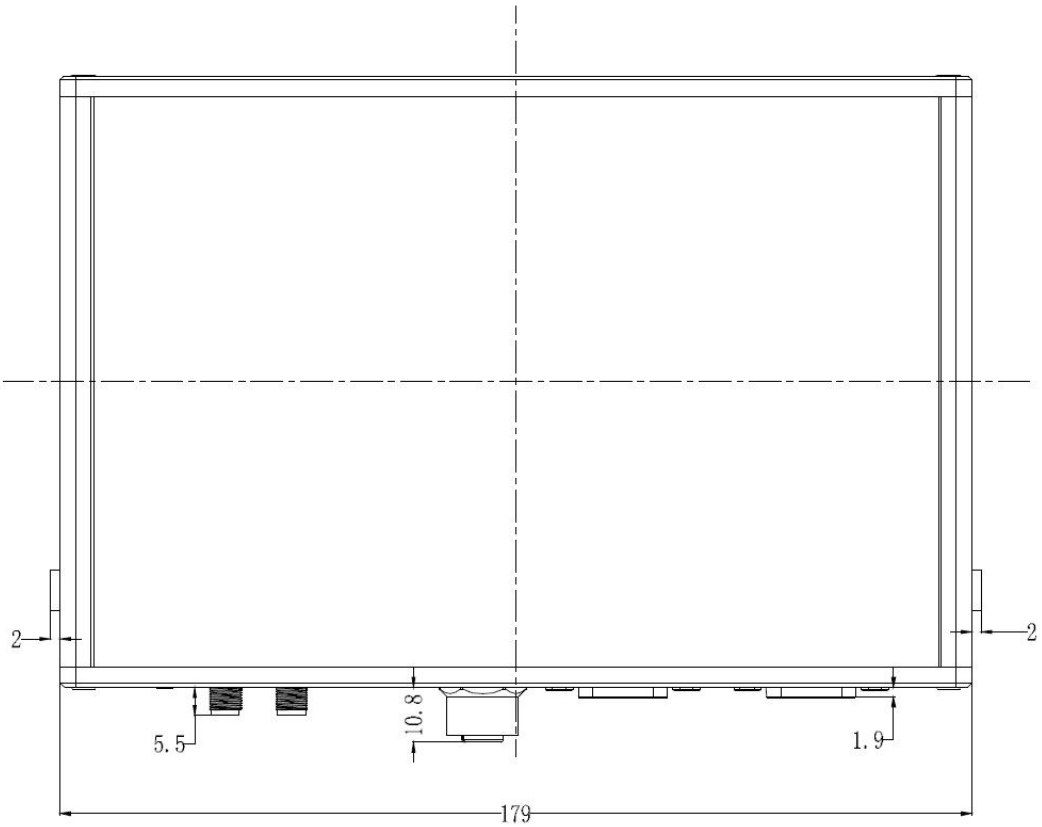


Figure 3.2 Host dimensions diagram 2

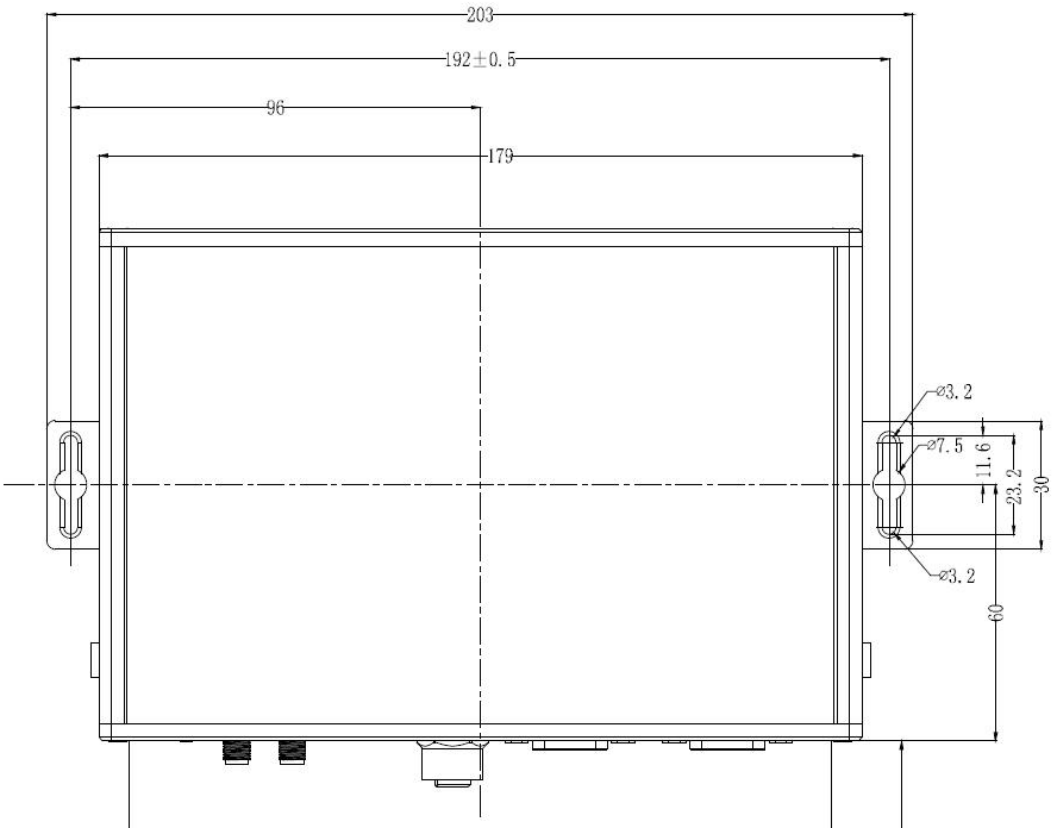


Figure 3.3 Installation method

4. Hardware Interfaces

This section describes the hardware interfaces of CANFDDTU-400 series devices.

4.1 Panel Layout

Figure 4.1shows the panel layout.

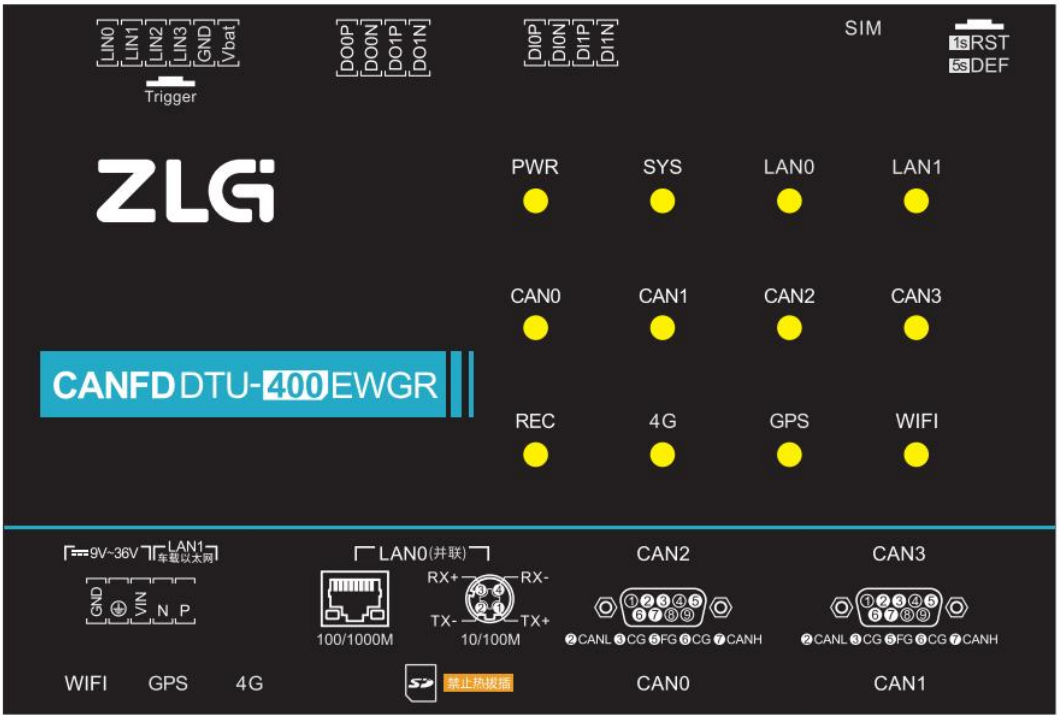


Figure 4.1 Panel layout

4.2 Indicators

Table 4.1 LED indicators

Silkscreen	Function	Status	Status Description	Flash Description
PWR	Power indicator	Light off	The device is not powered on	-
		Red	The device is powered on properly	-
SYS	System indicator	Green heartbeat	System running	100 ms cycle, after ON twice, wait for 500 ms
		Always red	Device reset and restart	-
		Flashing red light	Card removed not properly	Flash at an interval of 200 ms
LAN0	Ethernet indicator	Light off	Ethernet no connected	-
		Green normally on	Ethernet connected	-
		Green flashing	The application has data transmission and reception	Flash at an interval of 200 ms
		Flash in red	Received data parsing error	Flash at an interval of 200 ms
LAN1	Vehicle Ethernet	Light off	Ethernet no connected	-

	Indicator	Green normally on	Ethernet connected	-
		Green flashing	The app has data transfer	200 ms periodic blink -
CAN0~ CAN3	CAN channel indicator	Light off	Channel not open	-
		Green normally on	Channel open	-
		Green flashing	The CAN channel sends and receives data properly	Flash at an interval of 200 ms
		Flash in red	CAN bus error	Flash at an interval of 200 ms
REC	Record indicator	Light off	No record	-
		Continuous green light	The recording status is normal	-
		Green flashing light	Recording/formatting SD card	Flash at an interval of 200 ms
		Flashing red light	SD card abnormal	Flash at an interval of 200 ms
4G	4G indicator	Light off	Not started	-
		Continuous green light	4G connection normal	-
		Green flashing light	Data communication	Flash at an interval of 200 ms
		Continuous red light	No connection	-
		Flashing red light	No SIM card	Flash at an interval of 200 ms
GPS	GPS indicator	Light off	Not started	-
		Continuous green light	Connection normal	-
		Green flashing light	Connecting	Flash at an interval of 200 ms
WiFi	WiFi indicator	Light off	Not started	-
		Continuous green light	AP mode	-
		Green flashing light	Station connecting	Flash at an interval of 200 ms
		Green indicator heartbeat	Station connected	The heartbeat flashes with the SYS indicator

4.3 Buttons

The device provides two buttons. One is a trigger button, with the silkscreen "Trigger". It marks the CANFD message data, so that users can locate the data recorded in the SD card. The other one is RST, used to reset the device and restore factory settings.

Table 4.2 Trigger button functions

Silkscreen	Function
RST/DEF	Resets the device (press)
	Restores factory settings (5s)
Trigger	Starts the firmware upgrade mode (press and hold to power on)
	Records the text markup (press)
	Removes the SD card (5s)

Table 4.3 Trigger button functions

Silkscreen	Function
RST/DEF	Resets the device (press)
	Restores factory settings (5s)
Trigger	Starts the firmware upgrade mode (press and hold to power on)

	Records the text markup (press)
	Removes the SD card (5s)

4.4 Power Interface

The rated voltage of the power input is 9-36 V DC, and the shell is marked as "⎓9V~36V". The physical form of the interface is a 5.08 terminal. Table 4.4Table 4.5andTable 4.6. list the interface diagram, signal definition, and interface specifications.

Table 4.4 Power interface

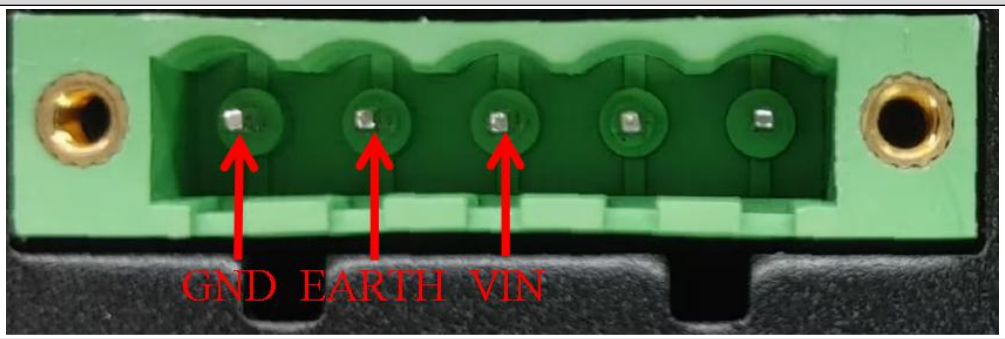
Type	Schematic Diagram
5.08 terminal	

Table 4.5 5.08 terminal signal definition

Function Interface	Signal Definition	Signal Description	Interface Type
			5.08 Interface
Power supply	VIN	positive electrode of power	√
	GND	negative electrode of power	√

Table 4.6 Specifications of power interfaces

Item	Conditions	Rating			Unit
		Minimum	Typical Value	Maximum	
Working voltage	DC	9	12	36	V
Power consumption			5.1		W

4.5 CANFD-bus Interfaces

The device provides four isolated CANFD-Bus interfaces: "CAN0", "CAN1", "CAN2", and "CAN3". The physical form of the interface is a DB9 terminal. Table 4.7,Table 4.8 and Table 4.9. list the interface diagram, signal definition, and interface specifications.

Table 4.7 Pin definitions

Type	Schematic Diagram

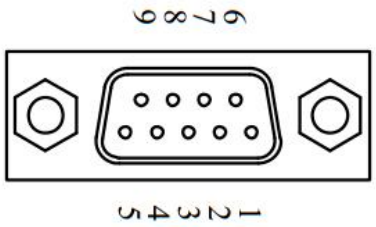
Pin definitions	

Table 4.8 Signal definitions

Function Interface	Signal Definition	Signal Description	Pin Number
CANFD0~CANFD3	CANFD_L	CANFD data transceiver differential inverted signal	2
	CANFD_GND	CANFD isolation ground	3, 6
	CANFD_H	CANFD data transceiver differential positive phase signal	7
	CANFD_FG	Shielding ground	5
	NC	Not connected	1, 4, 8, 9

Table 4.9 CANFD-Bus interface specifications

Parameter		Minimum	Typical Value	Maximum	Unit
Communication baud rate		5k		1M	bps
Number of nodes				110	pcs
Dominant level (logic 0)	CANFDH	2.75	3.5	4.5	V
	CANFDL	0.5	1.5	2	
Recessive level (logic 1)	CANFDH	2	2.5	3	
	CANFDL	2	2.5	3	
Differential level	Dominant (logic 0)	1.2	2	3.1	
	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)		3500			V

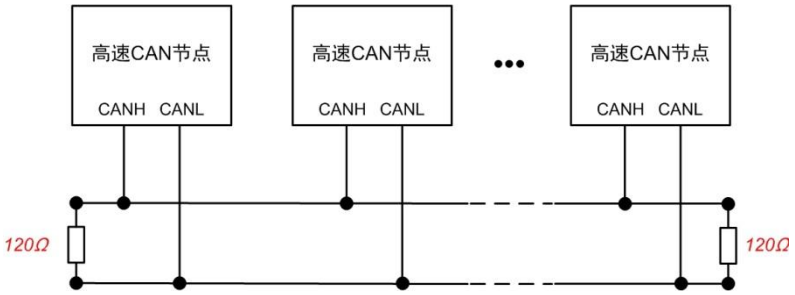


Figure 4.2 Typical network connection diagram of high-speed CANFD

Balanced transmission is adopted for the CANFD bus. According to ISO11898-2: In the high-speed CANFD, 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 4.2 shows the high-speed CANFD network topology.

The device has a built-in 120 ohm terminal resistance, which can be turned on or off by using the configuration tool CANFDDTU. For operation details, see5.4.1.

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. CANFD-Bus cable can be 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.

4.6 Switching Value Input Interface

The device provides 2-channel digital input. The shell is identified as "DI0(1)P(N)". The physical form of the interface is a 3.81 terminal. Table 4.10,Table 4.11, and 错误!未找到引用源。 list the interface schematic diagram, signal definition, and interface specification.

Table 4.10 DI interface

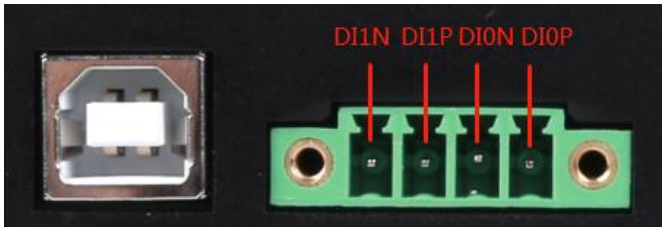
Type	Schematic Diagram
3.81 Terminal	

Table 4.11 OPEN, 3.81 signal definition

Function Interface	Signal Definition	Signal Description	Interface Type	
			OPEN Interface	3.81 Interface
DI	DI0_P	Digital input channel 0 positive		√
	DI0_N	Digital input channel 0 negative		√
	DI1_P	Digital input channel 1 positive		√
	DI1_N	Digital input channel 1 negative		√

Table 4.12 DI interface specifications

parameter	Conditions	Minimum	Typical Value	Maximum	Unit
Logic 0 signal	DC	0		3	V
Logic 1 signal	DC	5		24	V
Isolation voltage	Valid value		3750		V

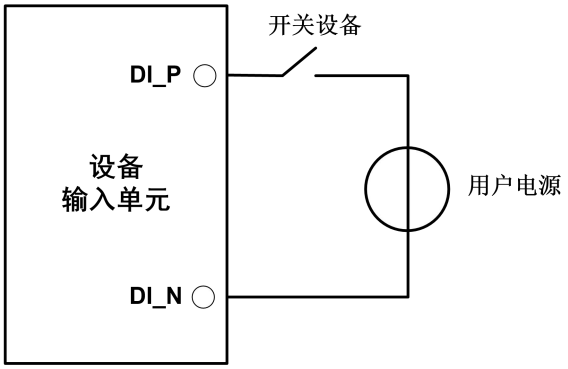


Figure 4.3 DI network connection

By using the configuration tool, the switch input interface can be configured as timing recording mode and analog key-pressing mode.

1) The timing recording mode is used to regularly collect the switching status of external equipment, such as valve closing and opening, motor start and stop, and contact connection and disconnection. Figure 4.3 shows the connection diagram.
2) The analog key-pressing mode can be used to simulate on-board buttons, including message marking, pause recording, resume recording, and user upgrades.

4.7 Switch Output Interfaces

The device provides two digital outputs. The shell is marked as "DO0(1)P(N)". The physical form of the interface is a 3.81 terminal. Table 4.13, Table 4.14, andTable 4.15 list the interface schematic diagram, signal definition, and interface specifications.

Table 4.13 DO interface

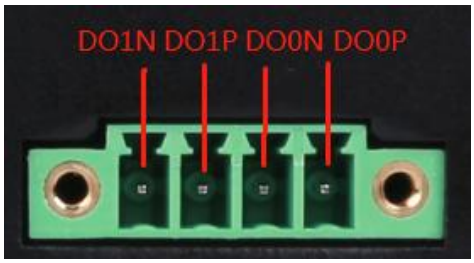
Type	Schematic Diagram
3.81 Terminal	

Table 4.14 OPEN, 3.81 signal definition

Function Interface	Signal Definition	Signal Description	Interface Type	
			OPEN Interface	3.81 Interface
DO	DO0_P	Digital output channel 0 positive		√
	DO0_N	Digital output channel 0 negative		√
	DO1_P	Digital output channel 1 positive		√
	DO1_N	Digital output channel 1 negative		√

Table 4.15 DO interface specifications

Parameter	Conditions	Minimum	Typical Value	Maximum	Unit
Contact load	DC 3A, resistive			30	V
Contact load	AC 3A, resistive			250	V
Contact Resistance	DC 1A, 24V		0.1		Ω
Isolation voltage	Valid value		4000		V

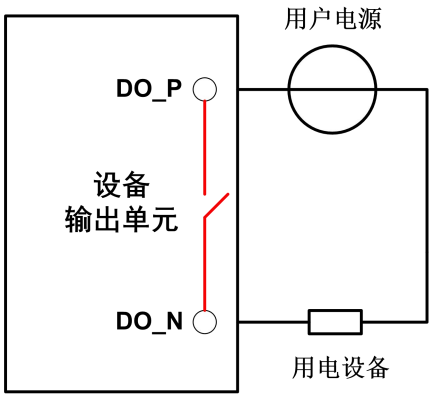


Figure 4.4 DO network connection

The switch output interface is a relay output type, and the interior is a relay contact. The output control circuit is not limited by voltage and polarity, and can be 24 V DC or 220 V AC. Since it is a dry contact output, users need an external power supply to supply power to alarm devices (such as buzzers).Figure 4.4 shows the connection.

The switch output interface is used to output the alarm signal. Through the configuration tool, configurable trigger events include record full, CAN bus error, and SD card status abnormality. In addition, the relay can be configured to be normally open or normally closed based on user needs.

4.8 LIN-Bus Interface

The device provides four independent LIN-Bus interfaces. The shell is identified as "LIN". The physical form of the interface is a 3.81 terminal. Table 4.16, Table 4.17, and Table 4.18 list the interface schematic diagram, signal definition, and interface specification.

Table 4.16 LIN interface

Type	Schematic Diagram
3.81 Terminal	

Table 4.17 OPEN, 3.81 signal definition

Function Interface	Signal Definition	Signal Description	Interface Type	
			OPEN Interface	3.81 Interface
LIN	Vbat	LIN DC voltage	√	√
	GND	LIN DC GND		
	LIN	LIN bus signal	√	√
	GND	Digital ground		√

Table 4.18 LIN-Bus interface specifications

Parameter		Minimum	Typical Value	Maximum	Unit
LIN line	Communication baud rate			20k	bps
	DC voltage	-36		36	V
	Dominant output level (logic 0)			0.75	V
	Receiver dominant level (logic 0)			2	V
	Receiver stealth level (Logic 1)	3			V

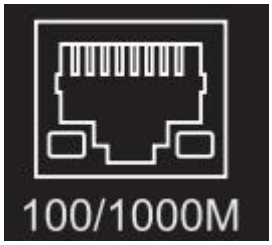
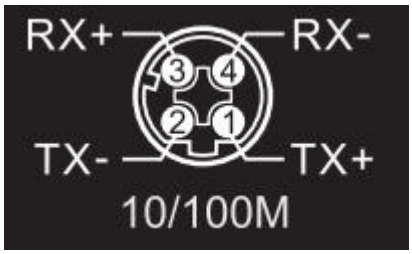
4.9 USB Interface

The device provides one USB interface. The device communicates with the PC over the USB cable. The interface conforms to the high-speed USB2.0 protocol specification and can communicate with PCs compliant with USB1.1 and USB2.0 standards. The physical form of the interface is a Type-B USB port.

4.10 Ethernet Interface

The device provides one Ethernet interface. The physical form of the interface is RJ45 or M12 terminal, which realizes the communication between the device and the PC. The interface 100/1000M specification, interface schematic diagram and signal definition are shown in 错误!未找到引用源。.

Table 4.19 Ethernet interface

Type	Schematic Diagram
RJ45 terminal	
M12 terminal	

4.11 Vehicle Ethernet Interface

The device provides one on-board Ethernet interface, which meets the OPEN Alliance BroadR-Reach specification. The physical form of the interface is the OPEN terminal, which realizes on-board Ethernet communication. This interface meets the 100M specification. Table 4.20, Table 4.21, and Figure 4.5 show the interface diagram and signal definition.

Table 4.20 Vehicle Ethernet interface

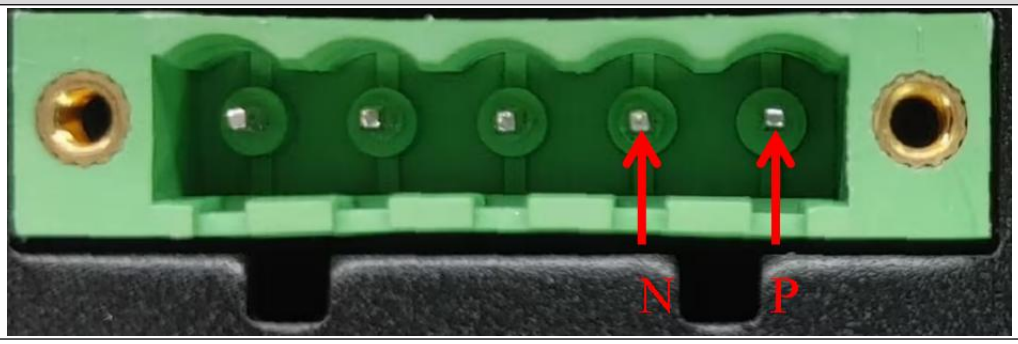
Type	Schematic Diagram
5.08 terminal	

Table 4.21 Signal definition

Function Interface	Signal Definition	Signal Description	Pin Number
LAN1	P	LAN1 data transceiver differential positive phase signal	1
	N	LAN1 data transceiver differential inverted signal	2

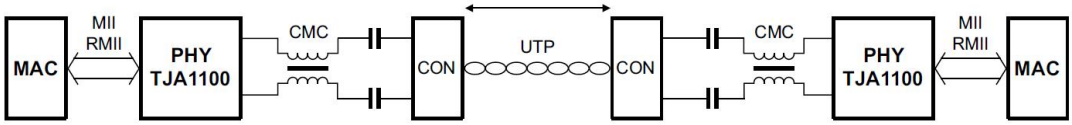


Figure 4.5 Typical network connection of on-board Ethernet

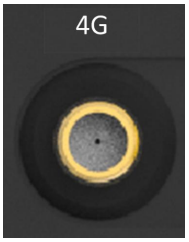
4.12 SD Card Interface

The device provides one SD card interface, which supports a maximum of 64 GB SD memory card for storing CANFD bus message data. The interface adopts a self-locking card slot, and the SD card can be locked after the card is inserted according to the direction of the shell logo to prevent accidental falling off during use. When pulling out the card, just push it inwards to eject the SD card.

4.13 4G Interface

The device provides one 4G interface. Table 4.22 lists the physical form of the interface.

Table 4.22 4G interface

Type	Schematic Diagram
4G interface	

4G antenna	

4.14 GPS Interface

The device provides one GPS interface. The physical form of the interface is shown in Table 4.23.

Table 4.23 GPS interface

Type	Schematic Diagram
4G interface	
GPS antenna	

4.15 WiFi Interface

The device provides one WiFi interface. The physical form of the interface is shown in Table 4.24.

Table 4.24 WiFi interface

Type	Schematic Diagram
4G interface	
WiFi antenna	

5. Quick Guide

5.1 Device Connection

Connect the hardware by referring to the interface instructions in the "Hardware Interfaces" chapter, and power on the device.

5.2 Configuration Tool Installation

Double-click the "CANDTUCfgSetup_Vxx.xx.xx.exe" configuration tool installation package. Follow the installation instructions to install the configuration tool. After the installation is complete, start the "CANDTU" configuration tool.

5.3 Device Search

After starting the configuration tool, click the "Device Model" area in the upper left corner of the configuration tool to display a list of devices. Click "CANDTU-Network Device" in the list. The "Search Devices" interface appears.

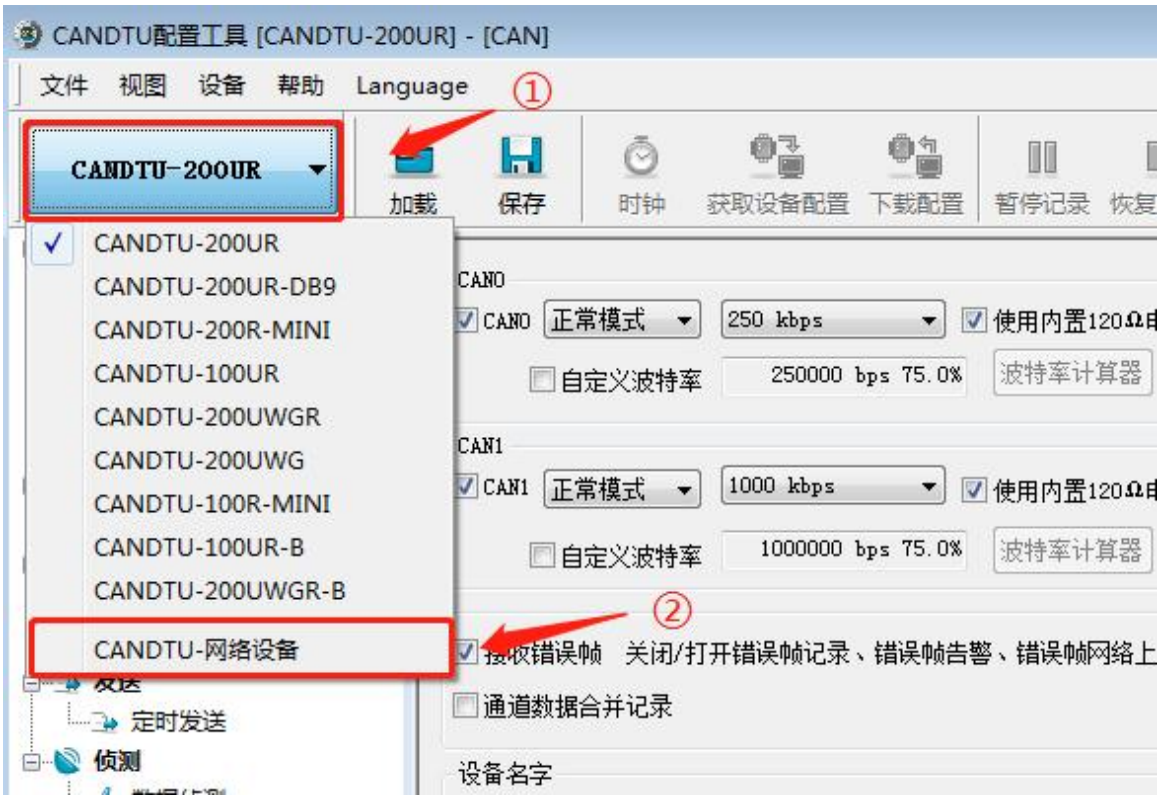


Figure 5.1 Starting the configuration tool

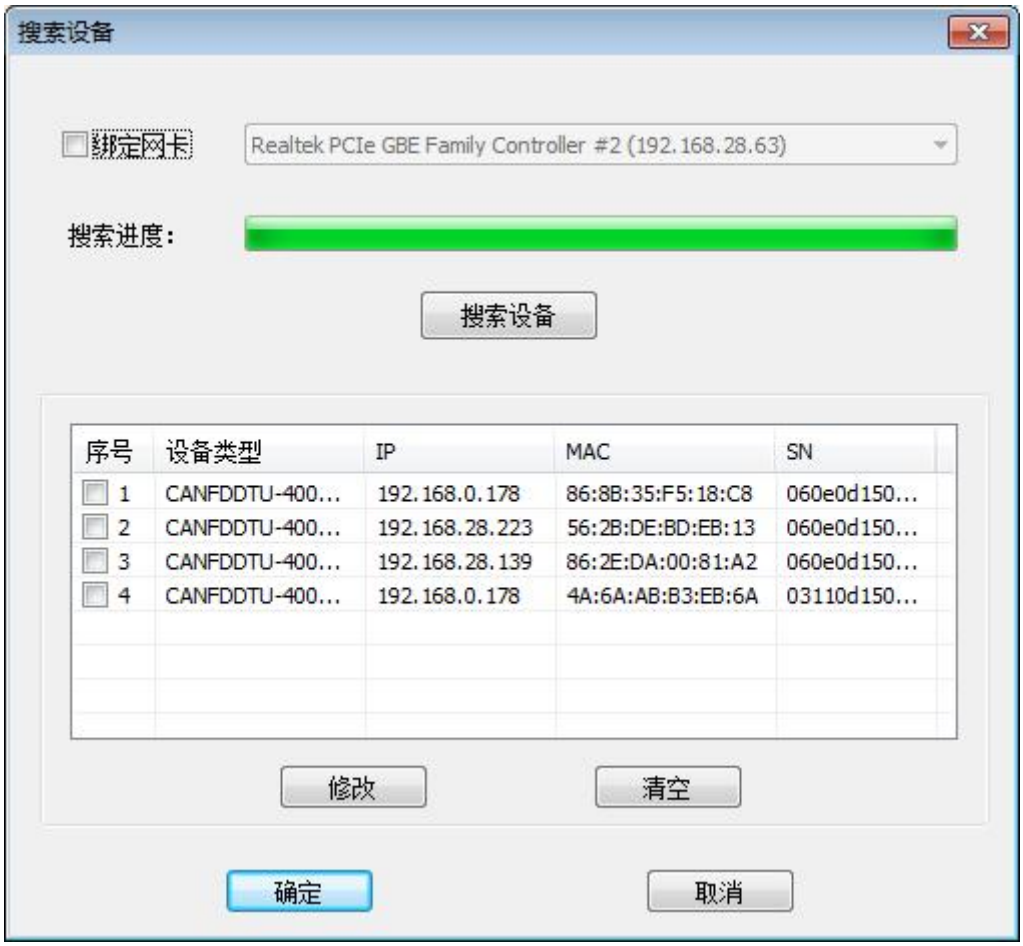


Figure 5.2 Searching devices

When the "Search Device" interface appears, it will automatically search for devices. If there is no device in the device list, click "Search Device" to refresh the device list. If the device cannot be found after several manual searches, try to "Bind NIC" and then manually search for the device.

After selecting the device in the device list, click "OK" to display the "Device Configuration" interface.

5.4 Basic Configurations

When using the device for the first time, configure the channel's baud rate parameter and termination resistance [1] switch as required.

5.4.1 Modifying Configurations

In the left menu bar of the configuration tool, click "CAN (FD)" to display the CAN (FD) channel configuration interface, as shown inFigure 5.3. After clicking the corresponding channel, configure the baud rate parameters and terminal resistance control of the channel.

[1]Theoretically, each CAN bus only needs two terminal resistors at the near end and the far end.

Figure 5.3 CAN (FD) channel configuration interface

After modifying the configuration parameters, click "Download Configuration" in the menu bar in the upper part of the configuration tool. Enter the password 88888 as prompted (modification is not supported). Click "OK" to start downloading the configurations, as shown inFigure 5.4. When downloading the configurations, the "Wait for device configuration to complete" interface appears, as shown in Figure 5.5. After the device is successfully configured, the interface disappears automatically.

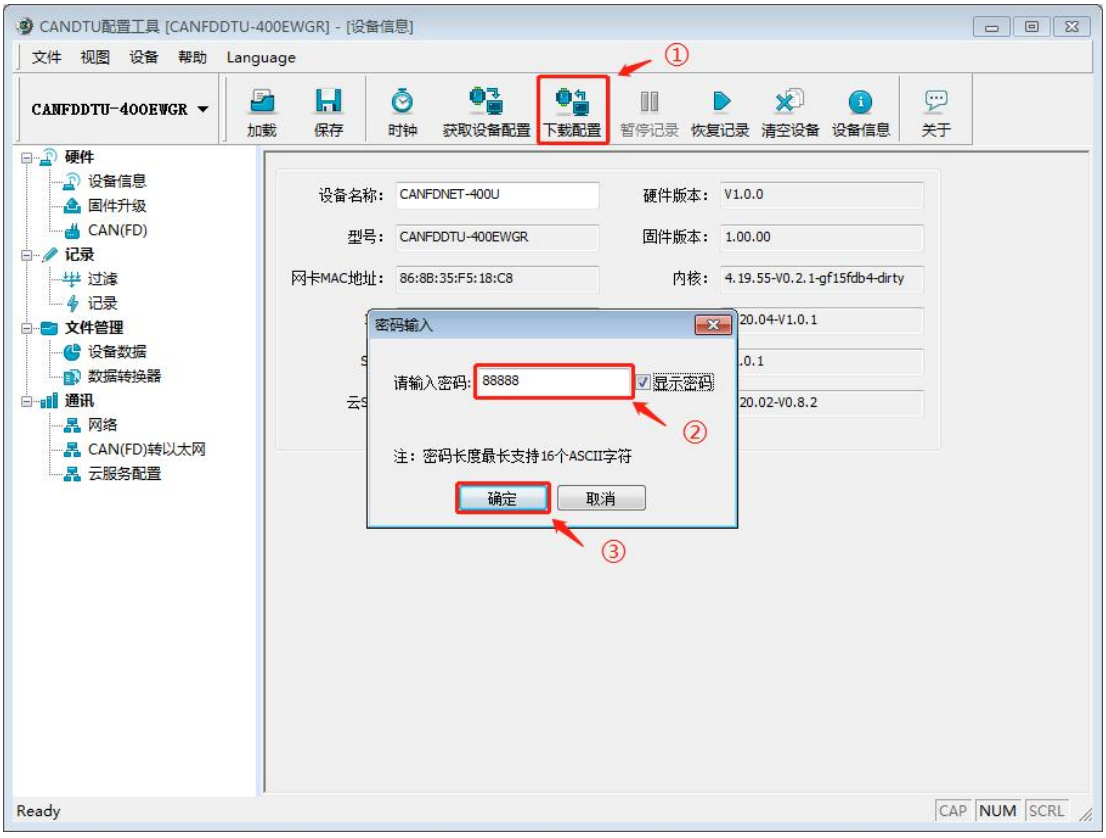


Figure 5.4 Downloading configurations

Figure 5.5 Waiting for configuration to complete

After the download is complete, click "Get Device Configuration" in the upper menu bar of the configuration tool to view the device configurations.

6. Disclaimer

Based on the principle of providing better service for users, Guangzhou Zhiyuan Electronics Co., Ltd. (hereinafter referred to as "Zhiyuan Electronics") will try to present detailed and accurate product information to users in this manual. However, due to the certain timeliness of this manual, Zhiyuan Electronics cannot fully guarantee the timeliness and applicability of this document at any time. Zhiyuan Electronics shall reserve the right to update this manual without prior notice. To get the latest version, please visit the official website of Zhiyuan Electronics regularly or contact Zhiyuan Electronics. Thank you for your tolerance and support!

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