Model: UT-6502M

(Product Name： Ethernet to Dual CANFD Protocol Converter)

User manual

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1. Overview

UT-6502M is a high-performance CAN(FD)-bus communication converter with 2 integrated CAN(FD) interfaces and 1 Ethernet (fiber optic) interface. The converter supports interconnection between CAN(FD)-bus and 10M/100M Ethernet networks with a communication rate of 50Kbps to 5Mbps, expanding the application range of CAN(FD)-bus and networks. UT-6502M converter provides a web configuration interface, allowing users to flexibly set operational parameters. Designed to industrial-grade standards with isolation between communication interfaces and systems, it is widely used in industrial control and data communication systems.

2. Technical Specifications

- Bidirectional data transfer between CAN(FD)-bus and network
- Supports CAN2.0/CANFD protocols
- 2 integrated CAN(FD)-bus communication interfaces, supporting communication rates from 50Kbps to 5Mbps
- Integrated 10M/100M Ethernet interface (100M fiber)
- Operating voltage: 12-36V DC
- Operating current: ≤ 120mA@12V
- Operating temperature: -40~+85°C
- Storage temperature: -40~+85°C
- Operating humidity: 5~95% (non-condensing)
- Storage humidity: 5~95% (non-condensing)
- Isolation voltage: 1000VDC
- ESD protection: Air 8kV, Contact 6kV
- Surge protection: Power port: 1.2/50us Common mode 2kV, Differential mode 1kV
  Ethernet port: 10/700us Common mode 2kV, Differential mode 1kV

3. Indicators

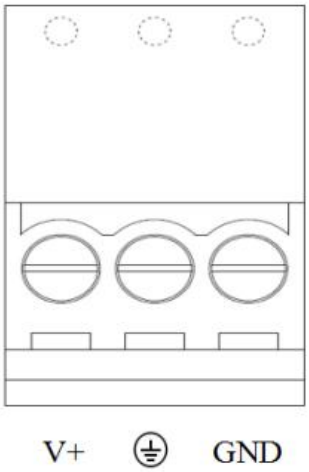
PWR	Green, power indicator; constantly lit when power is normal.
RUN	Green, system running indicator; flashes when the system is running normally.
CAN1	Green, communication indicator; flashes when CAN1 is sending or receiving data, extinguishes when transmission/reception is complete.
CAN2	Green, communication indicator; flashes when CAN2 is sending or receiving data, extinguishes when transmission/reception is complete.

4. Buttons

Reset: Button, press for 5 seconds to restore factory settings.

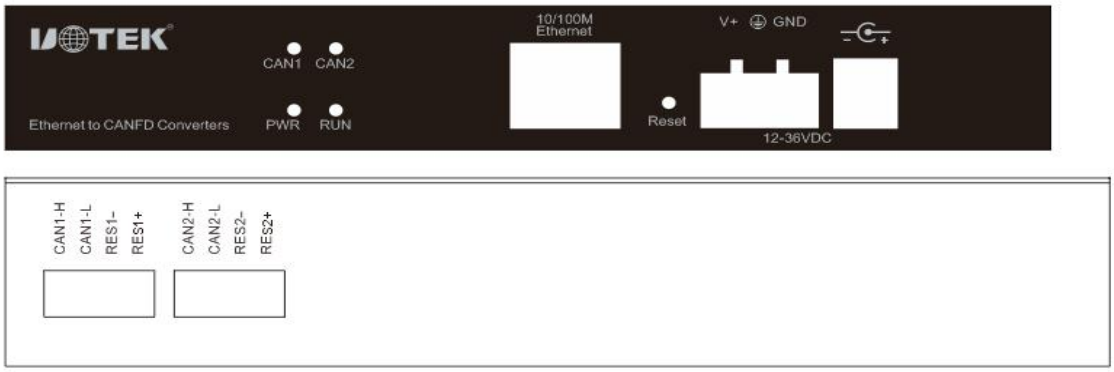
5. Pin Definitions

(1) Power Supply Pin Definitions



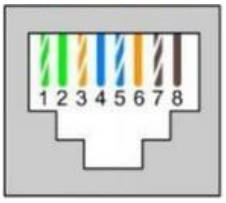
Pin name	Description
V+	Power positive
V-	Power negative
GND	GND

(2) Label Silk Screen

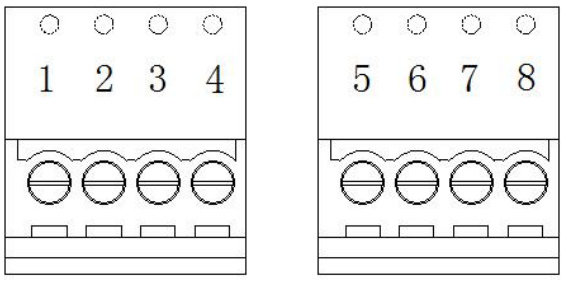


(3) RJ45 Network Port Definitions

RJ45	Definition	Description
1	TX+	Send positive
2	TX-	Send negative
3	RX+	Received positive
6	RX-	Received negative
4，5，7，8	-	-



(4) Terminal Pin Definitions



3.81-4pin Phoenix Terminal

Pin No.	Name	Description	Pin No.	Name	Description
1	CAN1-H	CAN1-H Signal Connection Terminal	5	CAN2-H	CAN2-H Signal Connection Terminal
2	CAN1-L	CAN1-L Signal Connection Terminal	6	CAN2-L	CAN2-L Signal Connection Terminal
3	RES1+	CAN1 Matching Resistor Terminal 1	7	RES2+	CAN2 Matching Resistor Terminal 1
4	RES1-	CAN1 Matching Resistor Terminal 2	8	RES2-	CAN2 Matching Resistor Terminal 2

*When the device functions as a CAN-bus terminal, connect CAN Matching Resistor Terminal 1 to Terminal 2, effectively short-circuiting them, equivalent to connecting a 120R matching resistor in parallel with the signal lines.

6. Factory Parameters

Default IP	192.168.1.125
Subnet Mask	255.255.255.0
Login Account	admin
Login Password	admin

7. Protocol Function Introduction

1. Transmission Modes

CAN transmission formats include CAN Fixed Format Transmission and Transparent Transmission.

"CAN Transparent Transmission" means that the device converts one format of bus data into another without adding or modifying data or performing any protocol analysis. In UT-6504, this involves transparent conversion between Ethernet data and CAN(FD) bus data, efficiently converting valid data between the two buses in real-time.

"CAN Fixed Format Conversion" is a simple usage mode with a fixed length for data. In CAN, it is fixed at 13 bytes, and in CANFD, it is fixed at 69 bytes. Fixed format transmission specifies that the frame content includes Frame Information (1 Byte) + ID (4 Bytes) + Data (8 Bytes for CAN, 64 Bytes for CANFD). By correctly configuring the frame information (first byte of data), the device can flexibly send various frame types, such as standard frames or extended frames. The specific frame information format is shown in Table 1.1.

FF	RTR	EDL	BRS (CANFD Valid)	DLC3	DLC2	DLC1	DLC0
0: Standard Frame 1: Extended Frame	0: Data Frame 1: Remote Frame	0：CAN 1：CANFD	0: Disable Acceleration 1: Enable Acceleration	Identifier Valid Data Length			

Table 1.1 Frame Information Explanation

Users can switch between the two transmission modes by configuring the operational parameters of the converter through the web configuration interface.

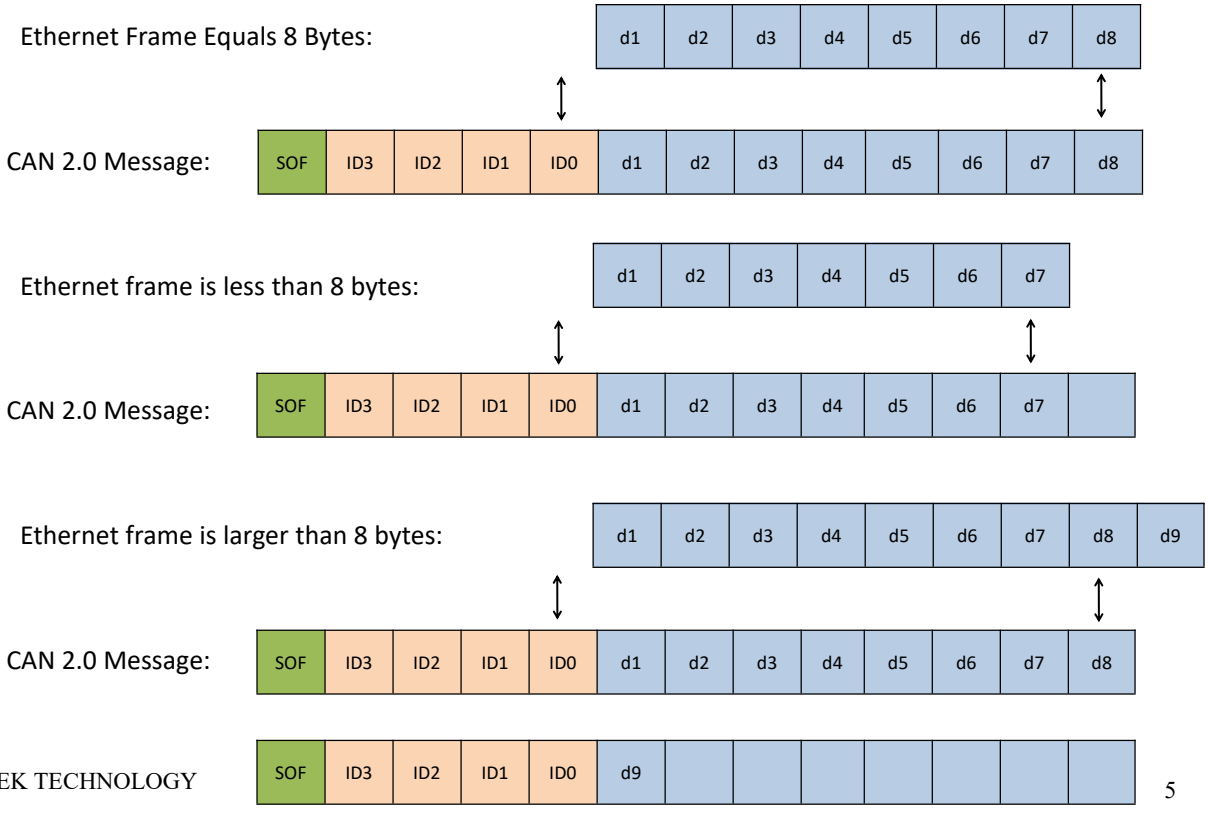
1.1 Transparent Transmission

In transparent transmission mode, the CAN(FD) frame ID is configured via the web configuration interface. When the device receives Ethernet TCP/IP frame data or the CAN port receives CAN protocol frames, it immediately performs the conversion.

(1) Transparent Transmission of CAN 2.0 Protocol

When configuring the CAN port for CAN 2.0 protocol, the Ethernet TCP/IP end needs to convert at most 8 bytes into a CAN message. If the Ethernet receives data larger than 8 bytes, it will be split into packets, with each 8-byte packet sequentially filled into the CAN frame data. When the CAN port receives a packet of CAN 2.0 protocol frame data, it forwards only the data field of the CAN frame to Ethernet TCP/IP.

Conversion format is as follows:



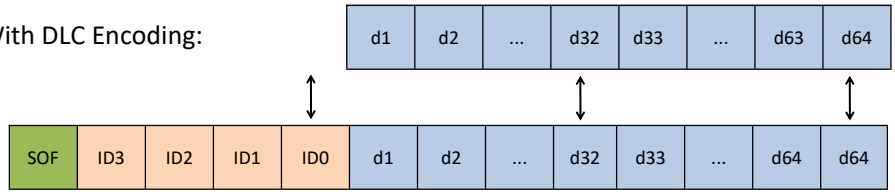
SOF is the Frame Information Byte, and ID0~ID3 are set via the WEB.

(2) Transparent Transmission of CANFD Protocol

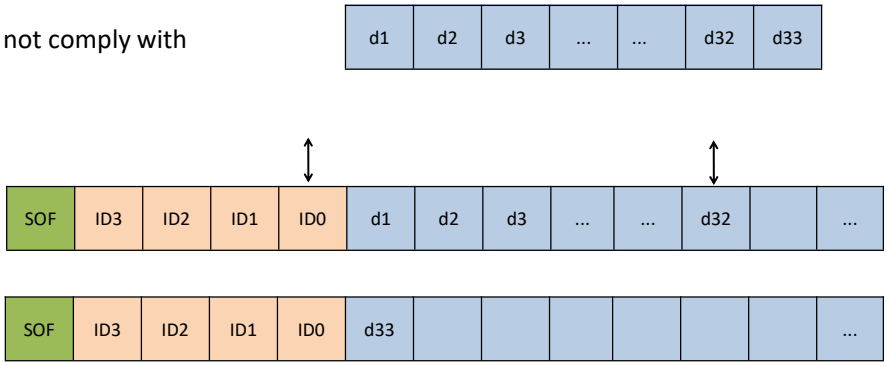
The principle of CANFD transparent conversion is similar to CAN 2.0. CANFD can convert at most 64 bytes of data into a CANFD message. However, it is crucial to note that when the Ethernet receives data lengths exceeding 8 bytes, it must be converted into a length encoded by DLC that CANFD can accurately represent. Specifically, the length should be 12, 16, 20, 24, 32, 48, or 64. Otherwise, the converter will automatically split the received Ethernet data into several CANFD messages of appropriate lengths. For example, if the Ethernet receives a data frame with a length of 40, and the DLC encoding of CANFD cannot represent a length of 40, the converter will look for the DLC encoding value closest to it, which is 32. Therefore, the converter will first convert a CANFD frame with a data field length of 32, and the remaining 8 bytes will be converted into another CANFD frame with a data field length of 8. The specific DLC encoding rules are explained in "2.2 Fixed Format Conversion."

Conversion format is as follows:

Ethernet Frame Less Than or Equal to 64 and Complies With DLC Encoding:



Ethernet frame does not comply with DLC encoding:



SOF is the Frame Information Byte, and ID0~ID3 are set via the WEB.

1.2 Fixed Format Transmission

During fixed format conversion, data protocol processing is based on the operational parameters set for the current device's CAN port. In CAN 2.0 mode, a fixed format defines a frame as 13 bytes, and any data less than 13 bytes or with incorrectly configured frame information will be ignored. In CAN FD mode, a fixed format specifies a frame as 69 bytes, and any data less than 69 bytes or with incorrectly configured frame information will be

disregarded. Whether CAN 2.0 or CAN FD, fixed format frames consist of CAN frame information + Frame ID + Frame data. In fixed format transmission mode, all CAN(FD) frame information is reflected in the received Ethernet data frame. Correctly configuring the frame information (SOF) Byte is essential for the converter to accurately transform data.

CAN 2.0 Fixed Format (13 bytes)		
Frame Information (SOF)	Frame ID	Frame Data
1Byte	4Byte	8Byte

Table 2.1 CAN 2.0 Fixed Format Frame

CAN FD Fixed Format (69 bytes)		
Frame Information (SOF)	Frame ID	Frame Data
1Byte	4Byte	64Byte

Table 2.2 CAN FD Fixed Format Frame

Frame Information (SOF) interpretation is as follows:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
FF	RTR	EDL	BRS	DLC3	DLC2	DLC1	DLC0

Table 2.3 Frame Information Interpretation

- FF: Standard and extended frame identifier; 0 for standard frame, 1 for extended frame.
- RTR: Remote frame and data frame identifier; 0 for data frame, 1 for remote frame.
- EDL: CAN 2.0 and CAN FD identifier; 0 for CAN 2.0, 1 for CAN FD.
- BRS: CAN FD acceleration enable identifier; 0 for no acceleration, 1 for acceleration. This bit is only effective in CAN FD mode; CAN 2.0 defaults to 0.
- DLC0~DLC3: Effective data length identifier. When operating in CAN 2.0 mode, the value range is 0x0-0x8, and in CAN FD mode, the range is 0x0-0xf.

When operating in CAN FD mode, DLC encoding follows the rules in Table 2.4.

0x0	0x1	0x2	0x3	0x4	0x5	0x6	0x7	0x8	0x9	0xA	0xB	0xC	0xD	0xE	0xF

0	1	2	3	4	5	6	7	8	12	16	20	24	32	48	64

Table 2.4 DLC Encoding Rules

Frame ID Explanation: The frame ID length is 4 bytes, with 11 valid bits for standard frames (0x00-0x7FF) and 29 valid bits for extended frames (0x00-0x1FFFFFFF).

Low Byte High Byte

12h	34h	56h	78h

Representation of Extended Frame ID 0x12345678

Low Byte High Byte

00h	00h	03h	FFh

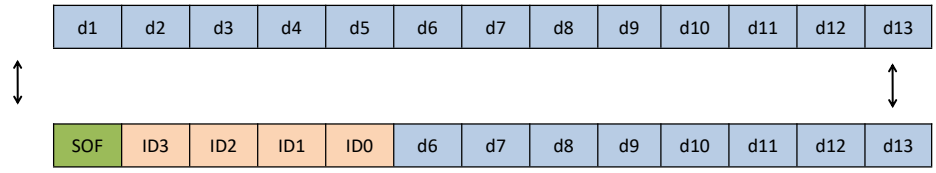
Representation of Standard Frame ID 0x3FF

(1) CAN 2.0 Fixed Format Conversion

Each CAN 2.0 fixed format frame is always 13 bytes, and any shortfall must be filled with zeros. In a given serial data frame, 13-byte formatted serial data corresponds to one CAN message, and serial data frames with fewer than 13 bytes are not converted. Therefore, it is essential to ensure that the serial data frames for conversion are aligned to 13 bytes.

During the process of converting Ethernet frames to CAN messages, if a 13-byte-aligned serial data frame has a segment with non-standard data format within those 13 bytes, these 13 bytes will not be converted. Subsequent data will continue to be converted. If certain CAN messages are missing after conversion, check if the 13-byte serial data format corresponding to those messages adheres to the standard format.

The conversion format is as follows:



Note: The EDL and BRS bits in the frame information must be 0; otherwise, the frame information error will not be processed.

Example:

The device receives data from the Ethernet side (hex):

88	00	00	00	3A	11	22	33	44	55	66	77	88

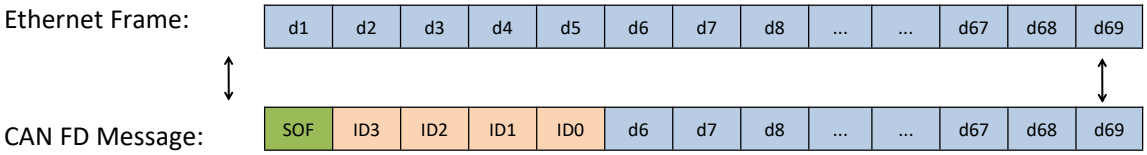
From data analysis, the frame information byte is 0x88, the frame ID is 0x0000003A, and the data field is 0x11~0x88. The FF bit of the frame information is 1, indicating an extended frame. The frame ID should not exceed 0x1FFFFFFF, which is also satisfied. Therefore, the converter packages this frame data as a CAN 2.0 frame for forwarding.

(2) CAN FD Fixed Format Conversion

Each CAN FD fixed format frame is always 69 bytes, and any shortfall must be filled with zeros. In a given serial data frame, 69-byte formatted serial data corresponds to one CAN message, and serial data frames with fewer than 69 bytes are not converted. Therefore, it is essential to ensure that the serial data frames for conversion are aligned to 69 bytes.

During the process of converting Ethernet frames to CAN messages, if a 69-byte-aligned serial data frame has a segment with non-standard data format within those 69 bytes, these 69 bytes will not be converted. Subsequent data will continue to be converted. If certain CAN messages are missing after conversion, check if the 69-byte serial data format corresponding to those messages adheres to the standard format.

The conversion format is as follows:



Note: The EDL bit in the frame information must be 1, indicating the CAN FD protocol; otherwise, the frame information error will not be processed.

Example:

The device receives data from the Ethernet side (hex):

3F	00	00	00	3A	01	02	03	04	...	3e	3f	40

Upon data analysis, the frame information byte is 0x3F, the frame ID is 0x0000003A, and the data field is 0x01~0x40. The FF bit in the frame information is 0, indicating a standard frame; the EDL bit is 1, indicating the CAN FD protocol; and the BRS bit is 1, indicating the CAN FD acceleration is enabled. The frame ID should not exceed 0x7FF, meeting the conditions. Therefore, the converter packages this frame data as a CAN FD frame for forwarding.

2. Filtering Mode

Filtering mode is divided into enabling filtering mode and disabling filtering mode.

(1) Enabling Filtering Mode: In this mode, filtering is accomplished by combining filter codes and mask codes, using a 32-bit filtering mode.

(2) Disabling Filtering Mode: Any CAN data packet ID can be received.

3. CAN Frame Packet Time

(1) Range of values (ms): It is advisable to be between (3, 500). The smaller the value, the faster the packet, and the faster the transmission speed.

4. Communication Mode

Module communication mode is divided into TCP and UDP, and module operating modes are Client and Server.

(1) Differences between Two Communication Modes:

TCP: Reliable, stable, ordered, etc. It is recommended for large-scale data transmission.

UDP: Faster speed, capable of broadcasting, etc. It is recommended for small-scale data transmission. TCP is preferred.

(2) Key Points:

Network debugging assistant should be configured to correspond to the respective mode for communication.

(3) Example:

TCP Client Mode:

Module Port Number	5001
Remote Device Port Number	6001
Module TCP/IP Communication Mode	TCP
Module TCP/IP Operating Mode	Client
Remote Server IP Address	192.168.1.176

In this scenario, the module is a TCP Client with port number 5001. On one end of the Ethernet, the server is enabled, configured with IP address 192.168.1.176, and port number 6001. The server's local IP should also be set to 192.168.1.176.

TCP Server Mode:

Module Port Number	5001
Module TCP/IP Communication Mode	TCP
Module TCP/IP Operating Mode	Server
Remote Server IP Address	N/A

In this case, the module is a TCP Server with port number 5001, and the IP is the device's IP address. On one end of the Ethernet, the client is enabled, configured with IP as the module's IP, and port number 5001.

UDP Client Mode:

(Note: Configure UDP server on the network interface before configuring this mode)

Module Port Number	5001
Remote Device Port Number	6001
Module TCP/IP Communication Mode	UDP
Module TCP/IP Operating Mode	Client
Remote Server IP Address	192.168.1.176

In this scenario, the module is a UDP Client with port number 6001. On one end of the Ethernet, the UDP server is enabled, configured with IP address 192.168.1.176, and port number 5005. The server's local IP should also be set to 192.168.1.176. After configuration, upon module restart, it will send "udp client start receive" to the UDP server, indicating the start of data reception.

UDP Server Mode:

Module Port Number	5001
Module TCP/IP Communication Mode	UDP
Module TCP/IP Operating Mode	Server

Remote Server IP Address	N/A

In this case, the module is a UDP Server with port number 5001, and the IP is the device's IP address. On one end of the Ethernet, the client is enabled, configured with IP as the module's IP, and port number 5001.

5. Data Transmission Protocol

（1）CAN 2.0 Protocol

Fixed Format: 13 bytes (hex)

Example: 88 00 00 00 3a 11 22 33 44 55 66 77 88

88: Frame information. The high four bits (8) indicate an extended frame (0 for standard frame), and the low four bits (8) indicate the number of data bits, ranging from [0, 8].

00 00 00 3a :Frame ID. Frame ID = 0x0000003a, with a range of [0, 0x1FFFFFFF] for extended frames and [0, 0x7FF] for standard frames.

11 22 33 44 55 66 77 88 ： Frame data. The number of data bits is the same as the low four bits of the frame information.

Transparent Transmission:

Transmit Command: 88 00 00 00 3a 11 22 33 44 55 66 77 88

Receiver Display: 88 00 00 00 3a 11 22 33 44 55 66 77 88

Fixed Format: 13 bytes (hex)

Example: 88 00 00 00 3b 11 22 33 44 55 66 77 88

88： Frame information. The high four bits (8) indicate an extended frame (0 for standard frame), and the low four bits (8) indicate the number of data bits, ranging from [0, 8].

00 00 00 3b :Frame ID. Frame ID = 0x0000003a, with a range of [0, 0x1FFFFFFF] for extended frames and [0, 0x7FF] for standard frames.

11 22 33 44 55 66 77 88：Frame data. The number of data bits is the same as the low four bits of the frame information.

Transparent Transmission:

Transmit Command: 88 00 00 00 3b 11 22 33 44 55 66 77 88

Receiver Display: 11 22 33 44 55 66 77 88

(2) CAN FD Protocol

Fixed Format: 69 bytes (hex)

Example: 3f 00 00 00 23 00 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 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f

3f： First byte of frame information. The high four bits (3) indicate a CAN FD standard frame with CAN FD acceleration enabled, and the low four bits (f) indicate the number of data bits, corresponding to DLC encoding of 64 bits, ranging from [0, f].

00 00 00 23： Frame ID. Frame ID = 0x00000023, with a range of [0, 0x1FFFFFFF] for extended frames and [0, 0x7FF] for standard frames.

00 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 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f ： Frame data. The number of data bits corresponds to the low four bits of the frame information and must comply with the DLC encoding rules.

When transmitting in fixed format:

Transmit Command：3f 00 00 00 23 00 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 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f

Receiver Display：3f 00 00 00 23 00 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 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f

Fixed Format: 69 bytes (hex)

Example： af 00 00 12 34 00 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 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f

af： The first byte represents frame information. The high four bits (a) indicate a CANFD extended frame with CANFD acceleration enabled, and the low four bits (f) indicate the number of data bits, corresponding to DLC encoding of 64 bits, with values in the range [0, f].

00 00 12 34:Frame ID. The frame ID is 0x0001234, with a range of [0, 0x1FFFFFFF] for extended frames and [0, 0x7FF] for standard frames.

00 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 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f：Frame data. The number of data bits is the same as the low four bits of the frame information.

Transparent Transmission:

Transmit Command： af 00 00 12 34 00 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 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f

Receiver Display: 00 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 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f

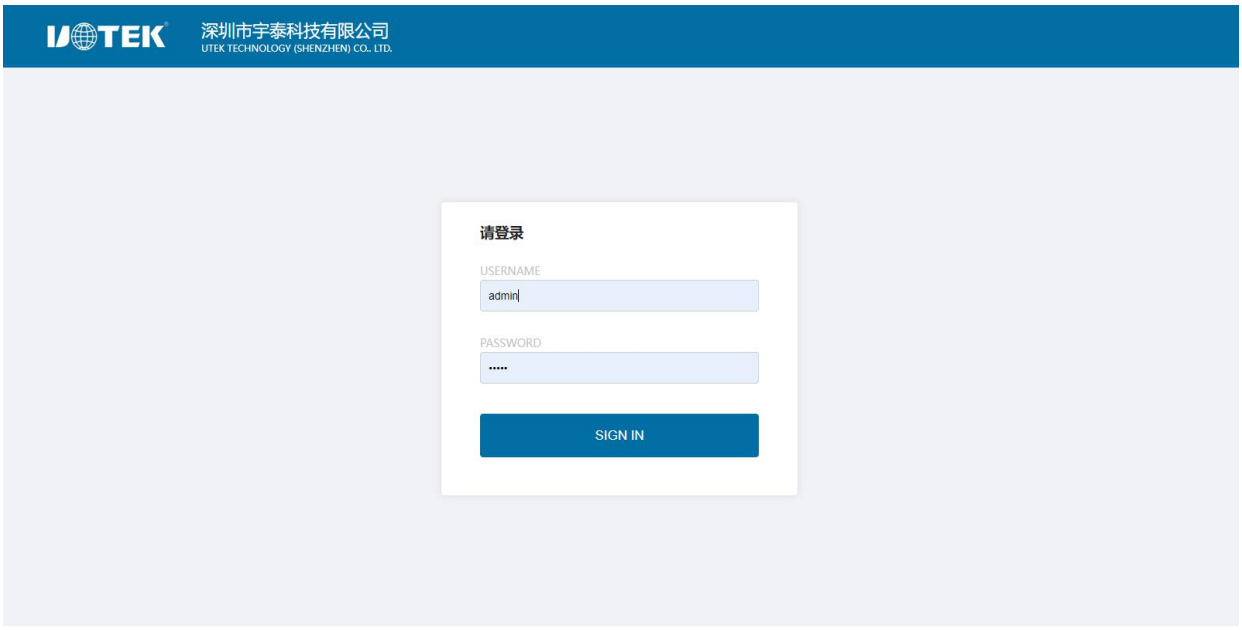
（3）Comparison:

Fixed format transmission/reception: Faster speed, good stability, displays the partner's ID as manually filled, but transmits slightly less data.
Transparent transmission/reception: More data bits, but slower speed, displays the partner's ID as a fixed ID configured via the web page.

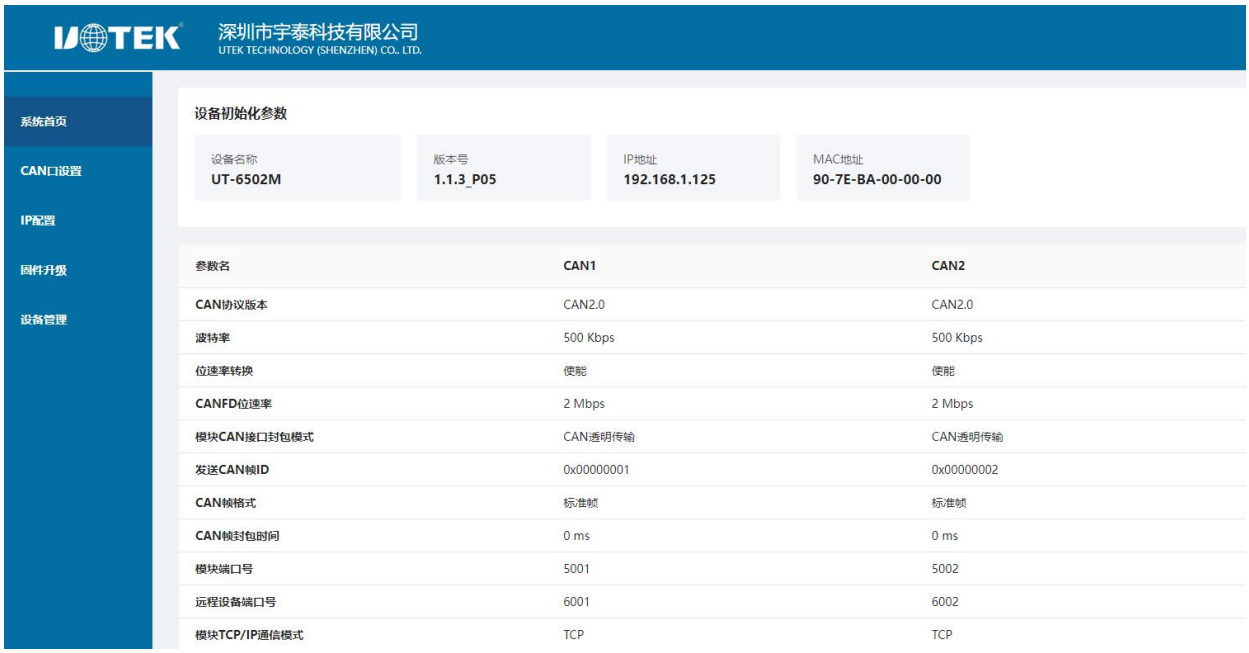
8. Web Operation Instructions

1. Login Interface

The default initial username and password are both "admin."



2. Main Interface

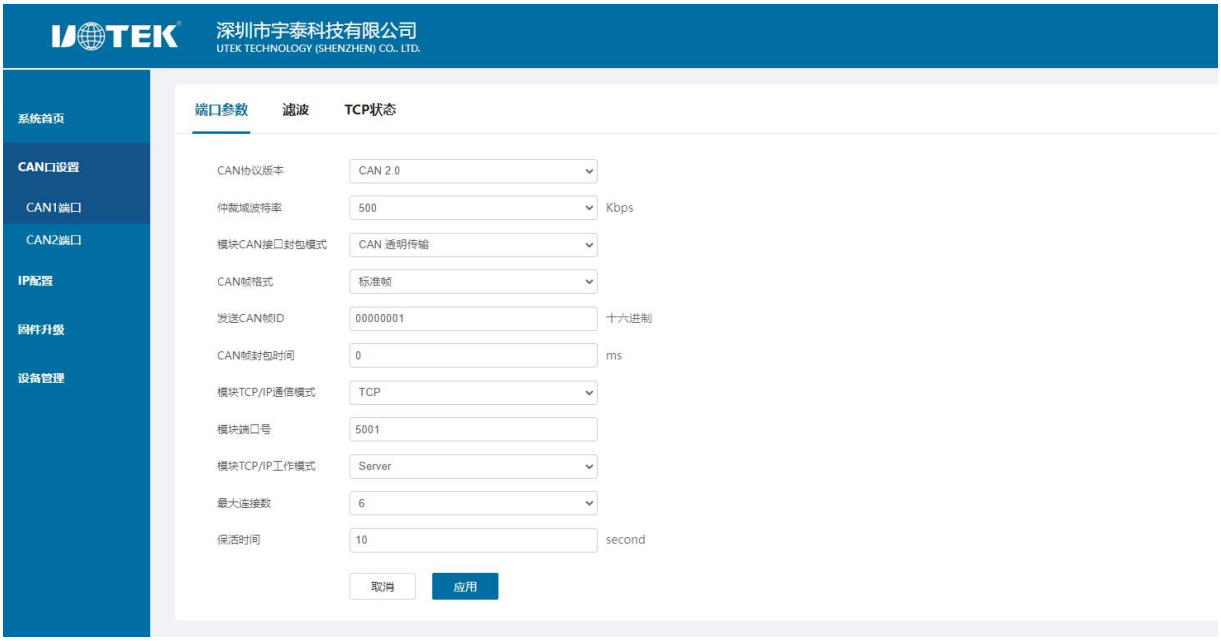


参数名	CAN1	CAN2
CAN协议版本	CAN2.0	CAN2.0
波特率	500 Kbps	500 Kbps
位速率转换	使能	使能
CANFD位速率	2 Mbps	2 Mbps
模块CAN接口封包模式	CAN:透明传输	CAN:透明传输
发送CAN帧ID	0x00000001	0x00000002
CAN帧格式	标准帧	标准帧
CAN帧封包时间	0 ms	0 ms
模块端口号	5001	5002
远程设备端口号	6001	6002
模块TCP/IP通信模式	TCP	TCP

Here, you can view current device parameter information, including device name, version, network parameters, and CAN port operating parameters.

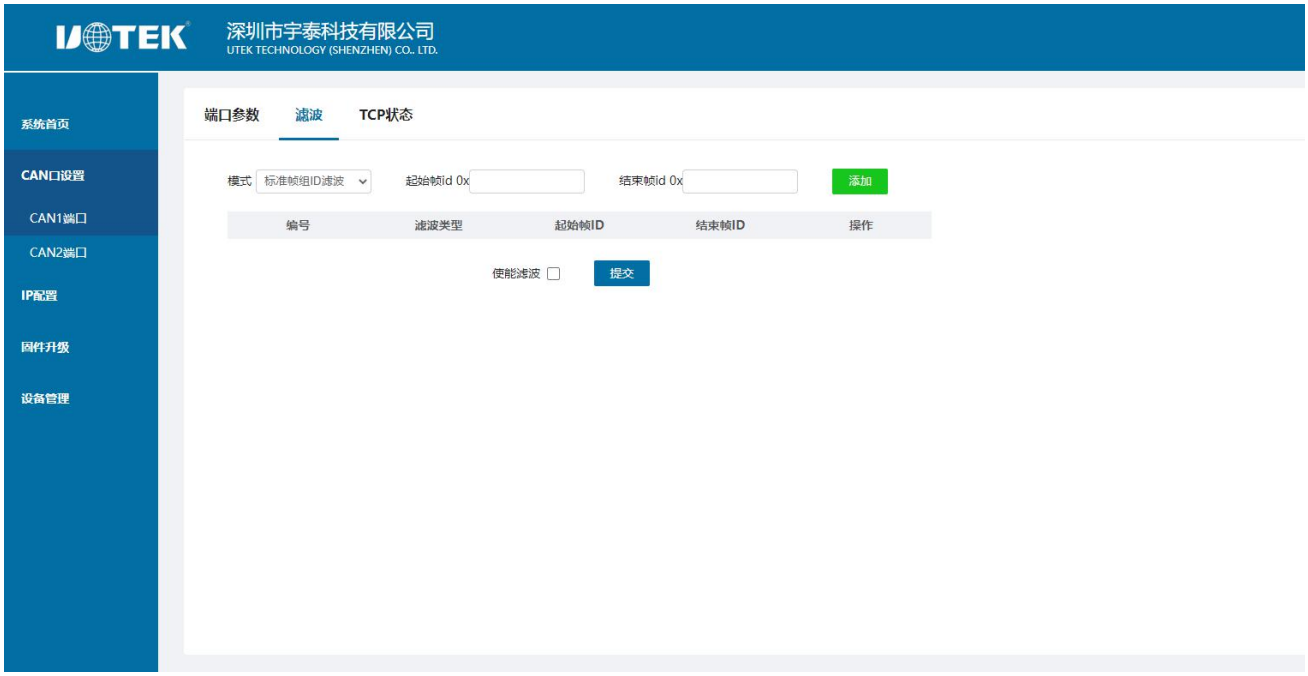
3. CAN Port Parameter Configuration

3.1 Port Parameter Settings



Configuration Items	Descriptions
CAN Protocol Version	CAN 2.0 or CANFD
Bit Rate Conversion	Enable CANFD data area acceleration
Data Area Baud Rate	CANFD data area baud rate, selectable range 1Mbps-5Mbps
Arbitration Area Baud Rate	CAN arbitration area communication rate, selectable range 50Kbps-1000Kbps
Module CAN Interface Packet Mode	CAN transmission mode, can be set to transparent transmission or fixed format transmission
CAN Frame Format	CAN frame format, can be set to standard frame or extended frame
Transmit CAN Frame ID	Set the frame ID
CAN Frame Packet Time	CAN packet transmission interval
Module TCP/IP Communication Mode	Device communication mode, divided into TCP and UDP
Module Port Number	Module port number as a server
Module TCP/IP Operating Mode	Set the module operating mode, Server, and Client
Remote Server IP Address	IP address of the remote server to connect to as a client
Remote Device Port Number	Port number of the remote server to connect to as a client
Maximum Connection Count	Maximum supported number of client connections
Keep-Alive Time	TCP keep-alive time

3.2 Filtering Settings

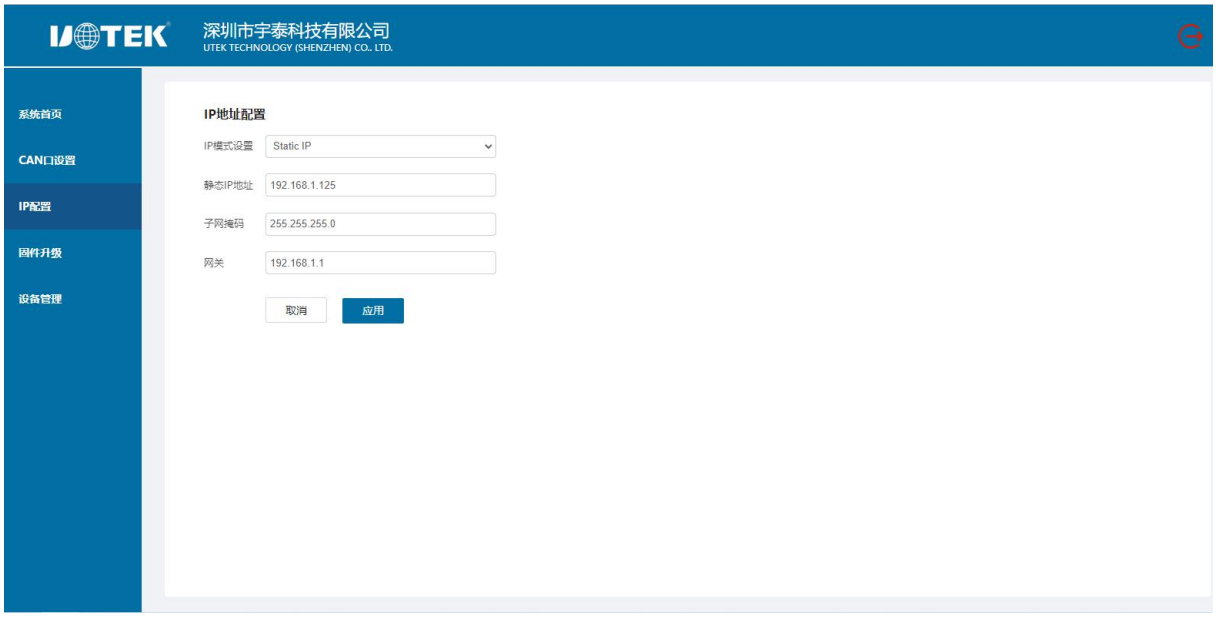


Configuration Items	Descriptions
Mode	Set the frame format to filter, including standard frame ID filtering and extended frame ID filtering.
Start Frame ID	Set the start frame ID for filtering.
End Frame ID	Set the end frame ID for filtering.
Note: ① When only setting standard frame ID filtering, it will only take effect for standard frames; no filtering effect will occur for extended frames. ② The generated filtering ID range is between the start frame and end frame IDs (including the set start and end frame IDs), and multiple sets can be configured simultaneously.	

3.3 TCP Status

Configuration Items	Descriptions
IP Address	IP address the device is connected to under TCP status.
Port	Port to which the device is connected under TCP status.
Status	Display connection status.
Tx, Rx	Current TCP connection's transmit and receive data count.

4. IP Configuration

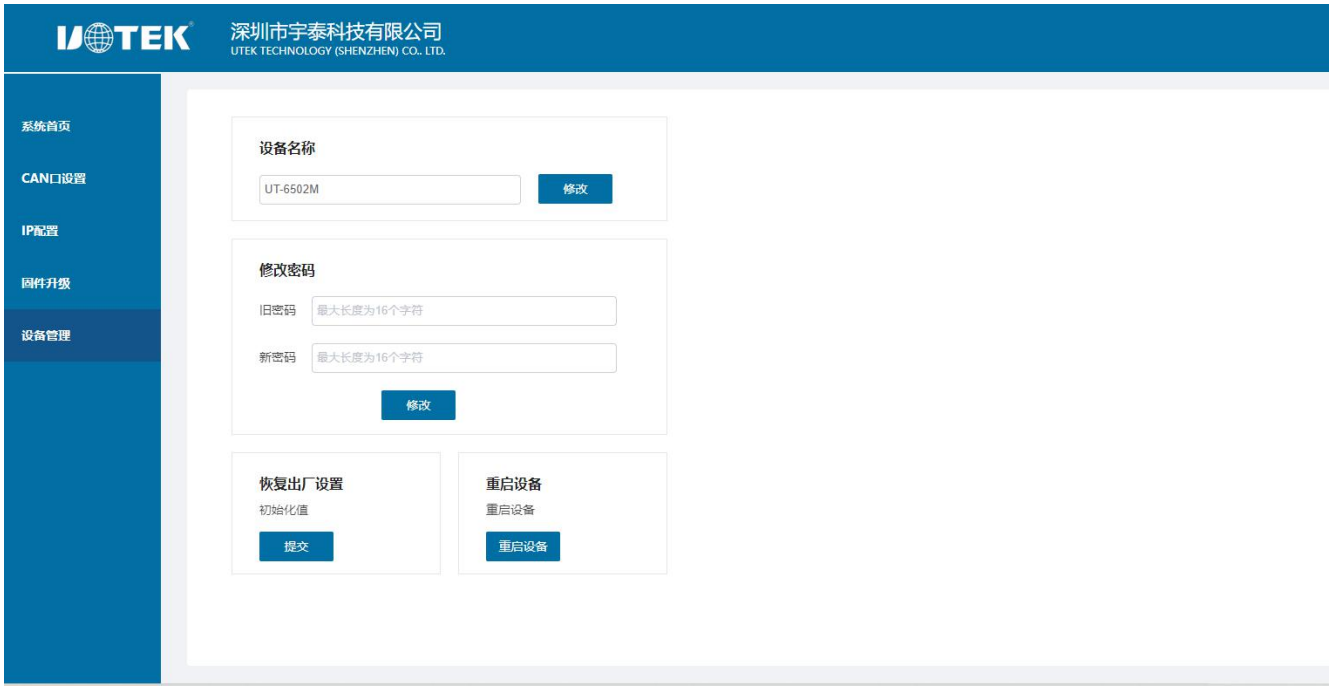


Configuration Items	Descriptions
IP Mode Setting	Set IP mode, either static IP or dynamic IP DHCP acquisition.
Static IP Address	Set the device's static IP address.
Subnet Mask	Device subnet mask.
Gateway	Device gateway address.

5. Firmware Upgrade

Here, you can upgrade the device's firmware. When upgrading the device, please use the official upgrade package; click "Select File" > "Import File" > click "Upgrade."

6. Device Management



Configuration Items	Descriptions
Device Name	Set the device's name, i.e., the device model.
Old Password	If you need to change the device's login password, you must first enter the current password.
New Password	Set a new login password.
Reset	Restore the device to factory parameters.
Restart Configuration	Restart button.