



EtherCAN/3-FD

Multifunctional CAN to Ethernet Gateway



Manual

For Product C.2055.62

Notes

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This manual contains important information and instructions on safe and efficient handling of the EtherCAN/3-FD. Carefully read this manual before commencing any work and follow the instructions.
The manual is a product component, please retain it for future use.

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The changes in the document listed below affect changes in the hardware as well as changes in the description of the facts, only.

Rev.	Chapter	Changes versus previous version	Date
1.0	-	First version of the manual	2025-02-18
1.1	-	CAN port number at InRail bus corrected to CAN 0 (fig. 2)	2025-02-20
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Technical details are subject to change without further notice.

Classification of Warning Messages and Safety Instructions

This manual contains noticeable descriptions, warning messages and safety instructions, which you must follow to avoid personal injuries or death and property damage.



This is the safety alert symbol.

It is used to alert you to potential personal injury hazards. Obey all safety messages and instructions that follow this symbol to avoid possible injury or death.

DANGER, WARNING, CAUTION

Depending on the hazard level the signal words DANGER, WARNING or CAUTION are used to highlight safety instructions and warning messages. These messages may also include a warning relating to property damage.



DANGER

Danger statements indicate a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

Warning statements indicate a hazardous situation that, if not avoided, could result in death or serious injury.



CAUTION

Caution statements indicate a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Notice statements are used to notify people on hazards that could result in things other than personal injury, like property damage.



NOTICE

This NOTICE statement indicates that the device contains components sensitive to electrostatic discharge.



NOTICE

This NOTICE statement contains the general mandatory sign and gives information that must be heeded and complied with for a safe use.

INFORMATION



INFORMATION

Notes to point out something important or useful.



Safety Instructions

- When working with the EtherCAN/3-FD follow the instructions below and read the manual carefully to protect yourself from injury and the EtherCAN/3-FD from damage.
 - The assembly is classified as open equipment and must therefore be installed in a control cabinet that is designed for the specific environment. To generally improve EMC immunity and operational safety, we recommend a lockable metal housing.
 - Do not use damaged or defective cables to connect the EtherCAN/3-FD and follow the CAN wiring hints in chapter: "Correct Wiring of Electrically Isolated CAN Networks".
 - In case of damages to the device, which might affect safety, appropriate and immediate measures must be taken, that exclude an endangerment of persons and animals and property.
 - The galvanic isolation of the EtherCAN/3-FD has only functional tasks and is not a protection against hazardous electrical voltage.
 - The EtherCAN/3-FD is a device of protection class III according to DIN EN 61140 and may only be operated on supply circuits that offer sufficient protection against dangerous voltages.
 - External circuits connected to the ports of the EtherCAN/3-FD must be sufficiently protected against dangerous voltage.
 - The user is responsible for compliance with the applicable national safety regulations.
-
- Do not open the housing of the EtherCAN/3-FD .
 - The EtherCAN/3-FD must be securely installed before commissioning.
 - The permitted operating position is specified as shown in chapter 16.4.1. Other operating positions are not allowed.
 - Never let liquids get inside EtherCAN/3-FD. Doing so may result in electric shocks or short circuits.
 - Protect the EtherCAN/3-FD from dust, moisture, and steam.
 - Protect the EtherCAN/3-FD from shocks and vibrations.
 - The EtherCAN/3-FD may become warm during normal use. Always allow adequate ventilation around the EtherCAN/3-FD and take care when handling
 - Do not operate the EtherCAN/3-FD adjacent to heat sources and do not expose it to unnecessary thermal radiation. Ensure that the ambient temperature remains within the limits specified in the technical data.



NOTICE

Electrostatic discharges may cause damage to electronic components.

→ Take the appropriate precautions for handling electrostatic discharge sensitive devices.

Qualified Personnel

This documentation is directed exclusively towards personnel qualified in control and automation engineering. The installation and commissioning of the product may only be carried out by qualified personnel, which are authorized to put devices, systems, and electric circuits into operation according to the applicable national standards of safety engineering.

Conformity

The EtherCAN/3-FD is an industrial product and meets the demands of the EU regulations and EMC standards printed in the conformity declaration at the end of this manual.

Warning: In a residential, commercial, or light industrial environment the EtherCAN/3-FD may cause radio interferences in which case the user may be required to take adequate measures.

Data Safety

This device is equipped with an Ethernet or other interface which is suitable to establish a connection to data networks. Depending on the software used on the device, these ports may allow attackers to compromise normal function, get illegal access or cause damage.

esd does not take responsibility for any damage caused by the device if operated at any networks. It is the responsibility of the user of the device to ensure that the necessary safety precautions are taken for the network ports of the device.

Intended Use

The intended use of the EtherCAN/3-FD is the operation as an Ethernet-CAN-Gateway or CAN-to-CAN bridge via Ethernet.

The guarantee given by esd does not cover damages which result from improper use, usage not in accordance with regulations or disregard of safety instructions and warnings.

- The EtherCAN/3-FD is intended for indoor use only.
- The operation of the EtherCAN/3-FD in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the EtherCAN/3-FD for medical purposes is prohibited.

Service Note

The EtherCAN/3-FD does not contain any parts that require maintenance by the user. The EtherCAN/3-FD does not require any manual configuration of the hardware. Unauthorized intervention in the device voids warranty claims

Disposal



Products marked with a crossed-out dustbin must not be disposed of with household waste. Devices which have become defective in the long run must be disposed in an appropriate way or must be returned to the manufacturer for proper disposal. Please, contribute to environmental protection.

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1 Overview

1.1 About this Manual

This manual describes the hardware and the software of the EtherCAN/3-FD module.

1.2 Description of EtherCAN/3-FD

The EtherCAN/3-FD is equipped with an ARM Cortex M4 processor, an Ethernet port and two CAN FD ports. The Ethernet port is suitable for 10 Mbit/s and 100 Mbit/s networks and can be connected via an RJ45-socket.

The two CAN ports are both connected via 5-pin Combicon® connectors. The ports comply with ISO 11898-2, are electrically isolated and can be used for transmission rates from 10 kbit/s up to 8 Mbit/s. The Ethernet connectors, status LEDs and dip switches are located on the front panel of the module. The CAN ports are located on the top and the bottom of the module. The CAN port on the bottom can also be connected via In-Rail bus.

The 4-pin Combicon connector for the power supply is located on the bottom of the module.

Usage as Gateway or Bridge

The EtherCAN/3-FD enables remote access to CAN FD or CAN CC buses via Ethernet. Three different modes of operation allow a versatile integration of a CAN bus into a system with LAN connectivity. EtherCAN mode or platform-independent client or server modes.

Furthermore, two EtherCAN/3-FDs gateways can operate autonomously in a bridge mode to seamlessly connect two CAN networks via Ethernet.

Ethernet and CAN FD Ports

The EtherCAN/3-FD features one (10/100 Mbit/s) Ethernet port and two galvanically isolated CAN FD ports for bitrates from 10 Kbit/s up to 8 Mbit/s. CAN FD is downward-compatible to the CAN 2.0 A/B standard, so the device can be integrated into any CAN CC based net.

EtherCAN Mode

The EtherCAN technology developed by esd enables the NTCAN API based access to a CAN bus from a host PC remotely connected via LAN in the same way as the access via a local CAN port. This can also be done with configurable TLS encryption.

A single EtherCAN/3-FD can be connected to different hosts and/or different applications on the same host. The EtherCAN mode is supported on Windows® and Linux®.

Platform-independent Server Mode

The EtherCAN/3-FD supports the open, proprietary, UDP and TCP based EtherCAN Low Level Socket Interface (ELLSI) protocol, so a CAN bus can be controlled and accessed from any UDP or TCP capable device.

Example C source code of ELLSI client implementation is provided as part of the SDK. S7-300/400 function blocks with ELLSI support on request. A separate manual providing the API is available (6).

Platform-independent Client Mode

The EtherCAN/3-FD streams all received CAN data to a server for custom storage, post-processing and visualization. The communication is based on an open TCP based network protocol.

Bridge Mode

With two EtherCAN/3-FD modules the Bridge operation mode allows to connect two CAN networks via LAN. The data is exchanged via TCP with configurable TLS encryption. To minimize the exchanged data the device supports sophisticated filter mechanisms.

Overview

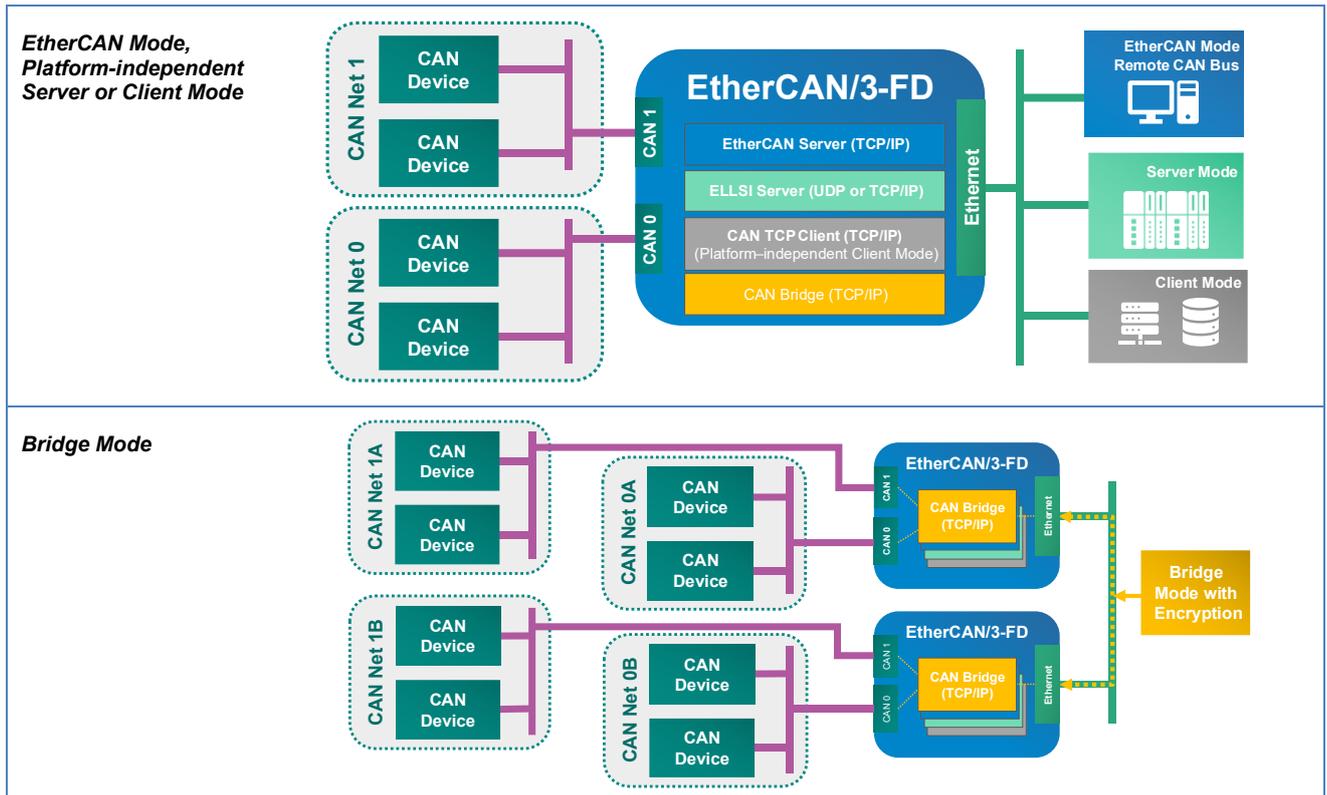


Figure 1: Schematic examples of application

1.3 Glossary

Abbreviations

Abbreviation	Term	Description
API	Application Programming Interface	
CAN	Controller Area Network	In this manual the term CAN only includes CAN CC and CAN FD. CAN XL is not supported.
CAN CC	CAN classic	
CAN FD	CAN flexible data rate	
CPU	Central Processing Unit	
CiA	CAN in Automation	
ELLSI	EtherCAN Low Level Socket Interface	
LSB	Least Significant Bit	
MSB	Most Significant Bit	
n.a.	not applicable	
OS	Operating System	
RTR	Remote Transmission Request	
PKI	Public Key Infrastructure	
SNTP	Simple Network Time Protocol	
TLS	Transport Layer Security	

2 Hardware

2.1 Connecting Diagram

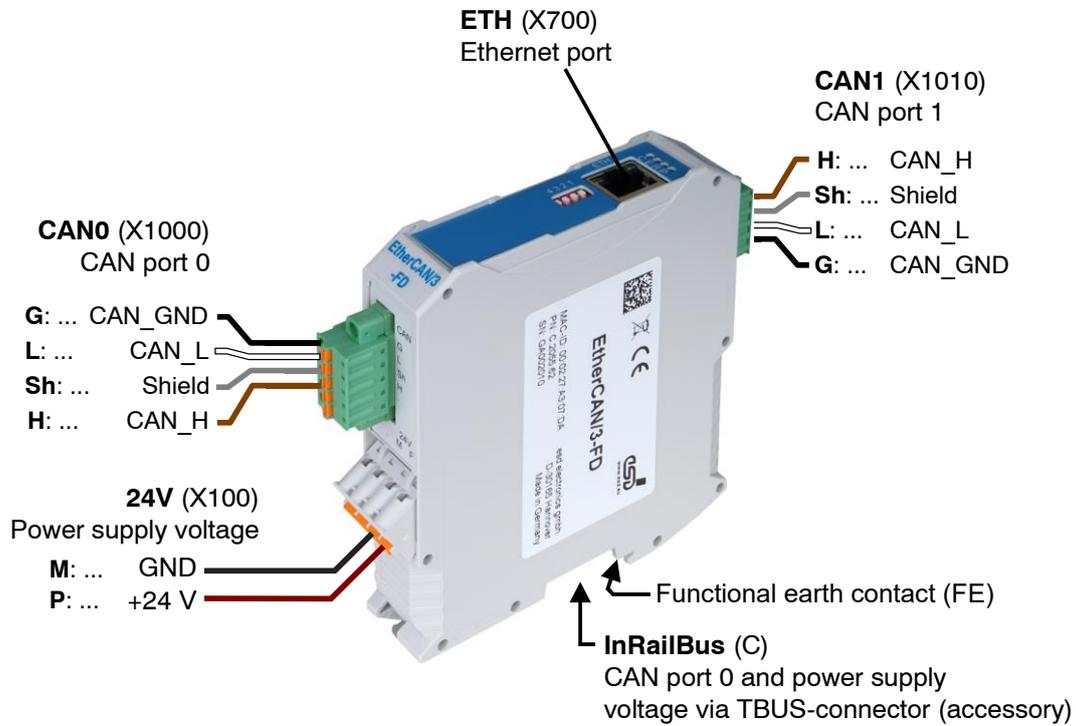


Figure 2: Connections in operable state

NOTICE
 Read chapter “3. Starting Up” from page 15, before you start with the installation of the hardware!
 Please refer to chapter “13. Connector Assignments” from page 73 for signal assignment of the connectors.

3 Starting Up

3.1 Installing and Uninstalling Hardware

To install or uninstall the EtherCAN/3-FD, please follow the installation notes.

Step	Procedure	See Page
	NOTICE Read the safety instructions at the beginning of this document carefully before you start with the hardware installation/!	5
	DANGER Hazardous voltage - Risk of electric shock due to unintentional contact with uninsulated live parts with high voltages inside of the system into which the EtherCAN/3-FD is to be integrated. → The EtherCAN/3-FD is a device of protection class III according to DIN EN 61140 and may only be operated on supply circuits that offer sufficient protection against dangerous voltages. → Compliance with the applicable national safety regulations is the responsibility of the user. → Ensure the absence of voltage before starting any electrical work.	-
	To install, continue as described in chapter 3.2 'Installing the Hardware'. To uninstall, continue as described in chapter 3.3 'Uninstalling the Hardware'.	15 16

3.2 Installing the Hardware

Step	Procedure	See Page
1.	Observe the safety instructions at the beginning of chapter 3.1.	15
2.	Mount the EtherCAN/3-FD module on a top hat rail. Connect the ports (CAN, Ethernet, power supply voltage). See also chapter 13 for Connector Assignments	14 73
3.	Please note that the CAN bus must be terminated at both ends! esd offers special T-connectors and termination connectors for external termination. Additionally, the CAN_GND signal must be connected to earth at exactly one point in the CAN network. For details, please read chapter "Correct Wiring of Electrically Isolated CAN Networks".	78
	NOTICE Incorrect wiring of the 24V power supply voltage can cause damage to the module! → Make sure to connect the cables correctly to the 24V cable connector! See page 76 → Only use suitable cables for the plug.	76
4.	Before you switch on the supply voltage, check that all plug connectors are correctly seated. Switch on the 24 V-power supply voltage of the EtherCAN/3-FD	-

Starting Up

Step	Procedure	See Page
5.	Go on with chapter further steps for Software setup as described in chapter 3.4.	17

3.3 Uninstalling the Hardware

Step	Procedure	See Page
1.	Observe the safety instructions at the beginning of chapter 3.1.	15
2.	Make sure that all connected ports and power supply are switched off.	-
3.	Disconnect the EtherCAN/3-FD from the connected ports.	-
4.	Unlock the retaining clamp with a screwdriver and carefully pull the EtherCAN/3-FD from the top hat rail.	-

3.4 Software Setup



INFORMATION

The software is supplied on the enclosed CD 'CAN Driver Software and Documentation'. The latest version of the software can also be downloaded from our website at <https://esd.eu/en/products/ethercan-3-fd>

3.4.1 Installation Steps for Operation in EtherCAN Mode

Step	Action	see Page
1.	Assignment of a valid IP address for EtherCAN/3-FD. 1a) If the current IP address is known, proceed to step 3. with the assignment of a fixed IP address and the further configuration. 1b) If the current IP address is not known, use <i>QESDCP</i> to detect it and to assign a fixed IP address. For that purpose, at first the EtherCAN SDK with the <u>host-driver</u> software has to be installed as described in step 2.	-
2.	1. Insert the CD 'CAN Driver Software and Documentation' in the appropriate drive of your PC. 2. Install the EtherCAN SDK with the EtherCAN/3-FD <u>host-driver</u> software, as described in the manual 'NTCAN-API Part 2 Installation Guide' (5). The installation will be guided by an installation program (<i>Install Shield Wizard</i>). The window of the installation program depends on the Windows operating system installed on your PC.	-
3.	Configure the EtherCAN/3-FD via web browser.	23
	Note: Please note that changes of the configuration generally will not be effective until a reboot!	-
4.	1. Install the EtherCAN SDK with the EtherCAN/3-FD host-driver now as described in step 2., if not already done. 2. Configure the host-driver on the Windows PC as described in the manual 'NTCAN-API Part 2 Installation Guide' for the EtherCAN/3-FD module.	-
5.	The CAN <u>device</u> driver is also already installed with the EtherCAN SDK. If the CAN tools (CANreal, CANplot, ...) are also required, the ' CAN SDK ', which is also on the CD, must now be installed.	



INFORMATION

Access via esd's NTCAN API is supported. The software installation via esd's NTCAN API is described in the manual 'NTCAN-API, Installation Guide' (5).

3.4.2 Software for Bridge Mode and Platform-independent Server or Client Mode

The 'Bridge Mode' does not need any host software installation. Just configure the bridge mode via the EtherCAN web browser (see chapter 5.2).

For the Platform-independent Server Mode please install the **EtherCAN SDK**. It contains examples in C source code for the UDP and TCP based EtherCAN Low Level Socket Interface (ELLSI) implementation. A separate ELLSI manual providing the API is available (6).

4 Compatibility with the EtherCAN/2

The EtherCAN/3-FD is the successor of the EtherCAN/2. It retains most of the features and is and is inter-compatible with the EtherCAN/2. The following overview shows the individual functions and notes on functionality.

4.1 EtherCAN Mode

The EtherCAN server of the EtherCAN/3-FD has improved performance and stability. It also supports CAN FD and up to two CAN ports over the same socket connection as well as an encrypted connection. To use the new features an EtherCAN client with a version 2.7 or higher is required. However, the EtherCAN/3-FD is compatible with older clients and can therefore be used as a replacement for the EtherCAN/2 without any changes to the EtherCAN client.

4.2 CAN Bridge Mode

The CAN bridge functionality of the EtherCAN/3-FD is compatible with the EtherCAN/2. It can be used as a replacement for the EtherCAN/2. The configuration of the EtherCAN/2 CAN bridge is still compatible with the EtherCAN/3-FD. To connect an EtherCAN/2 and an EtherCAN/3-FD the legacy mode needs to be enabled during configuration.

The EtherCAN/3-FD CAN bridge supports CAN FD and encryption. However, both new features only work with 2 EtherCAN/3-FD.

4.3 Platform-independent Client Mode

The CAN TCP client functionality of the EtherCAN/3-FD is compatible with the EtherCAN/2. It can be used as a replacement for the EtherCAN/2. The configuration of the EtherCAN/3-FD CAN TCP client looks similar to its predecessor. The EtherCAN/3-FD CAN TCP client supports CAN FD and up to 2 CAN ports. To use CAN FD changes on the CAN TCP server are necessary.

4.4 Platform-independent Server Mode

The EtherCAN/3-FD supports ELLSI over TCP, UDP and TCP WebSocket. However, the EtherCAN/3-FD does **NOT** support HTTP over web sockets. Therefore, the EtherCAN/3-FD can be used as a replacement for the EtherCAN/2 for ELLSI over TCP, UDP and TCP WebSocket. However ELLSI on the EtherCAN/3-FD has additional CAN FD support.

4.5 Others

Some features of the EtherCAN/2 have been removed due to low usage. The following list shows the deleted features:

- Universal Plug and Play (UPnP)
- Network Time Protocol (NTP) (has been replaced by a SNTP client)
- Simple Network Management Protocol (SNMP)
- Simple Mail Transfer Protocol (SMTP)



NOTICE

The EtherCAN/3-FD uses a different soft- and hardware platform than the EtherCAN/2. Therefore, small timing differences may occur.

5 Software Configuration

The following chapter describes the configuration of the EtherCAN/3-FD module in two steps:

1. Assignment of a valid IP address.
2. Configuration of the other parameters with the embedded web server.

The RJ45-socket has to be connected with the configuring host PC via a S/FTP (screened shielded twisted pair) cables of category CAT5 or higher with a switch or hub. The yellow (Link) LED has to turn on to indicate a correct connection.

5.1 Configuration of the IP Address

First a valid IP address has to be assigned to the EtherCAN/3-FD. An IP address is a unique address for a device within its network.

Therefore, it is necessary to configure a unique IP address that is not already assigned to another device in the network.

In delivery state the EtherCAN/3-FD tries to get an IP address from a DHCP server (maximum approx. 2 min.).

If no DHCP server is available assigning an IP address to the EtherCAN/3-FD, the EtherCAN/3-FD generates an Auto-IP address by itself in the range 169.254.X.X .

To check or overwrite the assigned IP address it is recommended to use the tool *QESDCP* (see chapter 5.1.2).

To find the device via ESDCP protocol, the PC running *QESDCP* must be in the same local network. If *QESDCP* finds the device, IP address and netmask can be modified to match the later use case. After a reboot of the EtherCAN/3-FD the newly assigned settings are applied and the EtherCAN/3-FD can be configured via the web browser (see chapter 5.2).

5.1.1 Configuration via DHCP

For a configuration via DHCP a running DHCP server must be in the same local network as the EtherCAN/3-FD.

The DHCP server may require configuration. Please contact your system administrator. The server assigns a valid IP address, a net mask, a gateway address and the IP address of a name server to the module. After a successful assignment, the EtherCAN/3-FD operates with these values without reboot.

The IP address **<IP Address>** assigned to the device has to be determined using the logging mechanisms of the DHCP server or *the* ESDCP protocol.

Further configuration of the network parameters can be done by any web browser, that is in the same local network, with the URL **http://<IP Address>**, as described in chapter 5.2.3.2.



NOTICE

Without further configuration, a DHCP server may assign a different IP address to a device each time it is rebooted or after a certain period of time. For the driver software on the host PC it is necessary that this IP address is fixed and remains unchanged for the complete period of operation. If at every reboot the same IP address shall be assigned to the EtherCAN/3-FD module via DHCP, the system administrator has to ensure this.

5.1.1.1 Using a Hostname instead of an IP Address

The DHCP client of the EtherCAN/3-FD automatically transmits the hostname configured at the configuration page *Network Settings* (see chapter 5.2.3.2) to the DHCP server.

There are some restrictions:

- In addition to the DHCP server a DNS server has to be available and both servers must cooperate accordingly. Enabling this is the task of your system administrator, if necessary - further support by esd concerning this matter is not possible.
- The choice of the hostname might be restricted depending on the system and the DHCP/DNS server used:
 - Hostnames are composed of a series of labels concatenated with dots ('.').
 - Each label can contain the ASCII letters 'a' to 'z' (in a case-insensitive manner), the numbers '0' to '9' and the hyphen ('-').
 - The entire hostname has a maximum of 253 characters while each label has a length between 1 and 63 characters.
 - Besides that, there could be some restrictions depending on your system. For example, there are DNS servers which only allows up to 15 characters per label or only solves the hostname correctly, if it contains the domain-suffix independent of the domain name.

Each time the EtherCAN/3-FD receives a new IP address from the DHCP server, all network connections of the EtherCAN/3-FD are terminated.

Thus, esd recommends using a **fixed** IP address instead!

Standard Hostname

If the hostname is not configured in the web-based configuration, a standard name is generated containing the serial number.

For example, for the serial number "AA001234" the hostname is: **Eth3-001234**.

5.1.2 Configuration via the ESDCP Protocol

QESDCP is a tool to find and configure esd devices with Ethernet port in a LAN. For this a stateless protocol – using UDP - is used.

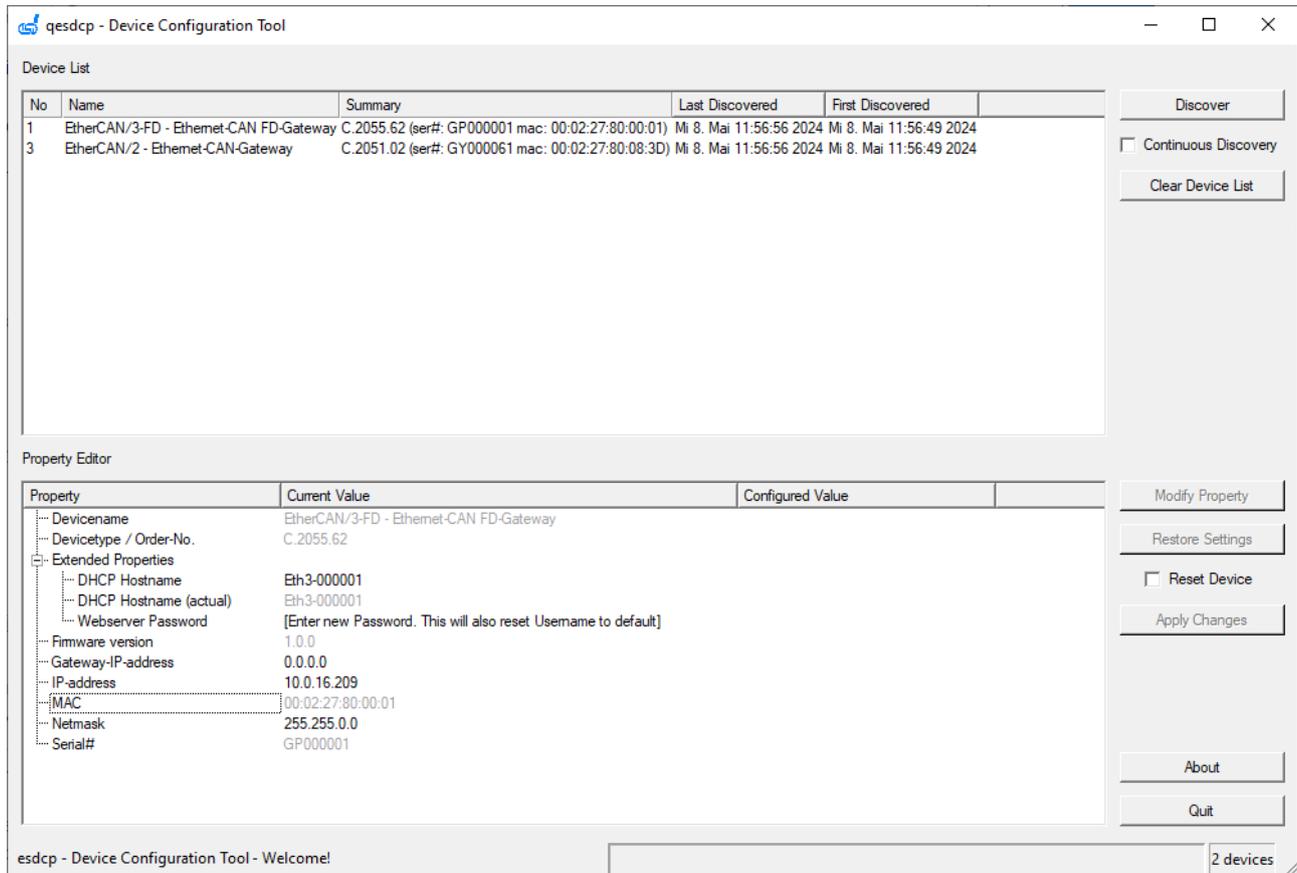


Figure 3: QESDCP - Device Configuration Tool

To discover devices with Ethernet port, your computer must be in the same local network.

Click the button *Discover* to search for esd devices. The detected devices are displayed in the *Device List*.

Enable the continuous search for esd devices by clicking the checkbox *Continuous Discovery*.

Devices that are no longer available are not automatically deleted from the list.

To delete the entries from the *Device List* click the button *Clear Device List*.

If the gateway is detected via ESDCP, the IP address and subnet mask can be configured, e.g. if a configuration via DHCP is not possible and no fixed IP address is configured.

To change a setting, select a line in the window *Property Editor* and press the button *Modify Property* or double click the line.

Software Configuration

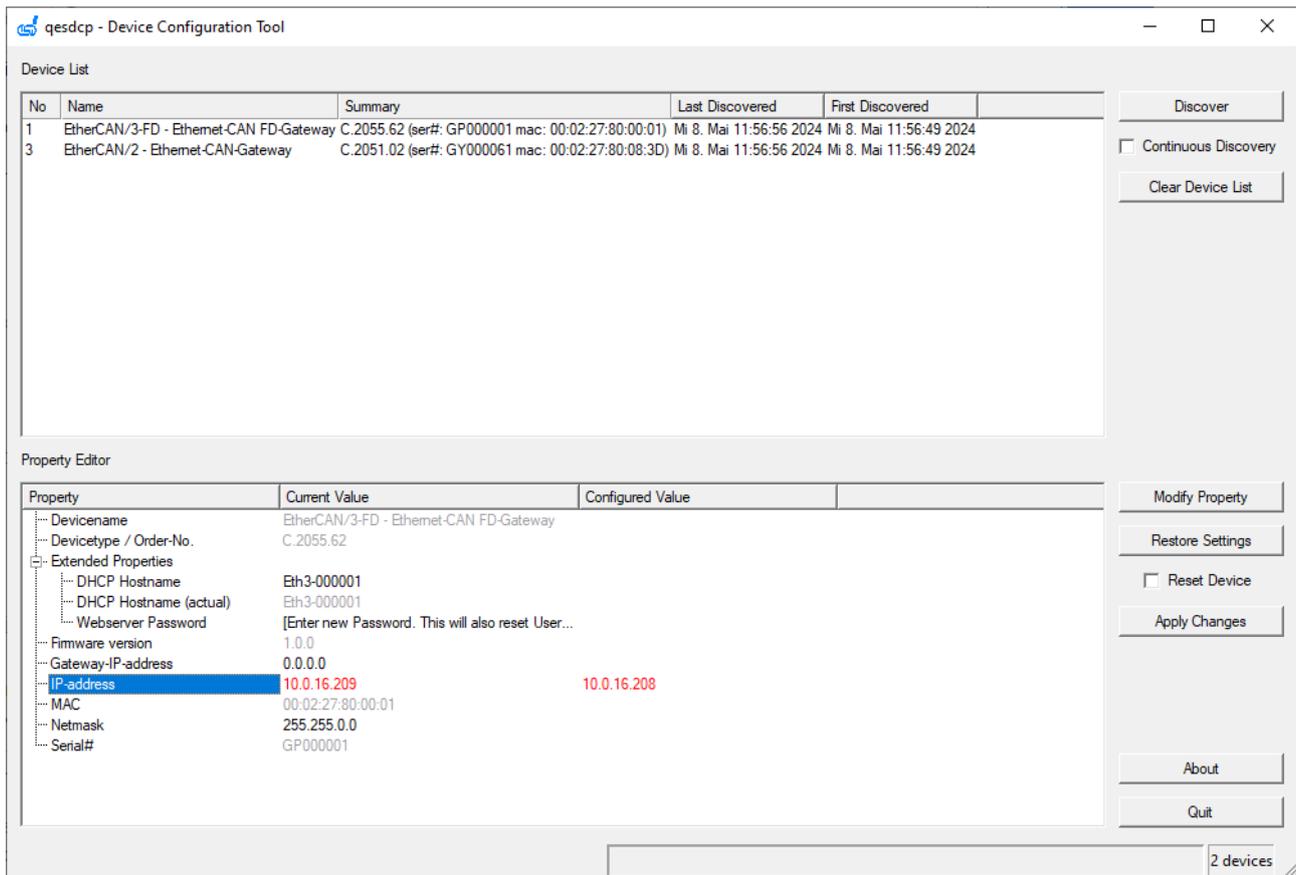


Figure 4: Modify the IP address via qesdcp

Enter the IP address in the input field in the column *Configured Value*.

Enter the Netmask in the same way.

Activate the checkbox *Reset Device* for a reboot of the EtherCAN/3-FD after confirming the entry, because the changes are not applied until the device is rebooted.

Confirm the entry of the IP address by Click the button *Apply Changes*.

After a password prompt the value entered in *Configured Value* will then be accepted as the current value and displayed in *Current Value*.

The button *Restore Settings* deletes the values entered in the field *Configured Value*. The actual values remain unchanged.

The ESDCP default password is: esd

The password can be changed via page *Network settings* of the web browser.

5.2 Web Based Configuration

The EtherCAN/3-FD offers an integrated HTTP server, which allows further configuration with a web browser. It follows the description of the pages as they are displayed in the browser.

5.2.1 Overview

The menu item *Overview* shows the module specific details of the EtherCAN/3-FD. Under *Gateway details* you will find firmware revision, hardware revision, order number and serial number. Beneath some status details about the Ethernet protocols as well as the CAN ports are displayed.

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Gateway Details

Product name	EtherCAN/3-FD
Firmware revision	1.0.0.6
Hardware revision	1.0
Order number	C.2055.62
Serial number	GA000020

Gateway Status

System	
Uptime	0d 0h 33m 45s
EtherCAN server address	10.0.180.62:22280(🔒)
EtherCAN clients	2
CAN bridge connection	Disabled
CAN TCP client	Disabled
ELLSI clients	0
CAN port 0	
CAN mode	CAN CC
CAN baud rate	1000.0 kbit/s
Controller status	OK
CAN port 1	
CAN mode	CAN FD
CAN baud rate	1000.0 kbit/s
CAN data baud rate	2000.0 kbit/s
Controller status	OK

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Figure 5: Web Page 'Overview'

5.2.2 Status

The web server provides several pages for viewing the status and statistics of the module components.

5.2.2.1 CAN Status

This page displays settings as well as statistics for both CAN ports. It also allows the user to reset the CAN statistic.

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CAN Status

This page displays the CAN status. Auto-refresh every 5 seconds.

Notes:

- All values are recorded on controller level, i.e. values in higher levels may differ.
- The 'Total bits' counter uses an estimated number of stuff bits for each CAN frame based on its length.
- The 'Controller' status as well as the 'Error counter' are handled by the controller and can only be reset by reboot. Both parameter can change based of a successful or faulty CAN communication.

Runtime: 0d 00h 04m 58s | 24-08-29 08:41:54 Reset statistics

CAN Port 0

Receive	
Standard frames	0
Standard RTR frames	0
Extended frames	0
Extended RTR frames	0
Total frames	0
Data bytes	0
Error counter	0

Transmit	
Standard frames	5
Standard RTR frames	0
Extended frames	0
Extended RTR frames	0
Total frames	5
Data bytes	0
Error counter	0

Other	
Controller	OK
Total bits	230
Baud rate [kbit/s]	1000.0
Busload [%]	0
Error frames	0
FIFO overruns	0
Controller overruns	0

CAN Port 1

Receive	
Standard frames	0
Standard RTR frames	0
Extended frames	0
Extended RTR frames	0
CAN FD frames	0
Total frames	0
Data bytes	0
Error counter	0

Transmit	
Standard frames	0
Standard RTR frames	0
Extended frames	0
Extended RTR frames	0
CAN FD frames	0
Total frames	0
Data bytes	0
Error counter	0

Other	
Controller	OK
Total bits	0
Baud rate [kbit/s]	1000.0
Data baud rate [kbit/s]	2000.0
Busload [%]	0
Error frames	0
FIFO overruns	0
Controller overruns	0

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Figure 6: Web Page 'CAN Status'

5.2.2.2 CAN Bridge Status

This page displays the status for the CAN bridge. It also allows the user to download the current protocol file.

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CAN Bridge Status

This page displays the CAN bridge status. Auto-refresh every 5 seconds.

[Download](#) current CAN bridge protocol.

Connection	
Remote side	10.0.16.85
Bridge running since	24-05-21 09:43:30 (0d 00h 00m 56s ago)
Last connection	24-05-21 09:43:33 (0d 00h 00m 53s ago)
Last disconnect	---
Last connection from remote side	24-05-21 09:43:39 (0d 00h 00m 47s ago)
Last disconnect by remote side	---
Connection counter	1 (Remote: 1)
Disconnect counter	0 (Remote: 0)

CAN	
Local RX	5
Local TX	0
Local TX lost	0
Remote RX	0
Remote RX lost	0

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Figure 7: Web Page ‘CAN Bridge Status’

5.2.2.3 Ethernet Status

This page displays the Ethernet status. This includes the current transmission speed (10/100 Mbit/s), the communication mode (half/full duplex) and the MAC-Adress of the EtherCAN/3-FD module as well as several statistical parameters of the Ethernet link.

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Ethernet Status

This page displays the Ethernet status. Auto-refresh every 5 seconds.

Runtime: 0d 00h 05m 51s | 24-08-29 08:41:54

Receive		Transmit		Other	
Packets	14301	Packets	5442	MAC-Adress	00:02:27:a3:00:14
Bytes	2498944	Bytes	893282	MTU	1500
Errors	0	Errors	0	Speed	100MBit/s
Length errors	0	Deferral errors	0	Communication	Full duplex
CRC errors	0	Collision errors	0	Connected	Yes
Overrun errors	0	Tx late collision errors	0		
Missed errors	0	Buffer underrun errors	0		

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Figure 8: Web Page 'Ethernet Statistics'

5.2.2.4 Clients Status

This page displays the status of all clients connected via EtherCAN and ELLSI protocol.

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Clients Status

This page displays information about connected Ethernet clients. Auto-refresh every 5 seconds.

EtherCAN Clients

Ethernet									CAN		
IP-address	Port	Client-port	Cmd-frames	Rx-bytes	Tx-bytes	Keep-alive-frames	Connect-time		Rx-frames	Tx-frames	Tx-done-frames
10.0.16.16	22280	58760	2056	57632	59864	0	70-01-01 00:00:13		0	0	0
10.0.16.16	22280	58759	2056	57632	59864	0	70-01-01 00:00:13		0	0	0

ELLSI (TCP)

Idx	Reg-count	Last Reg.	Last Rx	Last Tx	CAN RX Frames	CAN TX Frames	RX Out of Order	TX failed
0	0	---	---	---	0	0	0	0
1	0	---	---	---	0	0	0	0
2	0	---	---	---	0	0	0	0
3	0	---	---	---	0	0	0	0
4	0	---	---	---	0	0	0	0
5	0	---	---	---	0	0	0	0
6	0	---	---	---	0	0	0	0
7	0	---	---	---	0	0	0	0

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Figure 9: Web Page 'Clients Status'

ELLSI Clients

As the total number of connected clients is fixed, the number of table lines is fixed, too. Lines which contain clients that are not connected (or no longer connected) are displayed in a grey font. For further information about ELLSI see ELLSI software-manual: *ELLSI_Software_Manual.pdf* (6).

5.2.2.5 Event Log

This page displays the event log from the power up of the EtherCAN/3-FD. The events are classified depending on the severity into the categories *Error*, *Warning* and *Info*. The list will be deleted at every reboot. During the runtime of the module the logged events can be downloaded.

For correct date and time indication a time server has to be configured (see page 32). Otherwise, the calculation of time will restart from 1970-01-01 at 00:00 a.m. with every reboot of the EtherCAN/3-FD module.

EtherCAN/3-FD – Ethernet to CAN FD Gateway

Event Log

This page display the event log. Click [here](#) to configure which events should be logged.

current system protocol.

Date	Time	Source	Event
70-01-01	00:00:10	SYSTEM	DHCP assigned ip address 10.0.180.62
70-01-01	00:00:02	SYSTEM	Link Up (100 Mbit/s Full Duplex)
70-01-01	00:00:00	SYSTEM	EtherCAN/3 (Software Version 1.0.0.06 Hardware Version 1.00)

Colors: Error Warning Info

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Figure 10: Web Page 'Event Log'

5.2.3 Configuration

The web server provides several pages for configuration of the device. All settings are protected by a combination of username and password. The default setting at delivery is:

Username:	esd
Password:	esd

The changed settings are stored in the device after submitting a form. The new data will be applied when the module is rebooted, unless otherwise stated.

5.2.3.1 Security Configuration

The page *Security Configuration* can be used to change the *Webserver Username* and the *Webserver Password* for access protection. These values are needed to change the configuration or install a firmware update. It can also be used to change the ESDCP password.

Moreover, it provides the possibility to enable the EtherCAN protocol encryption. The default port for a non-encrypted EtherCAN connection is 22080. With encryption the port changes to 22280. To use this feature, a valid certificate and key in the .pem format must be provided. When the protocol encryption is being used, this certificate and key will be used within the device. On top of that, the user can provide a trusted certificate. This will ensure that only a client with a specific client certificate can establish a connection. Without providing a trusted certificate, every certificate will be accepted. For more information see chapter 5.3.

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Security Configuration

This page is intended to configure a user name and a password to restrict the access to the gateway configuration parameters and the possibility to update the gateway firmware.

Changed settings are applied after reboot. Click [here](#) to open the reboot page.

General

EtherCAN protocol encryption:

Web server username: (esd)

Web server password: (Not shown, empty to leave unchanged)

ESDCP password: (Not shown, empty to leave unchanged)

Device Certificate

File to upload: Keine ausgewählt

device certificate.

Device Key

File to upload: Keine ausgewählt

Trusted Certificate

File to upload: Keine ausgewählt

remote device certificate.

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Figure 11: Web Page ‘Security Configuration’

5.2.3.2 Network Configuration

The page *Network Configuration* contains an overview of the configured values of the TCP/IP and the Time Server configuration.

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Network Configuration

The values in braces reflect the current settings. These may differ from the configured values if the device is booted via DHCP or the configuration has been already changed without rebooting the device.

Changed settings are applied after reboot. Click [here](#) to open the reboot page.

TCP/IP Base Configuration

IP address:	<input type="text" value="10.0.16.209"/>	(10.0.16.209)
Subnet mask:	<input type="text" value="255.255.0.0"/>	(255.255.0.0)
Default gateway:	<input type="text" value="0.0.0.0"/>	(0.0.0.0)
Name server:	<input type="text" value="0.0.0.0"/>	(0.0.0.0)
Host name:	<input type="text" value="Eth3-000001"/>	(Eth3-000001)
MTU:	<input type="text" value="1500"/>	(1500)
Use DHCP for all above:	<input type="checkbox"/>	

Time Server Configuration

SNTP server:	<input type="text" value="10.0.0.239"/>	(10.0.0.239)
Update interval [s]:	<input type="text" value="3600"/>	
Timezone:	<input type="text" value="CET"/>	

qesdcp Configuration

Password: (Not shown, empty to leave unchanged)

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Figure 12: Web Page 'Network Configuration'

- **TCP/IP Base Configuration**

TCP/IP Base Configuration

IP address:	<input type="text" value="10.0.16.209"/>	(10.0.16.209)
Subnet mask:	<input type="text" value="255.255.0.0"/>	(255.255.0.0)
Default gateway:	<input type="text" value="0.0.0.0"/>	(0.0.0.0)
Name server:	<input type="text" value="0.0.0.0"/>	(0.0.0.0)
Host name:	<input type="text" value="Eth3-000001"/>	(Eth3-000001)
MTU:	<input type="text" value="1500"/>	(1500)
Use DHCP for all above:	<input type="checkbox"/>	

*Figure 13: Web Page 'Network Configuration'
- TCP/IP Base Configuration*

In this section the base TCP/IP network parameters can be configured. The current settings of the parameters are shown in brackets.

At the first time starting up at least the subnet mask and the IP address have to be adapted to the conditions of the network.

For the communication with other nets, e.g. to access internet or time server, a *Default Gateway* has to be assigned.

Enable the check box *Use DHCP* to assign IP address, gateway and subnet mask via DHCP. This may cause problems as described in chapter 'Configuration via DHCP' (5.1.1). To use the parameters above (*IP address, Subnet Mask, Default Gateway and Nameserver*) the check box must be disabled.

A domain name can be entered directly appended to the hostname.

The MTU (Maximum Transmission Unit) can be set according to the conditions of your network and is not affected by the DHCP setting.

TCP/IP Default Parameters

At the first start of the EtherCAN/3-FD the check box *Use DHCP* is enabled. Thus, the IP address is assigned by default via the DHCP Server.

- Time Server Configuration

Time Server Configuration

SNTP server: (10.0.0.239)

Update interval [s]:

Timezone: ▼

*Figure 14: Web Page 'Network Configuration'
- Time Server Configuration*

The SNTP server can be configured in this field.
For the correct date and time indication a time server must be configured.

To be able to use the Remote Logging-Support these parameters have to be configured.
Without an entry in this field, the calculation of times will restart from 1970-01-01 at 00:00 a.m.
with every reboot (power up) of the EtherCAN/3-FD module.

5.2.3.3 Event Log Configuration

The page *Event Log Configuration* can be used to configure which events should be logged based on source and category.

The module stores up to 100 events. When there are more than 100 event logs, the oldest one will be overwritten. The events are logged in the volatile memory of the device and are therefore cleared when the device is restarted.

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Event Log Configuration

This page is intended to configure logging of alarms and events.

Changed settings are applied after reboot. Click [here](#) to open the reboot page.

Log Source

System:

EtherCAN:

CAN bridge:

CAN TCP:

ELLSI:

Web server:

Log Category

Info:

Warn:

Error:

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Figure 15: Web Page 'Event Log Configuration'

5.2.3.4 CAN Baud Rate Configuration

This page can be used to configure the CAN baud rate after system startup. This can be done for each CAN port separately. There is a basic and advanced view. The basic view only provides a simple configuration page while the advanced view provides more options for experienced users.

After submitting a new baud rate, it is immediately set and active. If the values revert to the old values after submitting, the new baud rate values were invalid.

5.2.3.4.1 Basic View

The basic view provides a simple configuration of the baud rate.

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CAN Baud Rate Configuration

This page is used to configure the default baud rate after the system startup.

Click here to switch to the [Advanced](#) view.

Basic View

CAN port:

Baud rate mode:

Enable CAN FD:

Arbitration baud rate:

Data baud rate:

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Figure 12: Web Page 'CAN Baud Rate Configuration' – Basic View

CAN port	Select the CAN port whose baud rate is to be changed.
Baud rate mode	Choose between the baud rate mode 'Enable' or 'Disable' to decide whether a startup baud rate should be set or not. For the CAN Bridge a startup baud rate is necessary.
Enable CAN FD	Enable this checkbox to perform CAN FD. Only when this option is enabled the 'Data baud rate' is set.
Arbitration / Data baud rate	Select arbitration and data baud rate for the CAN port from the drop-down menu.

5.2.3.4.2 Advanced View

The advanced view provides more options than the basic view. Depending on 6 modes, there are different settings selectable. All unused settings are disabled. Please set the baud rate mode first to unlock the necessary inputs.

Figure 12: Web Page ‘CAN Baud Rate Configuration’ – Advanced View

CAN port Select the CAN port whose baud rate is to be changed.

Baud rate mode Choose between the following baud rate modes:

- **Disable:**
No CAN baud rate is set.
- **Index Mode:**
Select the baud rate based on a drop-down menu.
- **Numerical Mode:**
Set the baud rate in kbits/s.
- **BTR Mode (Controller):**
Set the controller register directly.
- **BTR Mode (Canonical):**
Set the CAN bit timings directly.
- **Autobaud:**
This mode detects the baud rate automatically. This mode is only supported for CAN CC.

For details check the NTCAN API manual (4).

Enable CAN FD Enable this checkbox to perform CAN FD. Only when this option is

Software Configuration

	enabled the 'Data Baud rate' is set.
Enable listen-only mode	Enable this checkbox to set the port in the 'Listen-Only Mode'. In this mode the EtherCAN3-FD acts as a passive bus participant and does not send acknowledges. Keep in mind that there have to be at least 2 active CAN participants on the bus. Otherwise, sending CAN frames is not acknowledged and resent.
Enable DAR mode	This option deactivates the automatic retransmission of CAN frames that have not been sent successfully.
Index Mode	Select arbitration and data baud rate for the CAN port from the drop-down menu.
Numerical Mode	Choose arbitration and data baud rate for the CAN port in kbit/s.
BTR Mode (Controller)	Choose a value for the NBTP and DBTP register of the MCAN CAN port. For more information, please read the NTCAN API manual (4).
BTR Mode (Canonical)	Choose the CAN bit-timings for the arbitration and data phase. The CAN port runs with a frequency of 40 MHz.

5.2.3.5 CAN Bridge Configuration

On this page the 'CAN Bridge' functionality of the EtherCAN/3-FD is configured. This functionality allows connecting two CAN CC / FD networks via Ethernet.

This configuration page is used to set up two EtherCAN/3-FD modules so that they can connect to each other to exchange the CAN messages.

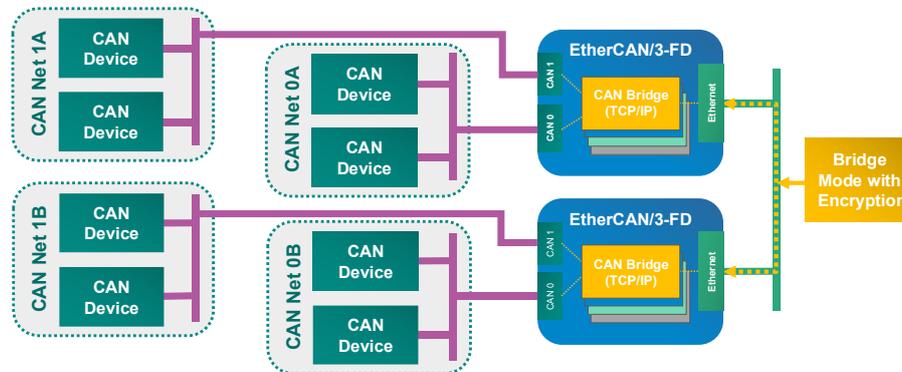


Figure 16: CAN Bridge

To establish a connection between two EtherCAN/3-FD the IP address of the other EtherCAN/3-FD needs to be known. In addition, it must be configured which CAN IDs should be received from the local CAN network and transferred to the other side – to avoid unnecessary data transfer.

Besides that, a mapping from received to transmitted CAN IDs can be set up to send the CAN frames of the other bridge side to the local CAN network with a different CAN ID.

That configuration is done either directly within the web browser (see chapter 5.2.3.5.3) or via a configuration file (see chapter 5.2.3.5.4), which can be up- and download from this page. In both cases a changed configuration becomes active after a restart.

5.2.3.5.1 Quick start guide

On both sides of the bridge at least the following settings needs to be configured:

1. Enable the CAN bridge.
 - 'Enable CAN bridge' under 'General'
2. Enter IP address of remote side.
 - 'Remote IP address' under 'General'
3. Select CAN Port
 - 'CAN Port' under 'CAN'
4. Enter CAN baud rate.
 - Set a valid baud rate on the page 'CAN Baud rate'
5. Select CAN-IDs
 - To transfer all IDs to the other side:
Select "Clear and enable all IDs" under 'CAN 29 bit filter' and 'Clear and enable all IDs' under 'CAN 11 bit filter'
6. Reboot the device on the page *Reboot*



EtherCAN/3-FD – Ethernet-CAN FD-Gateway

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CAN Bridge Configuration

This page is used to configure the CAN bridge functionality. Uploading a new configuration via file overwrites the current configuration.

Changed settings are applied after reboot. Click [here](#) to open the reboot page.

current CAN bridge protocol.

Configuration File

new configuration: Keine ausgewählt

current CAN bridge configuration.

Edit Configuration Online

General

Enable CAN bridge:
 Enable encryption:
 Remote IP address: (IP address of the EtherCAN at other bridge end)

CAN

CAN Interface:
 RX queue size: (RX buffer size for CAN driver, default: 256)
 TX queue size: (TX buffer size for CAN driver, default: 256)

CAN 11bit Filter

Enabled IDs

*IDs 0x00a..0x00c
 IDs 0x00f..0x012
 IDs 0x0ff..0x1ff*

Mapping

ID 0x001 is mapped to 0x002
 (Uncheck a mapping to delete it on submit)

Enable/disable IDs: ID: to disable IDs
 Set mapping: ID: to 29 bit ID
 Clear and enable all IDs:
 Clear and disable all IDs:

CAN 29bit Filter

Enabled IDs

All IDs

Mapping

ID 0x000000c8 is mapped to 0x0c9
 (Uncheck a mapping to delete it on submit)

Acceptance code: (Set to 0xffffffff and mask to 0 to disable all 29 bit IDs)
 Acceptance mask: (Set to 0x1ffffff to enable all 29 bit IDs)
 Set mapping: ID: to 29 bit ID
 Clear and enable all IDs:
 Clear and disable all IDs:

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Figure 17: Web Page CAN Bridge Configuration

5.2.3.5.2 Important Notes

- All numbers within the configuration page and -file are interpreted as decimal (base 10) by default. To use base 16 ("Hex") a "0x" has to be prefixed. To use base 8 ("Octal") a "0" has to be prefixed. Therefore, an input of e.g. "10" equals an input of "0xa"/"0xA" and "012".
- CAN-IDs: These are displayed in hexadecimal notation, thereby 3 digits are used for 11 bit IDs and 8 digits for 29 bit IDs: "0x100" → 11 bit ID, "0x00000100" → 29 bit ID.
- When entering a CAN-ID this distinction is not possible and the input is interpreted as usual number (The configuration page uses a check box "29 Bit ID", the configuration file uses bit 29 within the ID as marker – please follow the descriptions).
- A restart of a bridge side leads to a connection interrupt for the other side, too. This again triggers a restart of the bridge software there.
- Therefore, a bridge-software restart on one side leads to an interrupted bridge functionality for about 45 seconds.
- In case a bridge side can't connect to the other it will retry to do so every 10 seconds approx.
- When no remote IP address is given the bridge-software is deactivated.
- Although the TCP/IP connection between the bridge sides generally provides higher bandwidth than the CAN bus, it cannot be guaranteed that no CAN frames will be lost. Each side of the bridge has receive and send buffers for CAN frames. Frames are read from the network interface's receive buffer and transferred to the CAN interface's send buffer. Conversely, frames are read from the CAN interface's receive buffer and transferred to the network interface's send buffer. If any of these buffers become full, additional CAN frames cannot be stored and will be lost.
This issue is particularly evident when different CAN baud rates are used on each bridge side. The side operating at a higher baud rate transmits frames more quickly than the other side can process them. As a result, the send buffer on the slower side fills up because frames cannot be read from the network buffer fast enough. Once the buffer is full, any additional CAN frames must be discarded.
Apart from differing CAN baud rates, frame loss can also occur under high CAN bus load due to brief delays caused by other network traffic or simultaneous operations performed by the EtherCAN/3-FD, such as its web server or SNMP server. To mitigate frame loss, the CAN buffer sizes can be adjusted, as described in section 5.2.3.5.3 under "RX/TX queue size".
- The EtherCAN/3-FD can also be used to connect a CAN CC and CAN FD bus. CAN FD frames are sent as CAN CC frames on the CAN CC bus. Frames larger than 8 bytes are truncated. The original length of the CAN FD frame can be evaluated from the DLC field of the CAN frame.



NOTICE

If the EtherCAN/3-FD is used e.g. as CAN interface for a PC or in bridge mode at the same time, it has to be ensured that no conflicts arise. Especially, when the PC changes the baud rate of the module, it might differ from the startup baud rate.

5.2.3.5.3 Configuration via Web Browser

Used to edit the configuration directly within the browser. If a configuration file was uploaded before its settings are already included here.

All changes will be transferred to the EtherCAN/3-FD with each submit. When leaving the page or triggering any other action, such as a bridge restart or configuration file upload, all inputs made here will be lost.

General

General	
Enable CAN bridge:	<input checked="" type="checkbox"/>
Enable encryption:	<input type="checkbox"/>
Remote IP address:	<input type="text" value="10.0.16.85"/> (IP address of the EtherCAN at other bridge end)

Figure 18: Web Page 'CAN Bridge Configuration' - General

Enable CAN bridge	Select this checkbox to enable the CAN bridge functionality.
Enable Encryption	Select this checkbox to enable TLS encryption for the CAN bridge. Additional, the remote EtherCAN/3-FD also needs to enable this flag as well. The certificate information can be set at the page <i>Security Configuration</i> (see chapter 5.2.3.1).
Remote IP address	The IP address of the other bridge side. A hostname can't be entered.

CAN

CAN	
CAN Interface:	<input type="text" value="1"/> ▾
RX queue size:	<input type="text" value="4096"/> (RX buffer size for CAN driver, default: 256)
TX queue size:	<input type="text" value="4096"/> (TX buffer size for CAN driver, default: 256)

Figure 19: Web Page 'CAN Bridge Configuration' - CAN

CAN Interface	Select the CAN port that should be used for the CAN bridge functionality.
RX queue size	This option defines the size of the CAN receive buffer in the local CAN driver. Higher values decrease the chance of frame lost during periods of high CAN bus load. See also 'Loss of CAN frames' in chapter 5.2.2.2.
TX queue size	This option defines the size of the CAN send buffer in the local CAN driver, analogue to "RX queue size".

CAN 11bit Filter

CAN 11bit Filter

Enabled IDs

IDs 0x00a..0x00c
IDs 0x00f..0x012
IDs 0x0ff..0x1ff

Mapping

ID 0x001 is mapped to 0x002
(Uncheck a mapping to delete it on submit)

Enable/disable IDs: ID: to disable IDs
Set mapping: ID: to 29 bit ID

Clear and enable all IDs:
Clear and disable all IDs:

Figure 20: Web Page 'CAN Bridge Configuration' – CAN 11bit Filter

Enabled IDs	Lists which 11 bit CAN IDs are received, i.e. transferred to the other bridge side.
Mapping	Lists the 11 bit CAN ID-Mappings, i.e. on which CAN ID a frame from the remote side is sent to the local CAN port. Unchanged accepted CAN-IDs ("1:1 mapping") are not listed. When an item is unchecked it is deleted on 'Submit'.
Set mapping	Adds an entry to "Mapping". The first input is the receive CAN-ID, the second the send ID. The first input is always interpreted as 11 bit CAN-ID, the second according to the checkbox "29 bit ID", i.e. when checked an input of e.g. "0x100" is interpreted as 29 bit ID, else as 11 bit ID.
Clear and enable all IDs	Deletes all mapping entries and sets "Enable/disable IDs" so that all 11 bit CAN frames are received/forwarded.
Clear and disable all IDs	Deletes all mapping entries and sets "Enable/disable IDs" so that no 11 bit CAN frames are received/forwarded.

CAN 29bit Filter

CAN 29bit Filter

Enabled IDs

All IDs

Mapping

ID 0x000000c8 is mapped to 0x0c9
(Uncheck a mapping to delete it on submit)

Acceptance code: (Set to 0xffffffff and mask to 0 to disable all 29 bit IDs)

Acceptance mask: (Set to 0x1fffffff to enable all 29 bit IDs)

Set mapping: ID: to 29 bit ID

Clear and enable all IDs:

Clear and disable all IDs:

Figure 21: Web Page 'CAN Bridge Configuration' – CAN 29bit Filter

Enabled IDs	Lists which 29 bit CAN IDs are received, i.e. transferred to the other bridge side
Mapping	Lists the 29 bit CAN ID-Mappings, i.e. on which CAN ID a frame from the remote side is sent to the local CAN port. Unchanged accepted CAN-IDs ("1:1 mapping") are not listed. When an item is unchecked it is deleted on 'Submit'.
Acceptance code / mask	Determines which 29 bit CAN-IDs are received (listed under "Enabled IDs"). For details see NTCAN API Manual "Transmitting and Receiving CAN 2.0B (29-Bit) Messages". Examples: <ul style="list-style-type: none"> - Code: 0x100, Mask: 0 → Only the 29 bit CAN-ID 0x00000100 is received. - Code: 0x100, Mask: 0xff → The 29 bit CAN-IDs [0x00000100..0x000001ff] are received.
Set mapping	Adds an entry to "Mapping". The first input is the receive CAN-ID, the second the send ID. The first input is always interpreted as 29 bit CAN-ID, the second according to the checkbox "29 bit ID", i.e. when checked an input of e.g. "0x100" is interpreted as 29 bit ID, else as 11 bit ID.
Clear and enable all IDs	Deletes all mapping entries and resets "Acceptance code/mask" to receive/forward all 29 bit CAN frames.
Clear and disable all IDs	Deletes all mapping entries and resets "Acceptance code/mask" to receive/forward no 29 bit CAN frames.

5.2.3.5.4 Configuration via File

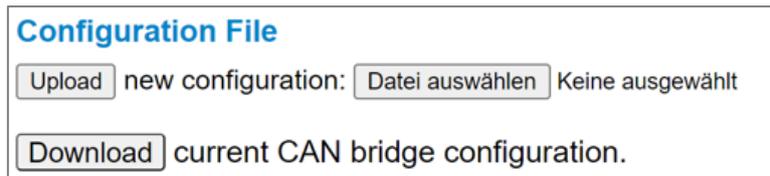


Figure 15: CAN Bridge – ‘Configuration file’

Upload new configuration	Used to upload a bridge configuration file to the EtherCAN/3-FD. A new configuration file will overwrite all current settings.
Download current CAN bridge configuration	Used to download the bridge configuration. The file is always recreated, i.e. it will contain all changes made online, but any unused settings or comments from an eventually uploaded file will be ignored.

The configuration file for the bridge-software is a simple text file that consists of key value pairs ordered in lines, see Figure 22.

The file name during upload is ignored, line breaks may be either “CR/LF” or “LF”, lines starting with “#” or “;” are comments and ignored, as well as empty lines. A delimiter between key and value spaces or tabs may be used. **Case sensitive.**

Key	Default Value	Comment								
version	0	Currently unused (for future changes)								
remote_ip		Equals "Remote IP address" in online configuration								
flags	1	<p>Defines multiple flags</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Bit 0</td> <td>Enable (is set by default if 'flags' is not present)</td> </tr> <tr> <td>Bit 1</td> <td>CAN FD</td> </tr> <tr> <td>Bit 2</td> <td>Encryption</td> </tr> </tbody> </table>	Bit	Description	Bit 0	Enable (is set by default if 'flags' is not present)	Bit 1	CAN FD	Bit 2	Encryption
Bit	Description									
Bit 0	Enable (is set by default if 'flags' is not present)									
Bit 1	CAN FD									
Bit 2	Encryption									
disable_nagles	1	When "0" is specified the so called "Nagle algorithm" is not deactivated. When it is activated CAN frames might be forwarded to the other side with a little delay, to assemble multiple CAN frames in a single Ethernet frame – this saves bandwidth and might be useful with low bandwidth connections								
can_baudrate	0x7fffffff	The EtherCAN/2 has a separate setting for the CAN baud rate. Because there is a high level for conflicts with other functions of the gateway (CAN2TCP Client, EtherCAN Server) it moved to the configuration page <i>CAN Baud rate</i> . However, for compatibility reason, the baud rate can still be set with this option and is also exported with the configuration file when CAN FD is not enabled.								
can_rxqueue	256	Equals "RX queue size" in online configuration								
can_txqueue	256	Equals "TX queue size" in online configuration								
can_29bit_acceptmask	0	Equals "Acceptance mask" in online configuration ("0x1fffffff": all 29 bit frames are received)								
can_29bit_acceptcode	0xffffffff	Equals "Acceptance code" in online configuration ("0xffffffff" and "0" for "can_29bit_acceptmask": no 29 bit frames are received)								
can_29bit_map		<p>Adds a 29 bit mapping entry. To add e.g. ID 0x00000100 to be sent as ID 0x101 the line shall be: "can_29bit_map 0x100 0x101". The receive ID is always interpreted as 29 bit ID, the send ID has to use bit 29 as marker. (So, this sample line sends the 29 bit ID 0x100 as 11 bit ID 0x101)</p> <p>Furthermore, the number of 29 bit mappings is limited to 16</p>								
can_11bit_enable		<p>Adds entries to "Enabled IDs" of the 11 bit filter. As value the first and last ID of the range to add is used. For the single ID 0x100 the line is e.g. "can_11bit_enable 0x100 0x100". For all 11 bit IDs: "can_11bit_enable 0 2047"</p>								
can_11bit_map		<p>Adds an 11 bit mapping entry. To add e.g. ID 0x100 to be sent as ID 0x00000101 the line shall be "can_11bit_map 0x100 0x20000101". The receive ID is always interpreted as 11 bit ID, the send ID has to use bit 29 as marker. (So, this sample line sends the 11 Bit ID 0x100 as 29 Bit ID 0x00000101)</p>								

Sample file

Line

```
1      #
2      # esd EtherCAN/3-FD CAN Bridge configuration file.
3      #
4
5
6      remote_ip                10.0.1.2
7
8
9
10     can_29bit_acceptmask     0x000000ff
11     can_29bit_acceptcode     0x00000100
12     can_29bit_map            0x00000120    0x00000100
13     can_29bit_map            0x00000121    0x20000101
14
15     can_11bit_enable          0                2047
16     can_11bit_map            0x00000100    0x20000100
17
```

Figure 22: CAN Bridge – Sample configuration file

- Line 6: (remote_ip)
 - The remote IP address is “10.0.1.2”
- Line 8: (can_baudrate)
 - The local CAN baud rate is 1000 kBit/s
- Line 10/11: (can_29bit_acceptmask/can_29bit_acceptcode)
 - The 29 bit CAN-IDs [0x00000100..0x000001ff] are received and sent to the remote side
- Line 12: (can_29bit_map)
 - When the 29 bit CAN-ID 0x00000120 is received from the remote side it is sent as 11 bit CAN-ID 0x100 to the local CAN port
- Line 13: (can_29bit_map)
 - When the 29 bit CAN-ID 0x00000121 is received from the remote side it is sent as 29 bit CAN-ID 0x101 to the local CAN port
- Line 15: (can_11bit_enable)
 - All 11 bit CAN-IDs [0x000..0x7ff] are received and sent to the remote side
- Line 16: (can_11bit_map)
 - When the 11 bit CAN-ID 0x100 is received from the remote side it is sent as 29 bit CAN-ID 0x100 to the local CAN port

5.2.3.6 CAN TCP Client Configuration

On this page the 'CAN TCP Client' functionality of the EtherCAN/3-FD is configured. This function allows it to forward CAN frames to a TCP server.

i **INFORMATION**
 This mode is a special application that is not needed for the usual use case of the EtherCAN/3-FD, such as CAN interface for PCs or bridge mode.
 In this mode the EtherCAN/3-FD acts as client and autonomously tries to connect to a PC – usually the connection is initiated by the other side.

To use this mode, at least the TCP server and its port must be provided. Moreover, a valid baud rate needs to be provided on the page 'CAN Baud Rate Configuration' (see chapter 5.2.3.4).

The configuration scope is limited. Basically, all CAN frames are transmitted (no ID filtering etc.) and the EtherCAN/3-FD always tries to maintain the connection and tries to reestablish the connection indefinitely if the connection is lost.

The communication protocol is declared in the next chapter.

! **NOTICE**
 If the EtherCAN/3-FD is used e.g. as CAN interface for a PC or in bridge mode at the same time, it has to be ensured that no conflicts arise. Especially different CAN baud rates must not be set at the same time.

EtherCAN/3-FD – Ethernet-CAN FD-Gateway

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CAN TCP Client Setup

This page is used to configure the CAN TCP client functionality. In this mode the EtherCAN/3 connects to a TCP server and forwards **all** CAN frames to it. (See manual for protocol details)
 Updating the configuration will restart the client software, thus interrupting any existing connection to a TCP server.

Changed settings are applied after **Reboot**.
 Click [here](#) to download the current CAN TCP client log protocol

Edit configuration

(All changes are saved by the "Submit" button below.)

Enable CAN TCP Client:

Name/IP address: (TCP server that will receive the CAN frames)

Port: (TCP port the server is listening on)

CAN Interface: (dropdown)

Enable timestamps:

Min. Tx interval (s): (Dummy data is sent when no CAN frames occur)

Reconnect delay (s): (Min. delay before retrying on error)

esd electronics gmbh

Figure 23: CAN TCP Client – configuration page

Software Configuration

Enable CAN TCP Client	This checkbox enables to CAN TCP Client.
Name / IP address	IP address or name of the TCP server. A name can only be used if a name server is configured, see chapter 5.2.3.2.
Port	The TCP port number on which the server is waiting for the connection of the EtherCAN/3-FD.
CAN Interface	This checkbox defines which CAN port should be monitored. It is also possible to monitor both CAN ports.
Enable timestamp	This checkbox defines whether there is a timestamp attached to the CAN frames or not.
Min. Tx interval (s)	The minimal interval data shall be sent to the TCP server, i.e. if no CAN frames are to be sent a "beacon" command is sent instead, to signal that the TCP client is still active. If 0, this is disabled.
Reconnect delay (s)	Waiting time for a failed connection before attempting to re-establish the connection. At loss of connection the reconnection is retried immediately. A connection attempt is terminated after 10 seconds.

5.2.3.6.1 Protocol

The data transmitted over TCP/IP is divided into 'commands'. Each command starts with a byte that identifies the command. This is followed by the specific data, which can be of different lengths depending on the command.

All values within the data are, unless otherwise stated, transmitted in 'network byte order', i.e. 'Big-endian'.

When the connection is established the EtherCAN/3-FD starts with sending its version information, unasked – the server has to do that, too, else the EtherCAN/3-FD won't accept commands from the server.

Command (ASCII)	Name	Data
66 ('B')	"Beacon"	None
86 ('V')	Version information	31 Bytes
118 ('v')	Version information request	None
99 ('c')	CAN frame array (little-endian)	2 Bytes (= n = No. of frames) + $n * 16$ Bytes
67 ('C')	CAN frame array (big-endian)	2 Bytes (= n = No. of frames) + $n * 16$ Bytes
116 ('t')	CAN frame array with timestamp (little-endian)	2 Bytes (= n = No. of frames) + $n * 24$ Bytes
84 ('T')	CAN frame array with timestamp (big-endian)	2 Bytes (= n = No. of frames) + $n * 24$ Bytes
120 ('x')	CAN FD frame array with timestamp (little-endian)	2 Bytes (= n = No. of frames) + $n * 80$ Bytes
88 ('X')	CAN FD frame array with timestamp (big-endian)	2 Bytes (= n = No. of frames) + $n * 80$ Bytes
112 ('p')	"Ping"	8 Bytes
80 ('P')	"Pong"	16 Bytes
100 ('d')	Change baud rate	4 Bytes
68 ('D')	Change baud rate reply	8 Bytes
103 ('g')	Read baud rate	None
71 ('G')	Read baud rate reply	8 Bytes
101 ('e')	Change baud rate (extended)	25 Byte
69 ('E')	Change baud rate reply (extended)	8 Bytes
102 ('f')	Read baud rate (extended)	1 Byte
70 ('F')	Read baud rate reply (extended)	25 Byte

Description of the Commands

Beacon No data, just used to signal client is still active.

Version information Must be sent as first command by every side, for contents see 5.2.3.6.2.

CAN frame array The first byte specifies the number of CAN frames that have been received. The second byte is '0', unless it is specified to check multiple CAN ports. In that case, the number of the CAN port is set here. The first two bytes are followed by the CAN frames, which are transferred as follows:

Byte	Member name	Short description
0..3	id	CAN ID*
4	len	Length of CAN data*
5	msg_lost	Lost CAN frames
6..7	reserved	Reserved/unused
8..15	data	CAN data

*Some bits with special meaning, please check chapter 5.2.3.6.3

Depending on the endian the CAN ID is swapped accordingly.

CAN frame array with timestamp This command works the same way as 'CAN frame array' but there is a timestamp attached to every timestamp:

Byte	Member name	Short description
0..3	id	CAN ID*
4	len	Length of CAN data*
5	msg_lost	Lost CAN frames
6..7	reserved	Reserved/unused
8..15	data	CAN data
16..23	timestamp	Timestamp

*Some bits with special meaning, please check chapter 5.2.3.6.3

CAN FD frame array with timestamp This command works the same way as 'CAN frame array with timestamp' but has additional bytes for CAN FD data.

Byte	Member name	Short description
0..3	id	CAN ID*
4	len	Length of CAN data*
5	msg_lost	Lost CAN frames
6..7	reserved	Reserved/unused
8..71	data	CAN FD data
72..79	timestamp	Timestamp

*Some bits with special meaning, please check chapter 5.2.3.6.3

Ping	Request to the other side to send a 'Pong'. The 8 data bytes are returned with that pong. These bytes usually are the system's time stamp (its frequency is sent with the version information – therefore this allows to approximate the time difference to the other side).
Pong	Reply to the 'Ping' command. The first 8 bytes are the bytes sent with the "Ping", the other 8 bytes are the local time stamp when sending this.
Change baud rate	The 4 bytes refer to the "uint32_t" value that is used internally for the canSetBaudrate() function, see NTCAN API manual for details. This command is deprecated and can only be used for CAN port 0.
Change baud rate reply	The first 4 bytes are the same that were sent with 'Change baud rate', the other 4 bytes are the result. 0 indicates that the baud rate was changed successfully.
Read baud rate	Request a 'Read baud rate reply' from the other side. This command is deprecated and can only be used for CAN port 0.
Read baud rate reply	The first 4 bytes contain the result of the attempt to read the baud rate. The other 4 bytes contain the baud rate value (according to the NTCAN API manual, see there for details). A result value of 0 indicates a successful operation, only then the baud rate value is valid.
Change baud rate (extended)	This command consists of two parts. The first byte contains the number of the CAN port, which should be changed. The following 24 bytes refer to the 'NTCAN_BAUDRATE_X' value that is used internally for the canSetBaudrateX() function, see NTCAN API manual for details.
Change baud rate reply (extended)	The first 4 bytes contain the number of the CAN port. The other 4 bytes are the result. 0 indicates that the baud rate was changed successfully.
Read baud rate (extended)	Request a 'Read baud rate reply (extended)' from the other side. This command has to be sent with one additional byte containing the number of the CAN port from which the baud rate is requested.
Read baud rate reply (extended)	The first 4 bytes contain the number of the CAN port. The other 24 bytes are the result based on the 'NTCAN_BAUDRATE_X' structure that is used for canGetBaudrateX() function, see NTCAN API manual for details.

- Read baud rate reply
- Reserved/other/future commands
 - These are already defined to be compatible with future versions of the software, as every command has to be read from the TCP socket.
For example, when the unknown command 'X' is received at first two bytes have to be read. These bytes specify the payload length, the length that has to read additionally. Thereafter follows the next command, and so on

5.2.3.6.2 Version Information Struct

Member name	Byte	
magic	0..2	Always 99, 50, 116 (ASCII: "c2t"). Used to ensure that the other side is actually an EtherCAN/3-FD CAN TCP Client/Server
reserved	3..6	Reserved for future use
version	7..10	Protocol version number
serial	11..14	Serial No. of the EtherCAN/3-FD. The format is described in the NTCAN API manual
reserved	15..18	Reserved for future use
reserved	19..22	Reserved for future use
tsFrequency	23..30	Frequency of the timestamps used in "Ping" / "Pong" commands (in Hz)

Reserved values must be set to 0. React on the client's version number only as/when described here.

5.2.3.6.3 CAN Frame Struct

Taken from NTCAN API documentation of the CAN-SDK: <http://esd.eu/en/products/can-sdk>

The following table describes the CAN frame struct for CAN **CC** without timestamp.

Member name	Bit	
id	0..28	CAN ID (bits 12..28 are zero in 11 bit IDs)
	29	Flag 29 bit ID (0: 11 bit ID, 1: 29 bit ID)
	30	Flag "event" (1: frame is event instead of normal CAN frame)
	31	Reserved
len	0..3	Length of CAN data (member "data"). Values greater than 8 are possible, in that case only 8 data bytes exist anyway.
	4	Flag "RTR" (1: "Remote Transmission Request", see CAN specification. Member "data" is not valid then)
	5	Flag "Mode" (1: Frame is "Interaction Frame", i.e. it was sent from another software on the EtherCAN/3-FD itself)
	6..7	Reserved
msg_lost	0..7	"Rx Lost" counter (No. of lost CAN frames. Limited to 255, i.e. when more than 255 frames were lost this value is still set to 255) Lost frames usually occur when the EtherCAN/3-FD failed to send them to the TCP connection in time, i.e. when the connection is too slow, or the server does not read them fast enough from its client socket.
reserved[0]..[1]	0..7	Reserved
data[0]..[7]	0..7	CAN data bytes

The following table describes the CAN frame struct for CAN **CC** with timestamp.

Member name	Bit	
id	0..28	CAN ID (bits 12..28 are zero in 11 bit IDs)
	29	Flag 29 bit ID (0: 11 bit ID, 1: 29 bit ID)
	30	Flag "event" (1: frame is event instead of normal CAN frame)
	31	Reserved
len	0..3	Length of CAN data (member "data"). Values greater than 8 are possible, in that case only 8 data bytes exist anyway.
	4	Flag "RTR" (1: "Remote Transmission Request", see CAN specification. Member "data" is not valid then)
	5	Flag "Mode" (1: Frame is "Interaction Frame", i.e. it was sent from another software on the EtherCAN/3-FD itself)
	6..7	Reserved
msg_lost	0..7	"Rx Lost" counter (No. of lost CAN frames. Limited to 255, i.e. when more than 255 frames were lost this value is still set to 255) Lost frames usually occur when the EtherCAN/3-FD failed to send them to the TCP connection in time, i.e. when the connection is too slow, or the server does not read them fast enough from its client socket.
reserved[0]..[1]	0..7	Reserved
timestamp	0..64	Timestamp in microseconds from the device start.
data[0]..[7]	0..7	CAN data bytes

The following table describes the CAN frame struct for CAN **FD** with timestamp. It is also compatible for CAN CC.

Member name	Bit	
id	0..28	CAN ID (bits 12..28 are zero in 11 bit IDs)
	29	Flag 29 bit ID (0: 11 bit ID, 1: 29 bit ID)
	30	Flag "event" (1: frame is event instead of normal CAN frame)
	31	Reserved
len	0..3	Length of CAN data (member "data"). Values greater than 8 are possible, in that case only 8 data bytes exist anyway.
	4	Flag "RTR" (1: "Remote Transmission Request", see CAN specification. Member "data" is not valid then)
	5	Flag "Mode" (1: Frame is "Interaction Frame", i.e. it was sent from another software on the EtherCAN/3-FD itself)
	6..7	Reserved
msg_lost	0..7	"Rx Lost" counter (No. of lost CAN frames. Limited to 255, i.e. when more than 255 frames were lost this value is still set to 255) Lost frames usually occur when the EtherCAN/3-FD failed to send them to the TCP connection in time, i.e. when the connection is too slow, or the server does not read them fast enough from its client socket.
reserved[0]..[1]	0..7	Reserved
timestamp	0..63	Timestamp in microseconds from the device start.

Software Configuration

Member name	Bit	
data[0]..[64]	0..511	CAN data bytes

5.2.3.7 ELLSI

The page *ELLSI Configuration* can be used to configure ELLSI. This includes selecting which ELLSI protocol is enabled as well as which port is used.

esd electronics gmbh
Vahrenwalder Str. 207
30165 Hannover
Germany

Phone: +49(0)511 37298-0
E-Mail: info@esd.eu
Website: www.esd.eu

Figure 24: Web Page ‘ELLSI Configuration’

ELLSI (EtherCAN Low Level Socket Interface) offers a simple solution to communicate with the CAN bus over Ethernet.

The EtherCAN/3-FD provides an ELLSI server which can be used by ELLSI clients to register themselves. After the registration the ELLSI client can be used to transmit and receive CAN frames as well as configure the other parameters like the baud rate or the CAN ID filter. Communication can be done via UDP, TCP or TCP WebSockets.

ELLSI can be used by all platforms not supported by the esd NTCAN driver and its EtherCAN client. For all platforms with an existing NTCAN driver, it is highly recommended to use NTCAN instead of ELLSI for communication with the EtherCAN/3-FD.

For details on the protocol check the *ELLSI Manual (6)*.

5.2.4 System

The web server provides several pages to interact with the system of the device. All system pages are protected by a combination of username and password. The default setting at delivery is:

Username:	esd
Password:	esd

It is highly recommended to change the default settings for security reasons.

5.2.4.1 Firmware Update

This page allows the user to update the device.

EtherCAN/3 – Ethernet-CAN-Gateway

Overview
Overview

Configuration
Security
Network
Event Logging
Firmware Update
CAN Baudrate
CAN Bridge
CAN TCP Client
ELLSI
Reboot

Status
CAN
CAN Bridge
Ethernet
Connected Clients
Events

Information
Contact

Firmware Update

This page is intended to upload a new firmware to the gateway

Important:
After clicking the Submit button it can take some time until the update is uploaded and processed. After a successful update, the overview page will be displayed.

File to upload: Keine ausgewählt

Please be patient after clicking "Submit", **do not power off the device!**


esd electronics gmbh

Figure 25: Firmware Update

The upload of the file is done via the web browser. Click the button 'Choose...' to select the update file.

Confirm by clicking the button 'Submit'. After the update is transferred to the module, the image is validated, and the update is started.

This may take some time. When the update is successful, the *Overview* page will be displayed. When the update file is invalid or something has gone wrong, a message will be displayed.

	NOTICE Do NOT switch off the power during the update, because the module could get into an inoperable state!
---	---

5.2.4.2 Reboot

The page *Reboot* can be used to reboot the system. The restart of the gateway will take approximately 10 seconds.

EtherCAN/3-FD – Ethernet-CAN FD-Gateway

Overview

Overview

Configuration

Security

Network

Event Logging

Firmware Update

CAN Baudrate

CAN Bridge

CAN TCP Client

ELLSI

Reboot

Status

CAN

CAN Bridge

Ethernet

Connected Clients

Events

Information

Contact

Reboot

This page is intended to reboot the Ethernet-CAN-Gateway. Some settings only become active after a reboot.

Important:
 The **Events Log** will be cleared after reboot.
 Also the webserver will be temporary unreachable and all gateway clients will be disconnected.



esd electronics gmbh

Figure 26: Web Page 'Reboot'



NOTICE

The **Events Log** will be cleared after reboot.
 Furthermore, the web server will be shut down and all links of the gateway clients/CAN Bridge will be disconnected.

5.2.5 Information

5.2.5.1 Contact

The page *Contact* provides contact information.

EtherCAN/3-FD – Ethernet to CAN FD Gateway 

Overview
Overview
Status
CAN
CAN Bridge
Ethernet
Clients
Event Log
Configuration
Security
Network
Event Log
CAN Baud Rate
CAN Bridge
CAN TCP Client
ELLSI
System
Reboot
Firmware Update
Information
Contact
License

Contact

Technical Support

You need support for this or a related product?

Our team will be glad to offer you assistance like

- answers on technical questions
- further technical documentation
- latest software updates

Contact:
+49 (0)511 37298-130
support@esd.eu

Sales

You would like to know more about buying this or a related product?

Our sales colleagues will provide

- detailed product information
- quotations for products and engineering
- prices and delivery times

Contact:
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sales@esd.eu

Support Center

The first point of contact for all questions and information about this and any related product is the product page and the support center. We offer you a self-service support portal with helpful information and numerous downloads including an overview of our current data sheets, a listing of all available manuals and download options for our software.

Product Page: www.esd.eu/en/products/ethercan-3
Support Center: www.esd.eu/en/support

esd electronics gmbh
Vahrenwalder Str. 207
30165 Hannover
Germany

Phone: +49(0)511 37298-0
E-Mail: info@esd.eu
Website: www.esd.eu

Figure 27: Web Page 'Contact'

5.2.5.2 License

The page *Licence* contains all license texts of external software components (see chapter 6).

5.3 TLS-Encryption

The EtherCAN/3-FD provides secure and encrypted communication for both Bridge Mode and EtherCAN Mode based on the TLS protocol. To enable encryption, the gateway and the host system use a simplified Public Key Infrastructure (PKI) with self-signed certificates. The user must provide valid certificates to ensure communication integrity and authentication.

PKI Structure and Certificate Requirements

The PKI structure is identical on all participating devices/systems:

- Each EtherCAN/3-FD device or host system must have its own certificate and private key.
- To establish a secure connection, both communication partners must store the trusted certificate of the other device.
- Each EtherCAN/3-FD device can store up to two trusted certificates.

Default Behavior and Security Considerations

- If no trusted certificates are configured, any valid certificate is accepted.
 -  Useful for debugging and commissioning, but not secure.
 -  Encrypted data may still be accessed by unauthorized devices.
- Once trusted certificates are configured, only explicitly approved devices can establish a connection.

Certificate Format

- All EtherCAN/3-FD devices and host systems use *.pem* format for certificates and private keys.

Example Scenarios

Scenario	Gateway Certificate Valid?	Host/2 nd Gateway Certificate Valid?	Gateway Trusted Host?	Host/2 nd Gateway Trusted Gateway?	Connection Status
Both the gateway and host have valid and trusted certificates.	 Yes	 Yes	 Yes	 Yes	 Secure connection established.
Host has a valid certificate, but the gateway does not trust it.	 Yes	 Yes	 No	 Yes	 Connection rejected by the gateway.
Gateway has a valid certificate, but the host does not trust it.	 Yes	 Yes	 Yes	 No	 Connection rejected by the host.
Both gateway and host have valid certificates but no trusted entries.	 Yes	 Yes	 No	 No	 Connection possible, but not secure.
One side has an invalid or expired certificate.	 No	 Yes /  No	N/A	N/A	 Connection rejected (invalid certificate).

5.3.1 PKI Configuration on the EtherCAN/3-FD

The Public Key Infrastructure (PKI) for encryption can be configured via the *Security Configuration* page on the EtherCAN/3-FD (see chapter 5.2.3.1).

Certificate Management on the Gateway

- The device certificate and trusted certificates can be uploaded and, if necessary, downloaded.
- The private key can only be uploaded but not downloaded, ensuring security.
- Each gateway supports up to two trusted certificates.
- Every EtherCAN/3-FD is shipped with a unique preinstalled device certificate and private key.

⚠ Important: Self-signed certificates are only secure if their generation, distribution, and renewal are strictly controlled by the user. It is therefore strongly recommended to generate and manage your own self-signed certificates.

Bridge Mode (EtherCAN/3-FD ↔ EtherCAN/3-FD)

In Bridge Mode, two EtherCAN/3-FD devices communicate directly without a host system.

Steps to Establish a Secure Connection:

1. Enable encryption on both devices.
2. Configure the remote IP addresses on both gateways and reboot the devices.
3. If no trusted certificates are configured, the connection will be established but remains insecure.
4. To secure the connection:
 - Navigate to the Security Configuration page on both devices.
 - Download the respective device certificates.
 - Upload each device's certificate to the opposite gateway as a trusted certificate.
 - Reboot both devices.
5. Now, a secure connection is established that only allows communication between the specific self-signed certificates configured.

EtherCAN Mode (EtherCAN/3-FD ↔ Host System)

In EtherCAN Mode, an EtherCAN/3-FD communicates with a host system that supports encryption.

Steps to Establish a Secure Connection:

1. Install a valid PKI on the host system (see next subsection).
2. If neither the EtherCAN/3-FD nor the host system has trusted certificates configured, a connection can still be established.
3. However, without trusted certificates, an unauthorized third party could establish its own connection and access the same information.
4. To ensure that only trusted devices can connect:
 - Install the host system's certificate as a trusted certificate on the EtherCAN/3-FD.
 - Install the EtherCAN/3-FD certificate as a trusted certificate on the host system.
 - Reboot both systems.
5. This ensures that only explicitly trusted devices can establish a connection.

5.3.2 Host System

During installation, the folder for the PKI is created with the following path:

```
C:\Users\<USERNAME>\AppData\Roaming\ESD\ethercan\pki
```

Within this directory, three subfolders are available: "own/cert", "own/key", and "trusted/certs".

- "own/cert" stores the device certificate.
- "own/key" contains the device's private key.
- "trusted/certs" holds trusted certificates.

The number of trusted certificates on the host system is not limited.

During installation, no certificates or private keys are generated.

The user is required to generate the certificate manually before enabling encryption.

5.3.3 Certificate Generation

This section explains how to generate self-signed certificates using OpenSSL. OpenSSL is an encryption library available on various operating systems and provides an easy-to-use command-line tool.

Prerequisites:

Before proceeding, ensure that OpenSSL is installed on your system. If OpenSSL is not available, install it first.

Generating a Self-Signed Certificate:

1. Open a command prompt.
2. Execute the following command:

```
openssl req -x509 -newkey rsa:2048 -sha256 -nodes -days 365 -keyout  
privkey.pem -out cert.pem
```
3. You will be prompted to provide details for the certificate subject. These details help identify the certificate holder.
If this information is not relevant to your use case, you can bypass the prompts by adding the following argument:

```
-subj "/CN=localhost"
```
3. Upon successful execution, two files will be generated in the current directory:

```
cert.pem – The self-signed certificate  
privkey.pem – The corresponding private key
```

Certificate Validity:

The generated certificate is valid for 365 days. To specify a different validity period, modify the `-days` argument accordingly.

6 Software Licenses



NOTICE

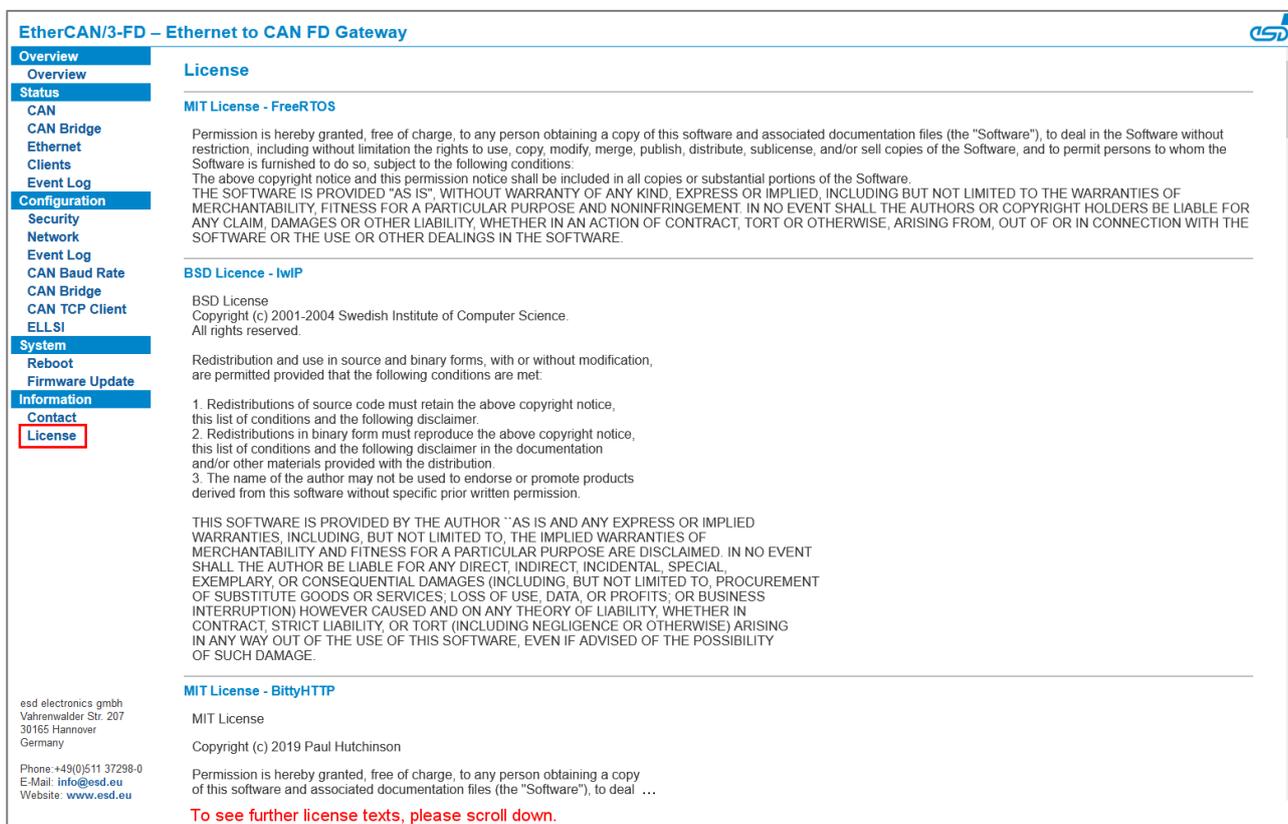
The software from esd and from third parties used in the EtherCAN/3-FD is subject to the license terms of the respective authors or rights holders. EtherCAN/3-FD may only be used in accordance with these license terms!

By using the EtherCAN/3-FD you agree to the terms of these software licenses.

6.1 License Texts

The license terms of esd (esd electronics License Conditions) and of 3rd parties (3rd Party Licenses) are displayed and installed on your system during installation via the installation program.

You can display the license terms at the following web page:



The screenshot shows the 'EtherCAN/3-FD – Ethernet to CAN FD Gateway' web interface. On the left is a navigation menu with categories: Overview, Status, Configuration, Security, Network, Event Log, System, and Information. The 'License' item under the 'Information' category is highlighted with a red box. The main content area displays the following license terms:

- MIT License - FreeRTOS**: Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions. The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software. THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.
- BSD Licence - lwIP**: BSD License Copyright (c) 2001-2004 Swedish Institute of Computer Science. All rights reserved. Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:
 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
 3. The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

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- MIT License - BittyHTTP**: MIT License Copyright (c) 2019 Paul Hutchinson Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal ...

At the bottom of the page, there is contact information for esd electronics gmbh and a red text prompt: "To see further license texts, please scroll down."

Figure 28: How to find the 3rd party software license terms

6.2 Open-Source Software Copy

You may obtain a copy of the source code, if and as required under the license by sending a mail to oss-compliance@esd.eu

You may also obtain a copy of the source code, if and as required under the license, by sending a check or money of EUR 25.00 to:

esd electronics gmbh
 Vahrenwalder Str. 207
 30165 Hannover, Germany

7 Host Software

7.1 EtherCAN SDK

The esd EtherCAN SDK is available for Windows® and Linux® and is included in delivery of the EtherCAN/3-FD. The SDK can also be downloaded from EtherCAN/3-FD product page on our website:

<https://esd.eu/en/products/ethercan-3-fd>

The EtherCAN SDK provides the host driver as well as examples and development tools.

For Windows® it also provides the configuration software *CAN Control Panel* to use the EtherCAN Mode of the EtherCAN/3-FD. On Linux® the configuration is file based. For more information on Linux® check the *ReadMe* file in the EtherCAN SDK.



Note:

The EtherCAN SDK is currently only available for Windows® and Linux®.

Other operating systems are available on request. For detailed information about the driver availability for your operating system, please contact our sales team: sales@esd.eu

7.1.1 CAN Control Panel

The *CAN Control Panel* is a small tool to configure the EtherCAN client.

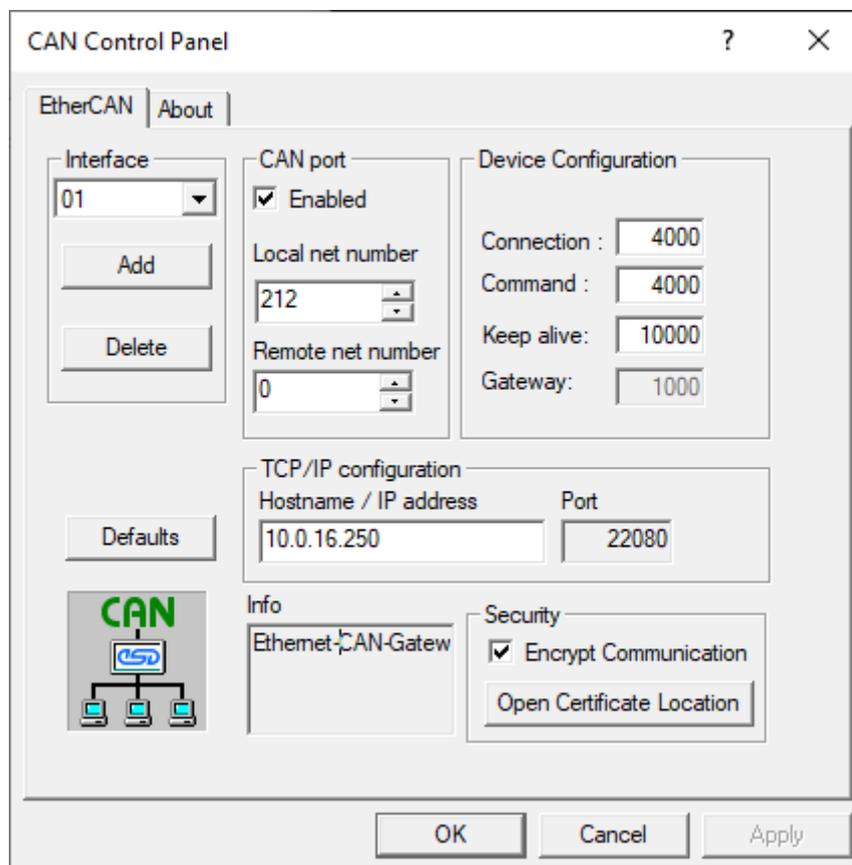


Figure 29: CAN Control Panel

Host Software

The following driver configuration options are available:

Interface In the drop-down box you can choose the EtherCAN/3-FD interface instance. With the *Add* button you can create additional instances. With the *Delete* button you can remove the currently selected instance. The default after installation is 5 EtherCAN instances which cannot be deleted.

Virtual CAN port You must assign a CAN network number between 0 and 255 and must enable it before this net number is available in the NTCAN environment to be used by your application.



Attention!

Please make sure that the assigned logical net number is not already in use by another EtherCAN/3-FD or another CAN interface attached to a local bus.

TCP/IP Configuration Configure the IP address or hostname (if registered in the DNS server) of the EtherCAN/3-FD interface. The supported ports are 22080 (unencrypted) and 22280 (encrypted). The IP address must be identical with the one that is assigned to the EtherCAN.

Timeouts Currently three separate timeouts can be configured. The **connection timeout** defines the time the EtherCAN driver waits for a response during the initial connection before the client software returns with a timeout. The **command timeout** defines the time after which a request to the EtherCAN/3-FD interface must be replied before the client software returns with a timeout. The **keep alive timeout** defines the time after which a keep alive request must be replied by the EtherCAN interface before the host driver tries to reset and re-establish the connection.

Defaults The *Default* button restores all driver defaults for the timeout parameter.

Security This Item has a checkbox *Encrypt Communication* which can be used to enable encrypted communication. The button *Open Certificate Location* opens the explorer in the *Public Key Infrastructure* (PKI) path:
(C:\Users\USERNAME\AppData\Roaming\ESD\ethercan\pki)

The directory itself contains three subfolders. The folder *own/cert* and */own/key* contain the certificate and key of the host EtherCAN client itself. The folder */trusted/certs* contains all certificates of EtherCAN/3-FD gateways that should be able to connect to the EtherCAN client. In contrast to the EtherCAN/3-FD, the EtherCAN client is able to hold multiple trusted certificates. For more information see chapter 5.3.



Note:

If you just want to run NTCAN based application on the system you are done.

If you intend to develop NTCAN based applications on this system you also have to install the CAN SDK as described in chapter 7.2 which contains in addition to many tools the required header files, library files and/or wrapper for your development environment.

For further information of the EtherCAN SDK please refer to 'NTCAN-API Part 2' (5).

7.2 CAN SDK

The esd CAN SDK is included in the delivery of the EtherCAN/3-FD. The SDK can also be downloaded from our website:

<https://esd.eu/en/products/can-sdk>



Note:

The CAN SDK is currently only available on Windows®.

Other operating systems are available on request. For detailed information about the driver availability for your operating system, please contact our sales team: sales@esd.eu

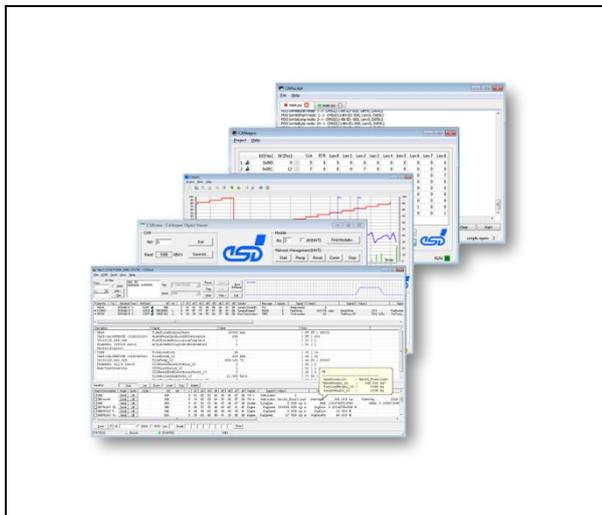
The esd CAN SDK provides support for software development with the esd NTCAN-API as well as additional free-of-charge tools which support efficient setup and analysis of CAN applications and networks.

CAN Tools

esd offers additional free-of-charge tools which support efficient setup and analysis of CAN applications and networks.

The CAN Tools are operational with all esd PC-CAN interfaces (e.g. PCIe, USB, EtherCAN/3-FD ...)

The following CAN Tools are available:



<u>CANreal</u>	Display and record of CAN message frames
<u>CANplot</u>	Graphical display of CAN data
<u>CANrepro</u>	Replay of pre-recorded CAN messages
<u>CANscript</u>	Python based scripting tool
<u>COBview</u>	Analysis and diagnostics of CANopen® nodes

System Requirements:

- Windows 32-bit or 64-bit system
- esd CAN driver installed

For further information of the esd NTCAN-API, refer to the following manuals:

- “NTCAN-API Part 1: Structure, Function and C/C++ API” Application Developers Manual (4) and
- “NTCAN-API Part 2: Installation, Configuration and Firmware Update” Installation Guide (5)

The manuals can be downloaded free of charge from our website via the product page of the EtherCAN/3-FD or the CAN SDK page: <https://esd.eu/en/products/can-sdk>.

Higher layer protocols (CANopen®, J1939, ARINC825) are supported for CAN CC applications. See chapter Order Information from page 96 for availability of the drivers.

8 LEDs

8.1 Position of the LEDs

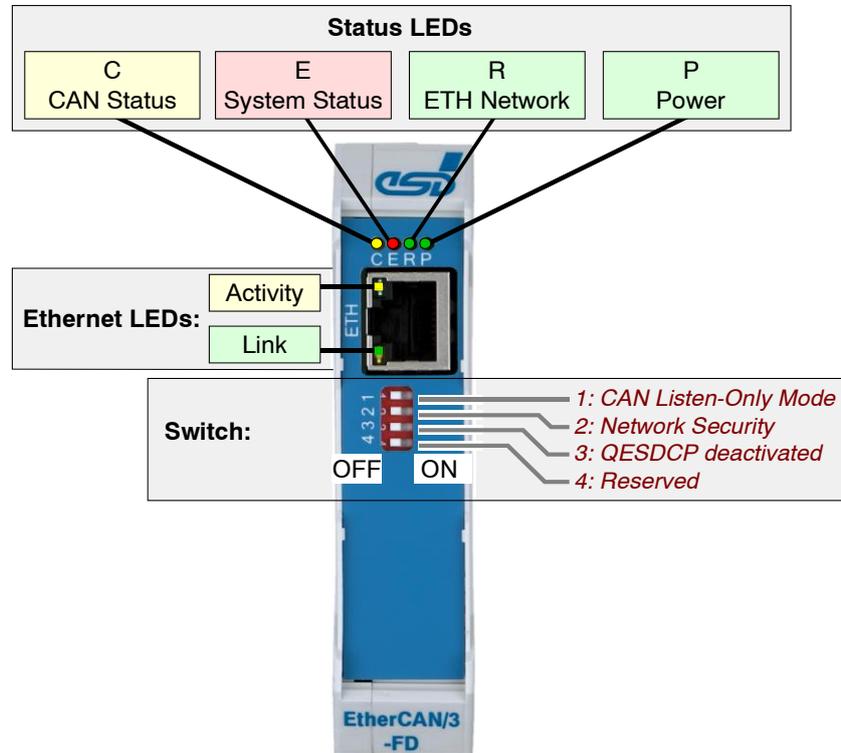


Figure 30: Position of the LEDs and Switch in the front panel

8.2 Status LED Indication

LED Status	Description
Flashing LS (long - short)	Alternating: 500 ms on - 100 ms off
Flashing SL (short - long)	Alternating: 100 ms on - 500 ms off

Table 1: Status LED flashing code

LED Name	Function	Indicator State	Description
C	CAN status	Off	Bus OK
		On	Bus OFF
		Flashing SL	Bus warning
		Flashing LS	Bus passive
E	System status	Off	No error detected
		On	System start failed
		Flashing LS	Network configuration error (System has set IP address automatically)
R	Ethernet Network	Off	No EtherCAN clients
		Flashing LS	EtherCAN clients connected
P	Power	Off	No power supply or hardware error
		On	Power supply is present and hardware is correctly initialized.
All	-	On	During the boot process, all four LEDs (C,E,R,P) are set to "On" for 500 ms.

Table 2: Status LED description

8.3 Ethernet LED Indication

LED	Indicator State	Description
Link	Off	10 Mbit/s
	On	100 Mbit/s
Activity	Off	No Ethernet link
	Flashing	Ethernet link is established, data is transferred
	On	Ethernet link is established but no data is transferred

Table 3: Ethernet LED description

9 Coding Switch

Feature	Parameters
Quantity	4
Function	<p>SW 1: CAN Listen-Only Mode: If this is set to “ON”, the CAN ports are forced to work in Listen-Only mode. This means that the gateway does not transmit CAN Frames or acknowledge incoming CAN frames.</p> <p>SW 2: Network Security - If this is set to “ON”, the internal web server is deactivated, and all unused network ports are blocked.</p> <p>SW 3: <i>QESDCP</i> - If this is set to “ON”, the <i>QESDCP</i> functionality is deactivated.</p> <p>SW 4: Reserved for future use.</p>
Notes	The status of the switches is only detected when the module is switched on. Switching during operation has no effect. Only exception is the <i>Recovery Mode</i> (see chapter 10).

Table 4: Coding Switch setting

10 Factory Reset

The EtherCAN/3-FD gateway includes a Recovery Mode that allows resetting specific settings to factory defaults. Follow these steps to enter and use Recovery Mode:

1. Entering Recovery Mode

1. Set all DIP switches to 'ON' before turning on the gateway.
2. Turn on the gateway and wait for it to boot (about 10 seconds).
3. Set all DIP switches back to 'OFF' within 2 minutes to activate recovery mode.
In recovery mode, all functions are disabled and all LEDs on the front panel start flashing. If the DIP switches are not set to 'OFF' within the time window, the gateway continues to operate normally.

2. Selecting a Reset Option

While in Recovery Mode, you can choose which settings should be restored to factory defaults by setting a specific DIP switch back to "ON". The corresponding LED numbered from left to right will start blinking to indicate the selected reset action:

SW 1 → Reset all settings to factory defaults.

SW 2 → Reset only network settings.

SW 3 → Reset user accounts and passwords.

SW 4 → Reserved for future use.

Once a switch is set, the reset action is performed, and the gateway automatically restarts.

3. Exiting Recovery Mode

- Recovery Mode is automatically exited after 2 minutes if no reset action is performed. The gateway then resumes normal operation.
- If no reset is needed, you can also power cycle the gateway (turn it off and on) to return to normal operation immediately.

11 Labels



Figure 31: View with name plate (example)

The name plate (Figure 31) shows among others the name, MAC-ID, esd order No. (PN) and the serial number (SN).

Name plate	Content
Name:	EtherCAN/3-FD
MAC-ID:	Individual MAC-ID of the module e.g.: 00:02:27:80:56:2A
PN (esd order No.):	C.2055..62
SN (Serial number):	Individual number of the module e.g. GA020010

12 Technical Data

12.1 General Technical Data

Power supply voltage	Nominal voltage: $U_{VCC} = 24 \text{ V DC}$ Permitted voltage range: $U_{VCC} = 12 \text{ V ... } 32 \text{ V DC}$
Power consumption	Typical: 4 W (FW 50% CPU load & 24 V supply voltage) Max: 5 W
Protective circuits	Reverse polarity protection, Protection against transient overvoltage
Temperature range	Operation: -20 ... 70 °C ambient temperature Storage: -20 ... 70 °C Transport: -20 ... 70 °C
Humidity	Operation: max. 90%, non-condensing Storage: max. 90%, non-condensing
Protection class	IP20
Pollution degree	Maximum permissible according to DIN EN 61131-2: Pollution Degree 2
Housing	Plastic housing for carrier rail mounting NS35/7,5 DIN EN 60715
Form factor / Dimensions	Width: 22.5 mm, height: 99 mm, depth: 114.5 mm (without connectors)
Weight	120 g

Table 5: General Data of the module

12.2 CAN Ports

Number of CAN ports	2x CAN FD
CAN controller	integrated in CPU (M467), acc. to ISO 11898-1
CAN protocol	According to ISO 11898-1
Physical CAN Layer	High-speed CAN interface according to ISO 11898-2, EtherCAN/3-FD: 10 kbit/s ... 8 Mbit/s
Electrical isolation	Separation by means of optocouplers and DC/DC-converters Voltage over CAN isolation: CAN to EARTH; CAN to Host/System Ground: 1kV DC @ 1s (I < 1 mA)
Bus termination	Terminating resistor must be set externally, if required
Connector	MC1.5/5-GF-3.81 (X1000 for CAN0 and X1010 for CAN1), and via the InRailBus connector (CAN0) of the module.

Table 6: Data of the CAN ports

12.3 Ethernet Port

Number of Ethernet ports	1
Standard	IEEE 802.3, 10BASE-T, 100BASE-TX
Bit rate	10/100 Mbit/s
Connection	S/FTP (screened shielded twisted pair) cables of category CAT5 or higher (compatible with IEEE 802.3), 100BASE-TX
Controller	Integrated in CPU
Electrical isolation	Via transformer, integrated in RJ-45 socket
LEDs	2, green + yellow, integrated into the RJ45 connector
Connector	RJ45 socket in the front panel with integrated LEDs

Table 7: Data of the Ethernet port

12.4 Connectors accessible from Outside

Name	Function, Ports	Type
CAN	CAN 0 and CAN 1	5-pos. Phoenix Contact PCB header MC 1,5/5-GF-3,81 with cable connector FK-MCP 1,5/5-STF-3,81 with push-in spring connection
ETH	Ethernet	Dual port RJ45 socket with integrated LEDs
24V	24V-power supply	4-pos. Phoenix Contact PCB header MSTBO 2,5/ 4-G1L KMGY with cable connector FKCT 2,5/4-ST KMGY with push-in spring connection
InRailBus	CAN 0 and 24V power supply via InRailBus	5-pos. TBUS connector (for connection plugs see accessories in order information in chapter 19.1)

Table 8: Connectors, accessible from outside

13 Connector Assignments

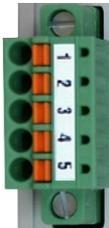
13.1 CAN 0 and CAN 1

CAN 0 (located at the bottom of the module) and CAN 1 (located at the top of the module) have the same pin assignment. CAN 0 is also routed to the InRailBus connector.

Device connector: Phoenix Contact PCB header MC 1,5/5-GF-3,81
Cable plug: Phoenix Contact connector FK-MCP 1,5/5-STF-3,81,
 Push-in spring connection, 3,81 mm pitch
 Phoenix Contact Order No.: 1851261, included in delivery
 For conductor connection and conductor cross section see page 77.

Pin Position:

(cable plug)



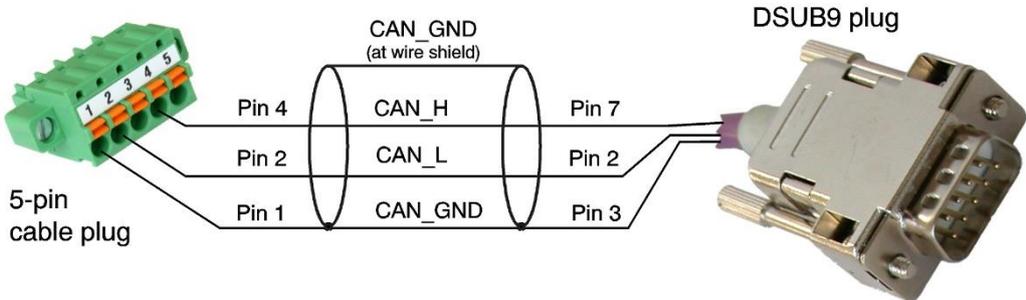
Pin Assignment:

Imprint	Signal	Pin
G	CAN_GND	1
L	CAN_L	2
Sh	Shield	3
H	CAN_H	4
•	-	5

Signal Description:

- CAN_L, CAN_H ... CAN signal lines
- CAN_GND ... Reference potential of the local CAN physical layer
- Shield ... Pin for line shield connection (using hat rail mounting direct contact to the mounting rail potential)
- ... Reserved, do not connect!

Recommendation of an adapter cable from 5-pin cable plug (here PCB connector FK-MCP1,5/5-STF_3,81 with spring-cage-connection) to DSUB9 connector:



The assignments of the DSUB9 connector and the cable plug are designed according to CiA 106 part 1.

i INFORMATION
 esd offers assembled CAN cables according to recommendations of CiA 303 part1 and CiA 106 as accessories, see chapter 19.

13.2 24 V and CAN0 via InRailBus

Power supply voltage and CAN can optionally be fed via the InRailBus.

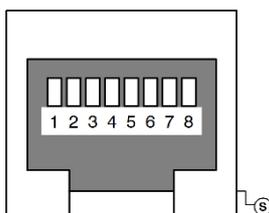
Use the mounting-rail bus connector (CAN-CBX-TBus) for the connection via the InRailBus, see Order Information InRailBus Accessories (page 88).

Read and follow the instructions for connecting power supply and CAN0 signals via InRailBus (see from page 89)!

13.1 Ethernet

Device Connector: RJ45 socket, 8-pin
 According to IEEE 802.3-2015,
 “Table 25–2—Twisted-pair MDI contact assignments”

Pin Position:



Pin Assignment:

Pin	Signal	Meaning
1	Tx0+ (TxD+)	Transmit Data +
2	Tx0- (TxD-)	Transmit Data -
3	Rx0+ (RxD+)	Receive Data +
4	-	-
5	-	-
6	Rx0- (RxD-)	Receive Data -
7	-	-
8	-	-
S	Shield	

Signal Description:

Tx0+/-, Rx0+/- ...	Ethernet data lines
- ...	Reserved for future applications, do not connect!
Shield...	RJ45 Case shield is not connected



NOTICE

esd grants the EU conformity of the product in networks with 100 Mbit/s, if the wiring is carried out with S/FTP (screened shielded twisted pair) cables of category CAT5 or higher.

13.2 24V Power Supply Voltage

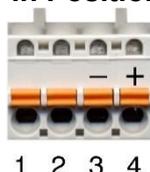


DANGER

The EtherCAN/3-FD is a device of protection class III according to DIN EN 61140 and may only be operated on supply circuits that offer sufficient protection against dangerous voltages.

Device socket: Phoenix Contact PCB header MSTBO 2,5/4-G1L-KMGY
Cable plug: Phoenix Contact connector FKCT 2,5/4-ST, 5.0 mm pitch, Push-in spring connection, included in the scope of delivery, (Phoenix Contact order No.: 19 21 90 0)
 For conductor connection and conductor cross section see page 77.

Pin Position:



Pin Assignment:

Device housing label			24V	
Connector label	.	.	M	P
	(none)	(none)	-	+

Pin	1	2	3	4
Signal	P24 (+ 24 V)	M24 (GND)	M24 (GND)	P24 (+ 24 V)
	Looped through contacts		Primary power feed	

Please refer to the connecting diagram at page 14.



NOTICE

The P24 pins (pin 1, 4) are connected internally! The M24 pins (pin 2, 3) are connected internally!



NOTICE

The +24V supply voltage can be looped through (see chapter "Connection of the Supply Voltage" at page 92) as long as the value of the looped-through current is less than 2.0 A!

There is also a connection between the +24V plug and the InRailBus so that the module can be supplied via the InRailBus. Note that this connection is not designed to feed the 24V supply voltage via the plug to the InRailBus!

- Use only suitable cables for the power plug.
- Make sure to connect the cables correctly to the cable plug!

Signal Description:

P24... Power supply voltage $U_{VCC} = 18 \text{ V/DC} \dots 32 \text{ V/DC}$

M24... Reference potential

13.3 Conductor Connection / Conductor Cross Section

The following table contains an extract of the technical data of the cable plugs.

<i>Characteristics</i>	<i>Connector Type¹</i>	
	Power Supply Voltage 24 V	CAN-Connector
Connector type plug component	FKCT 2,5/4-ST KMGY	FK-MCP 1,5/5-STF-3,81
Connection method	Push-in spring connection	Push-in spring connection
Stripping length	10 mm	9 mm
Conductor cross section rigid.	0.2 mm ² ... 2.5 mm ²	0.14 mm ² ... 1.5 mm ²
Conductor cross section flexible	0.2 mm ² ... 2.5 mm ²	0.14 mm ² ... 1.5 mm ²
Conductor cross section AWG	24 ... 12	26 ... 16
Conductor cross section flexible, with ferrule without plastic sleeve	0.25 mm ² ... 2.5 mm ²	0.25 mm ² ... 1.5 mm ²
Conductor cross section flexible, with ferrule with plastic sleeve	0.25 mm ² ... 2.5 mm ²	0.25 mm ² ... 0.75 mm ²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min./max.	0.5 mm ² ... 1.5 mm ²	not allowed

¹ Technical Data from Phoenix Contact website, printed circuit board connector, plug component

14 Correct Wiring of Electrically Isolated CAN Networks



NOTICE

This chapter applies to CAN networks with bit rates up to 1 Mbit/s.

If you work with higher bit rates, as for example used for CAN FD, the information given in this chapter must be examined for applicability in each individual case.

For further information refer to the CiA® CAN FD guidelines and recommendations (<https://www.can-cia.org/>).

For the CAN wiring all applicable rules and regulations (EU, DIN), such as regarding electromagnetic compatibility, security distances, cable cross-section or material, must be observed.

14.1 CAN Wiring Standards

The flexibility in CAN network design is a major strength of the various extensions based on the original CAN standard ISO 11898-2, such as CANopen®, ARINC825, DeviceNet® and NMEA2000. However, taking advantage of this flexibility absolutely requires a network design that considers the interactions of all network parameters.

In some cases, the CAN organizations have adapted the scope of CAN in their specifications to enable applications outside the ISO 11898 standard. They have imposed system-level restrictions on data rate, line length and parasitic bus loads.

However, when designing CAN networks, a margin must always be planned for signal losses over the entire system and cabling, parasitic loads, network imbalances, potential differences against earth potential, and signal integrities. **Therefore, the maximum achievable number of nodes, bus lengths and stub lengths may differ from the theoretically possible number!**

esd has limited its recommendations for CAN wiring to the specifications of ISO 11898-2. A description of the special features of the derived specifications CANopen, ARINC825, DeviceNet, and NMEA2000 is omitted here.

The consistent compliance with the ISO 11898-2 standard offers significant advantages:

- Reliable operation due to proven design specifications
- Minimization of error sources due to sufficient distance to the physical limits.
- Easy maintenance because there are no "special cases" to consider for future network modifications and troubleshooting.

Of course, reliable networks can be designed according to the specifications of CANopen, ARINC825, DeviceNet and NMEA2000, **however it must be observed that it is strictly not recommended to mix the wiring guidelines of the various specifications!**

14.2 Light Industrial Environment (*Single Twisted Pair Cable*)

14.2.1 General Rules

NOTICE
 esd grants the EU Conformity of the product if the CAN wiring is carried out with at least single shielded **single** twisted pair cables that match the requirements of ISO 11898-2. Single shielded *double* twisted pair cable wiring as described in chapter 14.3 ensures the EU Conformity as well.

The following **general rules** for CAN wiring with single shielded single twisted pair cable should be followed:

1	A suitable cable type with a wave impedance of about $120\ \Omega \pm 10\%$ with an adequate conductor cross-section ($\geq 0.22\ \text{mm}^2$) must be used. The voltage drop over the wire must be considered.
2	For light industrial environment use at least a two-wire CAN cable, the wires of which must be assigned as follows: <ul style="list-style-type: none"> • Two twisted wires must be assigned to the data signals (CAN_H, CAN_L). • The cable shield must be connected to the reference potential (CAN_GND).
3	The reference potential CAN_GND must be connected to the functional earth (FE) at exactly one point.
4	A CAN bus line must not branch (exception: short cable stubs) and must be terminated with the characteristic impedance of the line (generally $120\ \Omega \pm 10\%$) at both ends (between the signals CAN_L and CAN_H and not at CAN_GND).
5	Keep cable stubs as short as possible ($l < 0.3\ \text{m}$).
6	Select a working combination of bit rate and cable length.
7	Keep away cables from disturbing sources. If this cannot be avoided, double shielded wires are recommended.

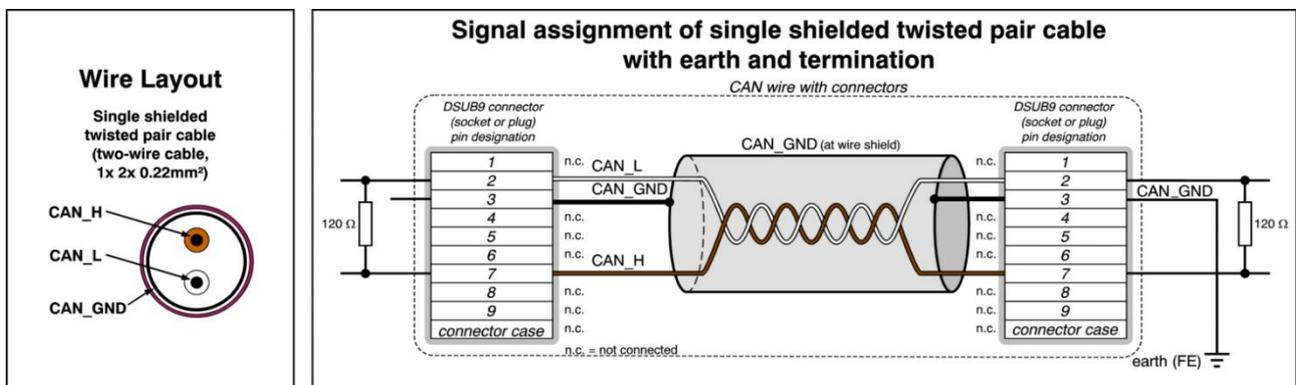


Figure 32: CAN wiring for light industrial environment

14.2.2 Cabling

- To connect CAN devices with just one CAN connector per net use a short stub (< 0.3 m) and a T-connector (available as accessory). If these devices are located at the end of the CAN network, the CAN terminator “CAN-Termination-DSUB9” can be used.

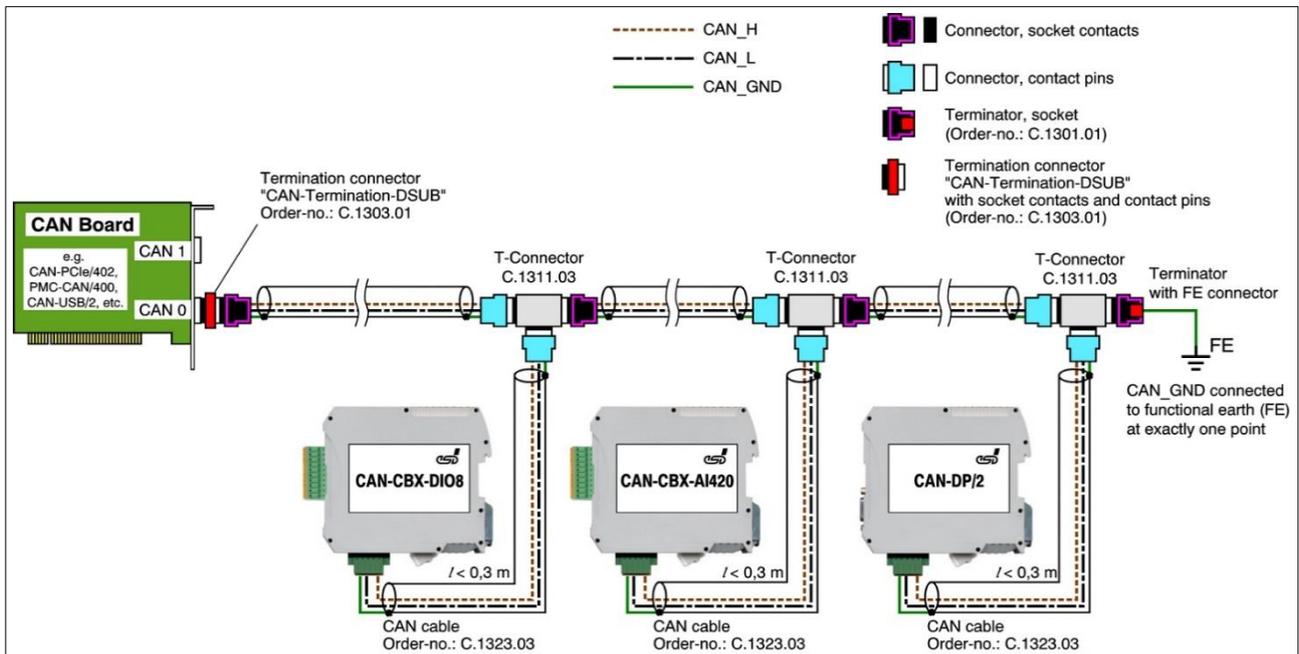


Figure 33: Example for proper wiring with single shielded single twisted pair wires

14.2.3 Branching

- In principle the CAN bus must be realized in a line. The nodes are connected to the main CAN bus line via short cable stubs. This is normally realized by so called T-connectors. esd offers the CAN-T-Connector (Order No.: C.1311.03)
- If a mixed application of single twisted and double twisted cables cannot be avoided, ensure that the CAN_GND line is not interrupted!
- Deviations from the bus structure can be realized by using repeaters.

14.2.4 Termination Resistor

- A termination resistor must be connected at both ends of the CAN bus. If an integrated CAN termination resistor is connected to the CAN interface at the end of the CAN bus, this integrated termination must be used instead of an external CAN termination resistor.
- 9-pole DSUB-termination connectors with integrated termination resistor and pin contacts and socket contacts are available from esd (order no. C.1303.01).
- For termination of the CAN bus and grounding of the CAN_GND, DSUB terminators with pin contacts (order no. C.1302.01) or socket contacts (order no. C.1301.01) and with additional functional earth contact are available.

14.3 Heavy Industrial Environment (Double Twisted Pair Cable)

14.3.1 General Rules

The following **general rules** for the CAN wiring with single shielded *double* twisted pair cable should be followed:

1	A suitable cable type with a wave impedance of about $120\ \Omega \pm 10\%$ with an adequate conductor cross-section ($\geq 0.22\ \text{mm}^2$) must be used. The voltage drop over the wire must be considered.
2	For heavy industrial environment use a four-wire CAN cable, the wires of which must be assigned as follows: <ul style="list-style-type: none"> • Two twisted wires must be assigned to the data signals (CAN_H, CAN_L) and • The other two twisted wires must be assigned to the reference potential (CAN_GND). • The cable shield must be connected to functional earth (FE) at least at one point.
3	The reference potential CAN_GND must be connected to the functional earth (FE) at exactly one point.
4	A CAN bus line must not branch (exception: short cable stubs) and must be terminated with the characteristic impedance of the line (generally $120\ \Omega \pm 10\%$) at both ends (between the signals CAN_L and CAN_H and not to CAN_GND).
5	Keep cable stubs as short as possible ($l < 0.3\ \text{m}$).
6	Select a working combination of bit rate and cable length.
7	Keep away CAN cables from disturbing sources. If this cannot be avoided, double shielded cables are recommended.

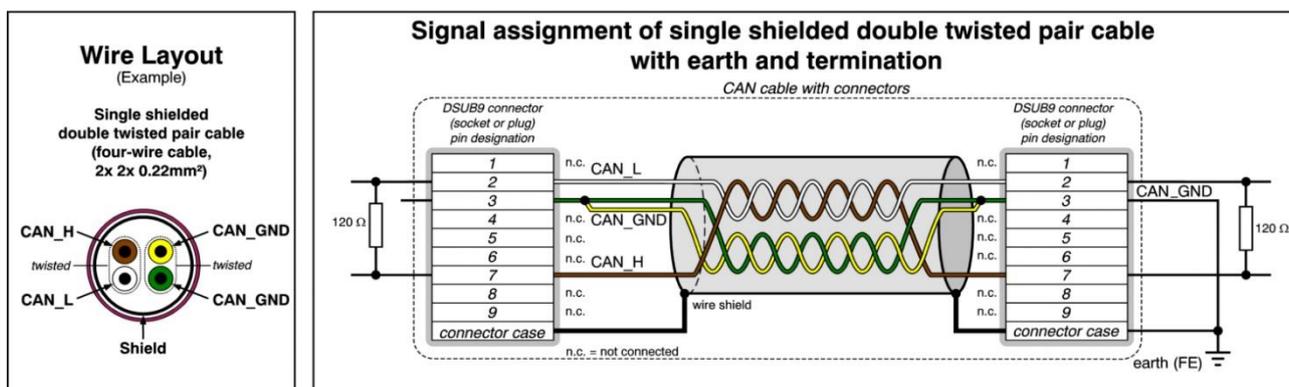


Figure 34: CAN wiring for heavy industrial environment

14.3.2 Device Cabling

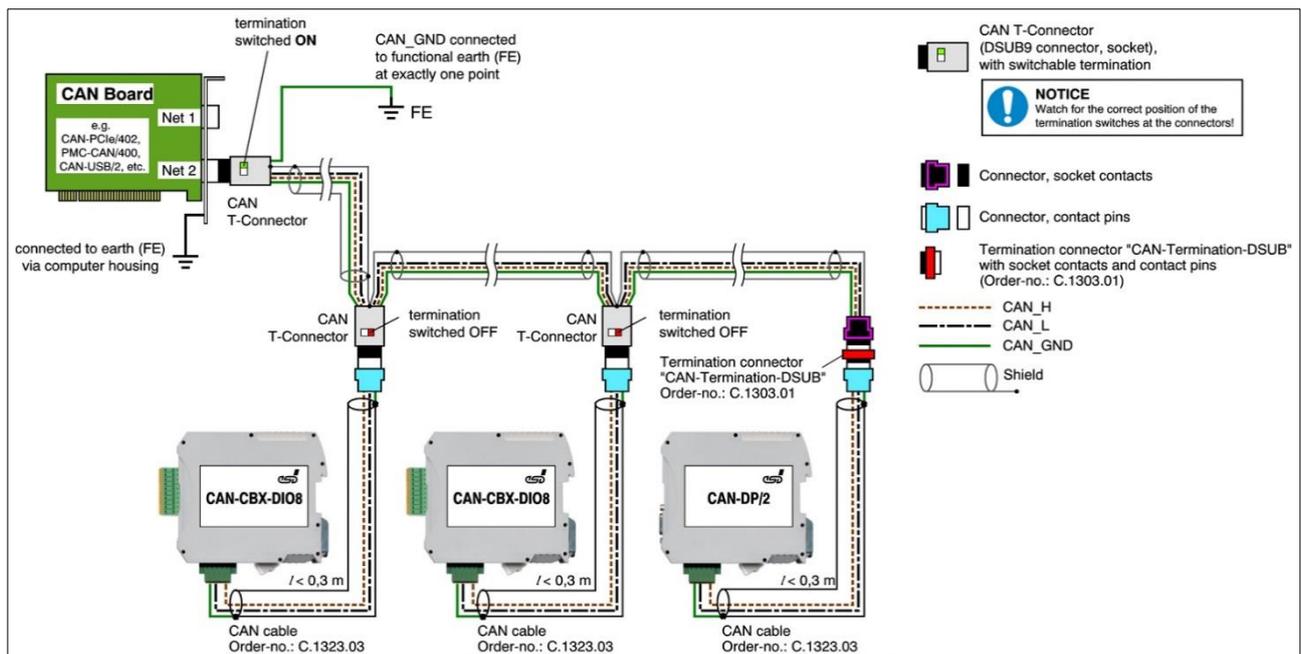


Figure 35: Example of proper wiring with single shielded double twisted pair cables

14.3.3 Branching

- In principle, the CAN bus must be realized in a line. The nodes are connected to the main CAN bus line via short cable stubs. This is usually realised via so called T-connectors. When using esd's CAN-T-Connector (order no.: C.1311.03) in heavy industrial environment and with four-wire twisted cables, it must be noted that the shield potential of the conductive DSUB housing is not looped through this type of T-connector. This interrupts the shielding. Therefore, you must take appropriate measures to connect the shield potentials, as described in the manual of the CAN-T-Connector. For further information on this, please refer to the CAN-T-Connector Manual (order no.: C.1311.21). Alternatively, a T-connector can be used, in which the shield potential is looped through, for example the DSUB9 connector from ERNI (ERBIC CAN BUS MAX, order no.:154039).
- If a mixed application of single twisted and double twisted cables cannot be avoided, ensure that the CAN_GND line is not interrupted!
- Deviations from the bus structure can be realized by using repeaters.

14.3.4 Termination Resistor

- A termination resistor must be connected at both ends of the CAN bus. If an integrated CAN termination resistor is connected to the CAN interface at the end of the CAN bus, this integrated termination must be used instead of an external CAN termination resistor.
- 9-pole DSUB-termination connectors with integrated termination resistor and pin contacts and socket contacts are available from esd (order no. C.1303.01).
- 9-pole DSUB-connectors with integrated switchable termination resistor can be ordered for example from ERNI (ERBIC CAN BUS MAX, socket contacts, order no.:154039).

14.4 Electrical Grounding

- For CAN devices with electrical isolation the CAN_GND must be connected between the CAN devices.
- CAN_GND should be connected to the earth potential (FE) at **exactly one** point of the network.
- Each *CAN interface with electrical connection to earth potential* acts as a grounding point. For this reason, it is recommended not to connect more than one *CAN device with electrical connection to earth potential*.
- Grounding can be done for example at a termination connector (e.g. order no. C.1302.01 or C.1301.01).

14.5 Bus Length

The bus length of a CAN network must be adapted to the set bit rate. The maximum values result from the fact that the time required for a bit to be transmitted in the bus system is shorter the higher the transmission rate is. However, as the line length increases, so does the time it takes for a bit to reach the other end of the bus. It should be noted that the signal is not only transmitted, but the receiver must also respond to the transmitter within a certain time. The transmitter, in turn, must detect any change in bus level from the receiver(s). Delay times on the line, the transceiver, the controller, oscillator tolerances and the set sampling time must be considered.

In the following table you will find guide values for the achievable bus lengths at certain bit rates.

Bit Rate [kbit/s]	Theoretical values of reachable wire length with esd interface l_{\max} [m]	CiA recommendations (07/95) for reachable wire lengths l_{\min} [m]	Standard values of the cross-section according to CiA 303-1 [mm ²]
1000	37	25	0.25 to 0.34
800	59	50	0.34 to 0.6
666. $\bar{6}$	80	-	
500	130	100	
333. $\bar{3}$	180	-	
250	270	250	
166	420	-	0.5 to 0.6
125	570	500	
100	710	650	0.75 to 0.8
83. $\bar{3}$	850	-	
66. $\bar{6}$	1000	-	
50	1400	1000	
33. $\bar{3}$	2000	-	not defined in CiA 303-1
20	3600	2500	
12.5	5400	-	
10	7300	5000	

Table 9: Recommended cable lengths at typical bit rates (with esd-CAN interfaces)

Optical couplers are delaying the CAN signals. esd modules typically achieve a wire length of 37 m at 1 Mbit/s within a proper terminated CAN network without impedance disturbances, such as those caused by cable stubs > 0.3 m.



NOTICE

Please note that the cables, connectors, and termination resistors used in CANopen networks shall meet the requirements defined in ISO 11898-2. In addition, further recommendations of the CiA, like standard values of the cross section, depending on the cable length, are described in the CiA recommendation CiA 303-1 (see CiA 303 CANopen Recommendation - Part 1: “Cabling and connector pin assignment,” Version 1.9.0, Table 2). Recommendations for pin-assignment of the connectors are described in CiA 106: “Connector pin-assignment recommendations”.

14.6 Examples for CAN Cables

esd recommends the following two-wire and four-wire cable types for CAN network design. These cable types are used by esd for ready-made CAN cables, too.

14.6.1 Cable for Light Industrial Environment Applications (Two-Wire)

Manufacturer	Cable Type
U.I. LAPP GmbH Schulze-Delitzsch-Straße 25 70565 Stuttgart Germany www.lappkabel.com	e.g. UNITRONIC ®-BUS CAN UL/CSA (1x 2x 0.22) (UL/CSA approved) Part No.: 2170260
	UNITRONIC ®-BUS-FD P CAN UL/CSA (1x 2x 0.25) (UL/CSA approved) Part No.: 2170272
ConCab GmbH Äußerer Eichwald 74535 Mainhardt Germany www.concab.de	e. g. BUS-PVC-C (1x 2x 0.22 mm ²) Order No.: 93 022 016 (UL appr.)
	BUS-Schleppflex-PUR-C (1x 2x 0.25 mm ²) Order No.: 94 025 016 (UL appr.)

14.6.2 Cable for Heavy Industrial Environment Applications (Four-Wire)

Manufacturer	Cable Type
U.I. LAPP GmbH Schulze-Delitzsch-Straße 25 70565 Stuttgart Germany www.lappkabel.com	e.g. UNITRONIC ®-BUS CAN UL/CSA (2x 2x 0.22) (UL/CSA approved) Part No.: 2170261
	UNITRONIC ®-BUS-FD P CAN UL/CSA (2x 2x 0.25) (UL/CSA approved) Part No.: 2170273
ConCab GmbH Äußerer Eichwald 74535 Mainhardt Germany www.concab.de	e. g. BUS-PVC-C (2x 2x 0.22 mm ²) Order No.: 93 022 026 (UL appr.)
	BUS-Schleppflex-PUR-C (2x 2x 0.25 mm ²) Order No.: 94 025 026 (UL appr.)



INFORMATION

Ready-made CAN cables with standard or custom length can be ordered from **esd**.

15 CAN Troubleshooting Guide

The CAN Troubleshooting Guide is a guide to finding and eliminating the most common problems and errors when setting up CAN bus networks and CAN-based systems.

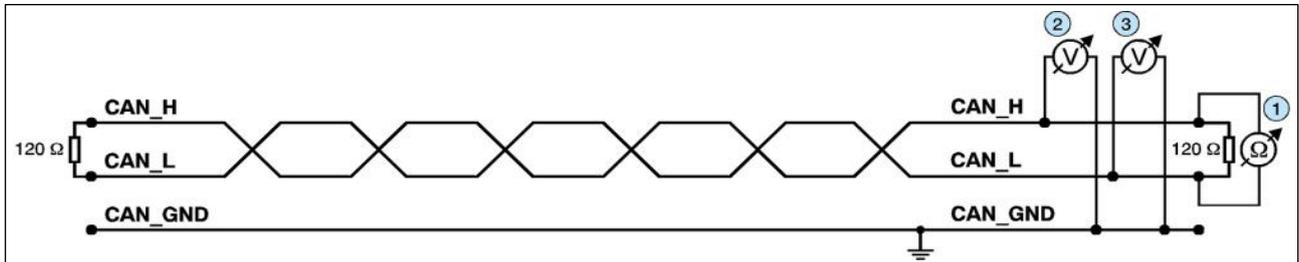


Figure 36: Simplified diagram of a CAN network

Termination

The bus termination is used to match impedance of a node to the impedance of the bus line used. If the impedance is mismatched, the transmitted signal is not completely absorbed by the load and will be partially reflected back into the transmission line.

If the impedances of the sources, transmission lines and loads are equal, the reflections are avoided. This test measures the total resistance of the two CAN data lines and the connected terminating resistors.

To **test this**, please proceed as follows:

1. Switch off the supply voltages of all connected CAN nodes.
2. Measure the DC resistance between CAN_H and CAN_L at one end of the network, measuring point ① (see figure above).

Expected result:

The measured value should be between 50 Ω and 70 Ω.

Possible causes of error:

- If the determined value is below 50 Ω, please make sure that:
 - There is no **short circuit** between CAN_H and CAN_L wiring.
 - **No more than two** terminating resistors are connected.
 - The transceivers of the individual nodes are not defective.
- If the determined value is higher than 70 Ω, please make sure that:
 - All CAN_H and CAN_L lines are correctly connected.
 - Two terminating resistors of 120 Ω each are connected to your CAN network (one at each end).

15.1 Electrical Grounding

The CAN_GND of the CAN network should be connected to the functional earth potential (FE) at only **one** point. This test indicates whether the CAN_GND is grounded at one or more points.

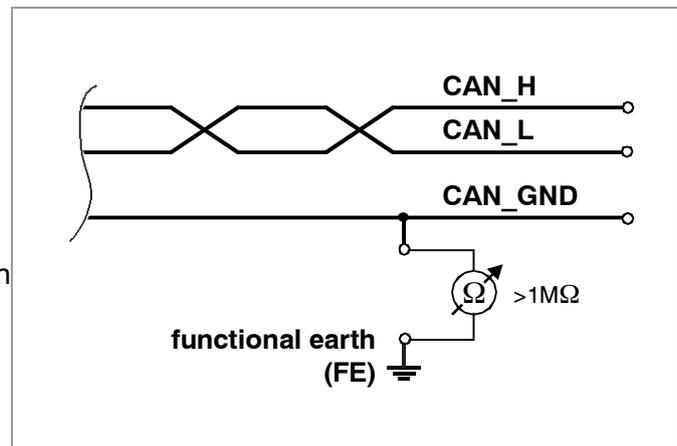
Please note that this test can only be performed with electrically isolated CAN nodes.

To test this, please proceed as follows:

1. Disconnect the CAN_GND from the earth potential (FE).
2. Measure the DC resistance between CAN_GND and earth potential (see figure on the right).

Do not forget to reconnect CAN_GND to earth potential after the test!

Figure 37: Simplified schematic diagram of ground test measurement



Expected result:

The measured resistance should be greater than 1 MΩ. If it is smaller, please search for additional grounding of the CAN_GND wires.

15.2 Short Circuit in CAN Wiring

A CAN bus might possibly still be able to transmit data even if CAN_GND and CAN_L are short-circuited. However, this will usually cause the error rate to rise sharply.

Ensure that there is no short circuit between CAN_GND and CAN_L!

15.3 Correct Voltage Levels on CAN_H and CAN_L

Each node contains a CAN transceiver that outputs differential signals. When the network communication is idle the CAN_H and CAN_L voltages are approximately 2.5 V measured to CAN_GND. Defective transceivers can cause the idle voltages to vary and disrupt network communication.

To test for defective transceivers, please proceed as follows:

1. Switch on all supply voltages.
2. Terminate all network communication.
3. Measure the DC voltage between CAN_H and CAN_GND, measuring point ②. (See “Simplified diagram of a CAN network” on previous page).
4. Measure the DC voltage between CAN_L and CAN_GND, measuring point ③. (See “Simplified diagram of a CAN network” on previous page).

Expected result:

The measured voltage should be between 2.0 V and 3.0 V.

Possible causes of error:

- If the voltage is lower than 2.0 V or higher than 3.0 V, it is possible that one or more nodes have defective transceivers.
 - If the voltage is lower than 2.0 V, please check the connections of the CAN_H and CAN_L lines.
- To find a node with a defective transceiver within a network, please check individually the resistances of the CAN transceivers of the nodes (see next section).

15.4 CAN Transceiver Resistance Test

CAN transceivers have circuits that control CAN_H and CAN_L. Experience shows that electrical damage can increase the leakage current in these circuits.

To measure the current leakage through the CAN circuits, please use an ohmmeter and proceed as follows:

1. Switch **off** the node ④ and **disconnect** it from the CAN network. (See figure below.)
2. Measure the DC resistance between CAN_H and CAN_GND, measuring point ⑤ (See figure below.)
3. Measure the DC resistance between CAN_L and CAN_GND, measuring point ⑥ (See figure below.)

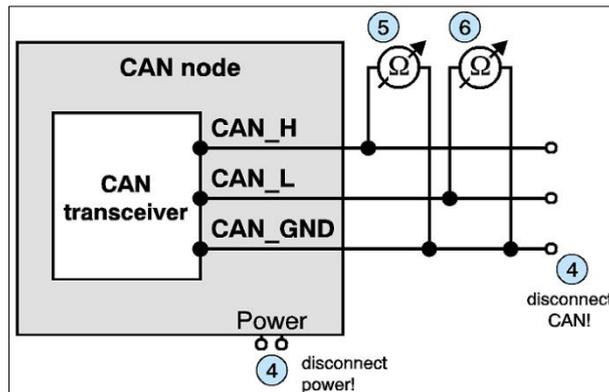


Figure 38: Measuring the internal resistance of CAN transceivers

Expected result:

The measured resistance should be greater than 10 k Ω for each measurement.

Possible causes of error:

- If the resistance is significantly lower, the CAN transceiver may be defective.
- Another indication of a defective CAN transceiver is a very high deviation of the two measured input resistances (>> 200 %).

15.5 Support by esd

If you have followed the troubleshooting steps in this troubleshooting guide and still cannot find a solution to your problem, our support team can help.

Please contact our support by email to support@esd.eu or by phone **+49-511-37298-130**.

16 Optional InRailBus

16.1 Order Information InRailBus Accessories

Type	Properties	Order No.
Accessories		
 CAN-CBX-TBus	DIN-rail bus connector of the CBX-InRailBus for CAN-CBX modules (ME 22,5 TBUS 1,5/ 5-ST-3,81 KMGY)	C.3000.01
 CAN-CBX-TBus-Connector-Socket	Terminal plug of the CBX-InRailBus for the connection of the +24V power supply voltage and the CAN port (MCVR 1,5/5-ST-3,81 AU), socket contacts	C.3000.02
 CAN-CBX-TBus-Connector-Plug	Terminal plug of the CBX-InRailBus for the connection of the +24V power supply voltage and the CAN port (IMC 1,5/ 5-ST-3,81 AU), pin contacts	C.3000.03

16.2 Conductor Connection/Conductor Cross Section

The following table contains an extract of the technical data of the cable plugs.

<i>Characteristics</i>	<i>Connector Type²</i>	
	CAN-CBX-TBus-Connector-Socket	CAN-CBX-TBus-Connector-Plug
Connector type plug component	MCVR 1,5/5-ST-3,81 AU	IMC 1,5/ 5-ST-3,81 AU
Connection method	Screw connection with tension sleeve	Screw connection with tension sleeve
Stripping length	7 mm	7 mm
Nominal cross section	1.5 mm ²	1.5 mm ²
Conductor cross section rigid.	0.14 mm ² ... 1.5 mm ²	0.14 mm ² ... 1.5 mm ²
Conductor cross section flexible	0.14 mm ² ... 0.5 mm ²	0.14 mm ² ... 1.5 mm ²
Conductor cross section AWG	28 ... 16	28 ... 16
Conductor cross section flexible, with ferrule without plastic sleeve	0.25 mm ² ... 1.5 mm ²	0.25 mm ² ... 1.5 mm ²
Conductor cross section flexible, with ferrule with plastic sleeve	0.25 mm ² ... 0.5 mm ²	0.25 mm ² ... 0.5 mm ²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min./max.	0.5 mm ² ... 0.5 mm ²	0.5 mm ² ... 0.5 mm ²

² Technical Data from Phoenix Contact website, printed circuit board connector, plug component

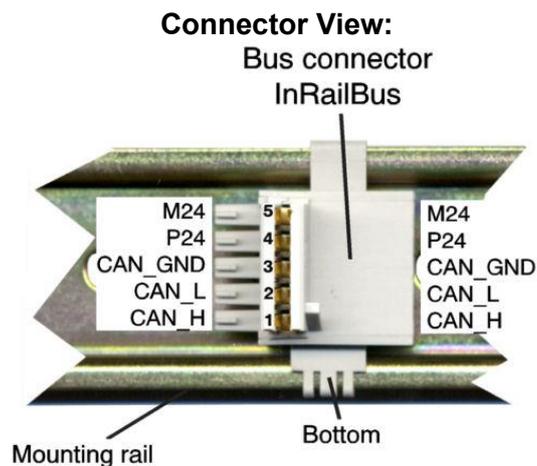
16.3 Connector Assignment 24V and CAN via InRailBus (Option)



DANGER

The EtherCAN/3-FD is a device of protection class III according to DIN EN 61140 and may only be operated on supply circuits that offer sufficient protection against dangerous voltages.

Connector type: Mounting-rail bus connector of the CBX-InRailBus
Phoenix Contact ME 22,5 TBUS 1,5/5-ST-3,81 KMGY



Pin Assignment:

Pin	Signal
5	M24 (GND)
4	P24 (+24 V)
3	CAN_GND
2	CAN_L
1	CAN_H
S	FE (PE_GND)

Signal Description:

CAN_L, CAN_H ... CAN signals
 CAN_GND ... reference potential of the local CAN-Physical layers
 P24... power supply voltage +24 V
 M24... reference potential
 FE... functional earth contact (EMC) (connected to mounting rail potential)

16.4 Using InRailBus (Option)

This chapter describes the installation of the module using InRailBus as an example for CAN-CBX-modules.

16.4.1 Installation of the Module when using the InRailBus Connector

If the CAN bus signals and the power supply voltage shall be fed via the InRailBus, please proceed as follows:

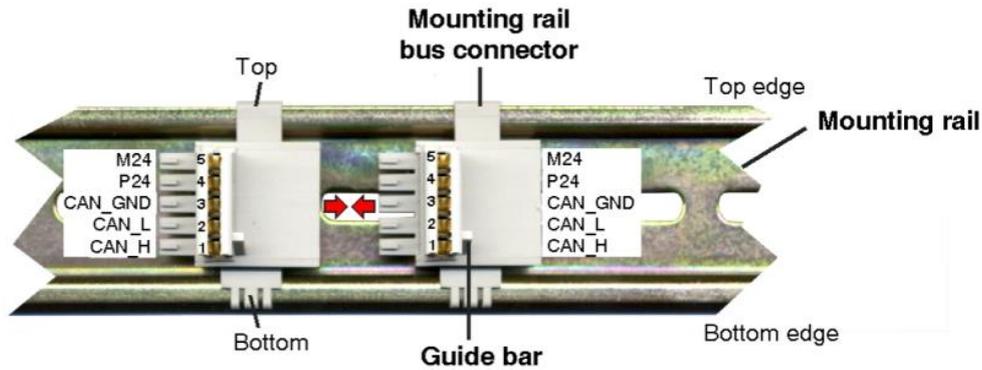


Figure 39: Mounting rail with bus connector

1. Position the InRailBus connector on the mounting rail and snap it onto the mounting rail using slight pressure. Plug the bus connectors together to contact the communication and power signals (in parallel with one). The bus connectors can be plugged together before or after the CAN-CBX module is plugged on.
2. Hold the CAN-CBX module tilted backwards at a slight angle and place it on the bus connector so that the DIN rail guideway is placed on the top edge of the mounting rail.



Figure 40: Mounting CAN-CBX modules

3. Now swivel the CAN-CBX module onto the mounting rail by moving the module downwards according to the direction of the arrow in Figure 40. The housing is mechanically guided by the guide bar of the bus connector.
4. When mounting the CAN-CBX module the metal foot catch snaps on the bottom edge of the mounting rail.
The module is now firmly seated on the mounting rail and is connected to the InRailBus via the bus connector. If necessary, connect the bus connectors to each other and connect the +24 V supply voltage and the CAN port to the InRailBus as described below.

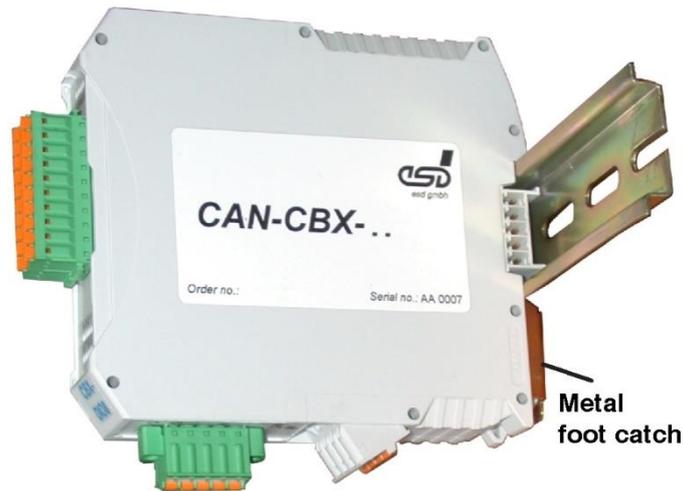


Figure 41: Mounted CAN-CBX module

16.4.2 Connecting via the InRailBus

To connect the power supply and the CAN signals via the InRailBus, a terminal plug is needed. The terminal plug is not included in the scope of delivery and must be ordered separately (order no.: C.3000.02, see order information for InRailBus Accessories).

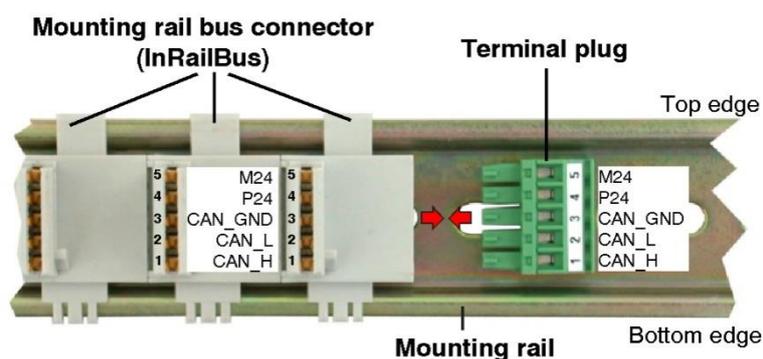


Figure 42: Mounting rail with InRailBus and terminal plug

Insert the terminal plug from the right into the socket side of the outer mounting rail bus connector of the InRailBus, as shown in Figure 42. Then connect the CAN port and the supply voltage via the terminal plug.

16.4.3 Connection of the Supply Voltage



DANGER

Hazardous Voltage - Risk of electric shock due to unintentional contact with uninsulated live parts with high voltages inside of the system into which the CAN-CBX-module is to be integrated.

- Read the safety instructions at the beginning of this document (from page 5) carefully before you start with the hardware installation!
- Ensure the absence of voltage before starting any electrical work.
- Switch off the power supply, before you connect it to the system.



DANGER

The EtherCAN/3-FD is a device of protection class III according to DIN EN IEC 61140 and may only be operated on supply circuits that offer sufficient protection against dangerous voltages.



NOTICE

The connections for the 24 V power supply are connected internally and must not be supplied by two independent power sources at the same time! Connecting 24 V at both connectors will cause damage to the CAN-CBX module. Also read the chapter on the assignment of the 24 V connector for further information.

The power supply can be connected either via the +24 V connector or via the InRailBus connector.

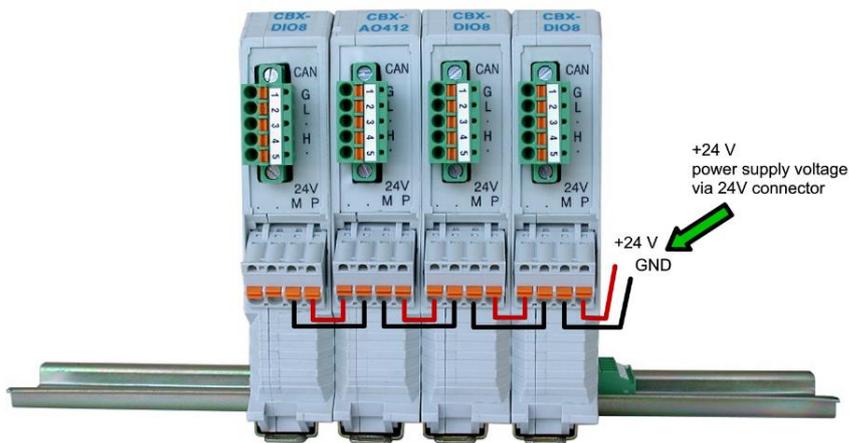


Figure 43:
Connection via
24V Connector



Figure 44:
Connection via
terminal plug

16.4.3.1 Earthing of the Mounting Rail



NOTICE

The module is connected to the mounting rail via its functional earth contact. This improves the stability against electromagnetic disturbances. The mounting rail must therefore be connected to a suitable functional earth contact in the environment or in the installation. It must be ensured that the impedance of the connection is kept low. The functional earth contact of the module does not ensure electrical safety.

16.4.4 Connection of CAN

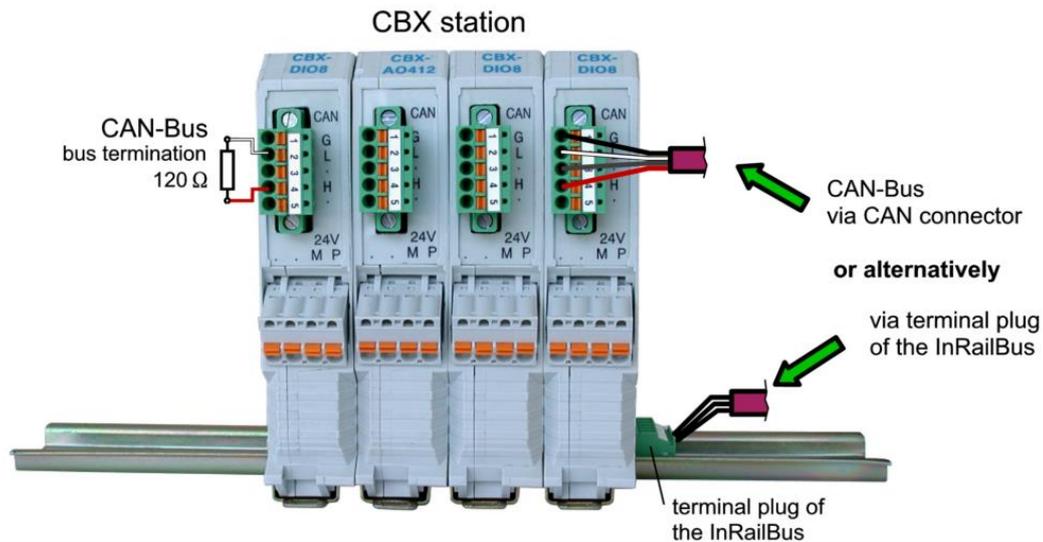


Figure 45: Connecting the CAN signals to the CAN-CBX station

In general, the CAN signals can be fed in via the InRailBus or via the CAN connector of the first CAN-CBX module in the CAN-CBX station. The signals are then connected through the CAN-CBX station via the InRailBus. The CAN signals may be lead through via the CAN connector of the CAN-CBX module mounted at the other end of the CBX station. However, the CAN signals must not be connected via the CAN connectors of the middle CAN-CBX modules of the CBX station, as this would lead to impermissible branching.

Please note that a bus terminating resistor must be connected to the CAN-CBX module located at the end of the InRailBus if the CAN bus ends there (see Figure 45).

16.4.5 Remove the CAN-CBX Module from InRailBus

If the CAN-CBX module is only connected via the InRailBus, proceed as follows when removing it: Detach the module from the mounting rail by moving the foot catch (see Figure 41) downwards (e.g., with a screwdriver). In doing so, the module detaches from the bottom edge of the mounting rail and can be removed.

Notice



INFORMATION

It is possible to remove individual devices from the CBX station without interrupting the InRailBus connection, because the contact chain will not be disrupted.

17 References

- (1) CiA 301, CANopen Application Layer and Communication Profile V4.2.0 (02.2011), CAN in Automation (CiA) e. V.
- (2) CiA 106, Connector Pin-assignment Recommendations, V1.1.0, CAN in Automation (CiA) e. V.
- (3) CiA 303-3 CANopen LEDs, CANopen Additional Specification V1.4.0 (04.2012), CAN in Automation (CiA) e. V.
- (4) esd electronics, "NTCAN Part 1: C/C++ Software Design Guide", Hannover, esd electronics gmbh (download at <https://esd.eu/en/products/can-sdk>)
- (5) esd electronics, "NTCAN-API Part 2: Installation, Configuration and Firmware Update", Hannover, esd electronics gmbh (download at <https://esd.eu/en/products/can-sdk>)
- (6) esd electronics, "ELLSI", EtherCAN Low Level Socket Interface, Hannover, esd electronics gmbh (download at <https://esd.eu/en/products/ethercan-3-fd>)

18 Declaration of Conformity

EU-KONFORMITÄTSERKLÄRUNG EU DECLARATION OF CONFORMITY



Adresse **esd electronics gmbh**
Address **Vahrenwalder Str. 207**
30165 Hannover
Germany

esd erklärt, dass die Produkte
esd declares, that the products

EtherCAN/3
EtherCAN/3-FD

Typ, Modell, Artikel-Nr.
Type, Model, Article No.

C.2055.02
C.2055.62

die Anforderungen der Normen
fulfill the requirements of the standards

EN 61000-6-2:2005,
EN 61000-6-4:2007/A1:2011

gemäß folgendem Prüfbericht erfüllen.
according to test certificate.

EMVP No.: 0237-202309

Die Produkte entsprechen damit der EU-Richtlinie „EMV“
Therefore the products conform to the EU Directive 'EMC'

2014/30/EU

Die Produkte entsprechen den EU-Richtlinien „RoHS“
The products conform to the EU Directives 'RoHS'

2011/65/EU, 2015/863/EU

Diese Erklärung verliert ihre Gültigkeit, wenn das Produkt nicht den Herstellerunterlagen
entsprechend eingesetzt und betrieben wird, oder das Produkt abweichend modifiziert wird.
*This declaration loses its validity if the product is not used or run according to the manufacturer's
documentation or if non-compliant modifications are made.*

Name / Name T. Bielert
Funktion / Title QM-Beauftragter / QM Representative
Datum / Date Hannover, 2024-01-05

Rechtsgültige Unterschrift / authorized signature

19 Order Information

19.1 Hardware

Type	Properties	Order No.
EtherCAN/3-FD	Ethernet CAN FD gateway Multifunctional CAN-to-Ethernet gateway with two CAN FD ports. Supports CAN-to-CAN bridging via encrypted TCP connection, advanced filtering mechanisms, NTCAN compatibility, platform-independent access and web interface for easy configuration.	C.2055.62
Accessories:		
CAN-Cable-S, 0.3 m (plug)	CAN cable assembly, 0.3 m length, 1 x DSUB-9 plug and 3 wire end sleeves	C.1323.03
CAN-Cable-S, 0.3 m (socket)	manufactured CAN cable, length 0.3 m, 1 x DSUB-9 socket and 3 wire end sleeves	C.1323.04
CAN-CBX-TBus	In-Rail-Bus connector	C.3000.01
CAN-CBX-TBus-Connector-Socket	to connect power supply (24V) and CAN at CBX-In-Rail-Bus; socket type	C.3000.02
CAN-CBX-TBus-Connector-Plug	to connect power supply (24V) and CAN at CBX-In-Rail-Bus; plug type	C.3000.03

Table 10: Order information hardware

19.2 Software

Type	Order No.
CAN software drivers for Windows and Linux on CD-ROM to EtherCAN/3-FD and EtherCAN/3-FD are included in delivery.	n.a.
Higher-Layer Protocols including CD-ROM for CAN CC Applications:	
CANopen-LCD Windows/Linux	These drivers are available for CAN CC Applications only!
J1939 Stack for Windows (Object)	
J1939 Stack for Linux (Object)	
CAN-OPC UA Server for Windows License	C.1103.31
For detailed information about the driver availability for your special operating system, please contact our sales team.	

Table 11: Order information software

19.3 Manuals

PDF Manuals

For the availability of the manuals see the table below.

Please download the manuals as PDF documents from our esd website <https://www.esd.eu> for free.

Manuals		Order No.
EtherCAN/3-FD-ME	Hardware manual in English	C.2055..21
CAN-API-ME	NTCAN-API: Application Developers Manual NTCAN-API: Driver Installation Guide	C.2001.21
ELLSI Manual	EtherCAN Low Level Socket Interface manual	C.2051.23
CANopen-ME	CANopen Manuals in English	C.2002.21

Table 12: Available Manuals

Printed Manuals

If you need a printout of the manual additionally, please contact our sales team (sales@esd.eu) for a quotation. Printed manuals may be ordered for a fee.