EtherCAN/3-FD

Multifunctional CAN to Ethernet Gateway



Manual

For Product C.2055.62

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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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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 of 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 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 Figure 2. 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 the device.
- 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 electronics assumes no responsibility for damage resulting from inadequate security measures when the device is connected to a network. 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 of in an appropriate way or must be returned to the manufacturer for proper disposal. Please, contribute to environmental protection.

Table of Contents

Safety Instructions 5
1 Overview 11
1.1 About this Manual 11
1.2 Description of EtherCAN/3-FD 11
1.3 Glossary 13
2 Hardware 14
2.1 Connecting Diagram 14
3 Starting Up 15
3.1 Installing and Uninstalling Hardware 15
3.2 Installing the Hardware 15
3.2.1 Correct Wiring of galvanically isolated CAN Nets 16
3.2.2 Troubleshooting 16
3.3 Uninstalling the Hardware 16
3.4 Software Setup 17
3.4.1 Installation Steps for Operation in EtherCAN Mode 17
3.4.2 Software for Bridge Mode and Platform-independent Server or Client Mode 17
4 Compatibility with the EtherCAN/2 18
4.1 EtherCAN Mode 18
4.2 CAN Bridge Mode 18
4.3 Platform-independent Client Mode 18
4.4 Platform-independent Server Mode 18
4.5 Others 18
5 Software Configuration 19
5.1 Configuration of the IP Address 19
5.1.1 Configuration via DHCP 19
5.1.1.1 Using a Hostname instead of an IP Address 20
5.1.2 Configuration via the ESDCP Protocol 21
5.2 Web Based Configuration 23
5.2.1 Overview 23
5.2.2 Status 24
5.2.2.1 CAN Status 24
5.2.2.2 CAN Bridge Status 25
5.2.2.3 Ethernet Status 26
5.2.2.4 Clients Status 27
5.2.2.5 Event Log 28
5.2.3 Configuration 29
5.2.3.1 Security Configuration 29
5.2.3.2 Network Configuration 30
5.2.3.3 Event Log Configuration 33
5.2.3.4 CAN Baud Rate Configuration 34
5.2.3.4.1 Basic View 34
5.2.3.4.2 Advanced View 35
5.2.3.5 CAN Bridge Configuration 37
5.2.3.5.1 Quick Start Guide 38
5.2.3.5.2 Important Notes 40
5.2.3.5.3 Configuration via Web Browser 41
5.2.3.5.4 Configuration via File 45
5.2.3.6 CAN TCP Client Configuration 48
5.2.3.6.1 Protocol 50
5.2.3.6.2 Version Information Struct 53
5.2.3.6.3 CAN Frame Struct 53
5.2.3.7 ELLSI 56
5.2.4 System 57
5.2.4.1 Firmware Update 57
5.2.4.2 Reboot 58

5.2.4.3 CAN Monitor 59
5.2.5 Information 61
5.2.5.1 Contact 61
5.2.5.2 License 61
5.3 TLS-Encryption 61
5.3.1 PKI Configuration on the EtherCAN/3-FD 63
5.3.2 Host System 64
5.3.3 Certificate Generation 64
6 Software Licenses 65
6.1 License Texts 65
6.2 Open-Source Software Copy 65
7 Host Software 66
7.1 EtherCAN SDK 66
7.1.1 CAN Control Panel 66
7.2 CAN SDK 68
8 LEDs 69
8.1 Position of the LEDs 69
8.2 Status LED Indication 69
8.3 Ethernet LED Indication 70
9 Coding Switch 71
10 Factory Reset 72
11 Labels 73
12 Technical Data 74
12.1 General Technical Data 74
12.2 CAN Ports 74
12.3 Ethernet Port 75
12.4 Connectors accessible from Outside 75
13 Connector Assignments 76
13.1 CAN 0 and CAN 1 76
13.2 24 V and CAN0 via InRailBus 77
13.3 Ethernet 78
13.4 24V Power Supply Voltage 79
13.5 Conductor Connection / Conductor Cross Section 80
14 Optional InRailBus 81
14.1 Order Information InRailBus Accessories 81
14.2 Conductor Connection/Conductor Cross Section 81
14.3 Connector Assignment 24V and CAN via InRailBus (Option) 82
14.4 Using InRailBus (Option) 83
14.4.1 Installation of the Module when using the InRailBus Connector 83
14.4.2 Connecting via the InRailBus 84
14.4.3 Connection of the Supply Voltage 85
14.4.3.1 Connection of the Power Supply Voltage via InRailBus 85
14.4.3.2 Connection of the Power Supply Voltage via 24 V Connector 86
14.4.3.3 Earthing of the Mounting Rail 86
14.4.4 Connection of CAN 87
14.4.5 Remove the CAN Module from InRailBus 87
15 References 88
16 Declaration of Conformity 89
17 Order Information 90
17.1 Hardware 90
17.2 Software 90
17.3 Manuals 91

List of Tables

Table 1: Status LED flashing code 69
Table 2: Status LED description 70
Table 3: Ethernet LED description 70
Table 4: Coding Switch setting 71
Table 5: General Data of the module 74
Table 6: Data of the CAN ports 74
Table 7: Data of the Ethernet port 75
Table 8: Connectors, accessible from outside 75
Table 10: Order information hardware 90
Table 11: Order information software 90
Table 12: Available Manuals 91

List of Figures

Figure 1: Schematic examples of application 12
Figure 2: Connections in operable state 14
Figure 3: QESDCP - Device Configuration Tool 21
Figure 4: Modify the IP address via qesdcp 22
Figure 5: Web Page 'Overview' 23
Figure 6: Web Page 'CAN Status' 24
Figure 7: Web Page 'CAN Bridge Status' 25
Figure 8: Web Page 'Ethernet Statistics' 26
Figure 9: Web Page 'Clients Status' 27
Figure 10: Web Page 'Event Log' 28
Figure 11: Web Page 'Security Configuration' 29
Figure 12: Web Page 'Network Configuration' 30
Figure 13: Web Page 'Network Configuration' 31
Figure 14: Web Page 'Network Configuration' 32
Figure 15: Web Page 'Event Log Configuration' 33
Figure 16: Web Page 'CAN Baud Rate Configuration' – Basic View 34
Figure 17: Web Page 'CAN Baud Rate Configuration' – Advanced View 35
Figure 18: CAN Bridge 37
Figure 19: Web Page CAN Bridge Configuration 39
Figure 20: Web Page 'CAN Bridge Configuration' - General 41
Figure 21: Web Page 'CAN Bridge Configuration' - CAN 42
Figure 22: Web Page 'CAN Bridge Configuration' – CAN 11bit Filter 43
Figure 23: Web Page 'CAN Bridge Configuration' – CAN 29bit Filter 44
Figure 24: CAN Bridge – 'Configuration file' 45
Figure 25: CAN Bridge – Sample configuration file 47
Figure 26: CAN TCP Client – configuration page 48
Figure 27: Web Page 'ELLSI Configuration' 56
Figure 28: Firmware Update 57
Figure 29: Web Page 'Reboot' 58
Figure 30: Web Page 'CAN Monitor' 59
Figure 31: Web Page 'Contact' 61
Figure 32: How to find the 3rd party software license terms 65
Figure 33: CAN Control Panel 66
Figure 34: Position of the LEDs and Switch in the front panel 69
Figure 35: View with name plate (example) 73
Figure 36: Mounting rail with bus connector 83
Figure 37: Mounting CAN module (Example) 83
Figure 38: Mounted CAN module (Example) 84
Figure 39: Mounting rail with InRailBus and terminal plug 84

Figure 40: Connection via terminal plug (Example) 85
Figure 41: Connection via 24V Connector (Example) 86
Figure 42: Connecting the CAN signals to the CAN Module Station (Example) 87

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 CAN FD data bit rates up to 8 Mbit/s and arbitration bit rate up to 1 Mbit/s or CAN CC bit rates up to 1 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 CAN FD data bitrates 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.

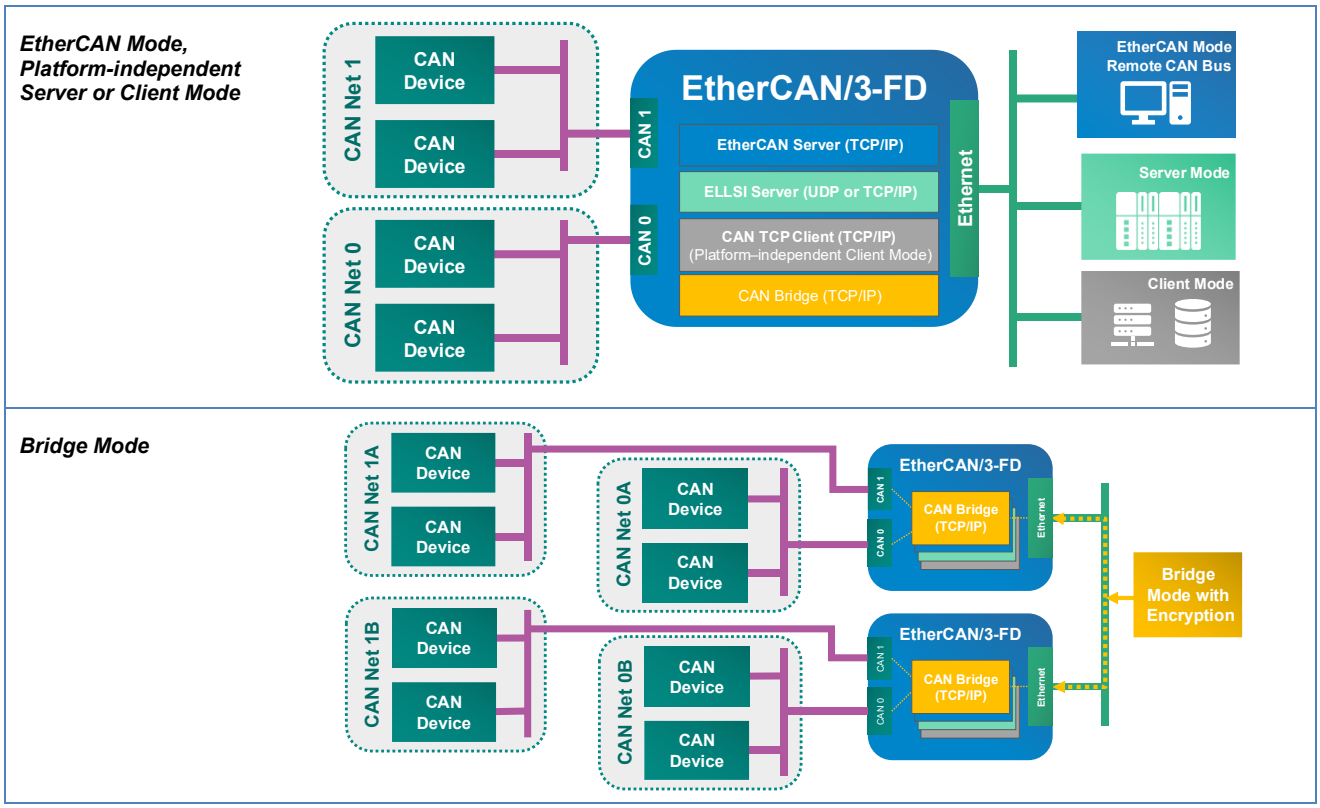


Figure 1: Schematic examples of application

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

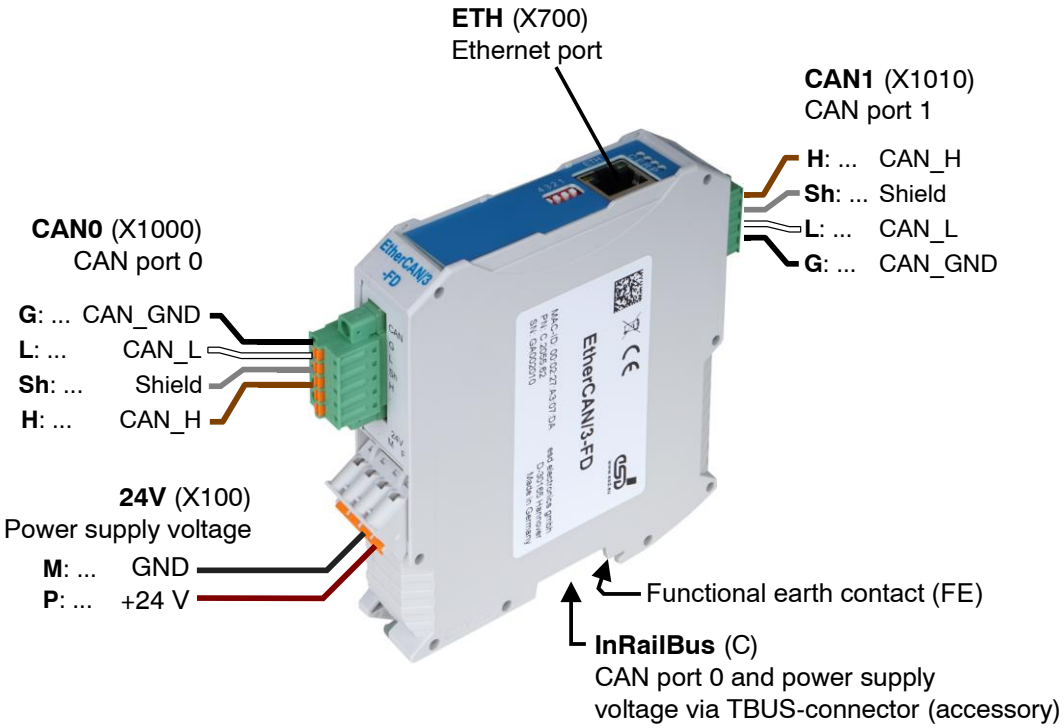


Figure 2: Connections in operable state

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 76 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).	14
	See also chapter 13 for Connector Assignments	76
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”.	16
	**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 79 → Only use suitable cables for the plug.	79
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	-
5.	Continue with the software setup described in chapter 3.4.	17

3.2.1 Correct Wiring of galvanically isolated CAN Nets

INFORMATION
For important information on correct wiring of galvanically isolated CAN networks please refer to our website: https://esd.eu/en/support/can-bus-wiring-notes.
Under *Documentation / Wiring Notes* you can also download the latest version of our "CAN-Wiring" guide as a PDF file.

3.2.2 Troubleshooting

INFORMATION
For troubleshooting in CAN networks please refer to our website:
https://esd.eu/en/support/can-bus-troubleshooting-guide
You can also find the latest version of our "Troubleshooting Guide" as a PDF file under *Content available for download*. This is a guide to finding and eliminating the most common problems and errors when setting up CAN bus networks and CAN-based systems.

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 *QESDCP* to detect it and to assign a fixed IP address. For that purpose, at first the EtherCAN SDK with the host-driver 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 host-driver software, as described in the manual 'NTCAN-API Part 2 Installation Guide' (5). The installation will be guided by an installation program (*Install Shield* Wizard). 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 device 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 compatible with the EtherCAN/2, subject to the restrictions described below. 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 hosting your own webpages via 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.
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. Check that the Ethernet link/activity LED indicates an established connection; see chapter 8.3.

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 co-operate 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’ case-insensitively, or 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 allow up to 15 characters per label or only resolve 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.

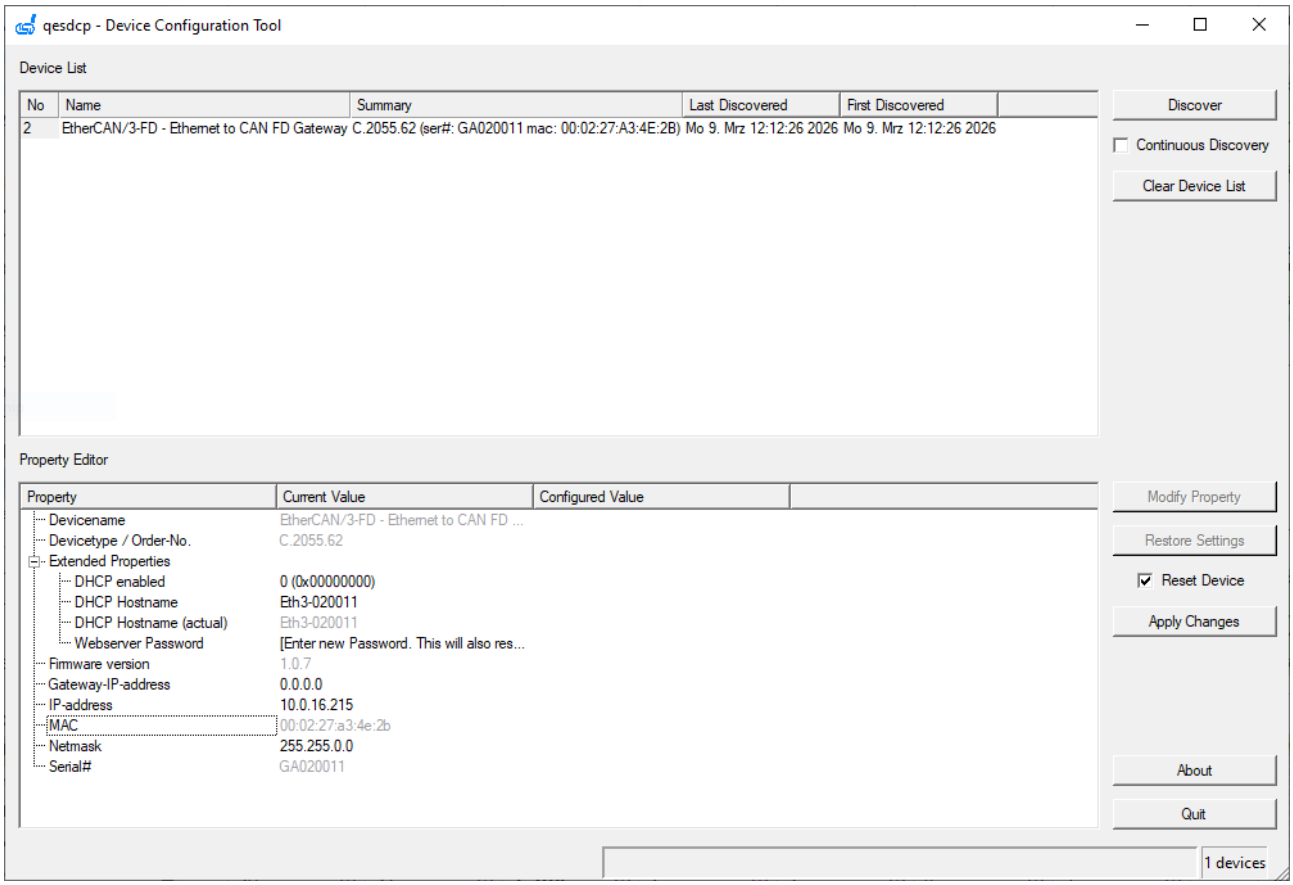


Figure 3: QESDCP - Device Configuration Tool

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.

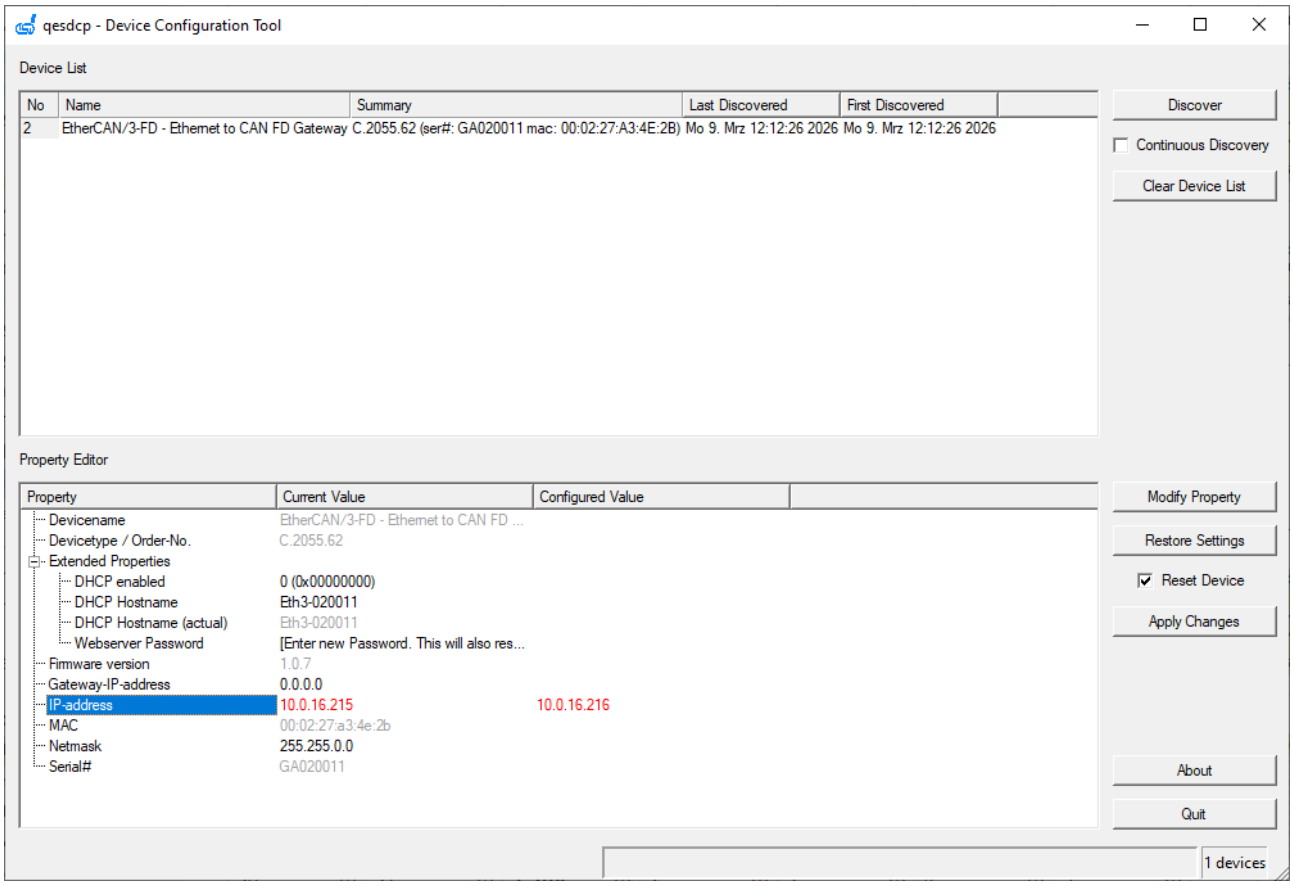


Figure 4: Modify the IP address via qesdcp

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 clicking 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 ESDCP password can be changed on the Security Configuration page; see chapter 5.2.3.1.

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.

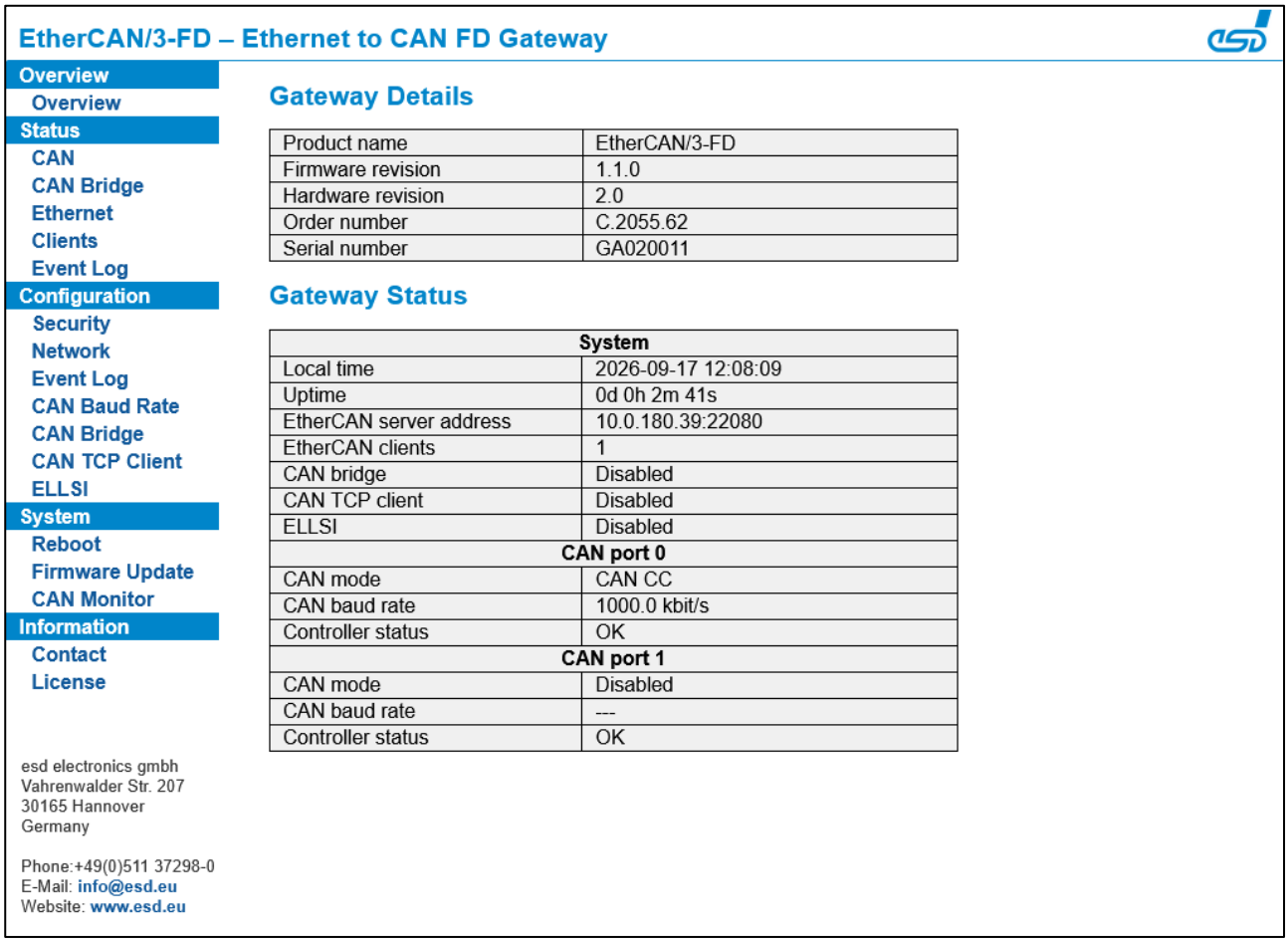


Figure 5: Web Page ‘Overview’

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.

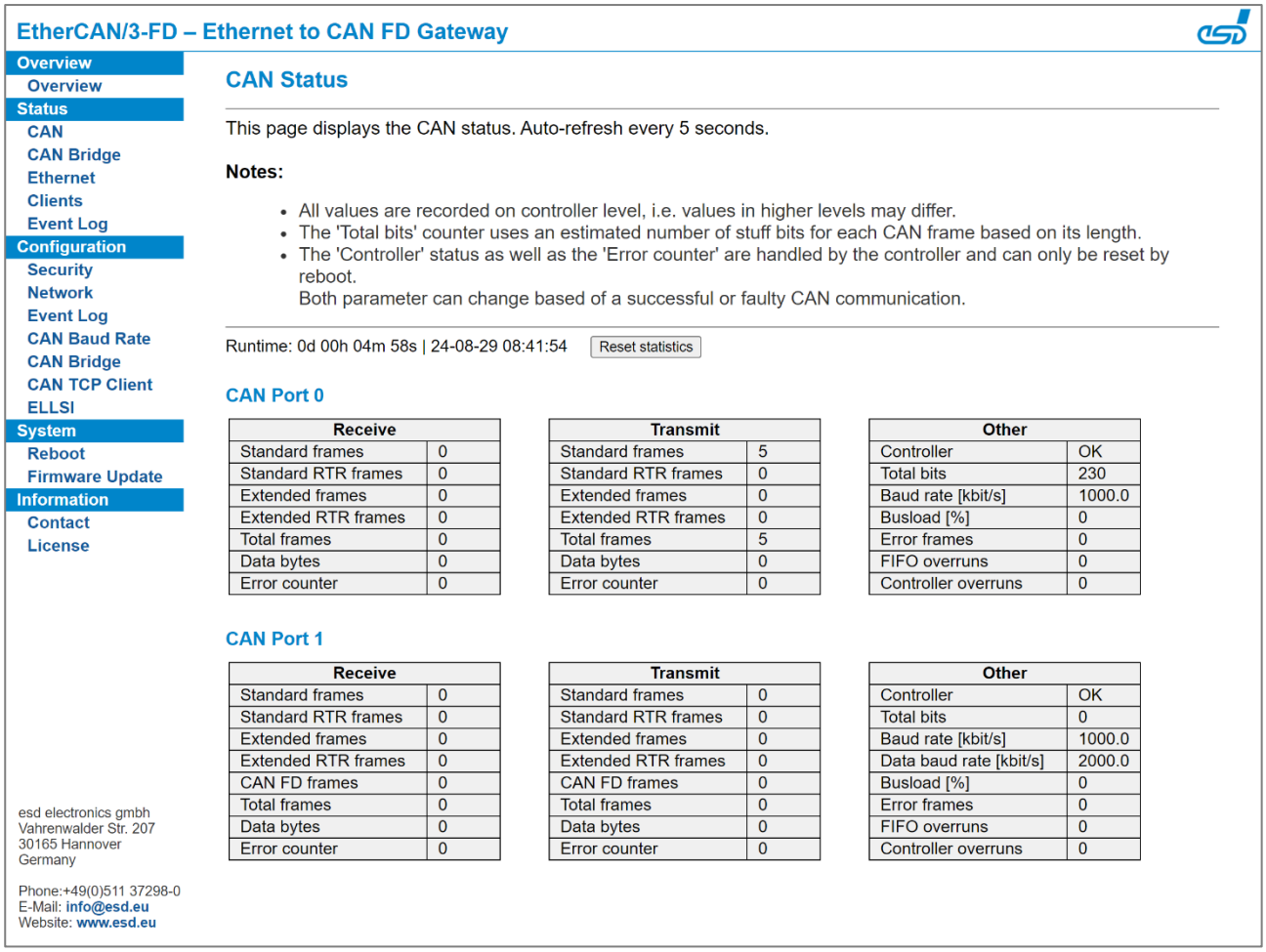


Figure 6: Web Page ‘CAN Status’

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.

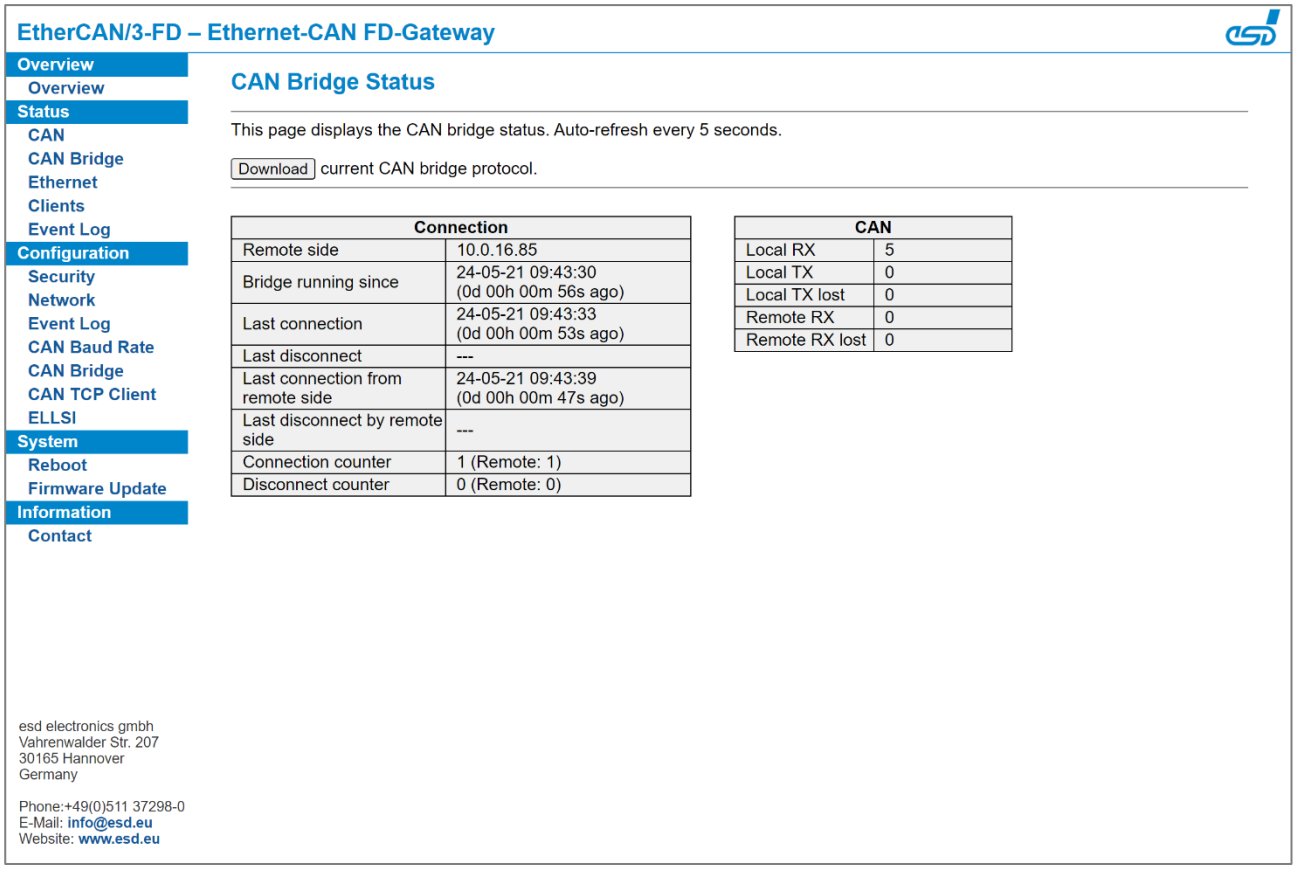


Figure 7: Web Page ‘CAN Bridge Status’

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 address of the EtherCAN/3-FD module as well as several statistical parameters of the Ethernet link.

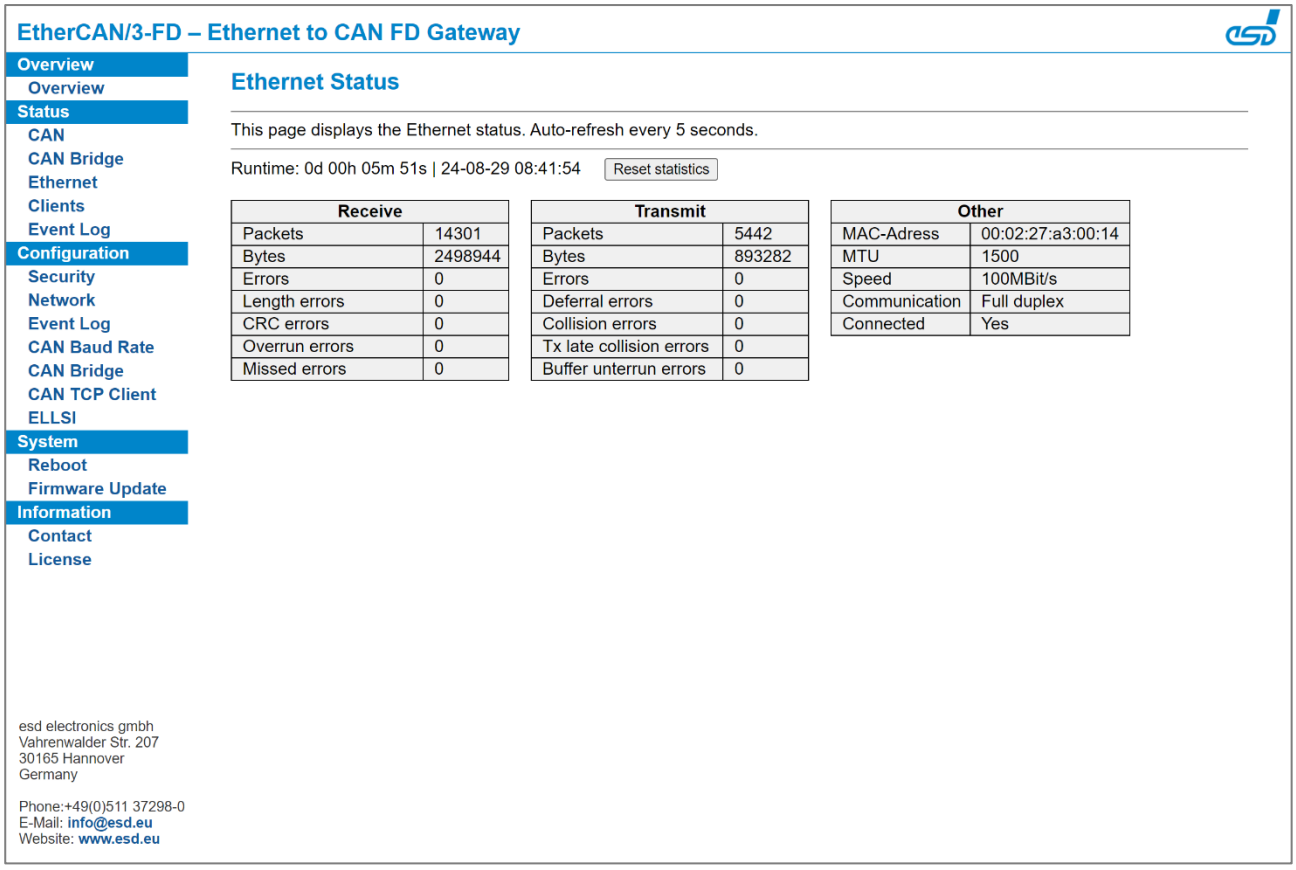


Figure 8: Web Page ‘Ethernet Statistics’

5.2.2.4 Clients Status

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

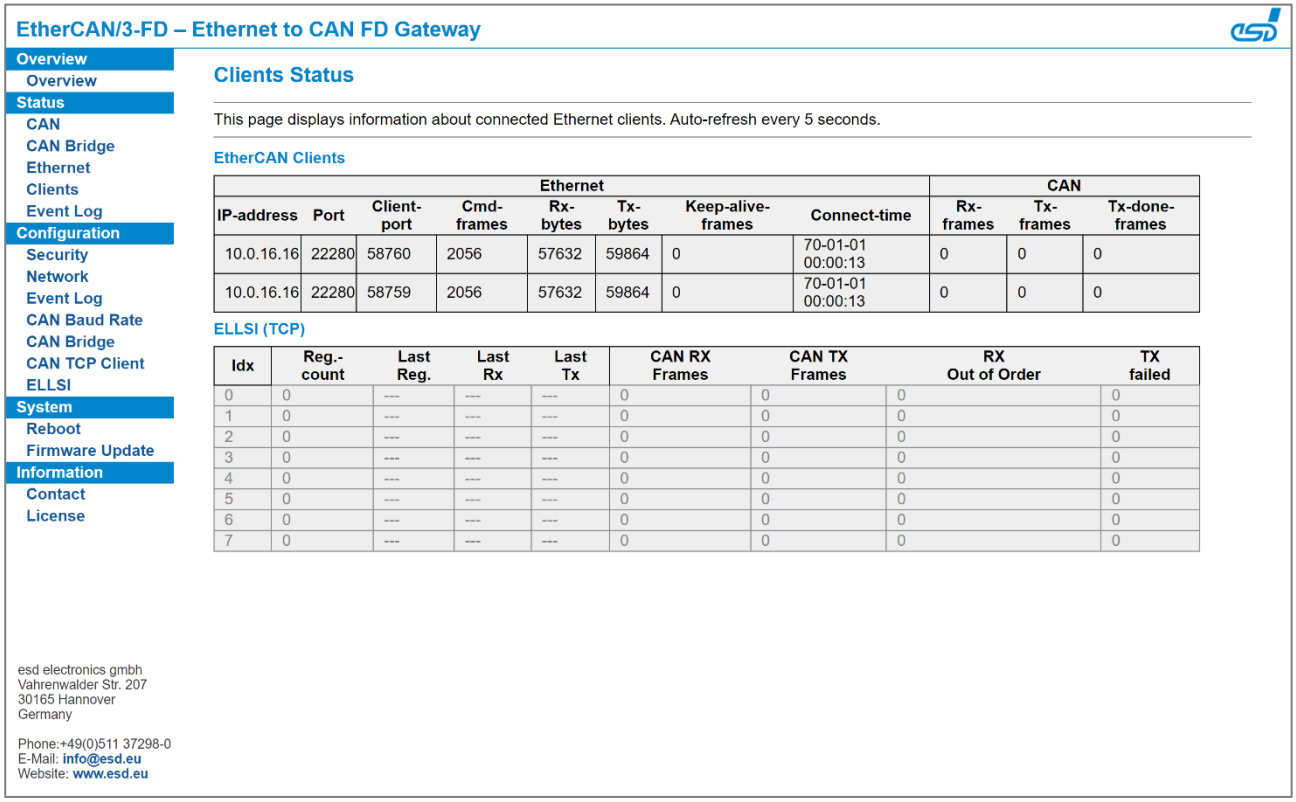


Figure 9: Web Page ‘Clients Status’

ELLSI Clients

The table contains a fixed number of client slots. Entries for empty clients are displayed in grey. 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 with every reboot of the EtherCAN/3-FD module.

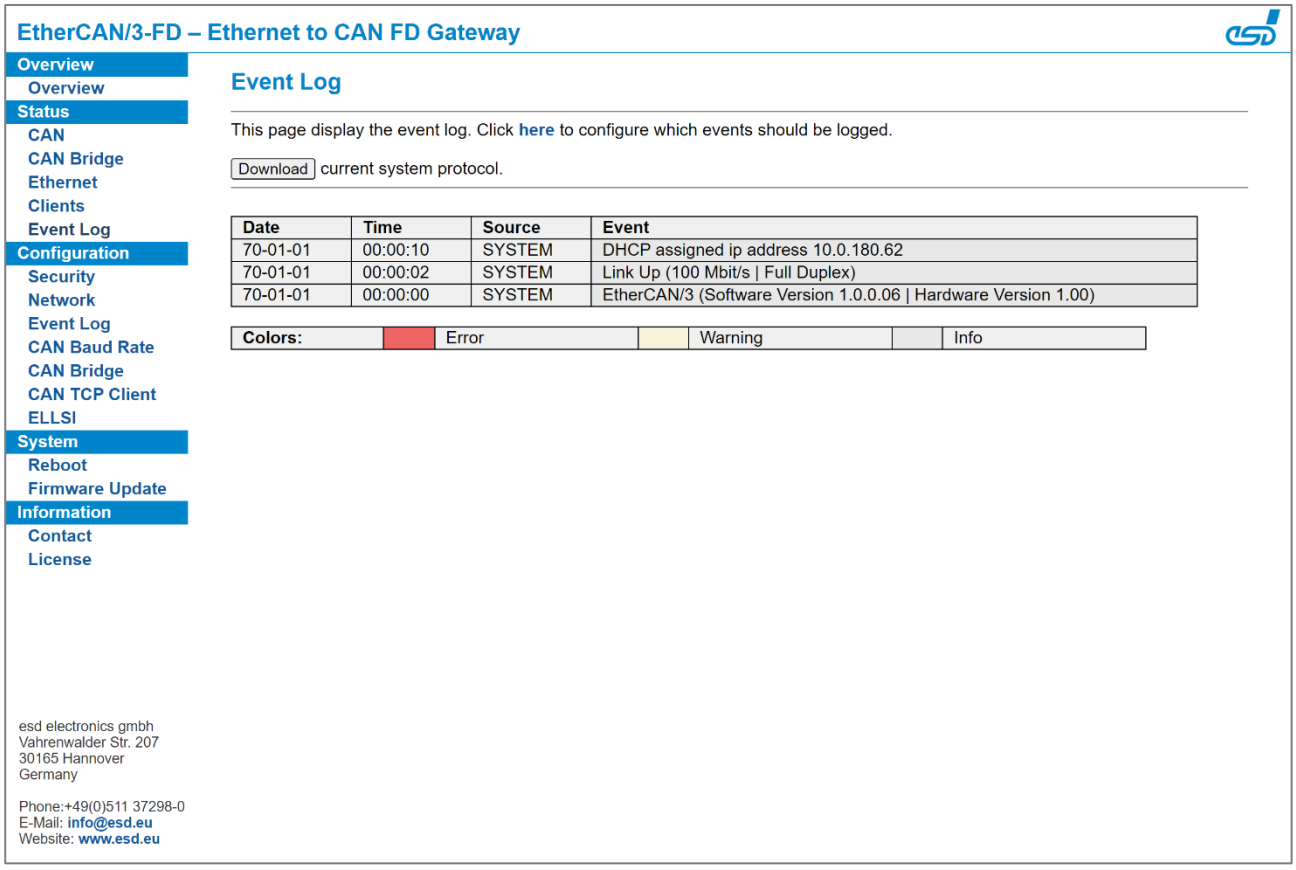


Figure 10: Web Page ‘Event Log’

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 are required. By default, a valid self-signed certificate is already installed. 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.

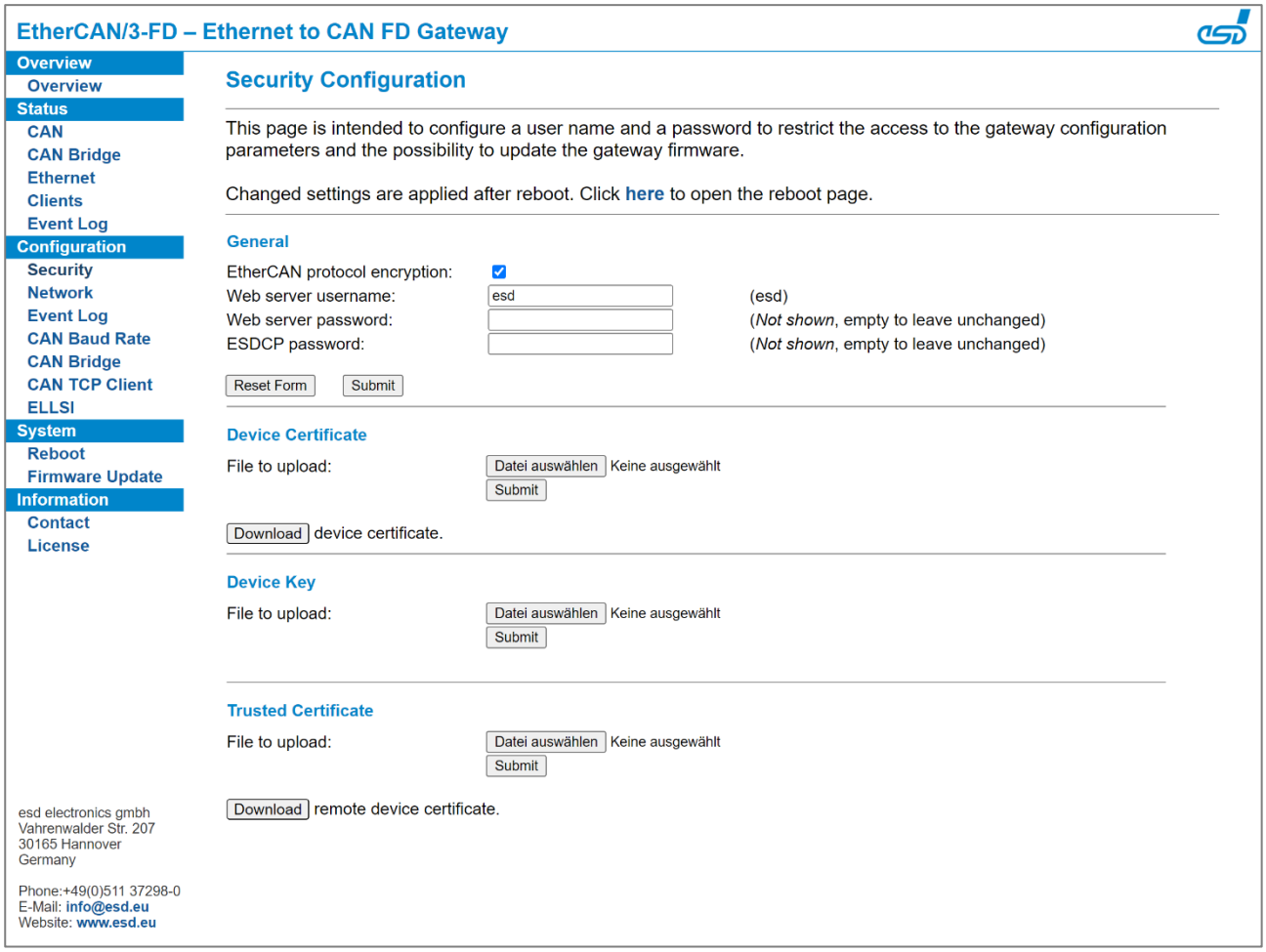


Figure 11: Web Page ‘Security Configuration’

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.

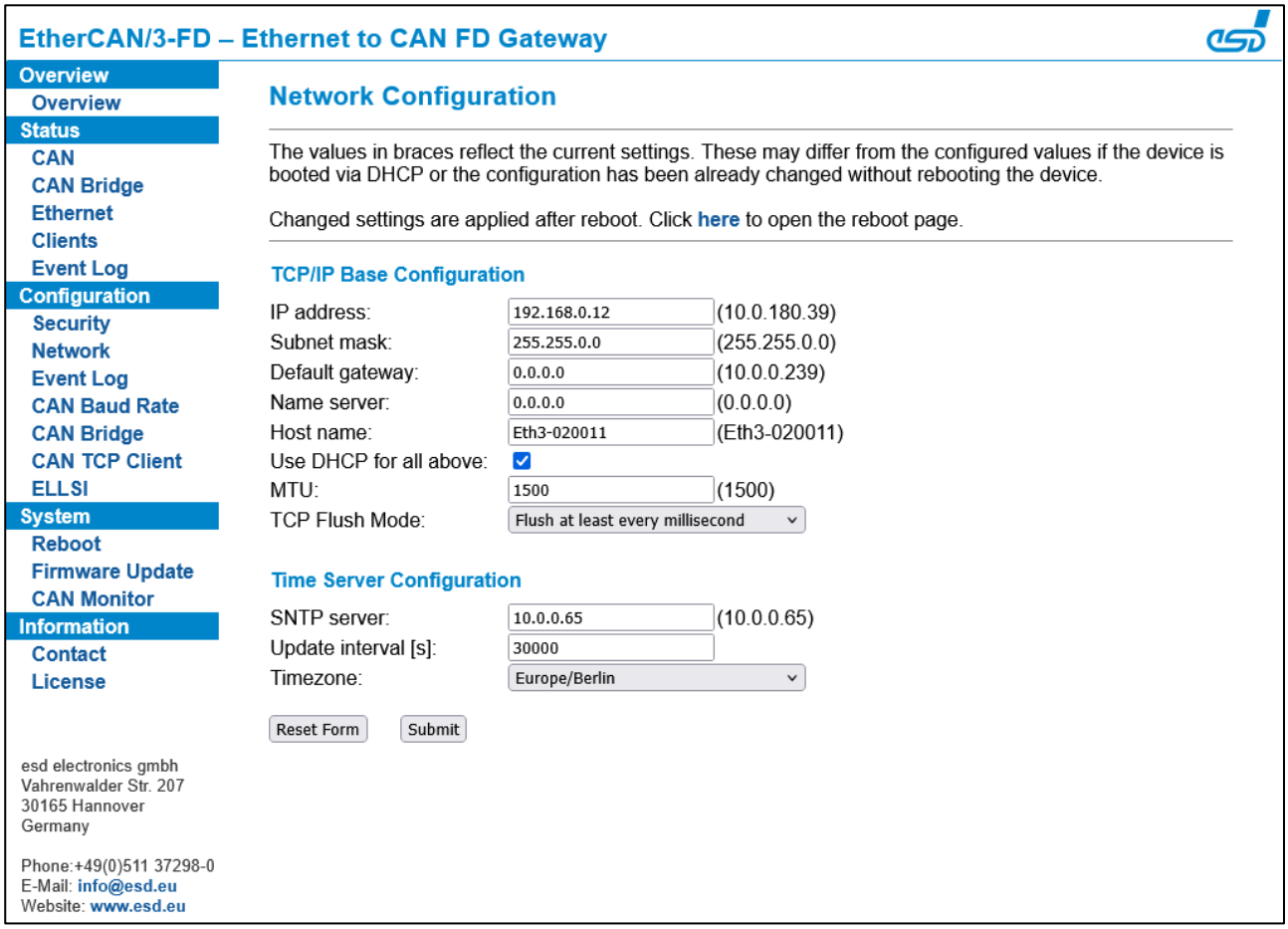


Figure 12: Web Page ‘Network Configuration’

- **TCP/IP Base Configuration**

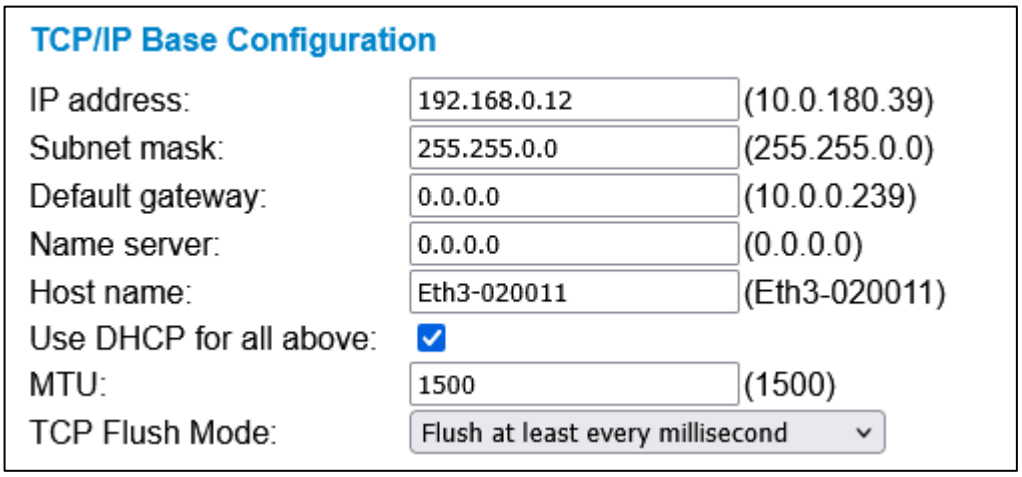


Figure 13: Web Page 'Network Configuration'

- 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.

When using a static IP configuration, set the IP address and subnet mask to match your 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.

The TCP Flush Mode allows users to configure how TCP connections of the EtherCAN/3-FD handle outgoing data.

The Nagle's algorithm reduces network overhead by buffering small TCP packets and combining them into larger packets before transmission. This improves network efficiency by reducing the number of small packets sent over the network. However, buffering can introduce additional latency, which can be undesirable for latency-sensitive applications.

The TCP Flush Mode provides three options:

- **Disable Nagle's algorithm:** Small packets are transmitted immediately, providing the lowest possible latency.
- **Enable Nagle's algorithm:** Small packets are buffered and combined to reduce network overhead.
- **Fixed TCP flush interval:** Pending TCP data is flushed at least after a fixed interval of 1, 2, 5, or 10 milliseconds. This provides a compromise between low latency and reduced network overhead.

By default, **Disable Nagle's algorithm** is selected to provide the lowest possible latency. For applications with high network load, selecting a fixed TCP flush interval can help reduce network overhead while maintaining predictable transmission latency.

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**

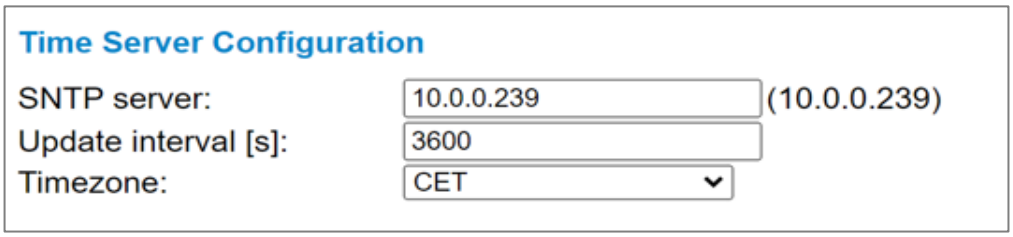


Figure 14: Web Page 'Network Configuration'

- 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.

Without an entry in this field, the calculation of times will restart from 1970-01-01 at 00:00 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.

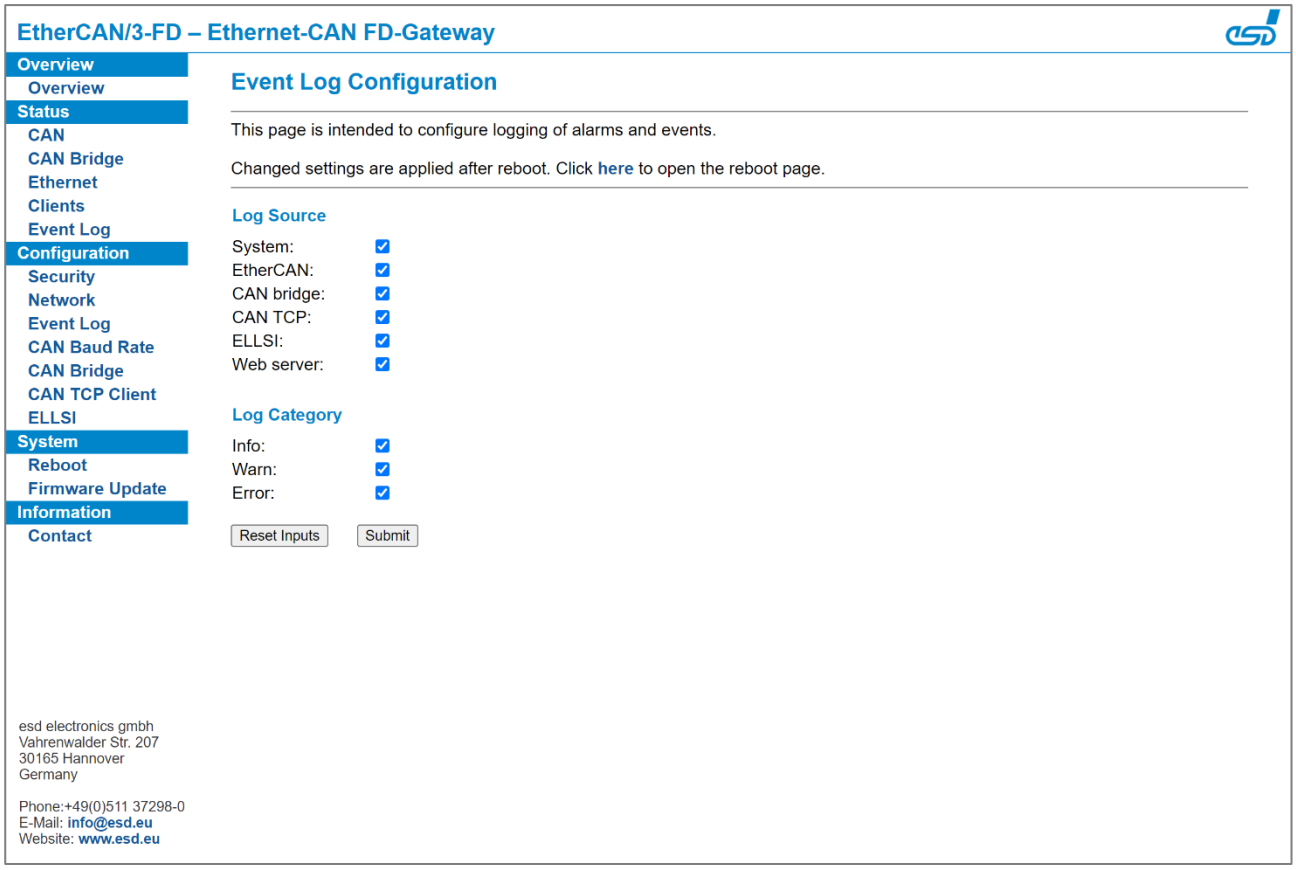


Figure 15: Web Page ‘Event Log Configuration’

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.

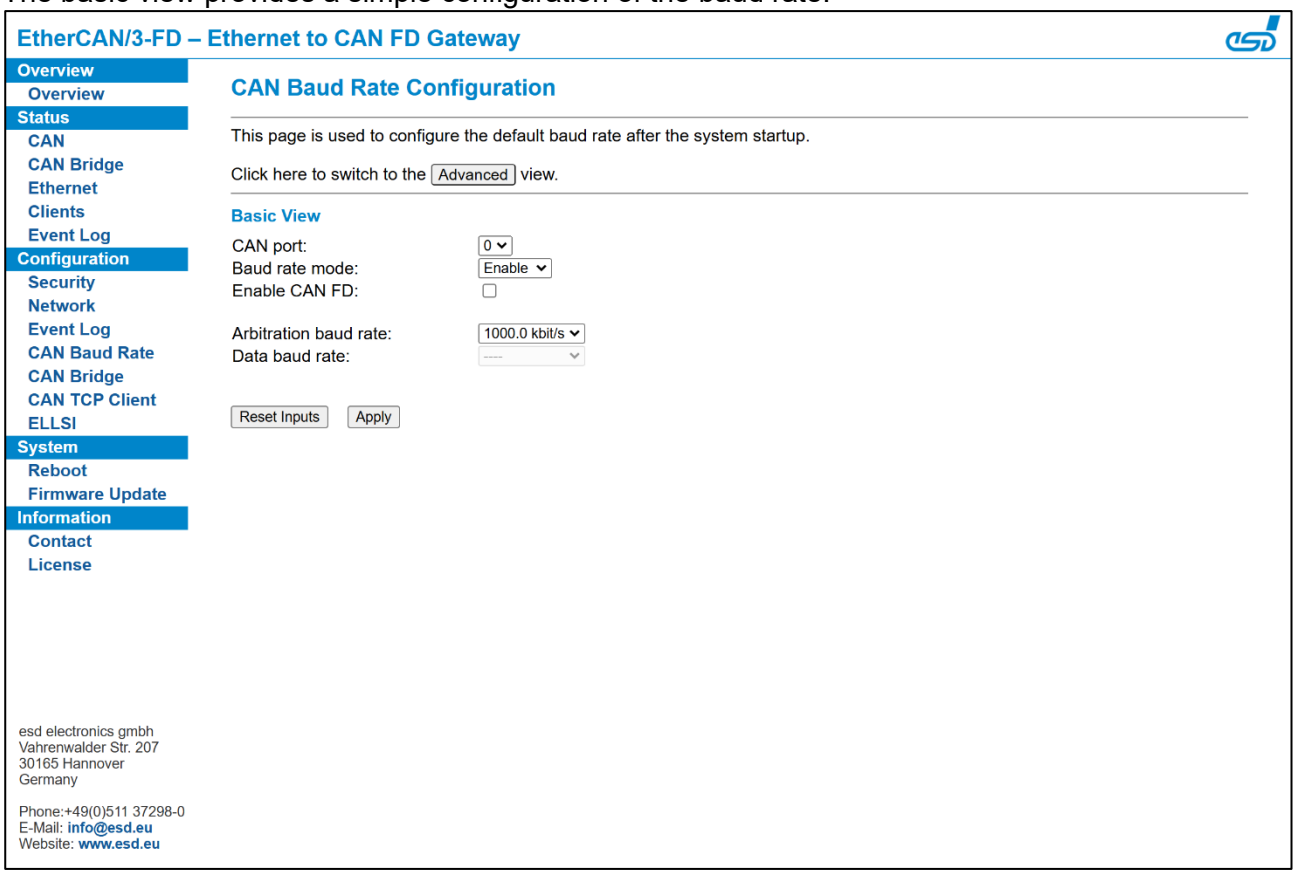


Figure 16: Web Page 'CAN Baud Rate Configuration' – Basic View

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.

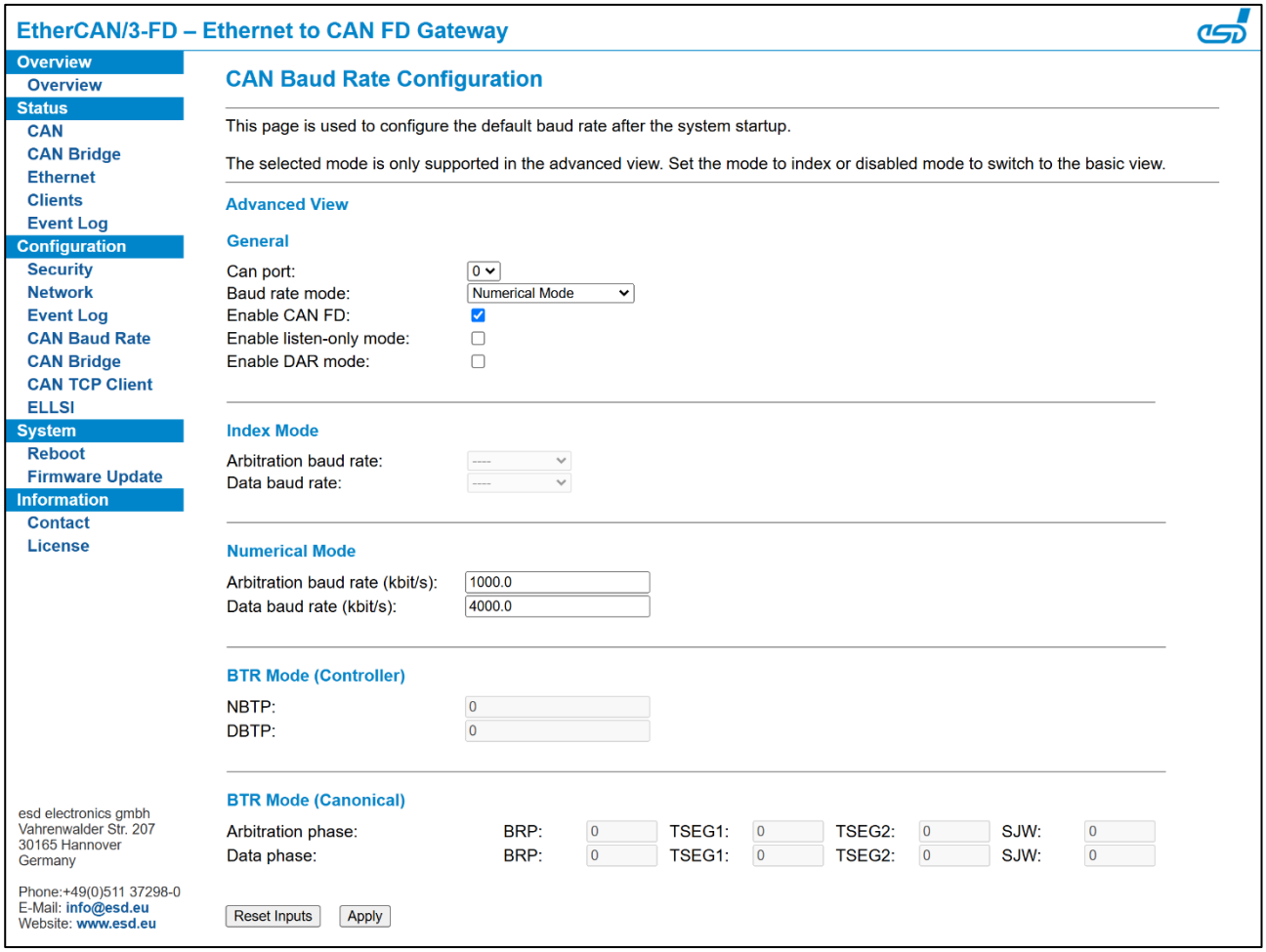


Figure 17: Web Page 'CAN Baud Rate Configuration' – Advanced View

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. For details check the NTCAN API manual (4).
Enable CAN FD	Enable this checkbox to perform CAN FD. Only when this option is enabled the 'Data Baud rate' is set.
Enable listen-only mode	Enable this checkbox to set the port in the 'Listen-Only Mode'. In 'Listen-Only Mode', the EtherCAN/3-FD does not acknowledge received frames. Without another active receiver, transmitted frames remain unacknowledged and may be retransmitted by the transmitting node.
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.

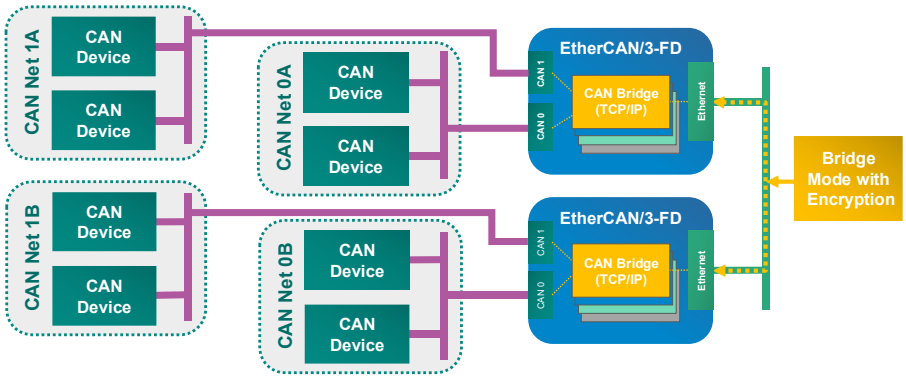


Figure 18: CAN Bridge

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 uploaded and downloaded from this page. In both cases a changed configuration becomes active after a restart.

5.2.3.5.1 Quick Start Guide

At least on both sides of the bridge the following settings need 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*

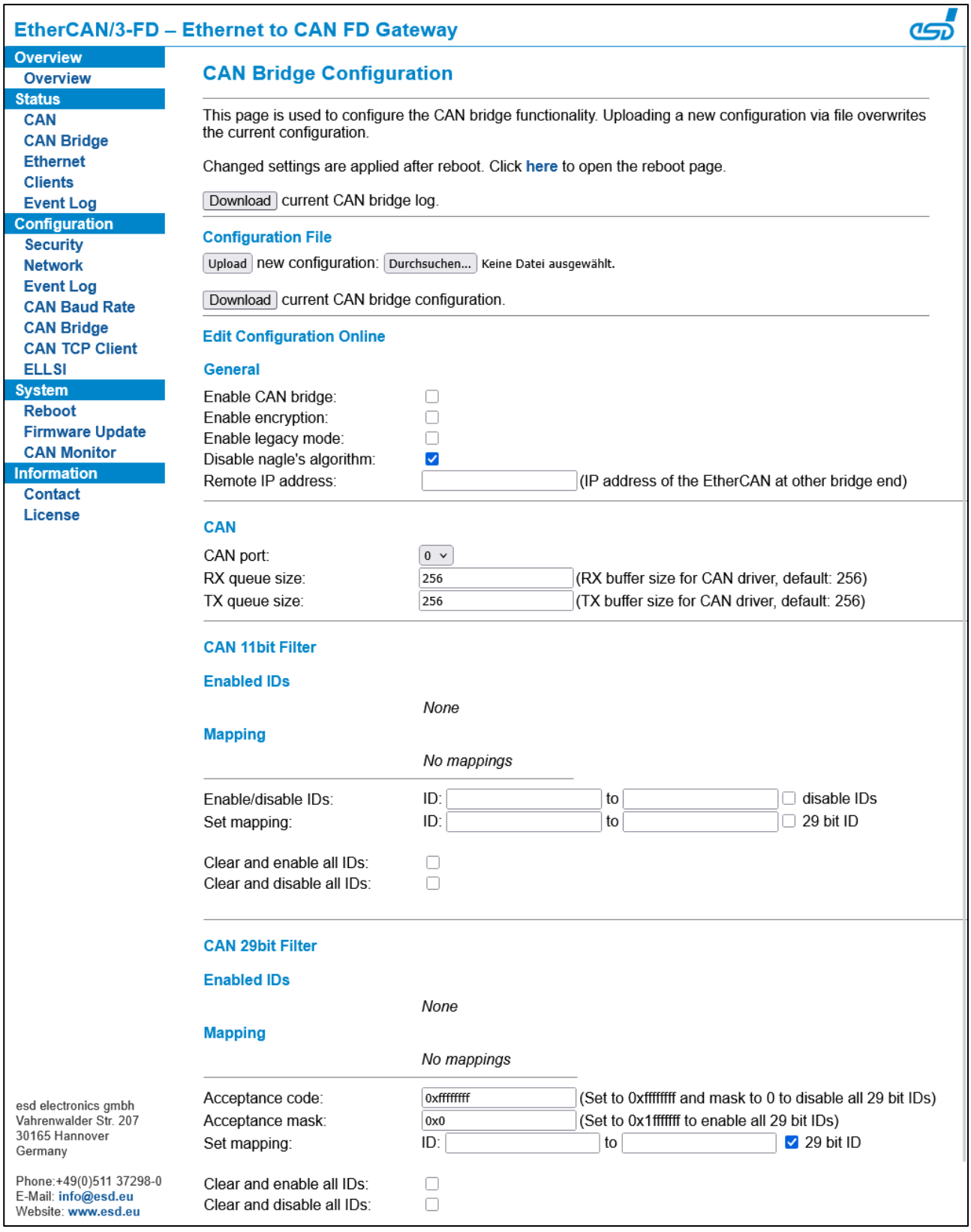


Figure 19: Web Page CAN Bridge Configuration

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. 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 another action, any changes that have not been submitted will be lost.

General

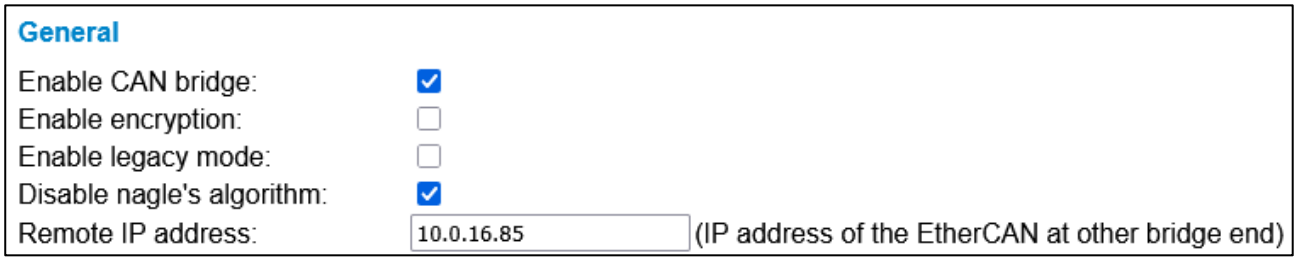


Figure 20: Web Page 'CAN Bridge Configuration' - General

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. Encryption must also be enabled on the remote EtherCAN/3-FD. The certificate information can be set on the page *Security Configuration* (see chapter 5.2.3.1).
Enable legacy mode	Select this checkbox when you want to use the EtherCAN/3-FD with an EtherCAN/2.
Disable Nagle's algorithm	Select this checkbox to disable the Nagle's algorithm independently of the *TCP Flush Mode.*
Remote IP address	The IP address of the other bridge side. A hostname can't be entered.

CAN

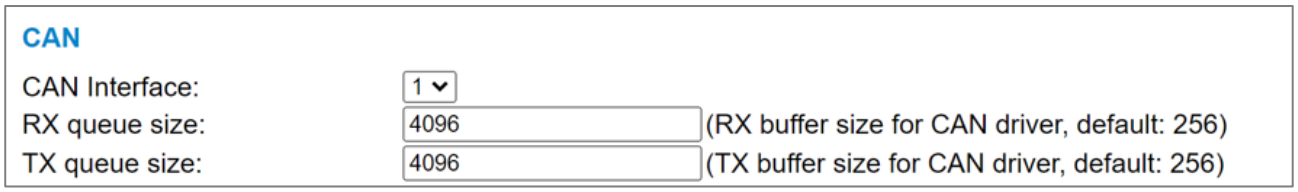


Figure 21: Web Page ‘CAN Bridge Configuration’ - CAN

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 loss during periods of high CAN bus load. See also the notes on frame loss in chapter 5.2.3.5.2.
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

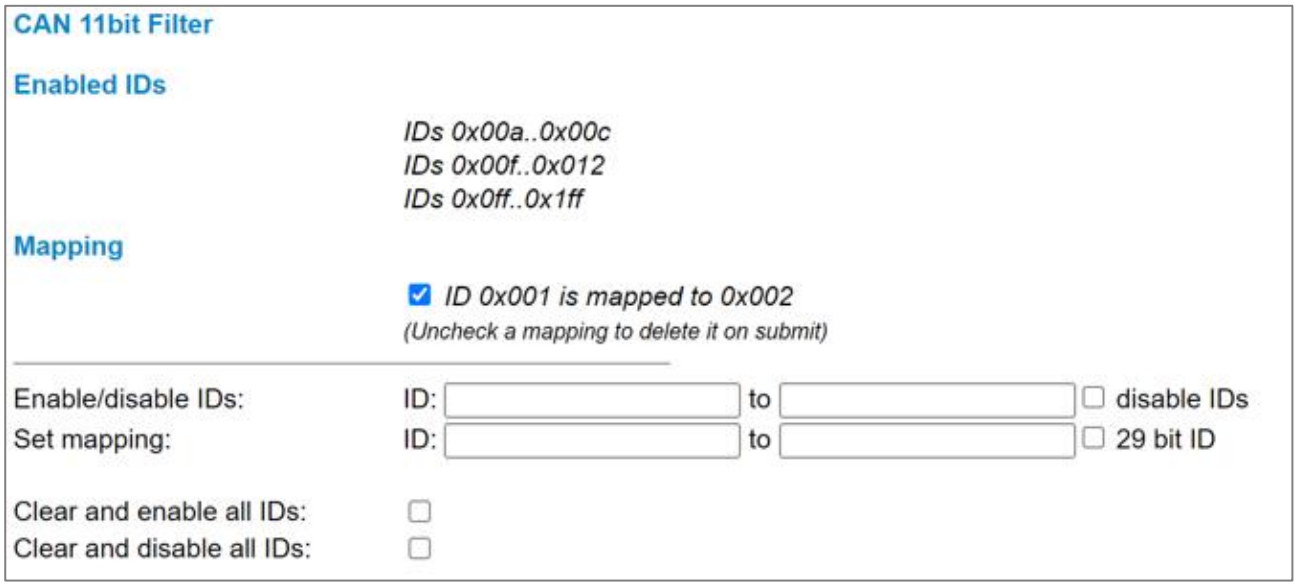


Figure 22: Web Page 'CAN Bridge Configuration' – CAN 11bit Filter

Enabled IDs	Lists the 11-bit CAN IDs that are received, that is, transferred to the other side of the bridge.
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

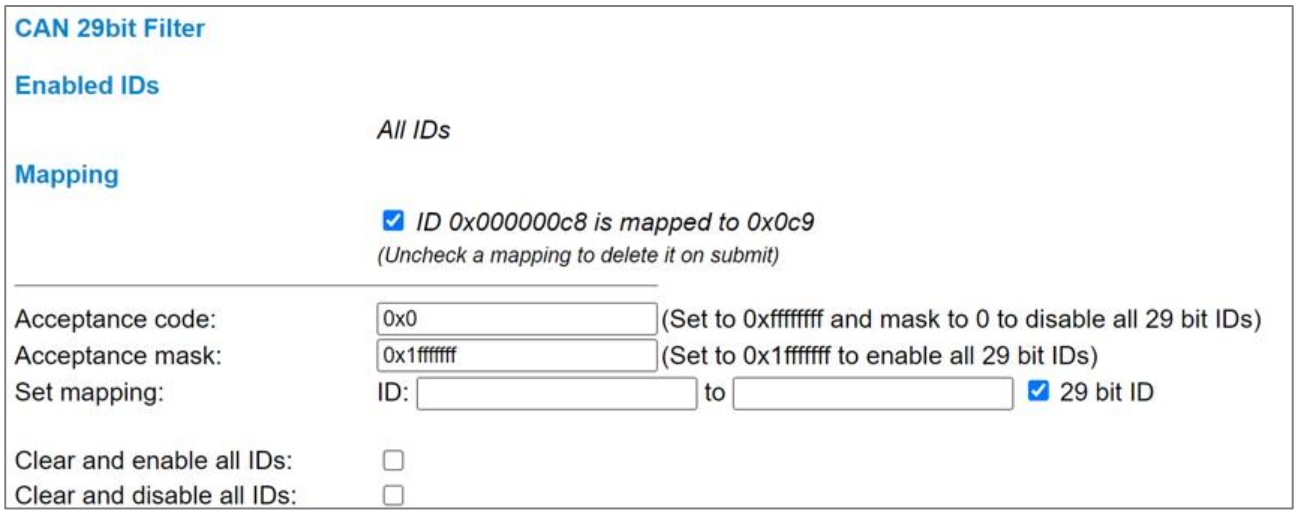


Figure 23: Web Page 'CAN Bridge Configuration' – CAN 29bit Filter

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: - 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

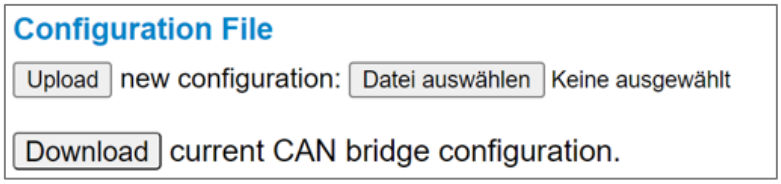


Figure 24: CAN Bridge – 'Configuration file'

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 25.
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. Use spaces or tabs to separate keys and values. Keys are case-sensitive.

<table>
<tr><th>Key</th><th>Default Value</th><th>Comment</th></tr>
<tr><td>version</td><td>0</td><td>Currently unused (for future changes)</td></tr>
<tr><td>remote_ip</td><td></td><td>Equals “Remote IP address” in online configuration</td></tr>
<tr><td>flags</td><td>1</td><td>Defines multiple flags
<table>
<tr><td>Bit</td><td>Description</td></tr>
<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>
</table></td></tr>
<tr><td>disable_nagles</td><td>1</td><td>When “0” is specified the so called “Nagle’s 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</td></tr>
<tr><td>can_baudrate</td><td>0x7fffffff</td><td>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 CAN Baud rate. However, for compatibility reasons, the baud rate can still be set with this option and is also exported with the configuration file when CAN FD is not enabled.</td></tr>
<tr><td>can_rxqueue</td><td>256</td><td>Equals “RX queue size” in online configuration</td></tr>
<tr><td>can_txqueue</td><td>256</td><td>Equals “TX queue size” in online configuration</td></tr>
<tr><td>can_29bit_acceptmask</td><td>0</td><td>Equals “Acceptance mask” in online configuration (“0x1fffffff”: all 29-bit frames are received)</td></tr>
<tr><td>can_29bit_acceptcode</td><td>0xffffffff</td><td>Equals “Acceptance code” in online configuration (“0xffffffff” and “0” for “can_29bit_acceptmask”: no 29-bit frames are received)</td></tr>
<tr><td>can_29bit_map</td><td></td><td>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)

Furthermore, the number of 29-bit mappings is limited to 16</td></tr>
<tr><td>can_11bit_enable</td><td></td><td>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”</td></tr>
<tr><td>can_11bit_map</td><td></td><td>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)</td></tr>
</table>

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         can_baudrate                     0
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 25: 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.

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.

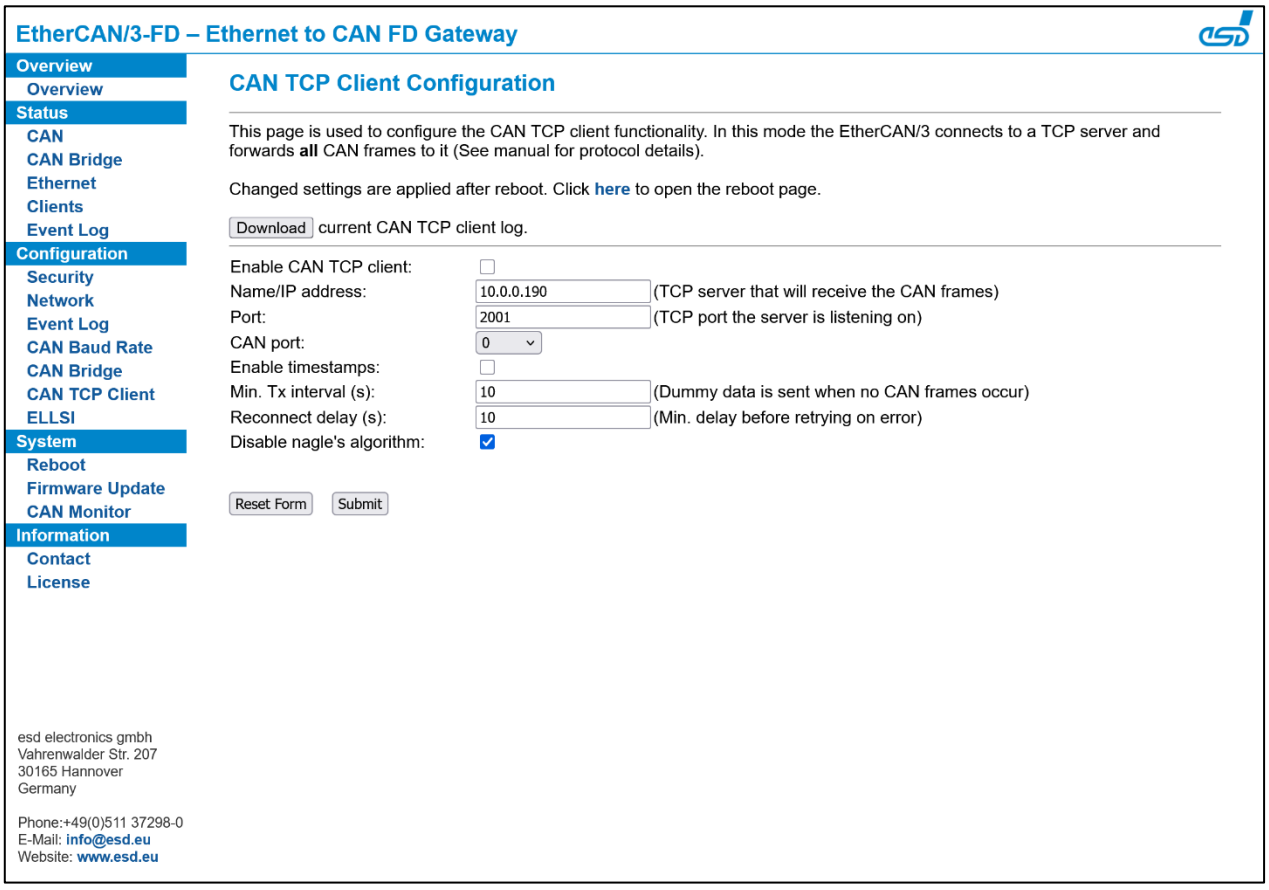


Figure 26: CAN TCP Client – configuration page

Enable CAN TCP Client	This checkbox enables the 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 menu 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. For CAN FD, the timestamp is always attached and the option is ignored.
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.
Disable Nagle’s algorithm	Select this checkbox to disable the Nagle’s algorithm independently of the *TCP Flush Mode.*

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)	*1 Byte* (= *n* = No. of frames) + *1 Byte* + *n * 16 Bytes*
67 ('C')	CAN frame array (big-endian)	*1 Byte* (= *n* = No. of frames) + *1 Byte* + *n * 16 Bytes*
116 ('t')	CAN frame array with timestamp (little-endian)	*1 Byte* (= *n* = No. of frames) + *1 Byte* + *n * 24 Bytes*
84 ('T')	CAN frame array with timestamp (big-endian)	*1 Byte* (= *n* = No. of frames) + *1 Byte* + *n * 24 Bytes*
120 (‘x’)	CAN FD frame array with timestamp (little-endian)	*1 Byte* (= *n* = No. of frames) + *1 Byte* + *n * 80 Bytes*
88 (‘X’)	CAN FD frame array with timestamp (big-endian)	*1 Byte* (= *n* = No. of frames) + *1 Byte* + *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 Bytes*
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

CAN frame array with timestamp

This command works the same way as 'CAN frame array' but a timestamp is appended to every CAN frame.

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 byte containing the number of the CAN port from which the baud rate is requested.
Read baud rate reply (extended)	The first byte contains 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.

- 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 is received the 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 11..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 11..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.
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 with CAN CC.

Member name	Bit	
id	0..28	CAN ID (bits 11..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 the length is defined as follows: • 9 = 12 Byte • 10 = 16 Byte • 11 = 20 Byte • 12 = 24 Byte • 13 = 32 Byte • 14 = 48 Byte • 15 = 64 Byte
	4	Flag “No Baudrate Switch” / “RTR” (depending of Flag “CAN FD”)
	5	Flag “Mode” (1: Frame is “Interaction Frame”, i.e. it was sent from another software on the EtherCAN/3-FD itself)
	6	Reserved
	7	Flag “CAN FD”
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.
data[0]..[63]	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.

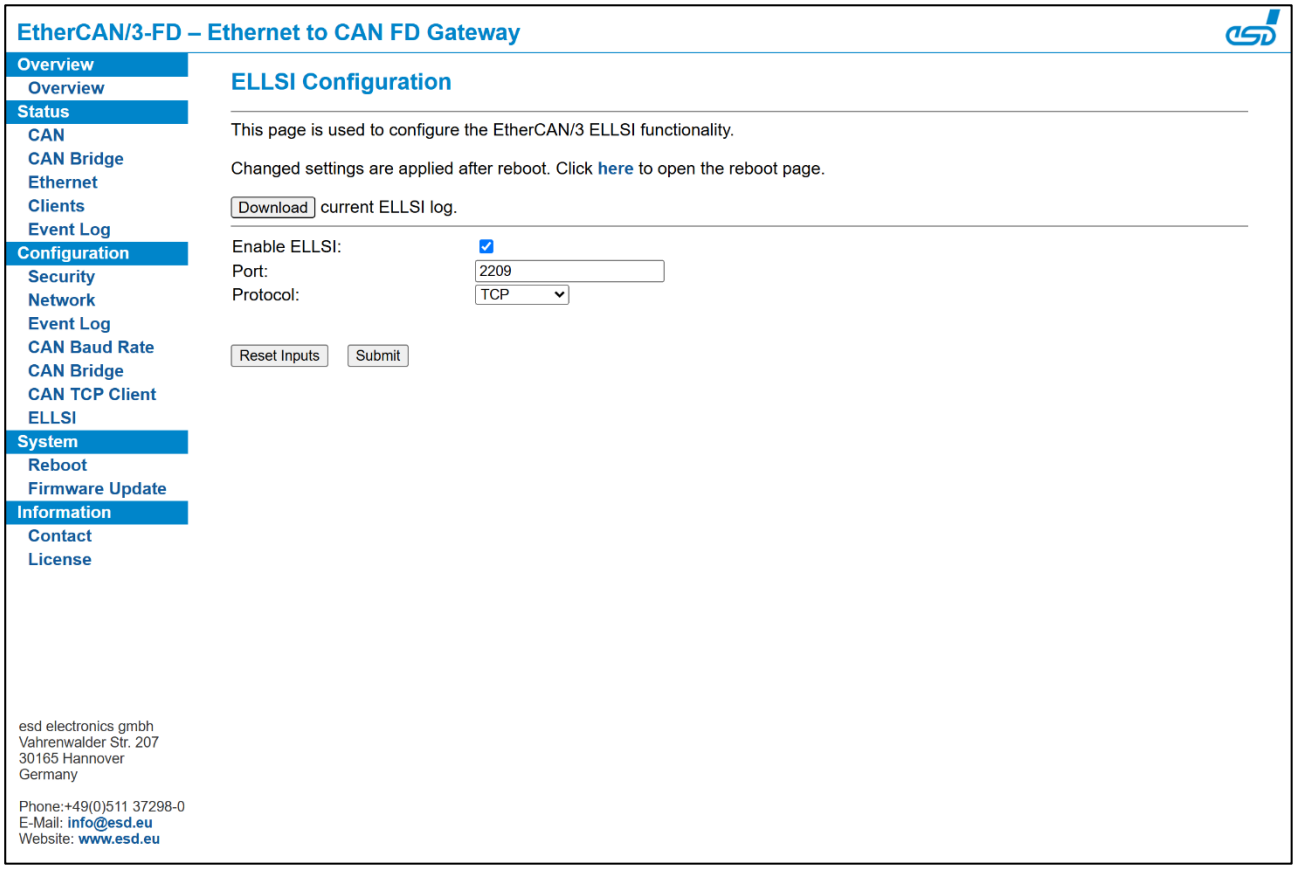


Figure 27: Web Page ‘ELLSI Configuration’

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.

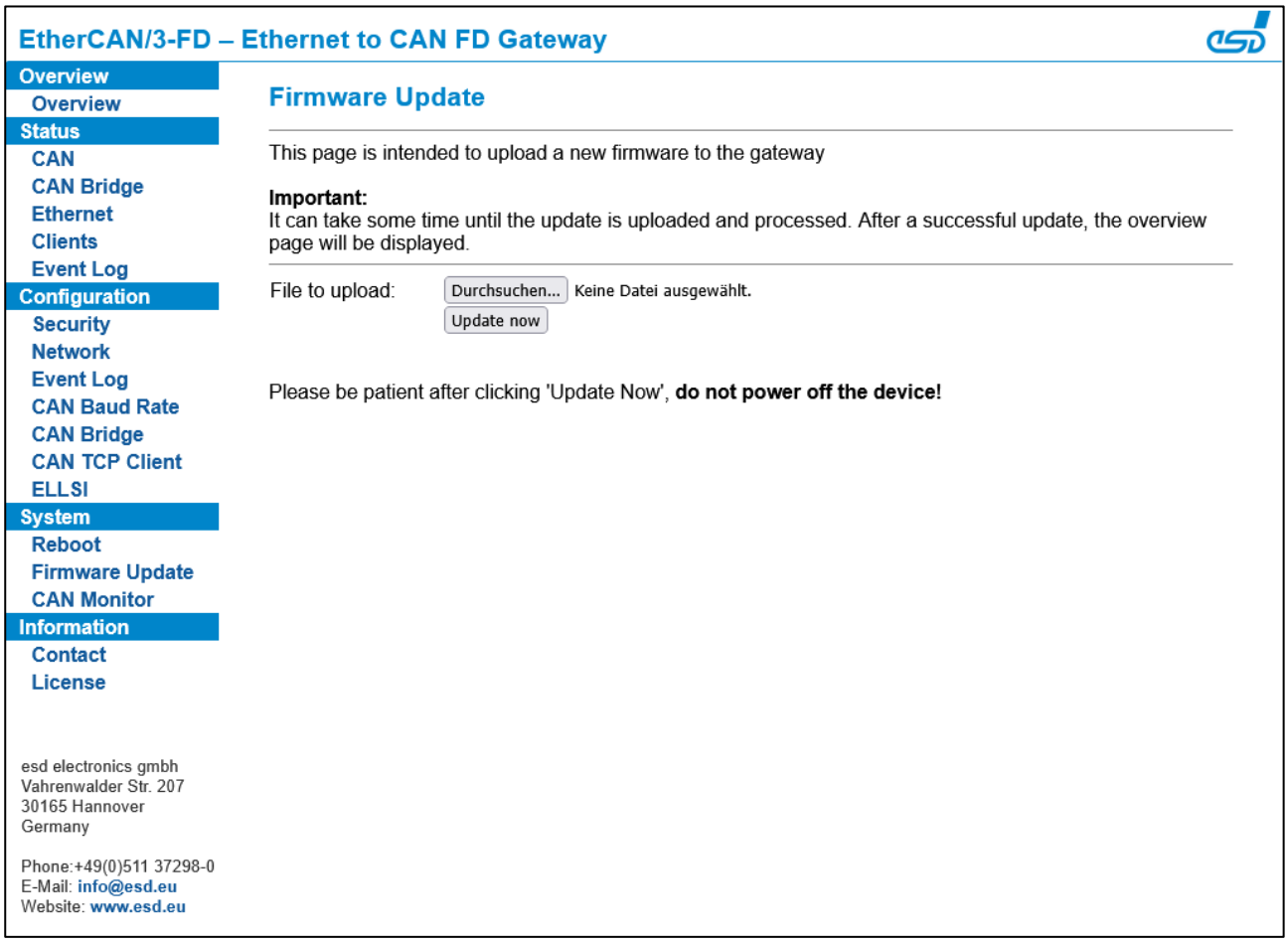


Figure 28: Firmware Update

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.

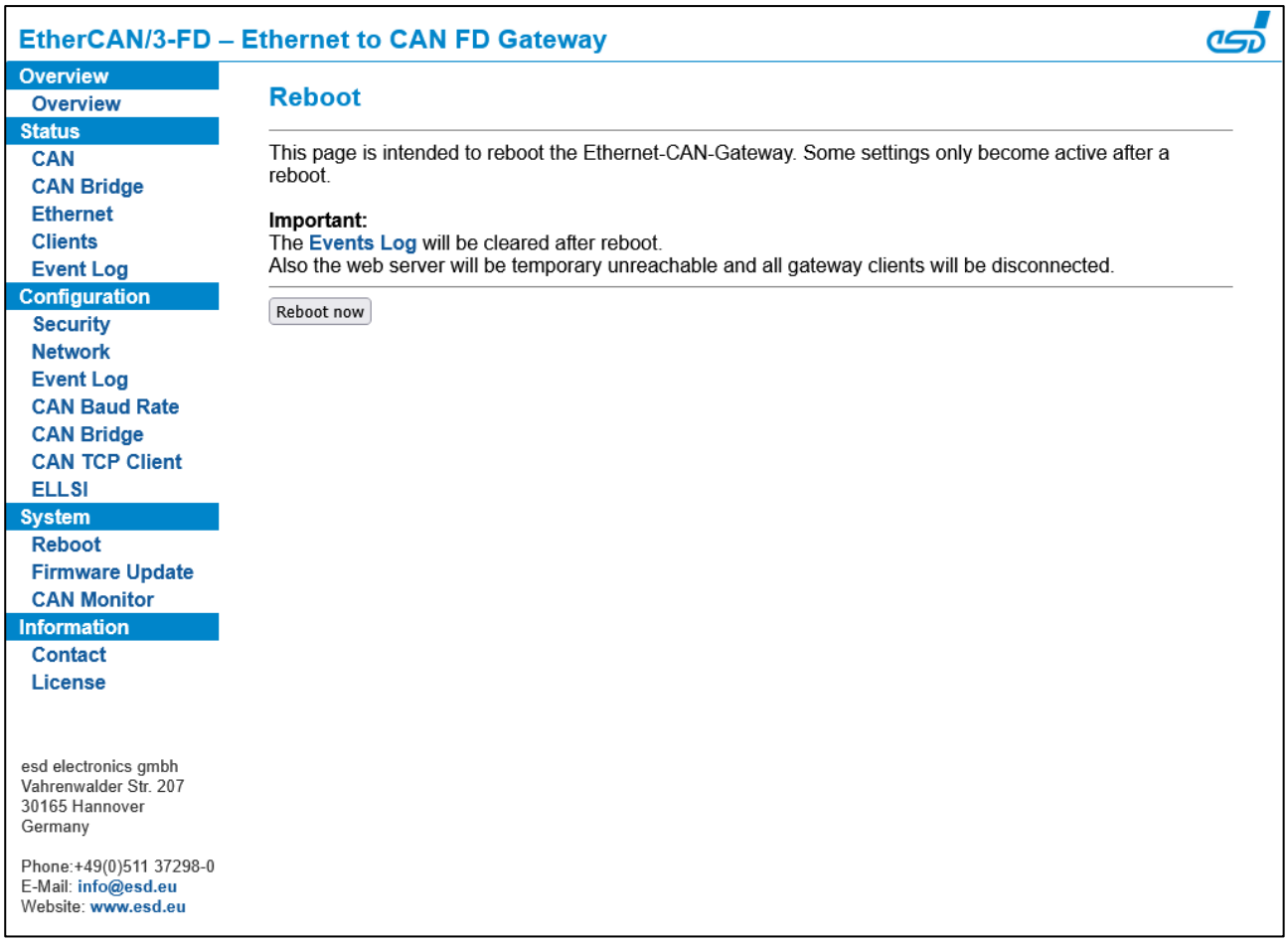


Figure 29: Web Page ‘Reboot’

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.

5.2.4.3 CAN Monitor

The page *CAN Monitor* can be used to check the current activity on the CAN bus. It displays in- and outgoing CAN frames, the bus statistics and the bus status.

Internally, it uses the ELLSI WebSocket protocol and can therefore serve as a starting point for custom ELLSI projects.

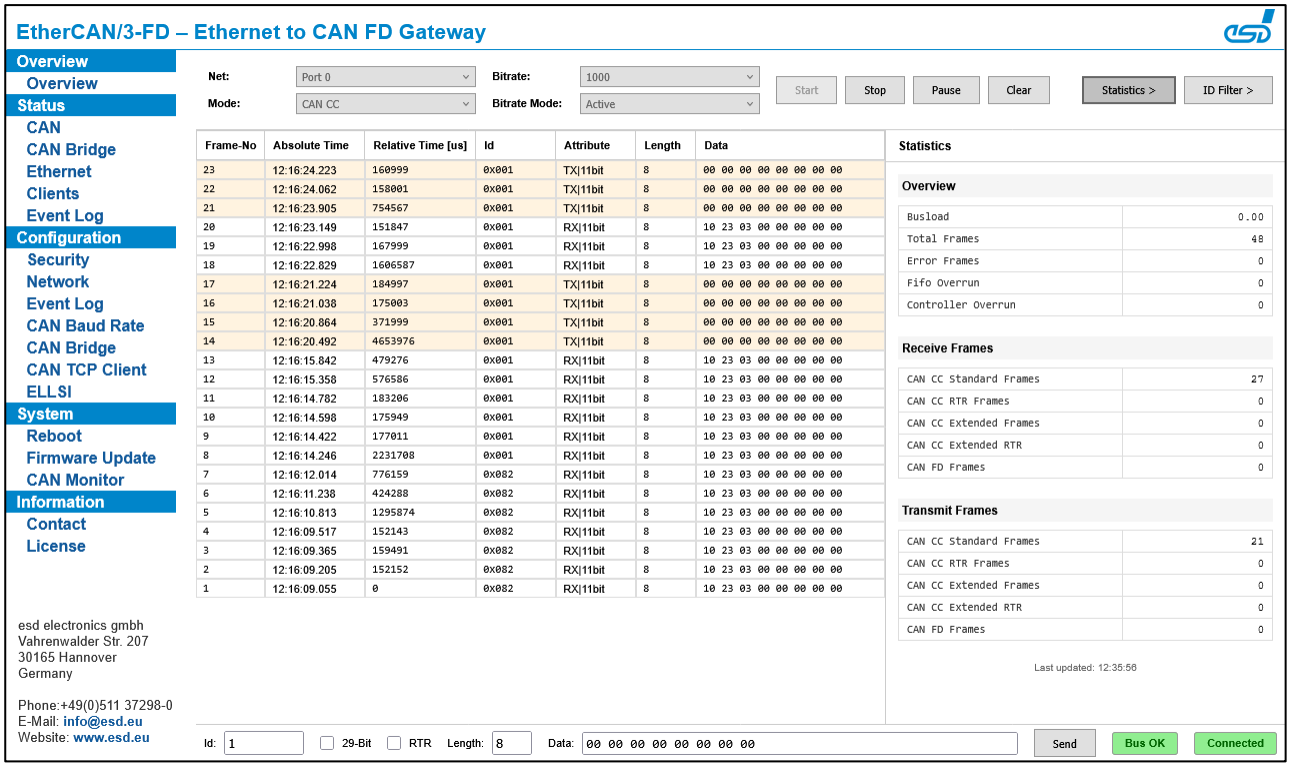


Figure 30: Web Page ‘CAN Monitor’

NOTICE

The CAN Monitor uses the ELLSI WebSocket protocol. Therefore, it is only available if ELLSI WebSocket is enabled. If it is not enabled, the gateway will automatically start ELLSI WebSocket, when the page is loaded. This does not have any change to the ELLSI configuration.

The following parameter can be configured:

Net	Select the CAN port that should be monitored.
Mode	Choose CAN CC for CAN Classic or CAN FD for CAN FD.
Bitrate	Select the baudrate that should be used. DEFAULT can be used if the baudrate should not be changed.
Bitrate Mode	Select the bitrate mode that should be used. • Active – The gateway actively acknowledges receipt of CAN frames • Listen Only – The gateway does not acknowledge receipt of CAN frames • Auto – The gateway detects the baudrate by itself • Disabled – The gateway is disabled

The following buttons are available:

Start	This button starts the CAN Monitor.
Stop	This button stops the CAN Monitor.
Pause	This button skips new frames from being added to the frame table.
Clear	This button clears the frame table.
Statistics	Opens the statistic sideview.
ID Filter	Open the ID filter sideview.
Send bar	At the bottom, there is a send bar, which can be used to manually send a specific frame. Select the ID, the length and data and press the send button to send a CAN frame.

5.2.5 Information

5.2.5.1 Contact

The page *Contact* provides contact information.

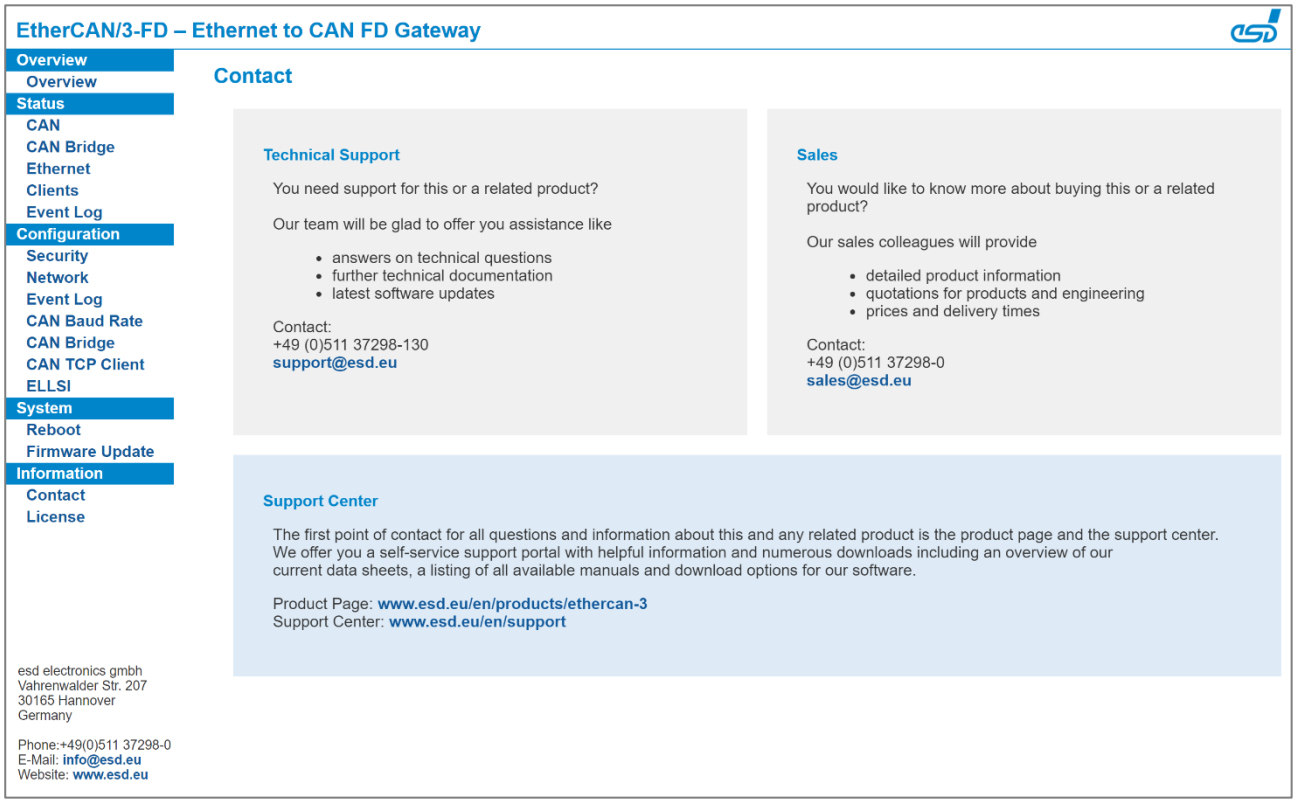


Figure 31: Web Page ‘Contact’

5.2.5.2 License

The page *License* 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.
- During the TLS handshake the following checks are performed.
  - Signature chain up to one of the configured trusted certificates (CA or self-signed peer certificate)
  - CA constraints of issuing certificates (Basic Constraints / Key Usage)
  - Minimum cryptographic strength (allowed hash algorithms and key sizes)
- The following checks are not performed:
  - Validity period ("not before" / "not after"): the device has no reliable time source, so expired or not-yet-valid certificates are accepted
  - Hostname / Common Name of the peer
  - Certificate revocation (no CRL / OCSP support)

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/2nd Gateway Certificate Valid?	Gateway Trusted Host?	Host/2nd 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.

⚠ **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.
Unlike the gateway, the host PC has a reliable time source, so the validity period ("not before" / "not after") of the gateway's certificate is checked on the host side.

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"
   ```
4. 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. As mentioned in chapter 5.3 the gateway does not check the validity of the certificate provided by the host driver.

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 on the following web page:

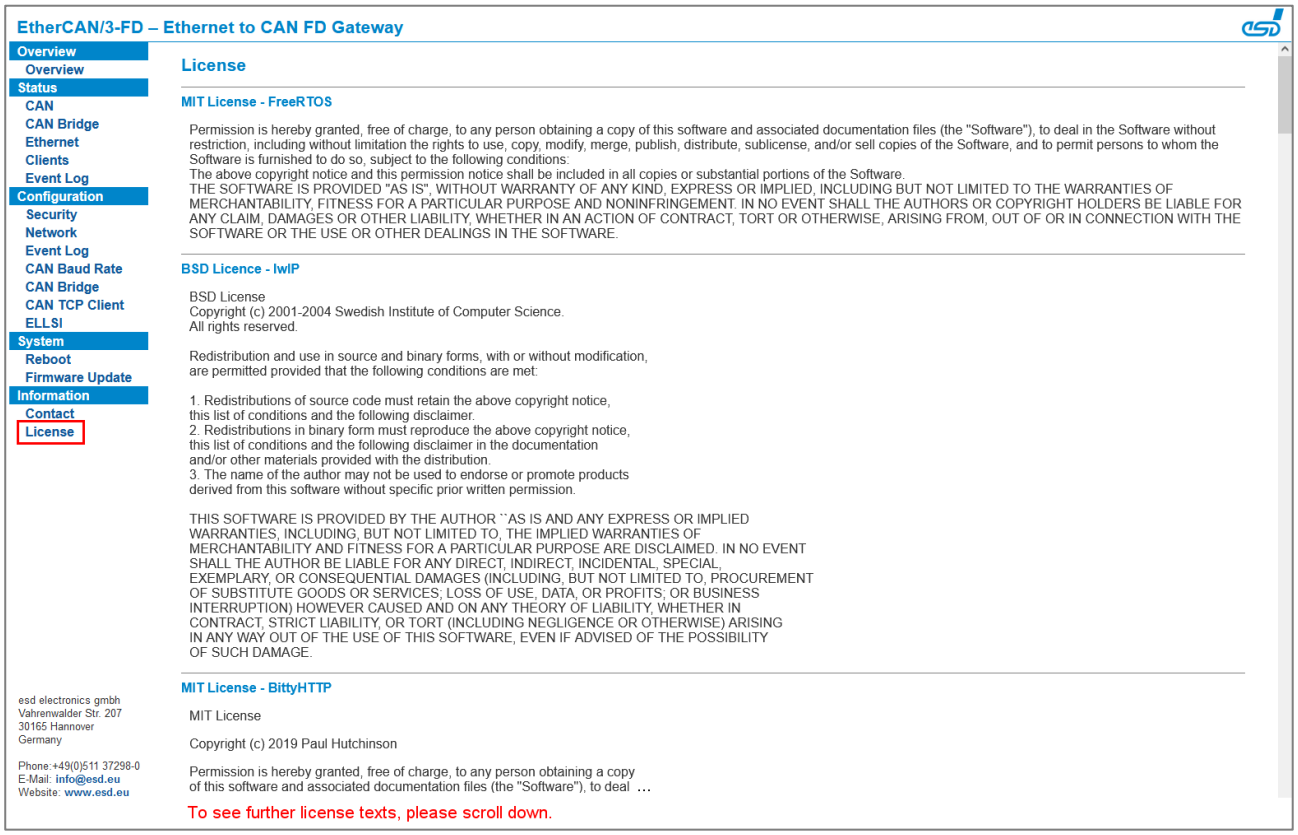


Figure 32: How to find the 3rd party software license terms

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.

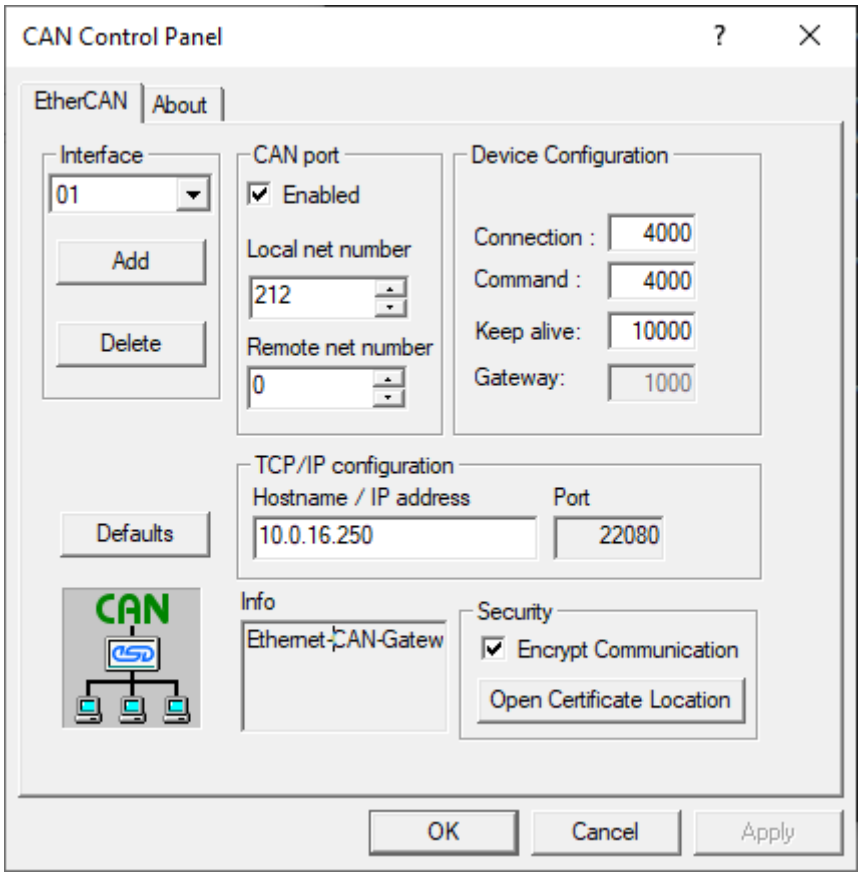


Figure 33: CAN Control Panel

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.

Local net number
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.

Remote net number
The EtherCAN/3-FD has two CAN interfaces. Select '0' for CAN port 0 and '1' for CAN port 1.

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. The host can store more than two trusted certificates; the EtherCAN/3-FD is limited to two. 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

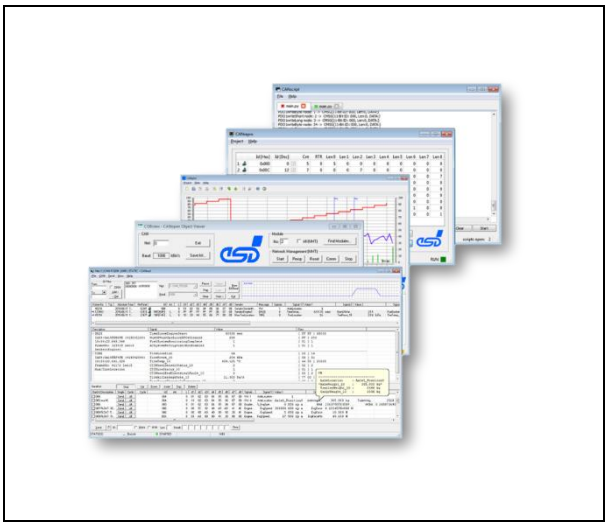
The esd CAN SDK is included in the delivery of the EtherCAN/3-FD. The SDK can also be downloaded from our website:
https://esd.eu/en/products/can-sdk

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:

CANreal	Display and record of CAN message frames
CANplot	Graphical display of CAN data
CANrepro	Replay of pre-recorded CAN messages
CANscript	Python based scripting tool
COBview	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 90 for availability of the drivers.

8 LEDs

8.1 Position of the LEDs

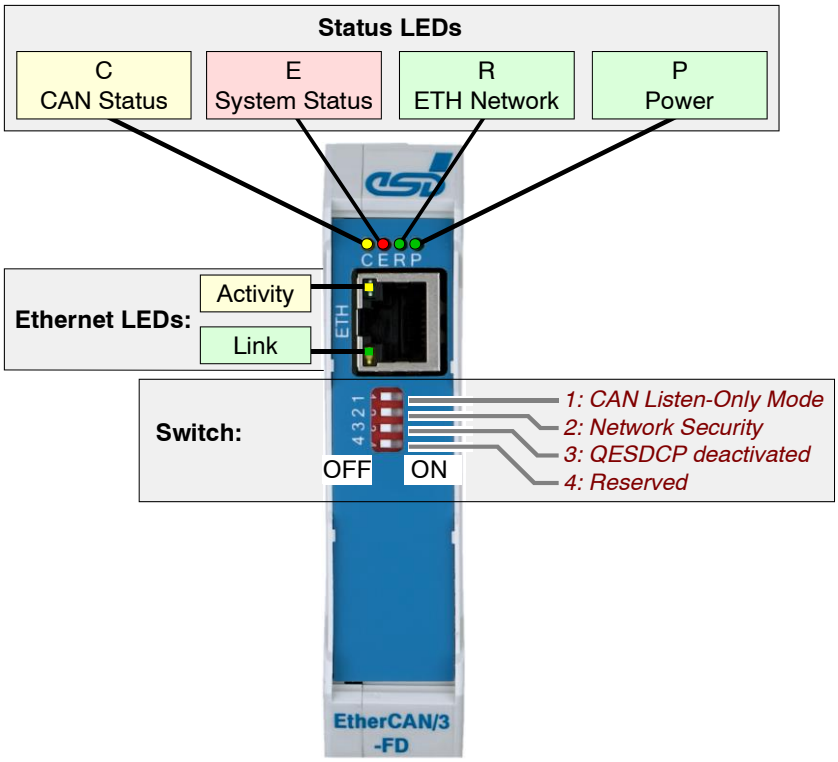


Figure 34: Position of the LEDs and Switch in the front panel

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	CAN Port1 and Port 2 Bus OK
		On	CAN Port1 and/or Port 2 Bus OFF
		Flashing SL	CAN Port1 and/or Port 2 Bus warning
		Flashing LS	CAN Port1 and/or Port 2 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	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. SW 2: Network Security - If this is set to “ON”, the internal web server is deactivated. SW 3: *QESDCP* - If this is set to “ON”, the *QESDCP* functionality is deactivated. SW 4: Reserved for future use.
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 *Recovery Mode* (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. After the restart, one of the DIP switches will be set. Therefore, one of the DIP switch functionalities will be active. See chapter 9 for more information.

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 35: View with name plate (example)

The name plate (Figure 35) 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 V DC Permitted voltage range: U_{VCC} = 12 V … 32 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, CAN FD: Data bit rate: Up to 8 Mbit/s, Arbitration bit rate: Up to 1 Mbit/s CAN CC: Bit rate: From 10 kbit/s up to 1 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	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 17.1)

Table 8: Connectors, accessible from outside

13 Connector Assignments

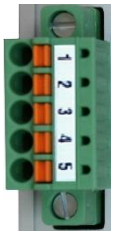
13.1 CAN 0 and CAN 1

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 80.

Pin Position:

(cable plug)



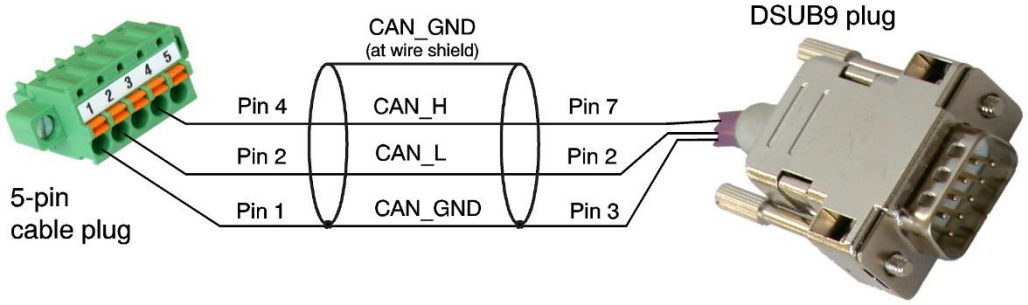
Pin Assignment:

Imprint	Signal	Pin
G	CANx_GND	1
L	CANx_L	2
Sh	Shield	3
H	CANx_H	4
•	-	5

Signal Description:

CANx_L, CANx_H …	CAN signal lines of CAN port x (x =0, 1)
CANx_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.

INFORMATION
esd offers assembled CAN cables according to recommendations of CiA 303 part1 (7) and CiA 106 (2) as accessories, see chapter 17.

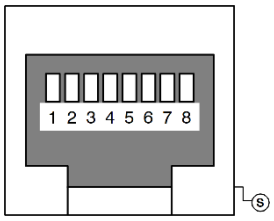
13.2 24 V and CAN0 via InRailBus

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 81).
Read and follow the instructions for connecting power supply and CAN0 signals via InRailBus (see from page 82)!

13.3 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

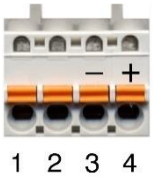
NOTICE
esd grants the EU conformity of the product in networks with 100 Mbit/s, if the wiring is carried out with S/FTP (screened shielded twisted pair) cables of category CAT5 or higher.

13.4 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 KMGY, 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 80.

Pin Position:



Pin Assignment:

			24V	
Device housing label	.	.	M	P
Connector label	(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 14.4.3.2 “Connection of the Supply Voltage” at page 86) as long as the value of the looped-through current is less than 2.0 A! Further wiring via the plug is possible if the modules are mounted on the DIN rail without InRailBus connectors. Use pin 1 and 2 as input wiring and pins 3 and 4 as output to the next module for example. Note that the limit values of the plug must not be exceeded and that voltage drops may occur in the plug.

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! See chapter 14.4.3.1

→ 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}= 12 V/DC … 32 V/DC
M24... Reference potential

13.5 Conductor Connection / Conductor Cross Section

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

Characteristics	*Connector Type*[1]	
	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 mm² … 2.5 mm²	0.14 mm² … 1.5 mm²
Conductor cross section flexible	0.2 mm² … 2.5 mm²	0.14 mm² … 1.5 mm²
Conductor cross section AWG	24 … 12	26 … 16
Conductor cross section flexible, with ferrule without plastic sleeve	0.25 mm² … 2.5 mm²	0.25 mm² … 1.5 mm²
Conductor cross section flexible, with ferrule with plastic sleeve	0.25 mm² … 2.5 mm²	0.25 mm² … 0.75 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min./max.	0.5 mm² … 1.5 mm²	not allowed

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

14 Optional InRailBus

14.1 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 interface (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-Interface (IMC 1,5/ 5-ST-3,81 AU), pin contacts	C.3000.03

14.2 Conductor Connection/Conductor Cross Section

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

Characteristics	*Connector Type*[2]	
	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 mm²	1.5 mm²
Conductor cross section rigid.	0.14 mm² … 1.5 mm²	0.14 mm² … 1.5 mm²
Conductor cross section flexible	0.14 mm² … 0.5 mm²	0.14 mm² … 1.5 mm²
Conductor cross section AWG	28 … 16	28 … 16
Conductor cross section flexible, with ferrule without plastic sleeve	0.25 mm² … 1.5 mm²	0.25 mm² … 1.5 mm²
Conductor cross section flexible, with ferrule with plastic sleeve	0.25 mm² … 0.5 mm²	0.25 mm² … 0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min./max.	0.5 mm² ... 0.5 mm²	0.5 mm² ... 0.5 mm²

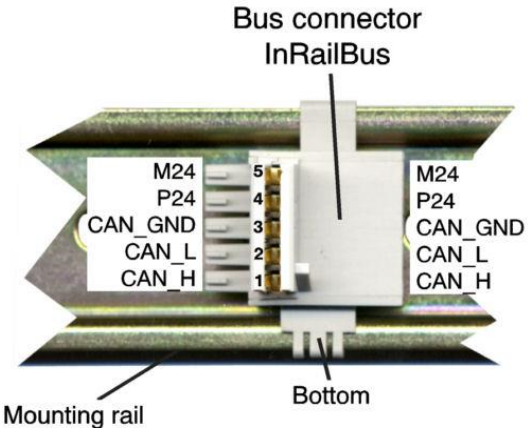
2 Technical Data from Phoenix Contact website, printed circuit board connector, plug component

14.3 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

Connector View:



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)

14.4 Using InRailBus (Option)

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

14.4.1 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:

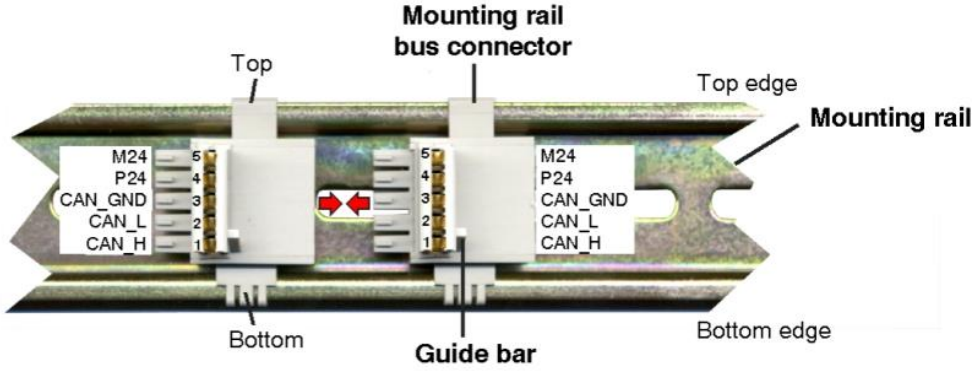


Figure 36: Mounting rail with bus connector

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 EtherCAN/3-FD is plugged on.

2. Hold the EtherCAN/3-FD 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 37: Mounting CAN module (Example)

3. Now swivel the EtherCAN/3-FD onto the mounting rail by moving the module downwards according to the direction of the arrow in Figure 37. The housing is mechanically guided by the guide bar of the bus connector.

4. When mounting the EtherCAN/3-FD the moveable snap-on foot snaps onto 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 interface to the InRailBus as described below.



Figure 38: Mounted CAN module (Example)

14.4.2 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).

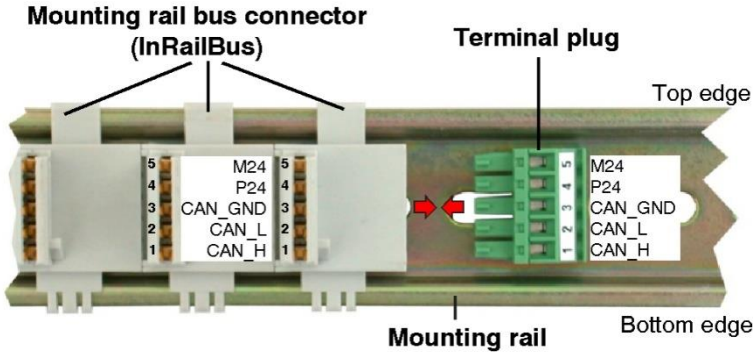


Figure 39: Mounting rail with InRailBus and terminal plug

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 39. Then connect the CAN interface and the supply voltage via the terminal plug.

14.4.3 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 EtherCAN/3-FD 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 61140 and may only be operated on supply circuits that offer sufficient protection against dangerous voltages.

There are two ways to feed the 24 V power supply voltage into the CAN module station:

- via the terminal plug of the InRailBus, see 14.4.3.1
- via the 24 V connector of the first module in the CAN module station, see 14.4.3.2

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

14.4.3.1 Connection of the Power Supply Voltage via InRailBus

NOTICE
If you feed the 24V power supply via the terminal plug of the InRailBus (see Figure below), the maximum load current must not exceed $I_{MAX_LOAD_InRailBus}$ = 8 A.

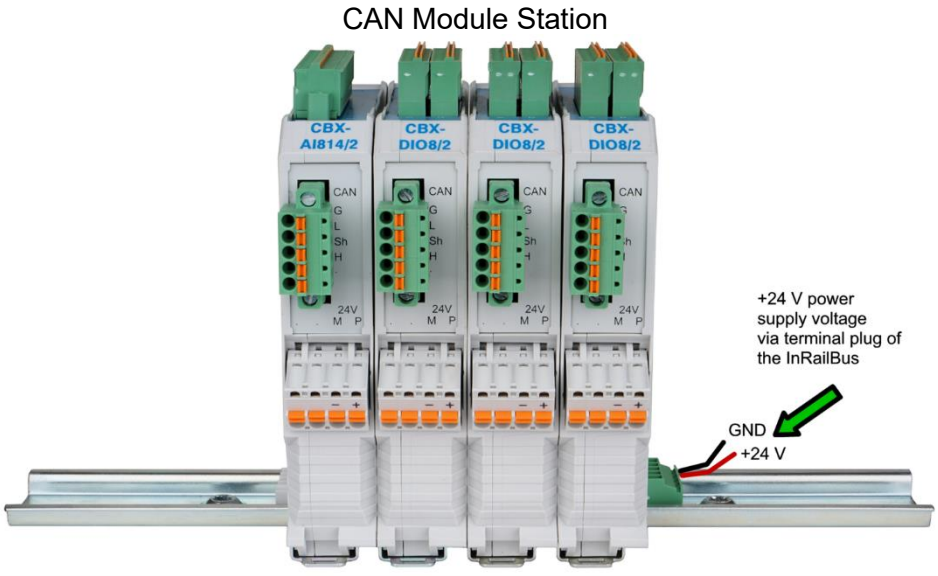


Figure 40: Connection via terminal plug (Example)

14.4.3.2 Connection of the Power Supply Voltage via 24 V Connector

NOTICE
Note that the connection between the 24V plug and the InRailBus is not designed to feed the 24V supply voltage via the plug to the InRailBus!
If the modules are mounted on the DIN rail without InRailBus connectors, it is allowed to bridge the power supply from one module to another (see Figure below), but the maximum load current must not exceed $I_{MAX_LOAD_24V_plug}$ = 2 A.

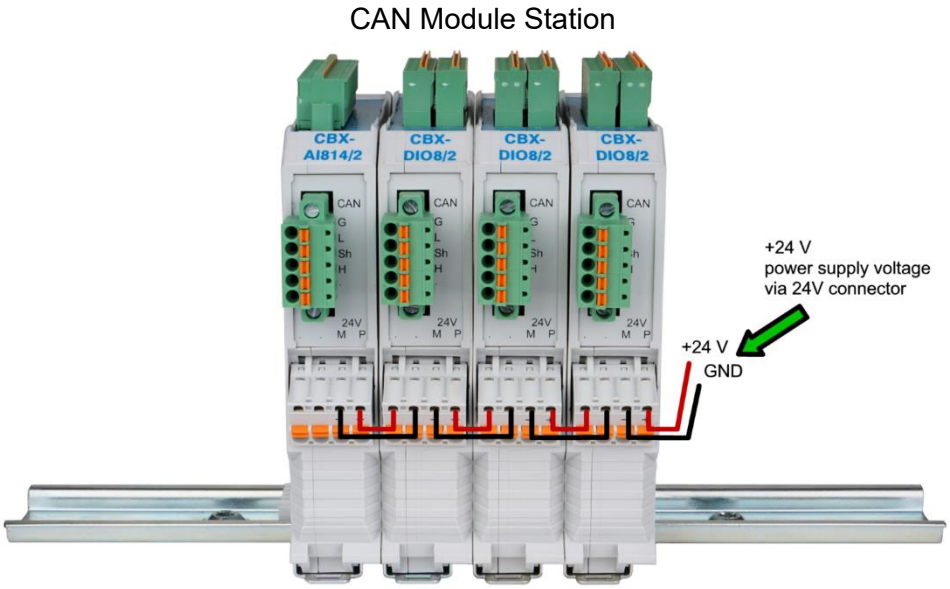


Figure 41: Connection via 24V Connector (Example)

14.4.3.3 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.

14.4.4 Connection of CAN

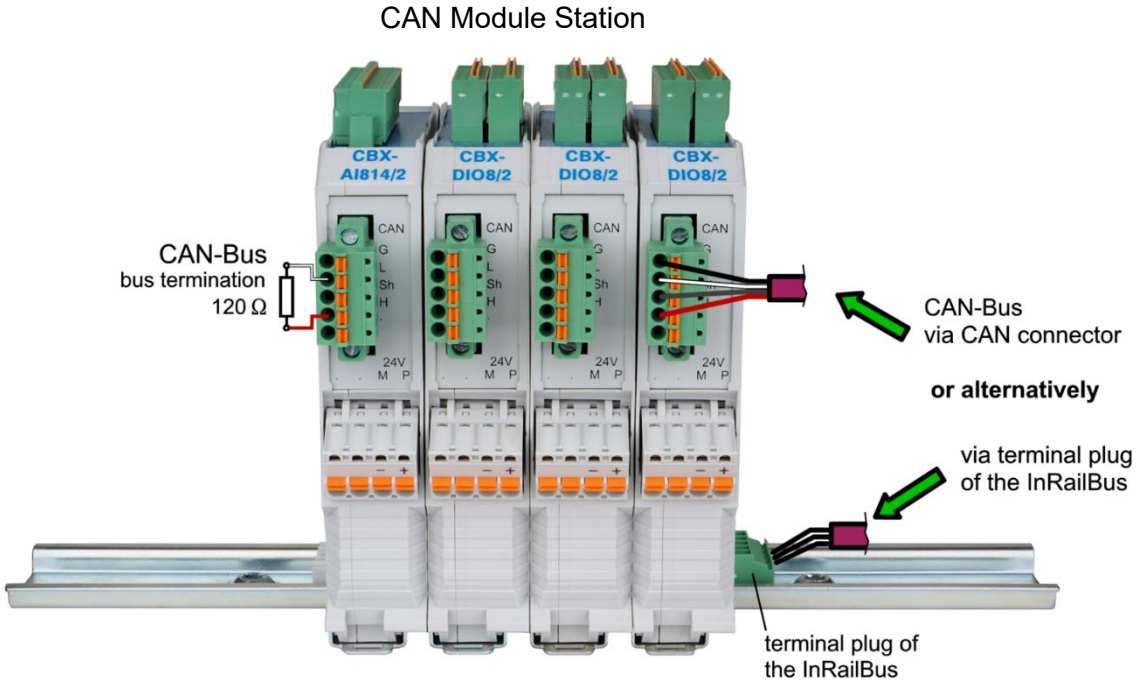


Figure 42: Connecting the CAN signals to the CAN Module Station (Example)

In general, the CAN signals can be fed in via the InRailBus or via the CAN connector of the first CAN module in the CAN module station. The signals are then connected through the CAN module station via the InRailBus. The CAN signals may be lead through via the CAN connector of the CAN module mounted at the other end of the CAN module station. However, the CAN signals must not be connected via the CAN connectors of the middle CAN modules of the CAN module station, as this would lead to impermissible branching.
Please note that a bus terminating resistor must be connected to the CAN module located at the end of the InRailBus if the CAN bus ends there (see Figure 42).

14.4.5 Remove the CAN Module from InRailBus

If the CAN module is only connected via the InRailBus, proceed as follows when removing it:
Release the module from the mounting rail by moving the snap-on foot (see Figure 38) downwards (e.g., with a screwdriver). This releases the module from the bottom edge of the mounting rail, and it can be removed.

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

15 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)
(7) CiA 303-1 CANopen Device and Network Design - Part 1: CANopen physical layer, V2.0.1, 2023-03-27, CAN in Automation (CiA) e. V.

16 Declaration of Conformity

EU-KONFORMITÄTSERKLÄRUNG
EU DECLARATION OF CONFORMITY

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

esd erklärt, dass die Produkte *esd declares, that the products*	Typ, Modell, Artikel-Nr. *Type, Model, Article No.*
EtherCAN/3 **EtherCAN/3-FD**	**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*

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17 Order Information

17.1 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 9: Order information hardware

17.2 Software

Type		Order No.
CAN software drivers for **Windows and Linux** on CD-ROM to EtherCAN/2 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!	C.1101.06
J1939 Stack for Windows (Object)		C.1130.10
J1939 Stack for Linux (Object)		C.1130.11
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 10: Order information software

17.3 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 11: 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.