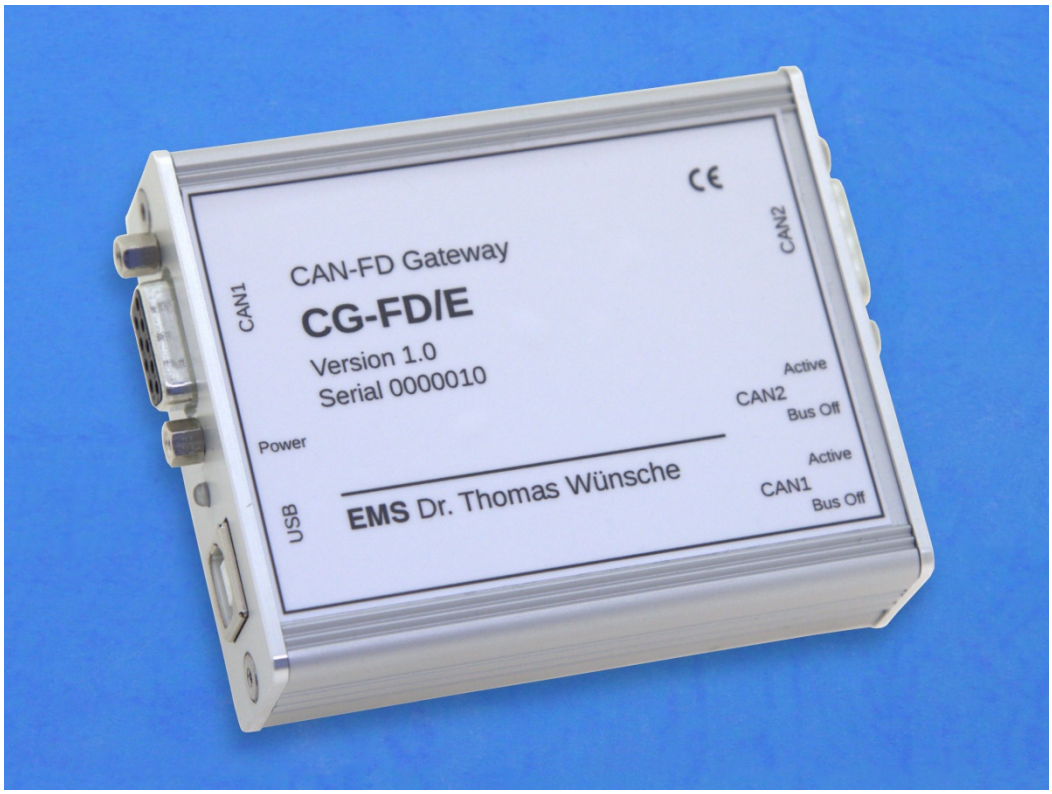

CAN FD/CAN Gateway

CG-FD/E

User manual

EMS
Thomas Wünsche

User manual CG-FD/E

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Our products are continously improved. Due to this fact specifications may be changed at any time and without announcement.

WARNING: CG-FD/E hardware and software may not be used in applications where damage to life, health or private property may result from failures in or caused by these components.

Content

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1 Overview

1.1 Features

- Support for CAN FD and CAN CC (Classic CAN)
- Connection of CAN CC systems with CAN FD systems
- Connection of CAN systems with differing data rates
- Filtering and buffering of data traffic
- Mapping of identifier between input and output
- Support for 11 bit and 29 bit identifier
- Cortex M4 Microcontroller running at 160 MHz with 2 internal CAN FD controllers
- USB interface for configuration and optional power supply
- Extended supply voltage range
- Extended temperature range
- Optional DIN Rail mounting

1.2 General Description

The CAN FD/CAN gateway CG-FD/E is designed for applications where high flexibility is crucial. The extended values of supply voltage and operating temperature range meet typical requirements of automotive applications. The USB interface is used to configure the device and to provide supply voltage. The configuration tool cg-fd-tool is in the scope of delivery and offers an intuitive way to set up the gateway.

Among available functions of the standard firmware are data rate adaption, message filtering as well as identifier conversion between the coupled busses. The restriction of the maximum data rate depending on cable length for a CAN or CAN FD segment can be abolished for the over-all system by use of CG-FD/E.

CG-FD/E obtains its potential through the use of a Cortex M4 microcontroller with 160 MHz clock. High speed processing and low latencies allow the use with high data rates and busloads.

1.3 Ordering Information

12-20-428-xx	**CG-FD/E** CAN FD/CAN Gateway to connect CAN Systems (CAN FD und CAN CC) with software for filtering, identifier conversion and data rate adaption, Cortex M4 Microcontroller 160 MHz with 2 internal CAN FD controller

Note: xx denotes language of delivery:

10 German
20 English

2 Handling

2.1 Connection

CG-FD/E has a male and a female SUB-D 9 plug to connect two CAN segments. An USB type B connector is intended for configuration purpose. Power can be supplied to the device either via the D-Sub9 or the USB connector. The assignment is described in chapter "3.1 Pin assignment".

2.2 Operation

To start up the gateway just connect the power supply, the device starts up automatically. As soon as the automatic diagnostic process is successfully completed the green power LED gets on permanently.

Important note: Ex factory the device offers no configuration and must be configured before its first run. Configuration instructions for the gateway are located in chapter "2.3 Configuration".

2.3 Configuration

CG-FD/E will be delivered with the following factory configuration for CAN1 and CAN2: nominal baudrate 1 MBaud, data baudrate 2 MBaud, all received messages are forwarded unchanged.

Customer specific gateways will be configured according to customer orders. This factory configuration can be changed by using a tool called cg-fd-tool.

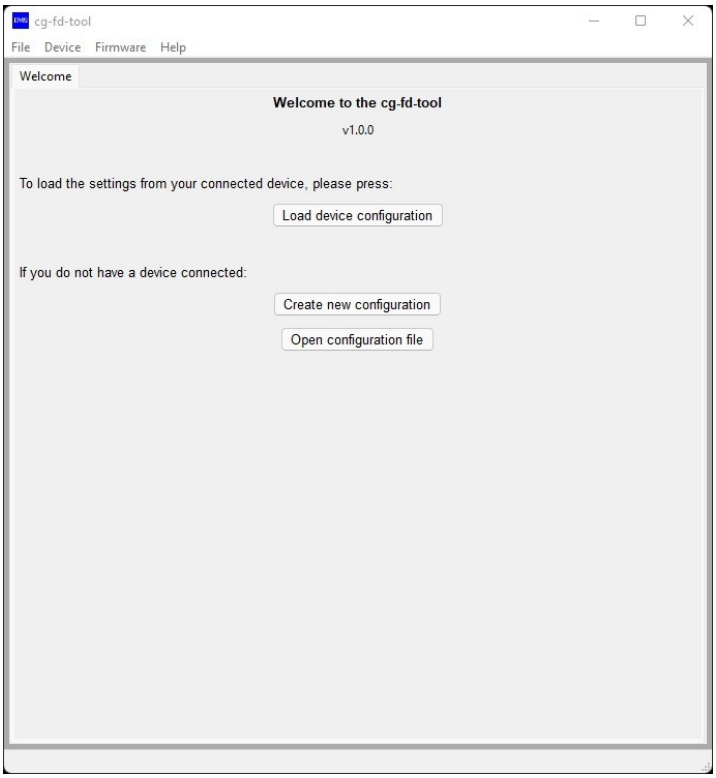
If cg-fd-tool has been loaded on a PC or laptop and an EMS gateway is connected, the current configuration is read out by the tool. cg-fd-tool allows to change the uploaded gateway configuration on the PC or laptop and download the adjusted configuration in the gateway afterwards. This is the recommended way to setup the device.

If no gateway is available, it is also possible to create a configuration from scratch, save it in a json file and load it in a device later.

The following screenshots show the different steps of the configuration process with regard to the initialization of the CAN controller and the setup of the identifier filter and mapping.

To help new users handling cg-fd-tool hints have been implemented for several items. These hints are displayed by hovering over those items.

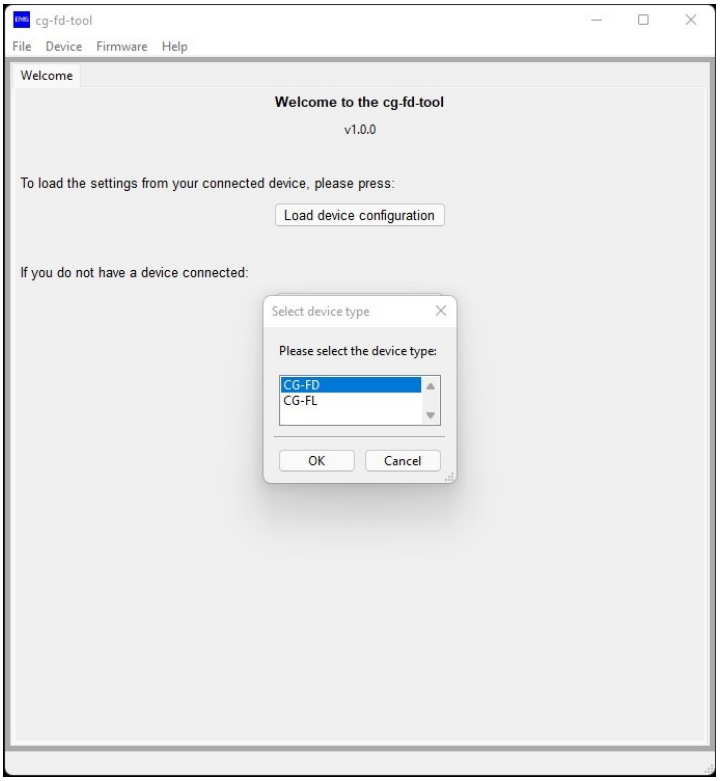
2.3.1 Welcome



The view "Welcome" contains an overview of the options to create or edit a configuration

- Load device configuration
  Read the current configuration out of the device to edit settings or save it to a json file.
- Create new configuration
  Create a new configuration for the chosen device type (see 2.3.3). This configuration can be saved as a json file and loaded to a gateway of chosen type anytime.
- Open configuration file
  Open a local configuration json file to edit it and save it again or apply it to a connected EMS gateway.

2.3.2 Create new configuration



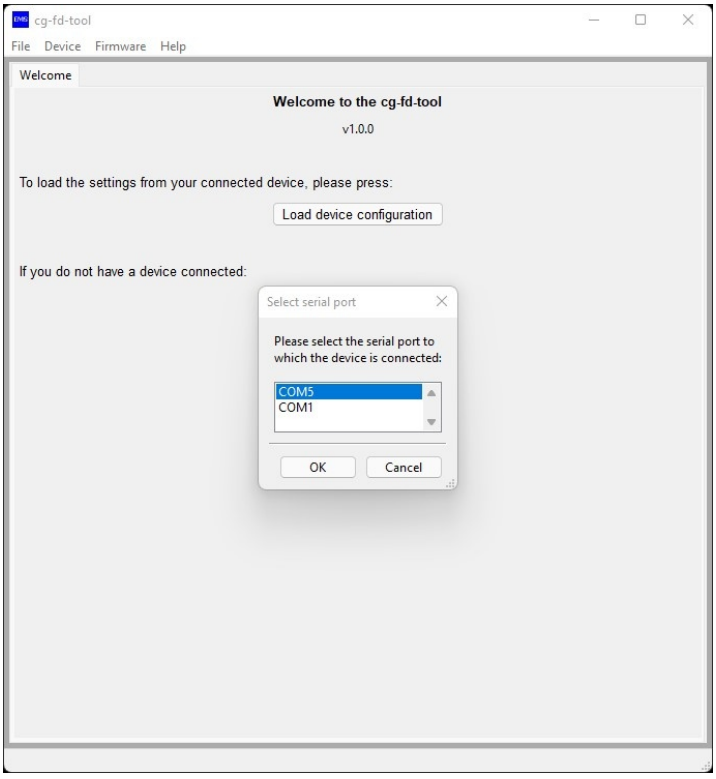
The "Create new configuration" button starts initiation of a new configuration for the selected device

- Select device type

  Select the device for which the configuration should be created.

  For CG-FD/E-AVL "CG-FD" has to be used.

2.3.3 Load device configuration

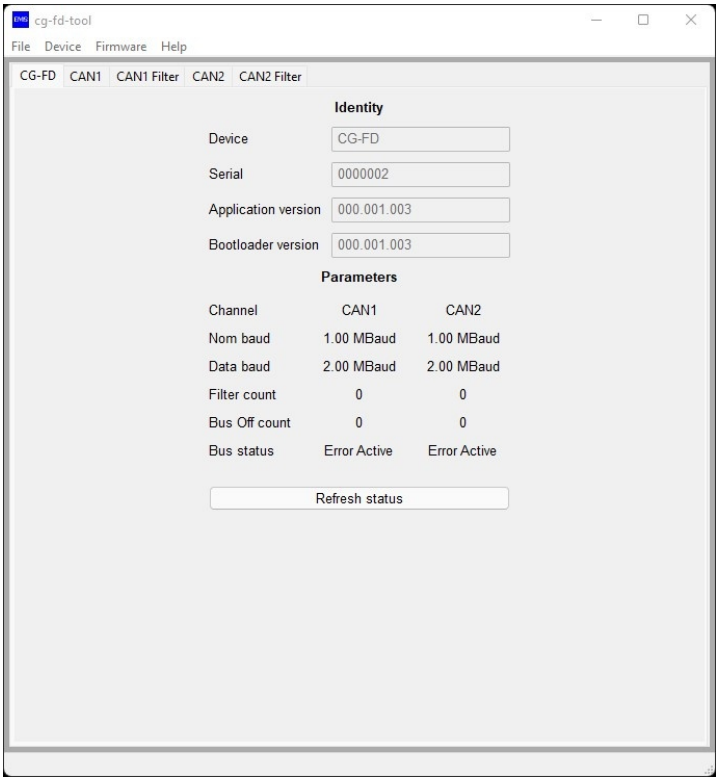


Load the settings of the device to edit or save it

- Select serial port

  Select the serial port, which is connected to the EMS gateway.

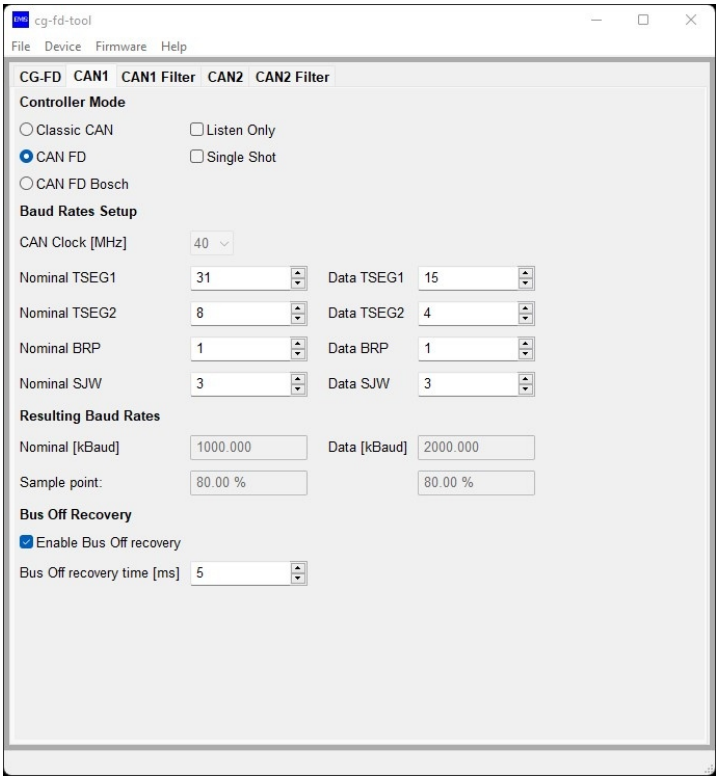
2.3.4 Identity view



The tab "CG-FD" contains the device settings

- Identity
  Contains the device name, serial number and the version of application and bootloader.
- Parameters
  Shows baud rates, filter count, Bus Off count and bus status of CAN1 and CAN2.
- Refresh status
  Refresh bus status of the device.

2.3.5 CAN Controller Settings



The tabs "CAN1" and "CAN2" contain the CAN controllers settings

- Controller Mode
  Select CAN controller mode.
  In "Single Shot" mode retransmission will stop, if arbitration was lost.
  In "Listen Only" mode no acknowledge will be generated.
- Baud Rates Setup
  Set up CAN baud rates according to chosen CAN controller mode.
- Resulting Baud Rates
  Shows the calculated baud rates and sample points for the chosen CAN controller settings.
- Bus Off Recovery
  Set a Bus Off recovery time, if required. It is recommended to enable it.

2.3.6 CAN Filter

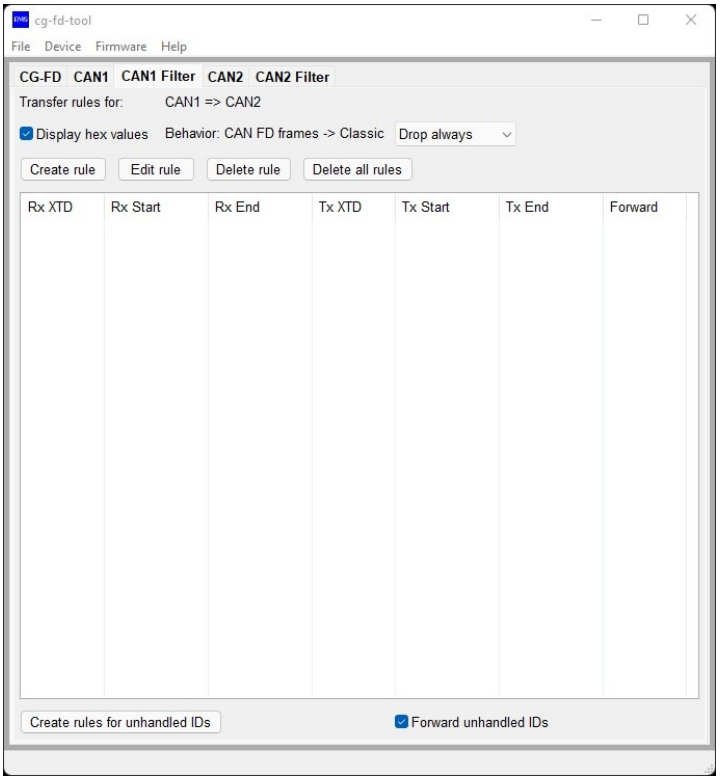
Behavior when no filter rules are set

If no filter rule is set, *all received messages are forwarded unchanged.*

However, if the receiving channel is configured for CAN FD and sending channel as Classic CAN received CAN FD messages will be handled according to related setting. Default behavior is "Drop always", which means all CAN FD frames are dropped (see 2.3.7).

Behavior when individual filter rules are set

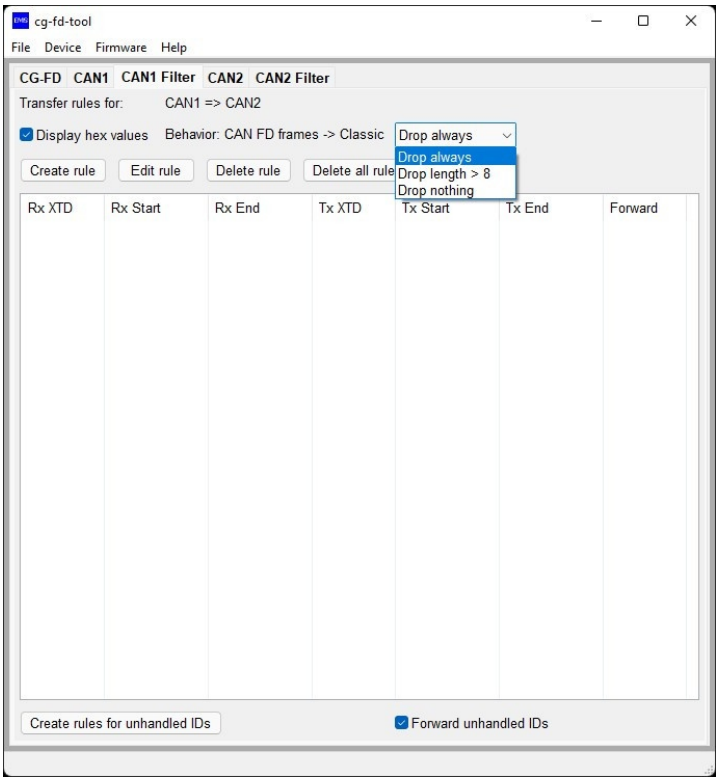
If a filter rule is set, the default behavior (all received messages are forwarded unchanged) is replaced for the message frame format (std or ext) of the set rule. The adjusted behavior is *all messages with no forward filter are dropped*. Filter rules must be created for all required IDs. Automatic creation of filter rules is possible by using the “Create rules for unhandled IDs” button (see 2.3.8).



The tabs "CAN1 Filter" and "CAN2 Filter" contain the possibility to create, edit and delete filter rules

- Create rule
  Open the "Create new rule" dialog
- Edit rule
  Open the "Edit rule" dialog
- Delete rule
  Delete the selected rule
- Delete all rules
  Delete all rules to start again with initial configuration

2.3.7 CAN Filter - CAN FD messages to Classic CAN channel



Behavior CAN FD messages to Classic CAN channel

In the case the receiving channel is configured as CAN FD, but the sending channel as Classic CAN, three options are available to handle this situation via drop down menu.

- Drop always

  All received CAN FD messages are dropped

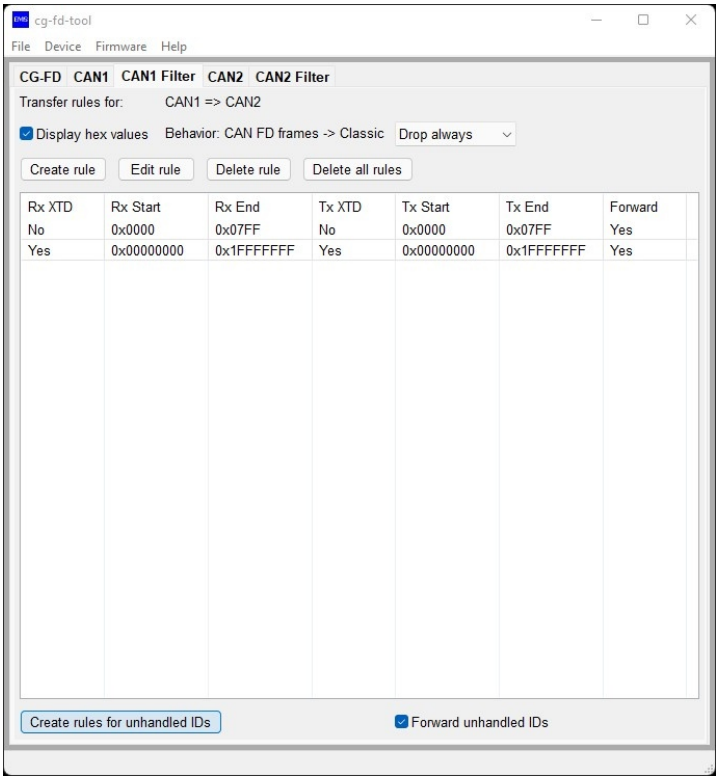
- Drop length > 8

  Received CAN FD messages are forwarded, if their length is not bigger than 8

- Drop nothing

  All received CAN FD messages are forwarded, but truncated to length 8, if their length is bigger than 8

2.3.8 CAN Filter - unhandled IDs



Automatically create rules for unhandled IDs

The “Create rules for unhandled IDs” button can be used to automatically create and display rules for all unhandled IDs, depending on the “Forward unhandled IDs” checkbox. All unhandled IDs can be forwarded or discarded. If the forwarding of the unhandled IDs has to be changed, the explicit filter rules have to be deleted first.

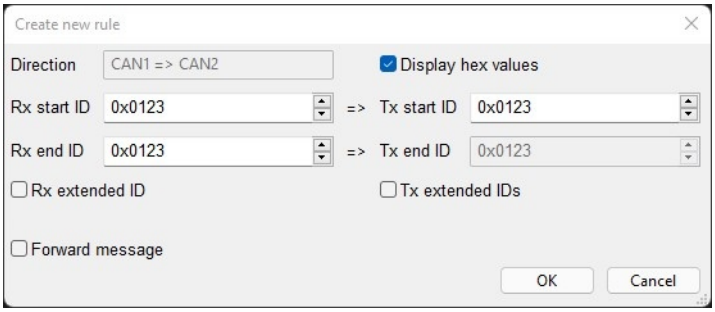
- Forward unhandled IDs

  Depending on this checkbox, filter rules for forwarding or discarding are created via the button "Create rules for unhandled IDs"

- Create rules for unhandled IDs

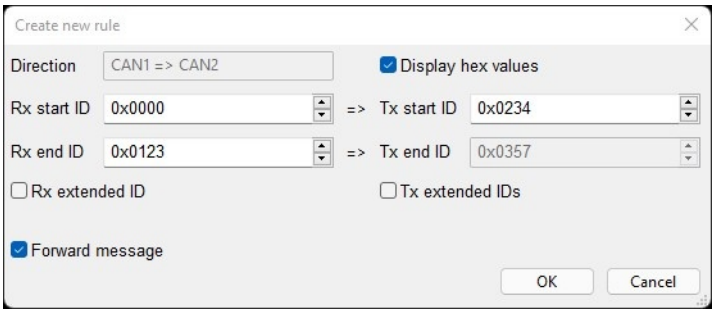
  With the click, filter rules are created for all unhandled IDs in order to forward or discard the unhandled IDs

2.3.9 CAN Filter - do not forward an ID



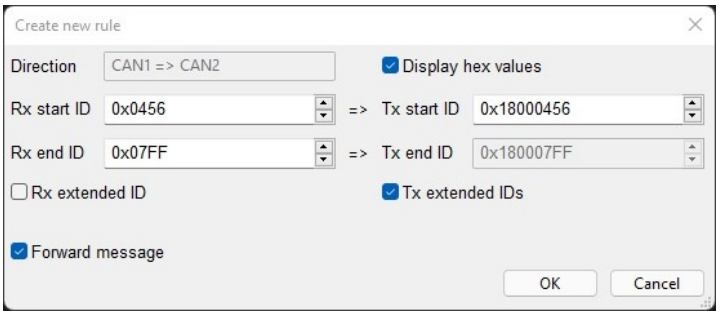
To create a rule, that will not forward a specific ID (in this case ID 0x0123) the "Forward message" checkbox must be unchecked, when the rule is confirmed.

2.3.10 CAN Filter - create new mapping rule



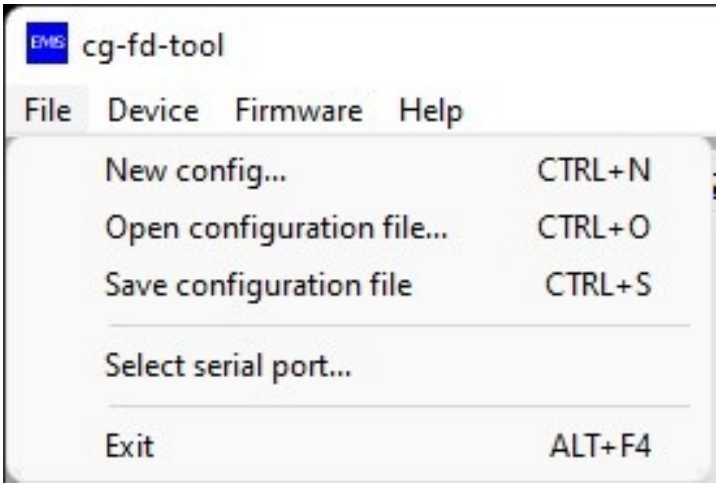
To create a conversion rule, that will forward a range of identifiers, several entries are necassary.

1. Set Rx start and end ID of the range, which should be converted (in this case start ID 0x0000 and end ID 0x0123)
2. Set Tx start ID (the first ID of the new range, in this case 0x0234). The Tx end ID is calculated automatically.
3. Activate checkbox "Forward message" before confirming the rule



It is also possible to convert a standard ID or a range of standard IDs into extended IDs. In addition to the entries of page 7, it is necessary to activate "Tx extended IDs".

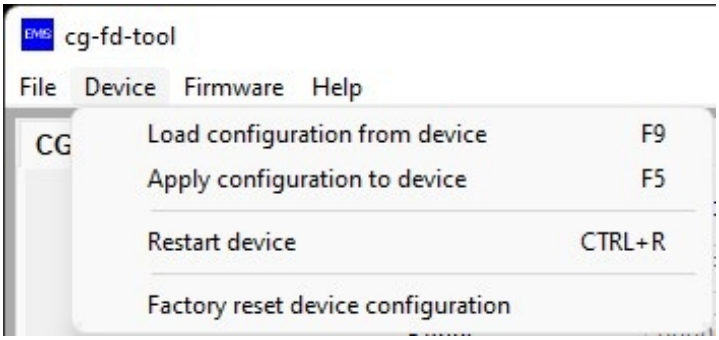
2.3.11 Menu File



The menu item "File" contains options for saving the configuration and selecting the serial port

- New config...
  Create a new configuration
- Open configuration file...
  Open a local configuration file to edit it or apply it to device
- Save configuration file
  Save the current settings and rules in a json file on hard disk
- Select serial port...
  Select the serial port, which is connected to the EMS gateway
- Exit
  Close the window

2.3.12 Menu Device



The menu item "Device" contains options to generally manipulate the configuration

- Load configuration from device
  The configuration of the device is loaded into the program
- Apply configuration to device
  The configuration is written into the device
- Restart device
  The device will reboot
- Factory reset device configuration
  The device is reset to the factory default configuration

2.4 LED

The device status is displayed by a LED.

CAN1	Active	yellow	ON indicates CAN bus activity
	Bus Off	red	ON indicates bus off condition
CAN2	Active	yellow	ON indicates CAN bus activity
	BusOff	red	ON indicates bus off condition
Power		green	ON indicates that device has successful booted

3 Technical Data

3.1 Pin Assignment CAN connectors

High speed CAN

Pin Number	Signal	Description
2	CAN_L	CAN bus line, dominant low
3	CAN_GND	CAN ground line
7	CAN_H	CAN bus line, dominant high
9	VCC	Power supply
1,4,5,6,8	-	Not connected

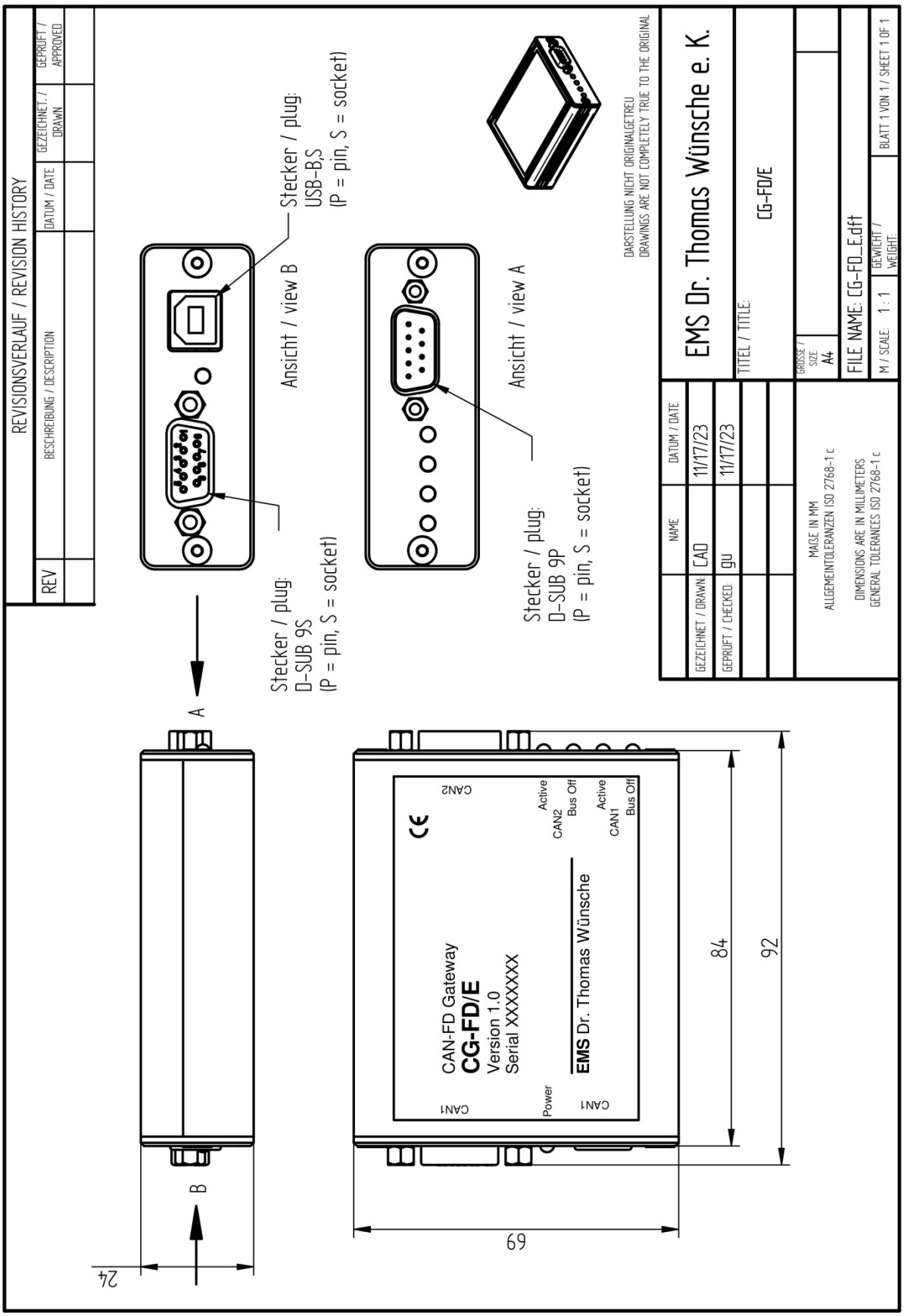
3.2 Limiting Values

Parameter	Minimal	Maximal	Unit
Storage temperature	-40	+85	°C
Operating temperature	-40	+85	°C
Supply voltage	-40	+35	V
Supply voltage via CAN connectors	-40	+30	V
Admissible power consumption (at 60 °C)	-	2000	mW

3.3 Nominal Values

Parameter	Minimal	Typical	Maximal	Unit
Current consumption (running idle)	-	20	-	mA
Current consumption (250 kBit/s, 100 % busload)	-	35	-	mA
Supply voltage	9	24	30	V
CAN baud rates	10	-	4000	kBit/s

3.4 Dimensions



4 Appendix

4.1 Instruction for Disposal

Electronic Equipment Act (WEEE)

EMS is selling its products exclusively to commercial customers. This is the reason why all devices are designed for commercial use and have to be disposed appropriately. In accordance to § 10 para. 2 clause 3 Electronic Equipment Act (WEEE) the disposal of EMS products is regulated the following way.

The equipment must not be disposed at the public collection points. In accordance with the applicable law the disposal has to be done by the customer for own account. The same applies to products, which have been sold to third parties, if those parties do not take care of a disposal in accordance to the applicable law. As an alternative the products can be returned to EMS free of charge.

4.2 CE Conformity

Declaration of Conformity

CE

The manufacturer

EMS Dr. Thomas Wünsche e.K.
Sonnenhang 3
DE - 85304 Ilmmünster

hereby declares, that the following products:

Name	Article Number
CG-FD/E	12-20-428-xx

meet the requirements of the following standards:

Electromagnetic Immunity

DIN EN 55032:2022-08 VDE 0878-32:2022-08 – Electromagnetic compatibility of multimedia equipment – Immunity requirements (CISPR 32:2015 + COR1:2016 + A1:2019); German version EN 55032:2015 + AC:2016 + A11:2020 + A1:2020

Electromagnetic Emission

DIN EN 55035/A11:2022-06 VDE 0878-35/A11:2022-06 – Electromagnetic compatibility of multimedia equipment – Emission Requirements; German version EN 55035:2017/A11:2020

and therefore conform with the EU requirements on:

Electromagnetic compatibility (2014/30/EU)

In accordance with the above mentioned EU directives, the EC declarations of conformity and the associated documentation are held at the disposal of the competent authorities.

RoHS 3 EEE

The RoHS 3 (EU 2015/863) commits manufacturers of „Electrical and Electronic Equipment" (EEE) to secure compliance with the RoHS Directive before placing a CE mark.

Based on technical documentation and to the best of our knowledge, we hereby confirm that the above mentioned products do not contain any of the restricted substances according to Article 4 of the RoHS Directive in excess of the maximum concentration values tolerated by weight in any of their homogeneous materials.

Ilmmünster, 21.05.24

Dr. Thomas Wünsche

EMS Thomas Wünsche