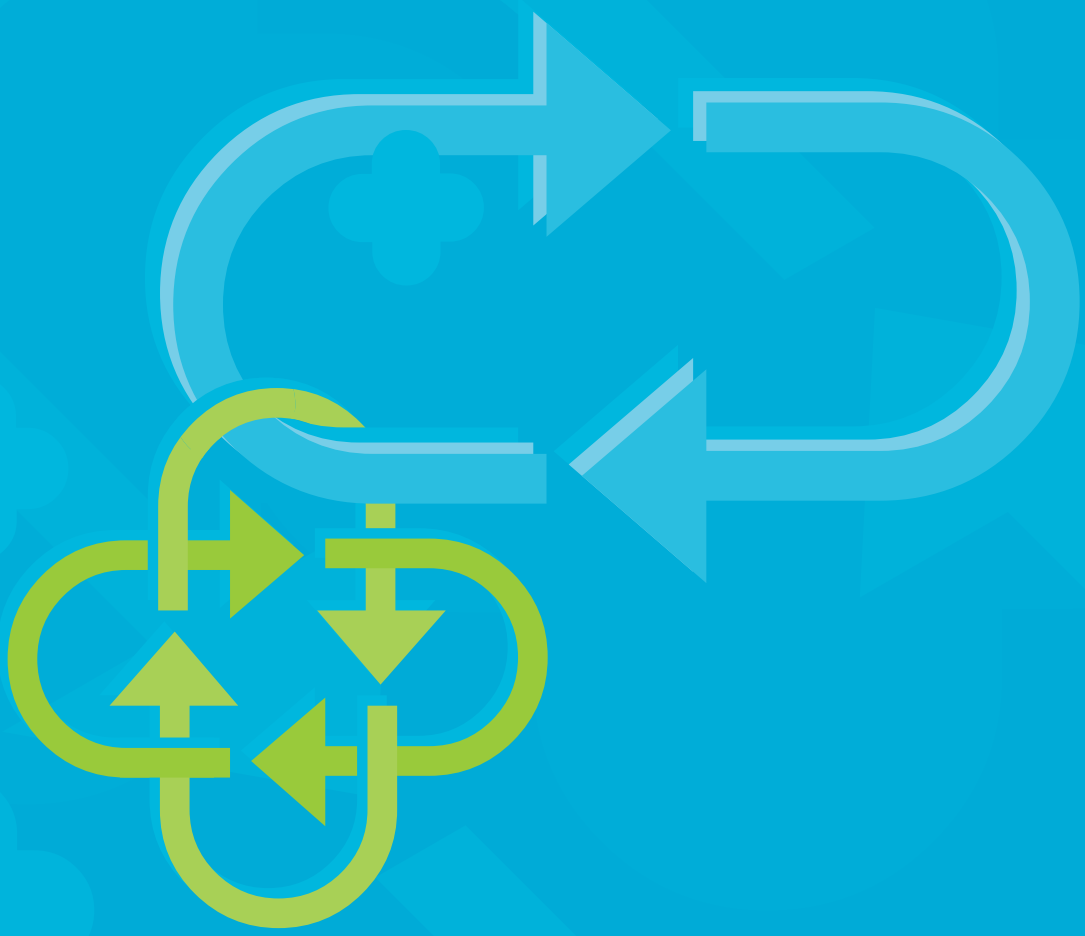
torrox



Torrox Bootloader Datasheet
for C2000 Family Microcontrollers

Torrox GmbH & Co. KG
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1.0 Datasheet

1.1 Description

The Torrox bootloader allows for the easy, fast, and reliable update and installation of new firmware for C2000 family microcontrollers over the CAN bus or over UART/SCI.

After a reset, instead of the firmware, the bootloader runs briefly and checks for an installed firmware. The firmware will only be started if this check finds valid and uncorrupted application firmware.

This boot order and checksum test guarantees that the bootloader can install new firmware even when the old firmware was faulty or corrupted, and that the bootloader will only start firmware that proved to be installed correctly.

For a configurable amount of time after the bootloader has been started, it accepts commands over the CAN bus or UART/SCI to start the installation of new firmware. This way, there is no need to trigger any external signals during the boot process. The only interface that the firmware needs to implement, in order to start the bootloader, is the ability to reset the device.

To update the firmware, the device is reset to start the bootloader, and the new firmware is transferred over the CAN bus or over UART/SCI.

1.1.1 Configuration Parameters

The bootloader will be configured specifically to your needs at build time. You provide us with the parameters (baud rate, pins, etc.) and options that you need for your project, and we will send you the bootloader binary and corresponding documentation.

We understand that a project might undergo some changes during its lifetime, so we provide you with the option to change your parameters 5 times within 2 years.

If you have obtained a source code license, you are free to change your parameters as often as you need to, since you will be able to configure and build the bootloader binary on your own.

1.1.2 Supported Devices

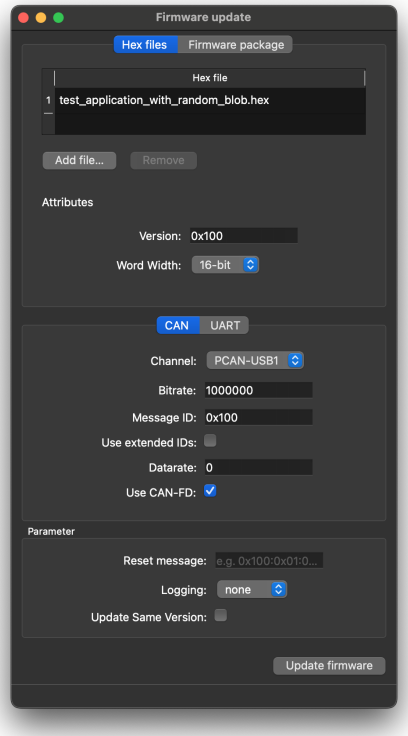
Currently the bootloader supports all devices of the TMS320F2806x, TMS320F28002x, TMS320F28003x, TMS320F28004x, TMS320F280015x, TMS320F2837xS, TMS320F2837xD, TMS320F28P55x, and TMS320F28P65x series. If you cannot find your particular device in this overview, please feel free to contact us. We are also planning to add support for other devices. If necessary, we can provide feedback as to whether and by when we will do this for your requested device.

1.1.3 Command-Line Client

A command line client to upload new firmware for Windows, Linux and MacOS is shipped with the bootloader. The client runs on a desktop PC and uses, either a PEAK or CANdo USB to CAN bus adapter. If the bootloader is configured to receive firmware updates over UART/SCI, any adapter that is supported by your operating system, will do.

1.1.4 Graphical User Interface

Besides the command-line client, there is an optional client with a graphical user interface (GUI). For some users, graphical user interfaces are more accessible than command-line interfaces, as the learning curve is usually less steep.



1.1.5 Protocol

The protocol is implemented by a library (written in C99) that is available to interested customers. The protocol requires 4 consecutive, configurable message IDs on the CAN bus and was designed with robustness, reliability, and upload speed in mind.

1.1.6 Client Library

The command line client uses a library that implements the protocol to update the firmware. This client library is written in C99 and factors out the access to hardware like CAN bus and timers. Customers can use this library to implement their own clients or to integrate the firmware update into their own systems.

The source code of this library is available to interested customers and is free of charge.

1.1.7 Application API

A small, header-only library provides useful functions to the application to retrieve meta information, like firmware version or version of the bootloader.

1.1.8 Deliveries

The bootloader is delivered as a hex file, ready to be deployed on your platform. The bootloader is accompanied with:

- documentation describing how to use the bootloader and how to set your design parameters
- a set of example linker scripts (cmd file), that shows you how to adjust your linker script to allow your application to be installed by the bootloader
- command line client to upload / install new firmware
- graphical user interface to upload / install new firmware (optional)
- a tool to merge the bootloader with your application to a single hex file, suitable for the production process
- a bootloader update firmware, that can be used to install the new version of the bootloader by an older version of the bootloader
- test firmware, that can be used to test your bootloader
- SBOM for bootloader and test firmware

The Cryptography Package includes an additional tool to generate encrypted firmware updates.

1.1.9 Required Resources

Most of the bootloaders fit into 16K bytes of flash memory (depending on your configuration and selected options). The remaining flash memory can be used by the firmware with the exception of the last 16 bytes of the last sector, which is used by the bootloader to store some required bookkeeping along with the application. Some versions of the bootloader also require 32 bit of RAM.

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1.2 Available Packages and Options

1.2.1 DUAL CPU Option

The DUAL CPU Option is required, when a second C28 CPU has to be updated (TMS320F2837xD for example). The option ships with a second bootloader, which has to be installed on the second CPU and allows the flash memory of both CPUs to be updated.

1.2.2 Cryptography Package

The Cryptography Package allows to keep your firmware secret (IP protection) by providing encrypted firmware update packages. These packages can be passed to untrusted third parties without exposing the firmware, while still enabling those parties to perform updates of the installed firmware. By additionally signing the firmware and metadata, the bootloader guarantees that only firmware signed by an authorized party (you) will be installed and run (system integrity; secure boot).

The Cryptography Package ships with a tool to create encrypted firmware update packages and extra documentation.

1.2.3 Reduced Application Flash Option

This option allows you to reduce the amount of flash memory available for application firmware. The remaining flash area can then be used for configuration data, which will not be deleted with a firmware update.

1.2.4 Activity Output Option

This option can be used to set a GPIO pin to a dedicated level. It can be useful if, for example, a CAN bus driver needs to be activated.

1.2.5 Blinking Option

If visual feedback is required, this option can be used to toggle a GPIO pin, with a configured frequency.

1.2.6 Instance by GPIO Option

This allows the CAN bus message IDs to ve derived from a set of GPIO pins. This can be used, for example, to have multiple devices with bootloaders on the very same CAN bus.

1.2.7 Source Code Option

If you need the source code of the bootloader, you can obtain the Source Code option. Keep in mind that you do not need the source code of the bootloader to implement your own client. In order to implement your own client, we recommend that you base that client on the Client Library that you will receive from us.

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1.3 Order, License and Prices

To order a bootloader, simply email us at Info@Torrox.de. Name the device to be supported, the required parameters for your bootloader, abd the license you want to buy.

1.3.1 Single Project License

A single project is either a product that you offer to the market, or a hardware component that you use unchanged internally to build other components or products.

By obtaining a Single Project license, you are allowed to install the bootloader on all C2000 microcontrollers of that project. Different variations of the project are also covered by this license (for example, if you have to change the layout of a PCB and thus have to change the pins for the CAN bus). There are no limitations to the number of installations of the bootloader, and no additional fees per installation.

This license should be your first choice. You can later upgrade your Single Project license to a Company license.

1.3.2 Company License

By obtaining a Company license, you get the right to install the bootloader on as many products, built by your company as you like to.

There are no limitations to the number of installations of the bootloader and no additional fees per installation.

If you already have a Single Project license, you can easily upgrade to a Company license by simply paying the price difference between the two.

1.3.3 Prices

Our current price list can be found here: https://www.torrox.de/prices/

2.0 Legal

2.1 Disclaimer

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