CAN Driver for Linux - Release Notes

Overview of CAN Driver for Linux

These are the release notes for the CAN driver core with the code name *esdcan*. This driver core is the base of the 3.x drivers and is also used for the 4.x drivers with CAN-FD support.

Supported CAN Hardware

Several of our CAN interface devices are similar in their internal structure and therefore constitute a CAN interface device family. For each interface device family there is a different variant of the *esdcan* driver that supports a whole interface device family and is addressed by its **Driver Family Name**. The following table gives an overview on how many and which different CAN interfaces are supported by a single CAN family device driver. The **Module Name** *card-id* is typically derived from the name of the first member of the interface device family.

The table below shows the interface device families that are fully supported.

Driver Family Name	Module Name card-id*	Supported CAN hardware	Release date	Release version
AMC4	amc4	AMC-CAN4	2022-06-06	4.1.4
C200	pci200	CAN-PCI/200 CAN-PCI/266 CPCI-CAN/200 CAN-PCIe/200 CAN-PCI104/200 PMC-CAN/266	2022-06-06	4.1.4
C331	pci331	CAN-PCI/331 CPCI-CAN/331 PMC-CAN/331 PMC-CAN/331-3.3	2022-06-06	4.1.4
C400	esdaccbm	CAN-PCI/400 CPCI-CAN/400 CAN-PCIe/400 PMC-CAN/400	2022-06-06	4.1.4
C402	pcie402	CAN-PCI/402(-2-FD) CAN-PCIe/402(-FD) CAN-PCIeMini/402-2(-FD) CPCI-CAN/402-4(-FD) CPCIserial-CAN/402-2(-FD) CPCIserial-CAN/402-4-FD PMC-CAN/402-4-FD XMC-CAN/402-4-FD	2022-06-06	4.1.4
C405	pci405	CAN-PCI/405 CAN-PCI/405-B4	2022-06-06	4.1.4
CNULL	null	Virtual CAN Interface	2022-06-06	4.1.4
CNULLFD	null_fd	Virtual CAN-FD interface	2022-06-06	4.1.4

The next table lists legacy interface board families for which the *esdcan* driver is provided as an engineering release and not fully qualified.

Driver Family Name	Module Name *card-id*	Supported CAN hardware	Latest release date	Latest release version
C200i	isa200	CAN-ISA/200 CAN-PC104/200 (SJA1000 Option)	2022-06-06	4.1.4
C331i	isa331	CAN-ISA/331 CAN-PC104/331	2022-06-06	4.1.4
C360	pci360	CAN-PCI/360 CPCI-CAN/360	2022-06-06	4.1.4

Supported Linux Kernel Versions

The current *esdcan* driver source code supports both the 2.4.x **Linux Kernel architecture API** and the 2.6.x **Linux Kernel architecture API** of Linux kernels. The 2.6.x **Linux Kernel architecture API** family contains the 2.6.x, the 3.x, the 4.x and the 5.x versions of Linux kernels.

The currently released driver supports Linux kernel versions 3.x, 4.x and 5.x if they were built with a GCC of version 4.8 and later. Inspect */proc/version* of your running Linux kernel to get the GCC version used to build your kernel. If you're interested in the reasons for that read on.

The driver archive contains a pre-built part (various *.o_shipped binaries) and a source code part that is built at the customer's site (by yourself). Therefore the **ABI** of the pre-built parts must match the **ABI** of the parts built at the customer's site which depends also on the GCC compiler used to build the kernel of the customer.

A hard break in the Linux kernel ABI (for x86) was introduced by GCC version 4.8 and following when the stack alignment for the x86 architecture was reduced from 16 bytes to 8 bytes (*-mpreferred-stack-boundary=3*).

During the Linux kernel development some enhanced features were introduced into the Linux kernel that depend on the compiler version used to compile the Linux kernel. Therefore we build the driver release currently with GCC 8.x which also automatically uses *-mpreferred-stack-boundary=3*.

New kernel features supported by using a recent GCC compiler for building the driver kernel module:

- Retpoline Support
  The Retpoline support provides a mitigation strategy for the Spectre type x86 security problems.
- Stackprotector Support
  Using GCC 8 for building the pre-built parts of the *esdcan* driver enables stack protector support using *-fstack-protector-strong*.

If you need an *esdcan* driver for older kernels that have been built with a GCC version less than 4.8 then please contact us via *support@esd.eu*.

The *esdcan* driver release archive still can be built for 2.4.x kernels (as of March 2017) but this is only done on explicit customer request.

Support of CAN-FD by different Driver Versions

The CAN-FD frames have a data payload of up to 64 bytes. To transfer the bigger CAN-FD frames the **NTCAN API** had to be changed. The solution was to introduce a new structure *CMSG_X* and new functions that can handle the *CMSG_X* structures:

- canSendX()
- canTakeX()
- canWriteX()
- canReadX()
- canGetOverlappedResultX()

To handle the additional data bitrate also new functions to control the bitrate together with the *NTCAN_BAUDRATE_X* structure have been implemented:

- canSetBaudrateX()
- canGetBaudrateX()

Any *esdcan* driver release with with a version number ≥ 4.0.0 supports the new **NTCAN API** that can be used to transfer CAN-FD frames. The new **NTCAN API** is implemented in **NTCAN** library versions ≥ 4.2.0.

Also *esdcan* drivers for CAN interface cards that are not CAN-FD capable will be migrated to the new API to enable software tools to operate always with *CMSG_X* internally, even when they talk to non CAN-FD interfaces. Any software that doesn't need to handle CAN-FD frames can still keep using the legacy interface with *CMSG* or *CMSG_T* structures to transfer Classic-CAN frames.

Delivery Format of the Driver Archive

Current releases of the driver are delivered per CAN driver family as gzipped Tar archive (*.tgz). For kernels 2.6.x, 3.x, 4.x and 5.x the archive name is constructed from the following components

1. *card-id*: module name, e.g.: "pci200"
2. *arch*: host-architecture: "x86", "x86_64" or "aarch64"
3. *ver*: driver version, e.g.: "3.7.2"
4. *-opt*: optional information regarding special releases. For example "-gcc-4.6" means the driver release has been built with GCC 4.6.

using this pattern: esdcan-<*card-id*>-linux-<*arch*>-<*ver*><*-opt*>.tgz

A valid example would be: esdcan-pci405-linux-x86_64-3.10.1.tgz

Installation

For detailed installation instructions refer to the "CAN-API, Part 2, Installation Manual". Up to date installation information can also be found in the README.rst file contained in the driver release archive.

Hint

The **NTCAN** library supplied in the driver archive was built **without** the plug-in interface in old releases. Since version 4.2.9 of the library the default delivery now includes a NTCAN library which is built **with** plug-in interface.

You only need a **NTCAN** library with plug-in interface activated if you want to use the *EtherCAN* driver plug-in or the *SocketCAN* wrapper library.

Revision History

Listed below are the improvements, changes and fixes between different releases of the *esdcan* driver in reverse chronological order. Changes which are considered to be very important are highlighted.

If you're looking for changes pertaining a certain driver family (e.g.: **C200** or **AMC4**) you may search for the **Driver Family Name** in this document to see when a release for this driver family was done and which changes are included.

Driver release 4.1.4 for x86 and x86_64

*Release date: 2022-06-06

The Linux *esdcan* drivers for the following driver families are included in this release: **AMC4**, **AMC825**, **C200**, **C331**, **C400**, **C402**, **C405**, **CNULL**, **CNULLFD**

New Features

- **AMC4**, **AMC825**, **C200**, **C200i**, **C331**, **C331i**, **C360**, **C400**, **C402**, **C405**, **CNULL**, **CNULLFD**
  - If a NTCAN handle is used in mode NTCAN_MODE_OBJECT then the CMSG*::msg_lost member is now used as an unsigned 8-bit wrapping RX messages counter. This enables the application to determine how many messages have been received for this CAN identifier since its last canTake() call as long as this amount is smaller than 255.
- **C402**
  - Add the support for LIN interface channels to the driver for the C402 boards. To fully utilize the LIN interfaces you need to install the *libntlin* which is used on top of the *libntcan* library to provide the concise NTLIN interface API.
  - Allow in CAN-FD mode to select an arbitration / data bitrate combination of 1MBit / 1MBit.
  - Added TDC Filter feature
    The TDC Filter value is the minimum TDC value that is used by a CAN controller to determine the SSP. It is used in case of the automatic measurement of the TDC value being invalid, i. e. less than the TDC filter value.
- **AMC4**, **AMC825**, **C400**, **C402**
  - Added DAR support
    The support for Disable Automatic Retransmission (also known as single shot mode) was implemented. The ESDACC can be configured to operate in DAR mode for all transmissions globally or you can add the NTCAN_DAR flag to a CMSG* to mark a single frame to be transmitted in single shot mode.
  - The transmit pause feature was added. Support for this feature can be checked by examining the NTCAN_FEATURE_TX_PAUSE feature flag.
  - Internal reorganisation to support boards with mixed CAN / LIN interfaces.

Fixed Bugs

- **AMC4**, **C200**, **C200i**, **C331**, **C331i**, **C360**, **C400**, **C402**, **C405**, **CNULL**, **CNULLFD**
  - Fixed a bug that could crash the system if a NTCAN handle is used in mode NTCAN_MODE_OBJECT. It is triggered if you call canTake() with a *len* parameter that exceeds the *rxqueuesize* of the NTCAN handle which was specified with canOpen().
    To work around this bug use a sufficiently large *rxqueuesize* during canOpen() that exceeds the maximum *len* parameter you plan to use with canTake().
  - Fixed build failure due to missing *config/modversions.h* for Linux kernel versions 5.6.0 and later.

    - Fixed build failure for non PCI interfaces for Linux kernel versions 5.6.0 and later due to ioremap() / ioremap_nocache() API changes.
- **C200**, **C200i**, **C331**, **C331i**, **C360**, **C405**, **CNULL**, **CNULLFD**
    - Since Linux version 4.8.0 the kernel timer implementation changed in a way that the timeouts didn't always have the jiffie resolution and may be rounded up to a bigger timeout value. The driver now uses the kernel timers in a way that timeouts again will have jiffie resolution (CONFIG_HZ resolution).

Component Updates

- **C402**
  Integrated **ESDACC** version 0.72 (00.48 hex). See changes below:
    - Implemented the support for LIN interfaces that are enabled if a LIN Addon board is connected instead of a CAN Addon board.
    - Fix TDC configuration in TDC automatic mode
      The TDC SSPS in TDC automatic mode is documented as signed entity to be able to move the SSP backward and forward from the default SSP. But the **ESDACC** interpreted this SSPS even in automatic mode to be an unsigned entity. This behaves now as documented.
    - Added TDC Filter feature
      The TDC Filter value is the minimum TDC value that is used by a CAN controller to determine the SSP. It is used in case of the automatic measurement of the TDC value being invalid, i. e. less than the TDC filter value.
    - Changed BRP width to 9 bit
      Increased internally the Bit Rate Prescaler width from 8 to 9 bits to make the support for low bit rates on CAN-FD capable boards straightforward in the driver.
    - Also the changes for the **ESDACC** mentioned below for the boards **AMC4**, **AMC825** and **C400** apply.
- **AMC4**, **AMC825**, **C400**

  Integrated **ESDACC** version 0.72 (00.48 hex). See changes below:
    - Fixed issue with transmit frame timeout (Mantis #3776)
      The transmit frame timeout is controlled with the canIoctl(NTCAN_IOCTL_SET_TX_TS_TIMEOUT, ...). If a frame was delivered to the CAN interface with the sum of the planned TX time plus the transmit frame timeout being in the past then the frame was NOT sent which was working as intended. But thereafter the TX state machine did get stuck and not further transmission was possible on this interface.
    - Fixed RTR reply (Mantis #3980)
      Fixed an indeterminism that could happen when an **ESDACC** controller and another CAN controller send a RTR frame and a data frame for the same ID at the same time (bit synchronous). When the CAN controller sending the RTR frame loses arbitration an indeterminism could occur.
    - Added DAR support (Mantis #2628)
      The support for Disable Automatic Retransmission (also known as single shot mode) was implemented. The ESDACC can be configured to operate in DAR mode for all transmissions globally or you can add the NTCAN_DAR flag to a CMSG* to mark a single frame to be transmitted in single shot mode.
    - Added the Transmit Pause feature

- **NTLIN libary**
    - This library is needed on top of the **NTCAN** library to support the **NTLIN** API. The current release version is 1.1.0.
- **NTCAN libary**

- For changes in the **NTCAN** API see section on the **NTCAN** library update 4.2.9 below.

Known Bugs

- **AMC4**, **AMC825**, **C400**

  The integrated **ESDACC** version 0.72 (00.48 hex) does support the Transmit Pause feature but the feature flag for "TX Pause" is **NOT** set.

NTCAN Library Update 4.2.9

Release date: 2022-06-06

This is the main update to provide support for LIN interfaces on the library level. See the changes for *ntcan.h* since r16708 and the library since revision 4.2.2 below.

Also the default delivery contents changed to include a **NTCAN** library which is build to include the plug-in interface.

New Features

- Added TDC Filter feature
  The TDC filter value can now be set via the NTCAN API and the structure NTCAN_TDC_CFG for CAN controllers supporting the TDC Filter feature (4.2.9). The TDC Filter value is the minimum TDC value that is used by a CAN controller to determine the SSP. It is used in case of the automatic measurement of the TDC value being invalid, i. e. less than the TDC filter value.
- Added defines to support DAR mode to *ntcan.h*: NTCAN_BAUDRATE_FLAG_DAR, NTCAN_FEATURE_DAR, NTCAN_FEATURE_DAR_FRAME
- Added evaluation of error counters for NTCAN_EV_CAN_ERROR

  The function canFormatEvent() ignored the error counters embedded in the event NTCAN_EV_CAN_ERROR till now. If any of the counters are set now an appropriate error string is appended to the CAN bus status string (4.2.8).
- The library now reads plug-in configuration from multiple files

  Implement the new feature of the *libntcan* library that it will be reading its plug-in configuration from multiple *.conf files from the */etc/esd-plugin.d/* directory (4.2.7). Formerly the configuration (for multiple plugins) had to be merged into the file /etc/esd-plugin. As a fall-back this file is still read if the */etc/esd-plugin.d/* directory(!) is NOT present!
- Bring NTCAN_MAX_[RT]X_QUEUESIZE of *ntcan.h* for Linux in sync with driver which has always supported 0x4000 for both defines (4.2.6).
- Added the following defines for a new CAN controller type and a CAN transceiver type to *ntcan.h* (4.2.5): NTCAN_CANCTL_CAST, NTCAN_TRX_SN65HVD230
- Added these defines needed to support LIN interfaces to *ntcan.h*: NTCAN_MODE_LIN, NTCAN_CANCTL_ESDLIN, NTCAN_NO_CAN_CAPABILITY, NTCAN_NO_LIN_CAPABILITY, NTCAN_FEATURE_LIN, NTCAN_IOCTL_LIN_MASTER_SEL
- Changed the API and the macros to assemble and dissect the TDC configuration parameter which can be read and written using NTCAN_IOCTL_GET_FD_TDC and NTCAN_IOCTL_SET_FD_TDC (deprecated). But now TDC settings should be set with canSetBaudrateX(). Please refer to the NTCAN API manual to understand how it should be done now.

- Added NTCAN_BAUDRATE_FLAG_TXP definition for the NTCAN_BAUDRATE_X *flags* parameter to configure a small pause between two TX frames (4.2.5). This is only supported on **ESACC** based boards. The application can test this by evaluating the NTCAN_FEATURE_TX_PAUSE feature flag.
- For reasons of code orthogonality added support for NTCAN_IOCTL_TX_OBJ_DESTROY_X (since 4.2.5). But it only works since version 4.2.6+ (see below for bug fix).
- For reasons of code orthogonality added support for NTCAN_IOCTL_GET_NATIVE_HANDLE which is not needed under Linux but returns simply the Linux NTCAN handle as is which is already the *native* handle (4.2.5).
- NTCAN_IOCTL_GET_TX_MSG_COUNT is still supported with the original value from *ntcanext.h* which is an *esd electronics* internal header only.
- Added support for NTCAN_IOCTL_GET_HW_TIMESTAMP, NTCAN_IOCTL_GET_HW_TIMESTAMP_EX (since 4.2.4).
- Added missing NTCAN_IOCTL_GET_TX_MSG_COUNT support (4.2.3).

Fixed Bugs

- Fixed in version 4.2.6+ the NTCAN_IOCTL_TX_OBJ_DESTROY_X.

Component updates

- Since version 4.2.0 the **NTCAN** library uses a common *ntcan.h* header that is shared between the implementations for Windows, Linux, QNX and VxWorks. Please use this common header now for your projects.

Driver release 4.1.1 for x86 and x86_64

*Release date: 2020-07-20

The Linux *esdcan* drivers for the following driver families are included in this release: **AMC4**, **C200**, **C331**, **C400**, **C402**, **C405**, **CNULL**

The drivers for the following driver families are only provided as an engineering release and not fully qualified: **C200i**, **C331i**, **C360**

This is a full range of Linux driver and library releases to switch all drivers to the new CAN-FD capable API and to provide operating compatibility with recent Linux kernel versions.

The version of the NTCAN library delivered with this driver release is 4.2.4.

The version 4.1 of the *esdcan* driver marks a big change in the way the driver is built. The new build environment builds the driver core against a longterm kernel obtained from *kernel.org*. It uses kernel version 4.19.124. The GCC version used is gcc-8. This automatically changes the compilation with regard to the following properties:

- Stack boundary:
  Compilation uses a smaller stack boundary of 8 bytes instead of 16 bytes by utilizing *-mpreferred-stack-boundary=3*.
- Retpoline support:
  Under x86 this enables mitigation stuff for indirect branch security breaches (Spectre). It uses the compiler options *-mindirect-branch=thunk-extern* and *-mindirect-branch-register*. This creates a dependency on the user's kernel because it must provide the `__x86_indirect_thunk_*` entries needed. That means that your kernel needs to be compiled with *retpoline* support.

- Stack protector support:
  Compilation enables the stack protector with *-fstack-protector-strong*. This creates a dependency on the user's kernel because it must provide the *__stack_chk_fail()* function. This requirement is mitigated by an extension to the OSIF layer that provides that function if the used kernel doesn't do that.

New Features

- **AMC4**, **C200**, **C200i**, **C331**, **C331i**, **C360**, **C400**, **C402**, **C405**, **CNULL**
  - Provide operating compatibility with recent Linux kernel versions that are built with a GCC version of 4.8 and later.
  - For the x86 and x86_64 architecture support the *retpoline* mitigation strategy for the Spectre type security vulnerabilities of Intel and AMD CPUs is applied.
  - Stack checking is enabled in the *esdcan* driver module.
  - All drivers now support the new CAN-FD capable API with *CMSG_X* CAN message structures.
  - Supports the new I/O control NTCAN_IOCTL_GET_TX_MSG_COUNT.
  - Supports the new I/O control NTCAN_IOCTL_TX_OBJ_AUTOANSWER_ONCE.
  - RX object mode handle: RX objects do not receive RTRs anymore.
- **CNULL**, **VCAN**

  The driver family name for the virtual CAN driver was renamed from **VCAN** to **CNULL** to represent the family name as it is used in the driver itself. Below this paragraph these release notes still use the family name **VCAN** when the **CNULL** driver family is meant to reflect the former usage.
- **AMC4**

  Enable the use of HW timers triggered by the FPGA on this board like on the other ESDACC boards. This is possible since the HW timers are used on every board separately.
- **C402**

  The driver for the **C402** family now supports the new **LIN interface** add-on boards that are available for some CAN interface cards of the **C402** device family. To use the new LIN interfaces you need to install the *libntlin.so* shared library that provides the **LIN interface API** on top of the *libntcan.so* library.
- **AMC4**, **C400**, **C402**

  Added preliminary support for the NTCAN_IOCTL_GET_HW_TIMESTAMP and NTCAN_IOCTL_GET_HW_TIMESTAMP_EX.

Fixed Bugs

- **AMC4**, **C200**, **C200i**, **C331**, **C331i**, **C360**, **C400**, **C402**, **C405**, **CNULL**
  - Fixed the possibility to enter an endless loop on NTCAN_IOCTL_TX_OBJ_SCHEDULE_STOP when using timestamped TX at same time.
  - Do not insert NTCAN_INTERACTION flag in RX objects when frame was received via interaction because it is the NTCAN_NO_DATA flag in the RX objects.
  - The *msg_lost* member of a CAN message structure was left uninitialized when the message was received from a TX object via interaction.
  - Calling NUC_TX_OBJ_SCHEDULE called with a RTR object and simultaneously using the INC/DEC-Flag was NOT returning NTCAN_INVALID_PARAMETER. It is rejected now because in a RTR frame there is no data to be incremented or decremeted.
- **AMC4**, **C200**, **C200i**, **C331**, **C331i**, **C360**, **C400**, **C405**, **CNULL**

For non-FD capable drivers from release 4.0.0 up to release 4.1.0 the time-stamp of the CMSG_X structure was not set correctly by the *canTakeX()* function. Additionally this could lead to a leak of kernel stack space. None of these drivers was officially released to customers.

- **C200**

  Added missing TX-done time stamp in bus-off error case.

- **AMC4**, **C400**, **C402**
  Fixed non-atomic non-locked access to interrupt enable control register.

- **C402**
  Fixes the wrong setup of the baudrate for slow baudrates with FD-capable FPGA, which has only 8 bits prescaler instead of 9 bits in non-FD FPGA.

Component updates

- **C402**
  All previous releases for the x86_64 architecture provided the FPGA firmware updater *updpcie402* compiled as 32-bit and as 64-bit application. Now the release archive contains a *updpcie402* updater for the Classic-CAN boards and a *updpcie402fd* updater for the CAN-FD boards that even needs to have two different FPGA images compiled in. This increased the memory footprint of the release archive significantly. To limit this increase only the 64-bit builds of the mentioned FPGA firmware update programs are still delivered!

C400 release 4.0.0 for x86 and x86_64

Release date: 2019-04-09

Please note that this driver release originates from the CAN-FD branch (revision 4.x) and contains a NTCAN library release version 4.2.2. Even if it is released from the CAN-FD branch the driver itself doesn't support CAN-FD because the hardware doesn't do this either. But the NTCAN library provides the new API calls needed for CAN-FD support and these API calls can also be used to transfer CAN-Classic frames.

New Features

- **C400**:

  Driver update to include the latest adaptions of the driver's interface to the Linux kernel (OSIF: Operating System InterFace) for compatibility to recent (4.15+) kernels.

Component Updates

- **C400:**
  Integrated **ESDACC** version 0.70 (00.46 hex) in the driver image. For implementation changes of the **ESDACC** FPGA image please refer to the change list of the release for the **C400** boards dated 2018-08-20.

OSIF maintenance release 3.10.3 (C200, C331, C405) for x86 and x86_64

Release date: 2019-02-11

Please note that this driver release originates from the CAN-Classic branch (revision 3.x) and contains a **NTCAN** library release version 4.1.4.

New Features

- **C200, C331, C405**:

  Driver update to include the latest adaptions of the driver's interface to the Linux kernel (OSIF: Operating System InterFace) for compatibility to recent (4.15+) kernels.

- **C200, C331, C405**:
  Serial numbers out of the "numerical encodeable" range will show up now but only in the *serial_string* member of the *NTCAN_INFO* structure. This is needed to tell the user about serial numbers out of the "numerical encodeable" A to P range of lot designations that can't be expressed by the 32-bit value returned via *canIoctl(..., NTCAN_IOCTL_GET_SERIAL, &...)*.
- **C200, C331:**
  Allow triple sampling support to be used.
- **C331:**
  Added capability to read out serial number of the CAN interface board.

AMC4 release 3.10.5 for x86 and x86_64

Release date: 2018-11-08

Please note that this driver release originates from the CAN-Classic branch (revision 3.x) and contains a **NTCAN** library release version 4.1.4.

Fixed Bugs

- **AMC4, C400, C402:**
  Changed the **ESDACC** specific code for the output printed to the system log. Now a whole output line is completely assembled and printed. We don't piece the output for a single line together any more which lead to the fact that the line was cut into many lines in the system log at the kprint() boundaries on newer Linux kernels.

Component Updates

- **AMC4:**
  Integrated **ESDACC** version 0.70 (00.46 hex) in the driver image. For implementation changes of the **ESDACC** FPGA image please refer to the change list of the release for the **C400** boards dated 2018-08-20.

C402 release 4.0.1 for x86 and x86_64 (FPGA Fix only)

Release date: 2018-10-12

This is an update to the *esdcan* driver release for the **C402** family. The driver itself is stays unchanged but the driver release archive now contains new releases of the updc402 and updc402fd tools that carry the FPGA version 0.71.

Fixed Bugs

WARNING: Do **NOT** use the FPGA version 0.70 for the **C402** board family any more. If your board(s) have the FPGA version 0.70 then in any case use the update tools to update your boards to revision 0.71!

Component Updates

- **C402**:

  New **ESDACC** FPGA version 0.71 (00.47 hex). See changes below:

  - Fixed an error that was introduced with FPGA version 0.70. Due to an over-optimization in the PCIe endpoint of the FPGA it could occur with some mainboards that previously sent CAN frames could be sent instead of the intended data!

C402 release 4.0.1 for x86 and x86_64

Release date: 2018-09-10

This is the first release of a CAN-FD capable driver for the **C402** family. All previous drivers could not transfer CAN-FD frames even if they could detect CAN-FD capable hardware boards. This is also the first release of the Linux driver that contains the *updc402fd* FPGA firmware updater to update the FPGA on CAN-FD capable boards.

New Features

- **C402**:
  - The *AUTOBAUD* feature has been enabled again for the CAN-FD capable driver. The *Measured AUTOBAUD* feature is still disabled. The driver is working in table based AUTOBAUD mode at the moment where it probes the baud rates from the table of recommended **CiA** baudrates whether any of them allows frame reception. Please note that this works only in Classic-CAN mode.
  - The bitrate indices 12 (for 12.5kBit) and 13 (for 10kBit) won't tune the bit rate of CAN-FD boards to the selected bit rate. For non CAN-FD boards these settings still operate normal.

Fixed Bugs

- **Common to all Linux implementations**:
  - Added missing support for *NTCAN_IOCTL_TX_OBJ{CREATE|UPDATE}X*.

Component Updates

- Switched internal format of README to *reStructuredText* but still release it without the **.rst* extension.

NTCAN Library Update 4.2.2

Release date: 2018-09-05

This is the main update to provide CAN-FD support on the library level.

New Features

- Added in version 4.2.2 the missing NTCAN_IOCTL_TX_OBJ*{CREATE|UPDATE}*X support.
- Since version 4.2.0 the **NTCAN** library supports the additional functions and declarations to handle CAN-FD frames.

Fixed Bugs

- Fixed in version 4.2.1 the missing TDC support.

Component updates

- Since version 4.2.0 the **NTCAN** library uses a common *ntcan.h* header that is shared between the implementations for Windows, Linux, QNX and VxWorks. Please use this common header now for your projects.

C402 release 3.10.7, C400 release 3.10.5 for x86 and x86_64

Release date: 2018-08-20

For the boards of the **C402** family it is strongly recommended to update the FPGA firmware to the latest version by using *updpcie402* or *updpcie402fd*. The FPGA update for the **AMC4** boards needs an updated HPM file to be programmed via the standard IPMI tools into the **AMC4** boards.

New Features

- **AMC4**, **C400**, **C402**:
  - Added support to count and indicate DMA stall situations supported in the FPGA firmware since 0.70 (00.46 hex).
  - Added support to count IRQs and (spurious) DPCs.
- **C402**:
  - Small change to detect failing accesses in the FPGA memory space earlier in the driver initialization sequence (boardrc_fpga_probe()).

Fixed Bugs

- **AMC4**, **C400**, **C402**:
  - Fixed regression for tools which use DEBUG IOCTLs on ESDACC boards (i. e. the FPGA updater). The driver rejected the DEBUG IOCTLs.
- **C402**:
  - Write host IRQ count back to FPGA also in case of MSI to prevent host being overrun (see Mantis #3163).

Component Updates

- **AMC4**, **C400**, **C402**:

  Integrated **ESDACC** FPGA version 0.70 (00.46 hex). See changes below:

  - Fixed host fifo overrun protection in BM state machine.
  - Added BM info flags (host fifo full) for RX- & TX-done, error and overrun messages.
  - C400, C402: Fixed hanging BM state machine in decoding interrupts.
  - C402: Added additional clear logic for internal avalon buffer FIFOs in reset path
  - Fixed Mantis issue #3163 by blocking the TX state machine, no new TX jobs are started when RX fifo is full, the last entry of RX fifo is reserved for a pending TX job in core.
  - Fixed internal modeReset handling. Changing the bitrate while sending should now bring state machine to idle and not lose TX-done.

C405 release 3.10.2 for x86 and x86_64

Release date: 2018-08-20

New Features

- **C405**:
  - Driver update to include the latest adaptions of the driver's interface to the Linux kernel for compatibility to recent (4.15+) kernels.
  - Allow triple sampling support to be used.

VCAN release 3.10.2 for x86 and x86_64

Release date: 2018-08-20

New Features

- **VCAN**:
  - Driver update to include the latest adaptions of the driver's interface to the Linux kernel for compatibility to recent (4.15+) kernels.

NTCAN Library Update 4.1.4

Release date: 2018-07-26

New Features

- **NTCAN**
  - Since version 4.1.4 the **NTCAN** library supports the "PeerPort" keyword for the EtherCAN plugin.

NTCAN Library Update 4.1.0 up to 4.1.3

Release date: 2018-04-27 till 2018-07-04

The **NTCAN** library is a library that provides the **NTCAN API** to the user level program and translates the **NTCAN API** calls into appropriate kernel calls destined to the *esdcan* driver. The updated library has version numbers of 4.1.x and later.

New Features

- The support for the *candev* driver (driver revisions 2.x) has now been deleted from the **NTCAN** library. Library versions with *candev* driver support have version numbers of 4.0.x and below.
- The **NTCAN** library has been changed to avoid a race condition that could affect the internal handle management with a small likelihood.
- Code changes due to new static code analysis tool.

C402 beta release 3.10.6 for x86 and x86_64

Release date: 2018-03-20

This release was not fully tested. It is an engineering release only.

Fixed Bugs

- **AMC4, C400, C402:**
  Fixed regression in control algorithm for local timestamps. This bug could lead to timestamps delivered by the NTCAN interface that are not strictly increasing.

Component updates

- **C400, C402:**
  Integrated **ESDACC** version 0.68 (00.44 hex). See changes below:
  - Fixed issue on Spartan 3e with hard sync compensation.
  - Added TX arm delay feature, to get a pci331 compatibility mode.
  - Fixed level triggered interrupts for C402.
  - Suppress statistic messages and interrupts of CAN cores not in use.

C402 beta release 3.10.5 for x86 and x86_64

Release date: 2017-11-27

This release was not fully tested. It is an engineering release only.

New features

- **AMC4, C400, C402:**
  Minimize usage of DMA memory of **ESDACC** boards by allocating only the needed amount (64kB per board) at first and checking for a sufficient alignment. Only if this fails allocate a bigger memory chunk to be able to align it manually.
- **C402:**
  This is the first release of the Linux driver that recognizes the **CAN-FD** variants of the boards. But it is only possible to use them in CAN-Classic mode.
- **C402:**
  The use of **MSI** interrupts may be disabled by adding a 0x40000000 flag to the "mode" module parameter.
- **AMC4:**
  Enable the use of HW timers triggered by the FPGA on this board like on the other **ESDACC** boards.
- **C200, C400, C402, C405:**
  Provide *udev* rules files that can be dropped into */etc/udev/rules.d/* which enable the automatic creation of the needed */dev/can** inodes.
- **AMC4, C200, C200i, C331, C331i, C360, C400, C402, C405, VCAN:**
  From this point in time we will not provide a static *libntcan.a* library any more.

Fixed Bugs

- **AMC4, C200, C200i, C331, C331i, C360, C400, C402, C405, VCAN:**
  The driver now supports to be built with the Linux kernel version of 4.15-rc1 and later after a change in the Linux timer API.

Component updates

- **C400, C402:**
  Integrated **ESDACC** version 0.66 (00.42 hex). Changes were already described in a previous section.

AMC4 release 3.10.3 for x86 and x86_64

Release date: 2017-05-03

New Features

- **AMC4:**
  Completely enabled Timestamped TX for this board because it is supported in the minimum FPGA version the driver demands on start (00.35 hex).

Fixed Bugs

- **AMC4, C400:**
  Fix in interrupt handler that multiple boards could share part of their IRQ context (idxCoreIrq). You need multiple boards and a SMP machine to get any problems.
- **AMC4:**
  Fixed internal configuration error that caused Timestamped TX not to be completely enabled. Therefore NTCAN_IOCTL_SET_TX_TS_WIN did not work.

Component Updates

- **AMC4**:

  Integrated **ESDACC** version 0.66 (00.42 hex). See changes below:

  - Fixed Mantis #2857: TX abort request while sending in an open bus could get stuck. This results in a 'hanging' driver on canClose().

VCAN release 3.10.1 for x86 and x86_64

Release date: 2017-04-28

New Features

- **VCAN**:
  Added the **VCAN** driver to the supported devices. This driver adds a virtual CAN device for testing without real hardware.

AMC4 release 3.10.2 for x86 and x86_64

Release date: 2016-11-25

New Features

- **AMC4, C200, C200i, C331, C331i, C360, C400, C402, C405**:
  Extended the NTCAN_INFO structure to return the number of open handles.

Fixed Bugs

- **AMC4, C400, C402**:
  Internal fix for non deferred messages to prevent choosing the wrong Tx FIFO which results in a 'hanging' driver.
- **AMC4, C200, C200i, C331, C331i, C360, C400, C402, C405:**
  Open handle failed if overlapped flag is set and platform is not Windows.

Component Updates

- **AMC4**:
  Integrated **ESDACC** version 0.63 (00.3F hex). See changes for **C400** release 3.10.4.

C402, C400 release 3.10.4 for x86 and x86_64

Release date C402: 2016-05-11

Release date C400: 2016-05-10

New Features

- **AMC4, C400, C402**:
  Implemented functionality for BM statistics message on driver level with measured busload, controller state and timestamp.

Fixed Bugs

- **C400, C402:**
  Fix reported bitrate for ESDACC baudrates without CANIO_NO_IMPLICIT_CLK_DIV due to an internal change.
- **AMC4, C400, C402:**
  Fixed possible internal overload situation in situations of very high bus load ("Error no cm" messages in kernel log).

Component Updates

- **C400, C402:**
  Integrated **ESDACC** version 0.63 (00.3F hex). See changes below:
  - Fixed issue on Spartan 3e with hard sync compensation
  - Fixed reset on overload condition
  - Fixed busmaster DMA operation could not be disabled
  - Added BM Statistics feature and disable register for irq counter updates which reduces protocol overhead and improves performance (already **ESDACC** version 0.62).

C402, C400 release 3.10.3 for x86 and x86_64

Release date: 2015-12-02

New Features

- **C400, C402:**
  Added support for NTCAN_RESET_CTRL_EC in library and driver.

Fixed Bugs

- **AMC4, C400, C402**:
  Fixed negative *bitcount* in statistic at startup.
- **AMC4, C200, C200i, C331, C331i, C360, C400, C402, C405:**
  Fixed hangup in canSend() when sending synchronous event. (tx.state update again regression of #2461).

Component Updates

- **C400, C402:**
  Integrated **ESDACC** version 0.61 (00.3D hex). See changes below:
  - Got small changes to fix defects for timing corner cases found during the certification process. This version is now certified to conform to "ISO 16845:2004".

Driver release 3.10.1+ for x86 and x86_64

Release date: 2015-08-28

The Linux *esdcan* driver for the following driver families are included in this release: **AMC4, C200, C200i, C331, C331i, C360, C400, C402, C405**

This is a full range of Linux driver and library releases to switch the **NTCAN** library to version 4.x (libntcan.so.4). This version of the library is binary incompatible with the old version 3.x releases and requires recompilation of all applications. The new **NTCAN** library version also introduces symbol versioning.

For a detailed explanation of the cause that made this binary incompatible change necessary please review the *README* file contained in the driver archive.

Hint: The releases of the ISA bus based driver families **C200i** and **C331i** for the x86_64 architecture could not be tested due to lack of a 64-bit capable ISA system.

New Features

- **AMC4, C200, C200i, C331, C331i, C360, C400, C402, C405**:
  - The drivers for all board families are released again to include the **NTCAN** library with the new **NTCAN API** version 4.
  - Changes to get the DPC kernel thread named like the loadable module is named (KBUILD_MODNAME) which is the *card-id*.
- **C400, IRIG-B:**
  Added support for *NTCAN_EV_IRIGB_1PPS* in driver for PMC/CAN-400-IRIG boards.

Fixed Bugs

- **AMC4, C200, C200i, C331, C331i, C360, C400, C402, C405:**
  Fixed the functions canIdRegionAdd() and canIdRegionDelete() that if called with invalid parameters did not clear the *count* parameter.
- **AMC4, C400, C402**:
  Fixed timestamps of aborted TX frames.
- **C405**:
  Fixed crash on enabled SmartDisconnect with PCI405 boards (OCB NULL pointer).
- **C400, IRIG-B:**
  Fixed timestamp operation if IRIG-B enabled boards are operated together with non IRIG-B enabled boards (osif_div64_sft).

Component Updates

- **AMC4:**
  Change: The driver requires minimum FPGA revision of 00.35 HEX and uses the baud rate tables suited for the new prescaler layout.
- **C400, C402**:
  Change: Dynamically determine if feature error injection is present.

- **C400, C402**:
  Integrated **ESDACC** version 0.58 (00.3A hex). See changes below:
  - Got small changes to fix defects for timing corner cases found during the certification process.

C400, C402 release 3.10.0 for x86 and x86_64

Release date: 2015-01-13

New Features

- **AMC4, C200, C331, C200i, C331i, C400, C402, C405:**
  Added IOCTL_ESDCAN_GET_INFO on driver level. This IOCTL is only accessible with NTCAN library 3.5.3 and later.
- **C400, C402:**
  Driver now requires minimum **ESDACC** version of 00.53 (00.35 HEX). It supports **ESDACC** versions without implicit clock divider in baud rate prescaler.

Fixed Bugs

- **C331, C331i, C402, C405**:
  Fix to make firmware updater work again also with a board in the "Wrong firmware" state.

Component Updates

- **C400, C402:**
  Integrated **ESDACC** version 0.54 (00.36 hex). See changes below:
  - This fixes the deadlock for re-enabling bus-error IRQs (see Mantis #2481 below) on FPGA level.
  - This fixes the possible transmission of an old CAN ID from the standard TX FIFO when a frame is waiting for transmission in the TS (Time Stamped) TX FIFO on FPGA level.
  - Removal of implicit clock divider in baud rate prescaler (already **ESDACC** version 0.53).
  - Support for 1 PPS signal on CAN-PMC/400 (already **ESDACC** version 0.53).

AMC4 release 3.9.5, C400 release 3.9.83, C402 release 3.9.6

Release date: 2014-10-31

New Features

- **AMC4, C200, C331, C200i, C331i, C360, C400, C402, C405:**
  Support Linux kernel newer than 3.12.
- **C331:**
  Code cleanup in IRQ reset support routine.

Fixed Bugs

- **AMC4, C400, C402**:
  Work around deadlock that occurs when enabling again bus-error IRQs after IRQ throttle caused in error-passive state (see Mantis #2481).
  This software work around will be removed when the **ESDACC** FPGA is fixed.

- **AMC4, C400, C402:**
  Fix driver blocked on node lock polling for controller recovery after bus-off condition (see Mantis #2461) without correct bus termination.
- **AMC4, C200, C331, C200i, C331i, C400, C402, C405:**
  Fix hang in canClose() after NTCAN_CONTROLLER_BUSY (see Mantis #2461) but breaks synchronous canSend() calls for events.
- **C402:**
  Fix in interrupt handler that multiple boards could share part of their IRQ context (idxCoreIrq).

C400 release 3.9.82 for x86 and x86_64

Release date: 2014-07-22

New Features

- **C200**:
  Internal code cleanup.

Fixed Bugs

- **AMC4, C400, C402:**
  Fix problem in deferred TX.

C200i release 3.9.4 for x86 and x86_64

Release date: 2014-07-10

This is the first release for **C200i** since version 3.8.7 of February 2009 and contains all the changes and fixes accumulated since then.

New Features

- **C405**:
  Initial support for PPC405-GPr in common parts of driver.

AMC4 release 3.9.4 for x86 and x86_64

Release date: 2014-06-30

Fixed Bugs

- **C360**:
  Fix unwanted use of different TX queues in CPCI-CAN/360.
- **C331:**
  Fix to avoid PCI write buffer issue with IRQ reset (see Mantis #2329).
- **AMC4, C400, C402**:
  Fix to force busmaster enable from Linux to override settings of a lazy (UEFI-)BIOS. Will work with a Linux kernel >= 2.6.33. Blown up with a Linux kernel 3.11.

C331 release 3.9.4 for x86 and x86_64

Release date: 2014-02-04

This is the first release for **C331** since version 3.9.3 of May 2012 and contains all the changes and fixes accumulated since then.

C200 release 3.9.2 for x86 and x86_64

Release date: 2014-02-03

This is the first release for **C200** since version 3.9.2 of October 2011 and contains all the changes and fixes accumulated since then.

C400 release 3.9.81 for x86 and x86_64

Release date: 2014-02-03

This is the first release for **C400** since version 3.9.75 of July 2013 and contains all the changes and fixes accumulated since then.

C402 release 3.9.5 for x86 and x86_64

Release date: 2014-02-03

This is the first release for **C402** since version 3.9.4 of August 2013 and contains all the changes and fixes accumulated since then.

Releases before February 2013

Releases before February 2013 are not documented here but can be found in the *CHANGELOG* file included in the old driver's release archives.