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Disclaimer

Contents

1 Introduction and functional overview

This specification describes the functionality, API and the configuration for the AUTOSAR Basic Software module `CAN XL Driver`.

The base for this document are [1, CiA610-1] and [2, CiA611-1]. It is assumed that the reader is familiar with these specifications. This document will not describe CAN XL functionality again.

The `CAN XL Driver` is part of the lowest layer, performs the hardware access and offers a hardware independent API to the upper layer. The two upper layers that have access to the `CAN XL Driver` are the `CanIf` and `EthIf` modules.

The `CAN XL Driver` is an extension of the `CAN Driver` module so this document shall only provide information and specifications which extends the existing CAN stack. Some general information is given for a better understanding.

The `CAN XL Driver` provides services for initiating transmissions and calls the callback functions of the `CanIf` and `EthIf` modules for notifying events, independently from the hardware.

Furthermore, it provides services to control CAN XL Controller specific hardware including e.g. the transmission and reception of generic CAN XL frames.

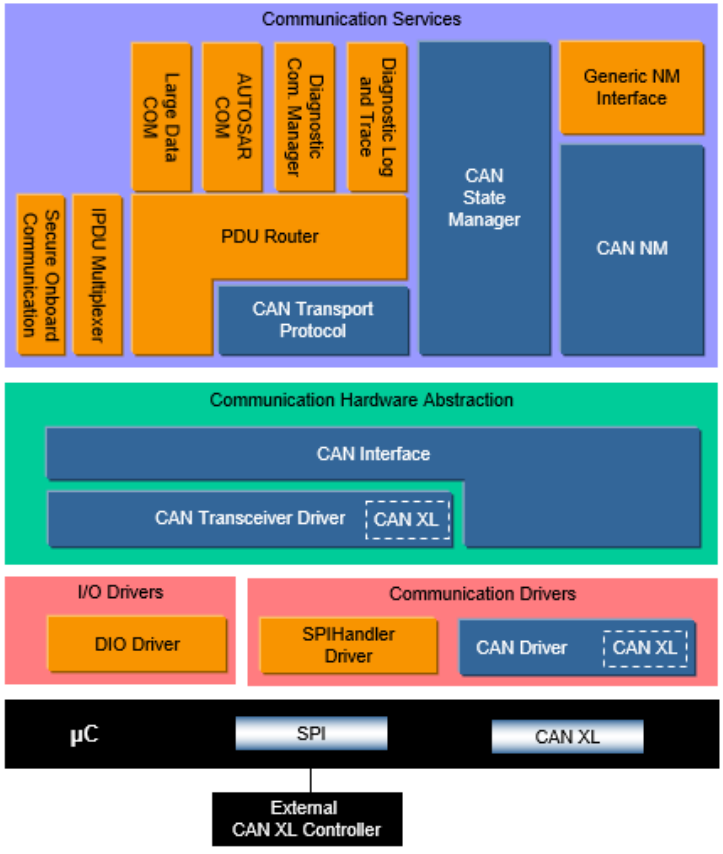

Figure 1.1: Autosar CanXL Layered Architecture

2 Acronyms and Abbreviations

The glossary below includes acronyms and abbreviations relevant to the `CAN XL Driver` module that are not included in the [3, AUTOSAR glossary].

Abbreviation / Acronym:	Description:
XLFF	XL Frame Format
SDU type	service data unit type
retransmit counter	Feature of some CAN XL controllers that allows to send a CAN frame multiple times in a row in case the ACK slot is not set on the bus. The counter gives the maximum number of transmissions.

3 Related documentation

3.1 Input documents & related standards and norms

[1] CiA 610-1 version 1.0.0 (DSP) - CAN XL specifications and test plans - Part 1: Data link layer and physical coding sub-layer requirements
http://www.can-cia.org

[2] CiA 611-1 version 1.0.0 (DSP) - CAN XL higher layer functions - Part 1: Definition of service data unit types
http://www.can-cia.org

[3] Glossary
AUTOSAR_TR_Glossary

[4] General Specification of Basic Software Modules
AUTOSAR_SWS_BSWGeneral

[5] Specification of CAN Driver
AUTOSAR_SWS_CANDriver

[6] Specification for CANXL transceiver driver functionality to provide additional required interfaces
AUTOSAR_SWS_CANXLTransceiverDriver

[7] Specification of CAN Interface
AUTOSAR_SWS_CANInterface

[8] Specification of Ethernet Interface
AUTOSAR_SWS_EthernetInterface

[9] General Requirements on Basic Software Modules
AUTOSAR_SRS_BSWGeneral

[10] Requirements on CAN
AUTOSAR_SRS_CAN

[11] ISO 11898-1:2015 – Road vehicles – Controller area network (CAN)

[12] Specification of Ethernet Driver
AUTOSAR_SWS_EthernetDriver

3.2 Related specification

AUTOSAR provides a General Specification on Basic Software modules [4, SWS BSW General], which is also valid for `CAN XL Driver`.

Thus, the specification SWS BSW General shall be considered as additional and required specification for `CAN XL Driver`.

4 Constraints and assumptions

The constraints and assumptions of the CAN XL Driver are the same as for the CAN Driver module.

It is assumed, that all CAN XL Hardware supports out of the box both ingress and egress timestamping. Should this not be available, then it needs to be emulated in software.

4.1 Limitations

In [2, CiA611-1] there are several SDU Types specified which shall not directly supported by the AUTOSAR CAN XL stack. The solely directly in AUTOSAR communication stack supported SDU Types are as following:

1. 01h (content based CAN XL frames)
2. 03h (tunneled CAN 2.0/FD frames)
3. 05h (mapped tunneled 802.3 Ethernet frames)

Any other types like 02h (node addressing) and 04h (unmapped tunneled 802.3 Ethernet frames) shall not be directly supported. They still can be used with CDD, for details refer to CanXL_Write() and CanIf_XLRxIndication() API.

Furthermore, future extensions making use of SEC bit of CAN XL Frame header like Security and Multi-PDU are currently in development and therefore not supported yet.

5 Dependencies to other modules

The CAN XL Driver module extends the CAN Driver [5] and has interfaces towards the [6, CAN XL Transceiver Driver], [5, CAN Driver], the [7, CAN Interface] and the [8, Ethernet Interface].

5.1 File Structure

This section explains the file structure of the CAN XL Driver module.

5.1.1 Code File Structure

For details, refer to the section 5.1.6 “Code file structure” in [4, SWS BSW General].

6 Requirements Tracing

The following tables reference the requirements specified in [9] as well as [10] and link to the fulfillment of these. Please note that if column “Satisfied by” is empty for a specific requirement this means that this requirement is not fulfilled by this document.

Requirement	Description	Satisfied by
[SRS_BSW_00312]	Shared code shall be reentrant	[CP_SWS_CanXL_00104]
[SRS_BSW_00323]	All AUTOSAR Basic Software Modules shall check passed API parameters for validity	[CP_SWS_CanXL_00107] [CP_SWS_CanXL_00108] [CP_SWS_CanXL_00109] [CP_SWS_CanXL_00110] [CP_SWS_CanXL_00112] [CP_SWS_CanXL_00116] [CP_SWS_CanXL_00119]
[SRS_BSW_00369]	All AUTOSAR Basic Software Modules shall not return specific development error codes via the API	[CP_SWS_CanXL_00106] [CP_SWS_CanXL_00107] [CP_SWS_CanXL_00108] [CP_SWS_CanXL_00109] [CP_SWS_CanXL_00110] [CP_SWS_CanXL_00112] [CP_SWS_CanXL_00116] [CP_SWS_CanXL_00119] [CP_SWS_CanXL_00129]
[SRS_Can_01045]	The CAN Driver shall offer a reception indication service.	[CP_SWS_CanXL_00009]
[SRS_Can_01051]	The CAN Driver shall provide a transmission confirmation service	[CP_SWS_CanXL_00011]
[SRS_Can_02001]	The CAN Driver shall support CAN XL	[CP_SWS_CanXL_00001] [CP_SWS_CanXL_00002] [CP_SWS_CanXL_00003] [CP_SWS_CanXL_00004] [CP_SWS_CanXL_00005] [CP_SWS_CanXL_00006] [CP_SWS_CanXL_00007] [CP_SWS_CanXL_00008] [CP_SWS_CanXL_00009] [CP_SWS_CanXL_00010] [CP_SWS_CanXL_00011] [CP_SWS_CanXL_00012] [CP_SWS_CanXL_00013] [CP_SWS_CanXL_00113] [CP_SWS_CanXL_00114] [CP_SWS_CanXL_00117] [CP_SWS_CanXL_00118] [CP_SWS_CanXL_00121] [CP_SWS_CanXL_00122] [CP_SWS_CanXL_00128]

7 Functional specification

7.1 Initialization

[CP_SWS_CanXL_00001] ⌈The `Can_Init()` shall be extended by all functionality necessary to properly initialize the `CAN XL Driver`.⌋*(SRS_Can_02001)*

7.2 State Handling

7.2.1 Communication Request

State handling is performed individually per bus, for native CAN by `CanSM` and for tunneled Ethernet via CAN XL by `EthSM`. The `EthIf` does directly communicate with `CAN XL Driver` and `CAN XL Transceivers` as lower layer.

The actual physical bus state is only controlled by the CAN stack. The `CAN XL Transceiver` indicates the physical bus state through LinkState polling to the Ethernet stack, independently of the Ethernet controller mode.

The Ethernet controller mode is stored by the `CAN XL Driver`, and returned on request.

[CP_SWS_CanXL_00113] ⌈The Ethernet controller mode shall initially be set to `ETH_MODE_DOWN`.⌋*(SRS_Can_02001)*

[CP_SWS_CanXL_00002] ⌈The controller mode requested by the Ethernet stack via `CanXL_SetControllerMode()` shall have no effect on the CAN XL controller hardware. The new mode shall be solely stored.⌋*(SRS_Can_02001)*

[CP_SWS_CanXL_00114] ⌈`CanXL_GetControllerMode()` shall return the stored mode.⌋*(SRS_Can_02001)*

[CP_SWS_CanXL_00128] ⌈When the Ethernet controller mode changes, the `CAN XL Driver` shall report this change via `EthIf_CtrlModeIndication()`.⌋*(SRS_Can_02001)*

7.2.2 BusOff Handling

There always needs to be a CAN Stack configured even in case no native CAN communication is used and `BusOff Handling` is performed as defined in `CAN Driver`.

[CP_SWS_CanXL_00003] ⌈Changes of the bus error state shall be notified to `CAN XL Transceiver` by a call to `CanXLTrcv_ReportErrorState()`.⌋*(SRS_Can_02001)*

All buffers of the affected `CAN XL controller` are flushed within `CAN XL Driver` if a `BusOff` occurs.

[CP_SWS_CanXL_00004] ⌈In case an Ethernet stack is configured, also the buffers containing frames for Ethernet shall be flushed and `EthIf_TxConfirmation()` shall be called with result E_NOT_OK at the event of a `BusOff`.⌋*(SRS_Can_02001)*

`EthIf` is polling its hardware if the current mode and link state match the requested mode and link state. A `BusOff` event is returned by `CAN XL Transceiver` to `EthIf` by reporting link down in context of `CanTrcv_GetLinkState()`. Furthermore, the link status which is present in the `EthIf` does not differentiate between error active and error passive state, they both are reported as link up. See [6, CAN XL Transceiver Driver] for further information.

7.2.3 BusOff Handling without error signaling

In case `transceiver mode switching` is used, `error signaling` must be turned off for currently existing transceivers. Without `error signaling`, there also won't be any busoff handling by the controller hardware itself. Therefore, in this case, there shall be a simple implementation in `CAN XL Driver` to still perform babbling protection.

[CP_SWS_CanXL_00005] ⌈If `error signaling` is disabled, a basic CAN busoff handling with `TEC (Transmission Error Counter)` and `REC (Reception Error Counter)` shall be emulated in software.⌋*(SRS_Can_02001)*

The following example shows how this handling would typically look like:

`TEC` is normally a counter initialized with 0 saturating in range of 0 to 256, and `REC` is a counter initialized with 0 saturating in range of 0 to 128. The `retransmit counter` is turned off completely or at least configured to a very low value.

There would be a state machine following this basic rule set:

- When a frame is transmitted but no ACK slot was set on the bus, `TEC` shall be increased by 8. `TEC` shall not be increased beyond 128 before at least one frame has been received on the bus since the last startup or bus-off recovery. It does not matter whether this frame was received successfully or not.
- When a frame is transmitted and the ACK slot was set on the bus, `TEC` shall be decreased by 1.
- When a frame is received but is not consistent, `REC` shall be increased by 1.
- When a frame is received consistent, `REC` shall be decreased by 1.

The detection of these events would be performed alongside the transmission and reception handling in their respective context (MainFunction or ISR) and additionally, depending on the hardware capabilities, in bus-off context for the error events.

The state transitions are expected to correspond to those defined in [11, ISO 11898-1:2015] chapter 12.1.4.4 "Bus-off management". In bus-off state, `TEC` and `REC` are

reset immediately. Basically, the CAN XL Driver state transitions should not differ when error signaling is disabled from the handling when error signaling is available.

7.2.4 Wake Up

Basic wakeup handling does not change.

[CP_SWS_CanXL_00006] ⌈There shall be no differentiation with regards to SDU-Type of the received frame triggering wakeup; any frame received by CAN XL Driver shall notify a CAN wakeup.⌋*(SRS_Can_02001)*

EcuM_SetWakeupEvent() is solely called for CAN. It is never notified for Ethernet, the CAN XL Transceiver indicates the physical bus state through LinkState polling to the Ethernet stack instead.

7.3 Reception Handling

[CP_SWS_CanXL_00007] ⌈All used reception queues for CAN XL frames shall be mapped individually to CAN XL HRHs.⌋*(SRS_Can_02001)*

Reception queues will also be used for CAN 2.0 and CAN FD frames mapped to CAN HRHs.

The reception mechanism of SDU Type shall be extended for XLFF, e.g. in polling mode Can_MainFunction_Read() shall be extended. See chapter "L-PDU reception" of CAN Driver for details.

[CP_SWS_CanXL_00008] ⌈On L-PDU reception of XLFF, first any configured filtering shall be performed before other functionality is performed.⌋*(SRS_Can_02001)*

[CP_SWS_CanXL_00009] ⌈On L-PDU reception of XLFF, if SDU Type equals 05h (mapped tunneled 802.3 Ethernet frames) the CAN XL Driver shall extract payload and addressing information from the received frame and pass them to EthIf_RxIndication(); otherwise it shall pass the received frame directly to CanIf_XLRxIndication().⌋*(SRS_Can_01045, SRS_Can_02001)*

Depending on available filtering on hardware support, there might be multiple reception queues available to filter received frames into.

As this is highly hardware vendor specific, there shall be no details given here beyond following:

Any field available in the CAN XL Frame Header might be used for filtering, it is not restricted to the Acceptance Field only. Purpose might be separation of traffic classes e.g. based on Priority ID, VCID and/or SDU Type.

When it comes to tunneling of ethernet frames, a common use case would be to filter any received SDU Type 05h (mapped tunneled 802.3 Ethernet frames) L-PDU for matching ethernet MAC address configured (see EthCtrlPhyAddress).

It can help to handle first high priority traffic before lower priority traffic. Also it would be possible to put unwanted traffic in a separate queue to keep for further inspection instead of filtering it out.

[CP_SWS_CanXL_00117] ⌈On L-PDU reception of XLFF, the frame shall be checked for consistency with CiA 611-1 chapter 5 SDU types specification.⌋ *(SRS_Can_02001)*

[CP_SWS_CanXL_00118] ⌈If the consistency check fails the received frame shall be discarded and a runtime error CanXL.CANXL_E_INV_DATA shall be reported.⌋ *(SRS_Can_02001)*

7.4 Transmission Handling

As CAN XL is designed to scale from small to big systems and the payload range goes up to 2048 bytes, the specific hardware implementations may differ.

The use of CAN XL HTH is similar to CAN HTH. See chapter "L-PDU transmission" of CAN Driver for details.

The CAN HTH is used for mapping to logical transmission objects. Depending on available hardware features these might map to separate message objects or hardware supported queues.

[CP_SWS_CanXL_00010] ⌈All used transmission queues for CAN XL frames shall be mapped individually to CAN XL HTHs.⌋ *(SRS_Can_02001)*

CAN XL transmission queues could also have a size of one and therefore correspond to traditional CAN hardware objects. Transmission queues for CAN 2.0 and CAN FD frames will be mapped similarly to CAN HTHs.

As the availability and behavior of hardware supported queues is is highly hardware vendor specific, there shall be no details given here. It is the responsibility of the CAN XL Driver vendor to document how the different CAN XL HTH behave. For same hardware there might be several mappings implemented depending of the specific needs of the system.

[CP_SWS_CanXL_00122] ⌈The functions CanXL_Transmit() (for SDU Type 05h) and CanXL_Write() (for other SDU Types) shall transfer the XLFF control information and data to hardware and shall request the start of transmission.⌋ *(SRS_Can_02001)*

[CP_SWS_CanXL_00011] ⌈After successful transmission of XLFF on the bus, if SDU Type of the original transmission equals 05h (mapped tunneled 802.3 Ethernet frames) the CAN XL Driver shall call EthIf_TxConfirmation() with the result E_OK,

else `CanIf_TxConfirmation()` shall be called.⌋*(SRS_Can_01051, SRS_Can_02001)*

[CP_SWS_CanXL_00012] ⌈In case a transmission can't be performed successfully, if `SDU Type` of the original transmission equals 05h (mapped tunneled 802.3 Ethernet frames) the `CAN XL Driver` shall call `EthIf_TxConfirmation()` with the result E_NOT_OK.⌋*(SRS_Can_02001)*

[CP_SWS_CanXL_00013] ⌈In case a `CAN XL controller` is in another state than `CAN_CS_STARTED`, all buffers of the affected `CAN XL controller` shall be flushed.⌋ *(SRS_Can_02001)*

7.5 Error Classification

Section 7.2 "Error Handling" of the document "General Specification of Basic Software Modules" [19] describes the error handling of the Basic Software in detail. Above all, it constitutes a classification scheme consisting of five error types which may occur in BSW modules. Based on this foundation, the following section specifies particular errors arranged in the respective subsections below.

7.5.1 Development Errors

[CP_SWS_CanXL_10024] ⌈

Type of error	*Related error code*	*Error value*
API Service called with wrong parameter	CANXL_E_PARAM_POINTER	0x01
API Service called with wrong parameter	CANXL_E_PARAM_HANDLE	0x02
API Service called with wrong parameter	CANXL_E_PARAM_DATA_LENGTH	0x03
API Service called with wrong parameter	CANXL_E_PARAM_CONTROLLER	0x04
API Service used without initialization	CANXL_E_UNINIT	0x05
Invalid parameter	CANXL_E_INV_PARAM	0x10
Invalid mode	CANXL_E_INV_MODE	0x11

⌋*()*

7.5.2 Runtime Errors

[CP_SWS_CanXL_10025] ⌈

Type of error	*Related error code*	*Error value*
Invalid data	CANXL_E_INV_DATA	0x12

⌋*()*

7.5.3 Transient Faults

There are no additional transient faults.

7.5.4 Production Errors

There are no addtional production errors.

7.5.5 Extended Production Errors

There are no addtional extended production errors.

8 API specification

Please note, that the CAN XL Driver uses the MSN Can for parts that are shared with the [5, CAN Driver] and the MSN CanXL for extensions defined in this document. Deviating from SRS_BSW_00101 and SRS_BSW_00407, the CAN XL Driver does not provide separate Init and GetVersionInfo APIs with the MSN CanXL. Following SWS_MemMap_00022, memory sections associated with APIs defined in this document will use the MSN CanXL, and also symbolic name values referring to containers defined in this document will use the MSN CanXL to follow TPS_ECUC_02108.

8.1 Imported types

In this chapter all types included from the following files are listed.

[CP_SWS_CanXL_10023] ⌈

Module	*Header File*	*Imported Type*
Can	Can_GeneralTypes.h	Can_ErrorStateType
	Can_GeneralTypes.h	Can_HwHandleType
ComStack_Types	ComStack_Types.h	BufReq_ReturnType
	ComStack_Types.h	PduIdType
	ComStack_Types.h	PduInfoType
	ComStack_Types.h	PduLengthType
Eth	Eth_GeneralTypes.h	Eth_BufIdxType
	Eth_GeneralTypes.h	Eth_CounterType
	Eth_GeneralTypes.h	Eth_DataType
	Eth_GeneralTypes.h	Eth_FilterActionType
	Eth_GeneralTypes.h	Eth_FrameType
	Eth_GeneralTypes.h	Eth_ModeType
	Eth_GeneralTypes.h	Eth_RxStatsType
	Eth_GeneralTypes.h	Eth_RxStatusType
	Eth_GeneralTypes.h	Eth_TimeStampQualType
	Eth_GeneralTypes.h	Eth_TimeStampType
	Eth_GeneralTypes.h	Eth_TxErrorCounterValuesType
	Eth_GeneralTypes.h	Eth_TxStatsType
Std	Std_Types.h	Std_ReturnType

⌋()

8.2 Type definitions

8.2.1 CanXL_Params

[CP_SWS_CanXL_10001] ⌈

Name	CanXL_Params	
Kind	Structure	
Elements	PriorityId	
	Type	uint16
	Comment	Priority ID of a CAN XL message.
	Vcid	
	Type	uint16
	Comment	VCID of a CAN XL message.
	SduType	
	Type	uint8
	Comment	SDU type of a CAN XL message.
	AcceptanceField	
	Type	uint32
	Comment	Acceptance field of a CAN XL message.
	Sec	
	Type	uint8
	Comment	Simple extended content field of a CAN XL message.
Description	Contains CAN XL specific information.	
Available via	Can_GeneralTypes.h	

⌋()

8.2.2 CanXL_PduType

[CP_SWS_CanXL_10026] ⌈

Name	CanXL_PduType	
Kind	Structure	
Elements	swPduHandle	
	Type	PduIdType
	Comment	Contains the PDU ID.
	length	
	Type	uint16
	Comment	Length of the data.
	sdu	
	Type	uint8*
	Comment	SDU data pointer.
	XLParams	
	Type	CanXL_Params*

▽

△

	Comment	Pointer to CAN XL params.
Description	This type extends the classical Can_PduType with a larger PDU length, the CanXL_Params and a sec to indicate simple or extended content.	
Available via	Can_GeneralTypes.h	

⌋()

8.2.3 CanXL_HwType

[CP_SWS_CanXL_10027] ⌈

Name	CanXL_HwType	
Kind	Structure	
Elements	XLParams	
	Type	CanXL_Params*
	Comment	Pointer to CAN XL params.
	ControllerId	
	Type	uint8
	Comment	ControllerId provided by CanIf, identifies the corresponding CAN XL controller.
	Hoh	
	Type	Can_HwHandleType
	Comment	ID of the corresponding CAN XL Hardware Object Range.
Description	This type defines a data structure which provides a CAN XL Hardware Object Handle including its corresponding CAN Controller and therefore CanDrv as well as the specific CAN XL parameters.	
Available via	Can_GeneralTypes.h	

⌋()

8.3 Function definitions

8.3.1 CanXL_EnableEgressTimeStamp

[CP_SWS_CanXL_10004] ⌈

Service Name	CanXL_EnableEgressTimeStamp	
Syntax	`void CanXL_EnableEgressTimeStamp ( uint8 CtrlIdx, Eth_BufIdxType BufIdx )`	
Service ID [hex]	0x17	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the addresses controller.

▽

△

	BufIdx	Index of the message buffer, where Application expects egress time stamping
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Activates egress time stamping on a dedicated message object. Some HW does store once the egress time stamp marker and some HW needs it always before transmission. There will be no "disable" functionality, due to the fact, that the message type is always "time stamped" by network design.	
Available via	CanXL.h	

⌋()

Note: This API is derived from Ethernet Driver ([SWS_Eth_00186]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver]. It is called by the AUTOSAR Ethernet Interface to achieve compatible CAN XL agnostic behavior.

[CP_SWS_CanXL_00123] ⌈The service `CanXL_EnableEgressTimeStamp()` has no functionality and shall return without performing any action.⌋()

8.3.2 CanXL_GetControllerMode

[CP_SWS_CanXL_10017] ⌈

Service Name	CanXL_GetControllerMode	
Syntax	`Std_ReturnType CanXL_GetControllerMode ( uint8 CtrlIdx, Eth_ModeType* CtrlModePtr )`	
Service ID [hex]	0x04	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
Parameters (inout)	None	
Parameters (out)	CtrlModePtr	ETH_MODE_DOWN: the Rx/Tx communication of the controller is disabled ETH_MODE_ACTIVE: the Rx/Tx communication of the controller is enabled
Return value	Std_ReturnType	E_OK: success E_NOT_OK: controller mode could not be obtained
Description	Obtains the communication state of the indexed controller	
Available via	CanXL.h	

⌋()

Note: This API is derived from Ethernet Driver ([SWS_Eth_91010]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00046] ⌈The function shall read the current communication state of the indexed controller.⌋*()*

The current communication state is set as described in [CP_SWS_CanXL_00113] and [CP_SWS_CanXL_00002].

[CP_SWS_CanXL_00047] ⌈If development error detection is enabled: `CanXL_GetControllerMode()` shall check the parameter `CtrlIdx` for being valid. If the check fails, the function shall raise the development error `CanXL.CANXL_E_PARAM_CONTROLLER`.⌋*()*

[CP_SWS_CanXL_00129] ⌈If development error detection is enabled: `CanXL_GetControllerMode()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*(SRS_BSW_00369)*

8.3.3 CanXL_GetCounterValues

[CP_SWS_CanXL_10005] ⌈

Service Name	CanXL_GetCounterValues	
Syntax	`Std_ReturnType CanXL_GetCounterValues ( uint8 CtrlIdx, Eth_CounterType* CounterPtr )`	
Service ID [hex]	0x14	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
Parameters (inout)	None	
Parameters (out)	CounterPtr	counter values according to IETF RFC 1757, RFC 1643 and RFC 2233.
Return value	Std_ReturnType	E_OK: success E_NOT_OK: counter values read failure
Description	Reads a list with drop counter values of the corresponding controller. The meaning of these values is described at Eth_CounterType.	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00226]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver]. It is called by the AUTOSAR Ethernet Interface to achieve compatible CAN XL agnostic behavior.

[CP_SWS_CanXL_00048] ⌈The service `CanXL_GetCounterValues()` has no functionality and shall always return E_NOT_OK without performing any action.⌋*()*

8.3.4 CanXL_GetCurrentTime

[CP_SWS_CanXL_10006] ⌈

Service Name	CanXL_GetCurrentTime	
Syntax	`Std_ReturnType CanXL_GetCurrentTime ( uint8 CtrlIdx, Eth_TimeStampQualType* timeQualPtr, Eth_TimeStampType* timeStampPtr )`	
Service ID [hex]	0x16	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the addresses controller.
Parameters (inout)	None	
Parameters (out)	timeQualPtr	quality of HW time stamp, e.g. based on current drift
	timeStampPtr	current time stamp
Return value	Std_ReturnType	E_OK: successful E_NOT_OK: failed
Description	Returns a time value out of the HW registers according to the capability of the HW. Is the HW resolution is lower than the Eth_TimeStampType resolution resp. range, than an the remaining bits will be filled with 0. Important Note: Eth_GetCurrentTime may be called within an exclusive area.	
Available via	CanXL.h	

⌋()

Note: This API is derived from Ethernet Driver ([SWS_Eth_00181]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00025] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋()

[CP_SWS_CanXL_00026] ⌈If development error detection is enabled: the function shall check the parameter timeQualPtr and timeStampPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋()

[CP_SWS_CanXL_00027] ⌈The function shall be pre compile time configurable On/Off by the configuration parameter `CanXLEthGlobalTimeSupport`.⌋()

[CP_SWS_CanXL_00028] ⌈If development error detection is enabled: `CanXL_GetCurrentTime()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋()

In case the Com-Stack is distributed across several partitions, the Can/Ethernet stack could reside in a different partition than the StbM module calling `CanXL_GetCurrentTime()` (via `EthIf_GetCurrentTime()`) API, means the call of `CanXL_GetCurrentTime()` could happen in another partition.

[CP_SWS_CanXL_00029] ⌈The CAN XL module shall apply appropriate mechanisms to allow calls of `CanXL_GetCurrentTime()` from other partitions than its main function, e.g. by providing an CAN XL satellite.⌋*()*

8.3.5 CanXL_GetEgressTimeStamp

[CP_SWS_CanXL_10007] ⌈

Service Name	CanXL_GetEgressTimeStamp	
Syntax	`Std_ReturnType CanXL_GetEgressTimeStamp ( uint8 CtrlIdx, Eth_BufIdxType BufIdx, Eth_TimeStampQualType* timeQualPtr, Eth_TimeStampType* timeStampPtr )`	
Service ID [hex]	0x18	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the addresses controller.
	BufIdx	Index of the message buffer, where Application expects egress time stamping
Parameters (inout)	None	
Parameters (out)	timeQualPtr	quality of HW time stamp, e.g. based on current drift
	timeStampPtr	current time stamp
Return value	Std_ReturnType	E_OK: success E_NOT_OK: failed to read time stamp.
Description	Reads back the egress time stamp on a dedicated message object. It must be called within the TxConfirmation() function.	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00190]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00031] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00032] ⌈If development error detection is enabled: the function shall check the parameter timeQualPtr and timeStampPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋*()*

[CP_SWS_CanXL_00124] ⌈The function shall be pre compile time configurable On/Off by the configuration parameter `CanXLEthGlobalTimeSupport`.⌋*()*

[CP_SWS_CanXL_00034] ⌈If development error detection is enabled: `CanXL_GetEgressTimeStamp()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.6 CanXL_GetIngressTimeStamp

[CP_SWS_CanXL_10008] ⌈

Service Name	CanXL_GetIngressTimeStamp	

Syntax	`Std_ReturnType CanXL_GetIngressTimeStamp (`
	`  uint8 CtrlIdx,`
	`  const Eth_DataType* DataPtr,`
	`  Eth_TimeStampQualType* timeQualPtr,`
	`  Eth_TimeStampType* timeStampPtr`
	`)`	

Service ID [hex]	0x19	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the addresses controller.
	DataPtr	Pointer to the message buffer, where Application expects ingress time stamping
Parameters (inout)	None	
Parameters (out)	timeQualPtr	quality of HW time stamp, e.g. based on current drift
	timeStampPtr	current time stamp
Return value	Std_ReturnType	E_OK: success E_NOT_OK: failed to read time stamp.
Description	Reads back the ingress time stamp on a dedicated message object. It must be called within the RxIndication() function.	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00195]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00036] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00037] ⌈If development error detection is enabled: the function shall check the parameter DataPtr, timeQualPtr and timeStampPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋*()*

[CP_SWS_CanXL_00125] ⌈The function shall be pre compile time configurable On/Off by the configuration parameter `CanXLEthGlobalTimeSupport`.⌋*()*

[CP_SWS_CanXL_00039] ⌈If development error detection is enabled: `CanXL_GetIngressTimeStamp()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.7 CanXL_GetPhysAddr

[CP_SWS_CanXL_10018] ⌈

Service Name	CanXL_GetPhysAddr	
Syntax	`void CanXL_GetPhysAddr ( uint8 CtrlIdx, uint8* PhysAddrPtr )`	
Service ID [hex]	0x08	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
Parameters (inout)	None	
Parameters (out)	PhysAddrPtr	Physical source address (MAC address) in network byte order.
Return value	void	None
Description	Obtains the physical source address used by the indexed controller	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00052]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00040] ⌈The function shall read the source address used by the indexed controller (see `CanXLEthPhysAddress`).⌋*()*

[CP_SWS_CanXL_00042] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00043] ⌈If development error detection is enabled: the function shall check the parameter PhysAddrPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋*()*

[CP_SWS_CanXL_00044] ⌈If development error detection is enabled: `CanXL_GetPhysAddr()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.8 CanXL_GetRxStats

[CP_SWS_CanXL_10009] ⌈

Service Name	CanXL_GetRxStats	
Syntax	`Std_ReturnType CanXL_GetRxStats ( uint8 CtrlIdx, Eth_RxStatsType* RxStats )`	
Service ID [hex]	0x15	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
Parameters (inout)	None	
Parameters (out)	RxStats	List of values according to IETF RFC 2819 (Remote Network Monitoring Management Information Base)
Return value	Std_ReturnType	E_OK: success E_NOT_OK: drop counter could not be obtained
Description	Returns the following list according to IETF RFC2819, where the maximal possible value shall denote an invalid value, e.g. if this counter is not available: 1. etherStatsDropEvents 2. etherStatsOctets 3. etherStatsPkts 4. etherStatsBroadcastPkts 5. etherStatsMulticastPkts 6. etherStatsCrcAlignErrors 7. etherStatsUndersizePkts 8. etherStatsOversizePkts 9. etherStatsFragments 10. etherStatsJabbers 11. etherStatsCollisions 12. etherStatsPkts64Octets 13. etherStatsPkts65to127Octets 14. etherStatsPkts128to255Octets 15. etherStatsPkts256to511Octets 16. etherStatsPkts512to1023Octets 17. etherStatsPkts1024to1518Octets	
Available via	CanXL.h	

⌋()

Note: This API is derived from Ethernet Driver ([SWS_Eth_00233]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver]. It is called by the AUTOSAR Ethernet Interface to achieve compatible CAN XL agnostic behavior.

[CP_SWS_CanXL_00020] ⌈The service `CanXL_GetRxStats()` has no functionality and shall always return E_NOT_OK without performing any action.⌋()

8.3.9 CanXL_GetTxErrorCounterValues

[CP_SWS_CanXL_10010] ⌈

Service Name	CanXL_GetTxErrorCounterValues	
Syntax	`Std_ReturnType CanXL_GetTxErrorCounterValues ( uint8 CtrlIdx, Eth_TxErrorCounterValuesType* TxErrorCounterValues )`	
Service ID [hex]	0x1d	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
Parameters (inout)	None	

▽

△

Parameters (out)	TxErrorCounterValues	List of values to read statistic error counter values for transmission.
Return value	Std_ReturnType	E_OK: success, E_NOTOK: Tx-statistics could not be obtained
Description	Returns the list of Transmission Error Counters out of IETF RFC1213 and RFC1643 defined with Eth_TxErrorCounterValuesType, where the maximal possible value shall denote an invalid value, e.g. this counter is not available.	
Available via	CanXL.h	

⌋()

Note: This API is derived from Ethernet Driver ([SWS_Eth_91006]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver]. It is called by the AUTOSAR Ethernet Interface to achieve compatible CAN XL agnostic behavior.

[CP_SWS_CanXL_00021] ⌈The service `CanXL_GetTxErrorCounterValues()` has no functionality and shall always return E_NOT_OK without performing any action.⌋()

8.3.10 CanXL_GetTxStats

[CP_SWS_CanXL_10011] ⌈

Service Name	CanXL_GetTxStats	

Syntax	`Std_ReturnType CanXL_GetTxStats (`
	`  uint8 CtrlIdx,`
	`  Eth_TxStatsType* TxStats`
	`)`	

Service ID [hex]	0x1c	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
Parameters (inout)	None	
Parameters (out)	TxStats	List of values to read statistic values for transmission.
Return value	Std_ReturnType	E_OK: success, E_NOTOK: Tx-statistics could not be obtained
Description	Returns the list of Transmission Statistics out of IETF RFC1213 defined with Eth_TxStatsType, where the maximal possible value shall denote an invalid value, e.g. this counter is not available.	
Available via	CanXL.h	

⌋()

Note: This API is derived from Ethernet Driver ([SWS_Eth_91005]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver]. It is called by the AUTOSAR Ethernet Interface to achieve compatible CAN XL agnostic behavior.

[CP_SWS_CanXL_00022] ⌈The service `CanXL_GetTxStats()` has no functionality and shall always return E_NOT_OK without performing any action.⌋()

8.3.11 CanXL_ProvideTxBuffer

[CP_SWS_CanXL_10012] ⌈

Service Name	CanXL_ProvideTxBuffer	
Syntax	`BufReq_ReturnType CanXL_ProvideTxBuffer ( uint8 CtrlIdx, uint8 Priority, Eth_BufIdxType* BufIdxPtr, uint8** BufPtr, uint16* LenBytePtr )`	
Service ID [hex]	0x09	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
	Priority	Frame priority for transmit buffer queue selection
Parameters (inout)	LenBytePtr	In: desired length in bytes, out: granted length in bytes
Parameters (out)	BufIdxPtr	Index to the granted buffer resource. To be used for subsequent requests
	BufPtr	Pointer to the granted buffer
Return value	BufReq_ReturnType	BUFREQ_OK: success BUFREQ_E_NOT_OK: request not accepted. BUFREQ_E_BUSY: all buffers in use BUFREQ_E_OVFL: requested buffer too large
Description	Provides access to a transmit buffer of the queue related to the specified priority	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00077]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00058] ⌈The function shall provide a transmit buffer resource. The `CAN XL Driver` shall lock the buffer until it receives a subsequent call of `CanXL_Transmit()` service with the buffer index returned in the BufIdxPtr parameter.⌋*()*

[CP_SWS_CanXL_00059] ⌈In case a matching configuration for parameter Priority exists in `CanXLEthEgressFifoIdx` of the controller, the contained parameter `CanXLEthEgressFifoCanXLPriority` and `CanXLEthEgressFifoCanXLQueue` shall be used. Otherwise the defaults `CanXLCtrlEthDefaultPriority` and `CanXLEthDefaultQueue` do apply.⌋*()*

[CP_SWS_CanXL_00060] ⌈If a buffer requested with `CanXL_ProvideTxBuffer()` that is larger than the available buffer length, the buffer shall not be locked but return the available length and BUFREQ_E_OVFL.⌋*()*

[CP_SWS_CanXL_00061] ⌈If all available buffers are in use the component shall return BUFREQ_E_BUSY.⌋*()*

[CP_SWS_CanXL_00063] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00064] ⌈If development error detection is enabled: the function shall check the parameter BufIdxPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋*()*

[CP_SWS_CanXL_00065] ⌈If development error detection is enabled: the function shall check the parameter BufPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋*()*

[CP_SWS_CanXL_00066] ⌈If development error detection is enabled: the function shall check the parameter LenBytePtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋*()*

[CP_SWS_CanXL_00067] ⌈If development error detection is enabled: `CanXL_ProvideTxBuffer()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.12 CanXL_Receive

[CP_SWS_CanXL_10020] ⌈

Service Name	CanXL_Receive	
Syntax	`void CanXL_Receive ( uint8 CtrlIdx, uint8 QueueIdx, Eth_RxStatusType* RxStatusPtr )`	
Service ID [hex]	0xB	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different queues. Non Reentrant for the same queue.	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
	QueueIdx	Specifies the related queue
Parameters (inout)	None	
Parameters (out)	RxStatusPtr	Indicates whether a frame has been received and if so, whether more frames are available for the related queue.
Return value	None	
Description	Receive a frame from the related queue.	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00095]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00068] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00069] ⌈The function shall read the next frame from the receive buffers of the corresponding queue referenced by parameter FifoIdx. The function passes the received frame to the Ethernet interface using the callback func-

tion `EthIf_RxIndication()` and indicates if there are more frames in the receive buffers.⌋*()*

[CP_SWS_CanXL_00132] ⌈If development error detection is enabled: `CanXL_Receive()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.13 CanXL_SetControllerMode

[CP_SWS_CanXL_10016] ⌈

Service Name	CanXL_SetControllerMode	
Syntax	`Std_ReturnType CanXL_SetControllerMode ( uint8 CtrlIdx, Eth_ModeType CtrlMode )`	
Service ID [hex]	0x03	
Sync/Async	Asynchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
	CtrlMode	ETH_MODE_DOWN: Disable Rx/Tx communication of the controller ETH_MODE_ACTIVE: Enable Rx/Tx communication of the controller
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: success E_NOT_OK: controller mode could not be changed
Description	Enables / Disables Rx/Tx communication of the indexed controller. The result is reported asynchronously via EthIf_CtrlModeIndication.	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_91009]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00023] ⌈The function shall store the current communication state of the indexed controller without influencing the CAN XL controller hardware.⌋*()*

See also subsection 7.2.1.

[CP_SWS_CanXL_00024] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00130] ⌈If development error detection is enabled: `CanXL_SetControllerMode()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.14 CanXL_SetPhysAddr

[CP_SWS_CanXL_10015] ⌈

Service Name	CanXL_SetPhysAddr	
Syntax	`void CanXL_SetPhysAddr ( uint8 CtrlIdx, const uint8* PhysAddrPtr )`	
Service ID [hex]	0x13	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same CtrlIdx, reentrant for different	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver.
	PhysAddrPtr	Pointer to memory containing the physical source address (MAC address) in network byte order.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Sets the physical source address used by the indexed controller	
Available via	CanXL.h	

⌋()

Note: This API is derived from Ethernet Driver ([SWS_Eth_00151]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00073] ⌈The function shall update the source address used by the indexed controller (see `CanXLEthPhysAddress`).⌋()

[CP_SWS_CanXL_00075] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋()

[CP_SWS_CanXL_00076] ⌈If development error detection is enabled: the function shall check the parameter PhysAddrPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋()

[CP_SWS_CanXL_00077] ⌈If development error detection is enabled: `CanXL_SetPhysAddr()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋()

8.3.15 CanXL_Transmit

[CP_SWS_CanXL_10003] ⌈

Service Name	CanXL_Transmit	
Syntax	`Std_ReturnType CanXL_Transmit ( uint8 CtrlIdx, Eth_BufIdxType BufIdx, Eth_FrameType FrameType , boolean TxConfirmation, uint16 LenByte, const uint8* PhysAddrPtr )`	
Service ID [hex]	0xA	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different buffer indexes and Ctrl indexes	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
	BufIdx	Index of the buffer resource
	FrameType	Ethernet frame type
	TxConfirmation	Activates transmission confirmation
	LenByte	Data length in byte
	PhysAddrPtr	Physical target address (MAC address) in network byte order
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: success E_NOT_OK: transmission failed
Description	Triggers transmission of a previously filled transmit buffer	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00087]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00078] ⌈The function shall build the Ethernet header with the given physical target address (MAC address) and trigger the transmission of a previously filled transmit buffer.⌋*()*

After transmission, the driver needs to release the allocated buffer. It is up to the implementation when the actual buffer release shall occur, e.g. within the context of the CanXL_TxConfirmation, the Can_MainFunction, or during the next CanXL_ProvideTxBuffer.

Note: Each successful transmission results in a `SDU Type` 05h (mapped tunneled 802.3 Ethernet frames) `XLFF` on the `CAN XL` pyhsical bus.

[CP_SWS_CanXL_00081] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00082] ⌈If development error detection is enabled: the function shall check the parameter BufIdx for being valid. If the check fails, the function shall raise the development error `CanXL.CANXL_E_INV_PARAM`.⌋*()*

[CP_SWS_CanXL_00083] ⌈If development error detection is enabled: the function shall check the parameter PhysAddrPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋*()*

[CP_SWS_CanXL_00084] ⌈If development error detection is enabled: the function shall check the controller mode for being active. If the check fails, the function shall raise the development error `CanXL.CANXL_E_INV_MODE`.⌋*()*

[CP_SWS_CanXL_00085] ⌈`CanXL_Transmit()` shall return `E_NOT_OK` if it is called withour a prior call to `CanXL_ProvideTxBuffer()`.⌋*()*

[CP_SWS_CanXL_00131] ⌈If development error detection is enabled: `CanXL_Transmit()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.16 CanXL_TxConfirmation

[CP_SWS_CanXL_10014] ⌈

Service Name	CanXL_TxConfirmation	
Syntax	`void CanXL_TxConfirmation ( uint8 CtrlIdx )`	
Service ID [hex]	0xC	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
Parameters (inout)	None	
Parameters (out)	None	
Return value	void	None
Description	Triggers frame transmission confirmation	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00100]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00086] ⌈The function shall check all filled transmit buffers for successful transmission. The function issues transmit confirmation for each transmitted frame using the callback function `EthIf_TxConfirmation()` if requested by the previous call of `CanXL_Transmit()` service.⌋*()*

[CP_SWS_CanXL_00087] ⌈If transmission confirmation was enabled by a previous call to `CanXL_Transmit()` the function shall release the buffer resource.⌋*()*

[CP_SWS_CanXL_00089] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00090] ⌈If development error detection is enabled: the function shall check the controller mode for being active. If the check fails, the function shall raise the development error `CanXL.CANXL_E_INV_MODE`.⌋*()*

[CP_SWS_CanXL_00091] ⌈If development error detection is enabled: `CanXL_TxConfirmation()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.17 CanXL_UpdatePhysAddrFilter

[CP_SWS_CanXL_10013] ⌈

Service Name	CanXL_UpdatePhysAddrFilter	
Syntax	`Std_ReturnType CanXL_UpdatePhysAddrFilter ( uint8 CtrlIdx, const uint8* PhysAddrPtr, Eth_FilterActionType Action )`	
Service ID [hex]	0x12	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same CtrlIdx, reentrant for different	
Parameters (in)	CtrlIdx	Index of the controller within the context of the Driver
	PhysAddrPtr	Pointer to memory containing the physical destination address (MAC address) in network byte order. This is the multicast destination address of the layer 2 packet.
	Action	Add or remove the address from the controllers filter.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: filter was successfully changed E_NOT_OK: filter could not be changed
Description	Update the physical source address to/from the indexed controller filter. If the controller is not capable to do the filtering, the software has to do this.	
Available via	CanXL.h	

⌋*()*

Note: This API is derived from Ethernet Driver ([SWS_Eth_00152]). For better understanding of the API's original intention you may check [8, Ethernet Interface] and [12, Ethernet Driver].

[CP_SWS_CanXL_00092] ⌈The function shall update the physical address receive filter of the indexed controller in case it is available.⌋*()*

Note for [CP_SWS_CanXL_00092]: See section 7.3 "Reception Handling".

[CP_SWS_CanXL_00096] ⌈If development error detection is enabled: the function shall check the parameter CtrlIdx for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_CONTROLLER.⌋*()*

[CP_SWS_CanXL_00097] ⌈If development error detection is enabled the function shall check the parameter PhysAddrPtr for being valid. If the check fails, the function shall raise the development error CANXL_E_PARAM_POINTER.⌋*()*

[CP_SWS_CanXL_00098] ⌈If development error detection is enabled: `CanXL_UpdatePhysAddrFilter()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*()*

8.3.18 CanXL_Write

[CP_SWS_CanXL_10002] ⌈

Service Name	CanXL_Write	
Syntax	`Std_ReturnType CanXL_Write ( Can_HwHandleType Hth, const CanXL_PduType* PduInfo )`	
Service ID [hex]	0x10	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different Hth	
Parameters (in)	Hth	Information which HW-transmit handle shall be used for transmit. Implicitly this is also the information about the controller to use because the Hth numbers are unique inside one hardware unit.
	PduInfo	Pointer to SDU user memory, Data Length and Identifier.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: Write command has been accepted E_NOT_OK: development error occurred CAN_BUSY: No TX hardware buffer available or pre-emptive call of CanXL_Write that can't be implemented re-entrant (see Can_ReturnType)
Description	This function is called by CanIf to pass a CAN XL message to the CAN XL driver for transmission. It provides the CAN XL specific parameters besides the hardware handle and actual PDU information.	
Available via	CanXL.h	

⌋*()*

The function is the counterpart to `Can_Write()` and expects additional `XLFF` specific parameters given by XLParams in the PduInfo.

While `Can_Write()` is used to request the transmission of CAN 2.0/FD frames, this function is used to request the transmission of CAN XL frames with following `SDU Types`:

- 01h (content based CAN XL frames)
- 03h (tunneled CAN 2.0/FD frames)
- further SDU Types defined in [2, CiA611-1]

SDU Type 05h (mapped tunneled 802.3 Ethernet frames) is not supported by this function and is exclusively used by `CanXL_Transmit()`.

For CAN 2.0 and CAN FD frames, a CanHardwareObject is configured as CAN HTH, while for CAN XL frames a CanXLHardwareObject is configured as CAN XL HTHs. A CanHardwareObject and a CanXLHardwareObject may share the same hardware queue.

[CP_SWS_CanXL_00121] ⌈When `CanXL_Write()` is called for transmitting a tunneled CAN 2.0/FD frame (`SDU Type` 03h), it is responsible to prepare the `LLC data`. Refer to [2, CiA611-1] for the structure. The `LLC data byte 1` shall be assembled from:

- ESI is always error active
- BRS is always disabled
- DLC of tunneled CAN 2.0/FD frame

⌋*(SRS_Can_02001)*

For other `SDU Types` the `SDU` data is transferred directly to hardware.

[CP_SWS_CanXL_00126] ⌈`CanXL_Write()` shall accept a null pointer as SDU (`Can_PduType.Can_SduPtrType = NULL`) if the trigger transmit API is enabled for this hardware object (`CanTriggerTransmitEnable = TRUE`).⌋*()*

[CP_SWS_CanXL_00127] ⌈If the trigger transmit API is enabled for the hardware object, `CanXL_Write()` shall interpret a null pointer as SDU (`Can_PduType.Can_SduPtrType = NULL`) as request for using the trigger transmit interface. If so and the hardware object is free, `CanXL_Write()` shall call `CanIf_TriggerTransmit` with the total size of the allocated message buffer to acquire the PDU's data.⌋*()*

The function first checks if the hardware transmit object that is identified by the HTH is free and if another transmission request is ongoing for the same HTH.

[CP_SWS_CanXL_00103] ⌈The function shall perform no actions if the hardware transmit object is busy with another transmit request for an L-PDU and shall return CAN_BUSY.⌋*()*

[CP_SWS_CanXL_00104] ⌈The function shall return CAN_BUSY if a preemptive call of `CanXL_Write()` has been issued, that could not be handled reentrant (i.e. a call with the same HTH).⌋*(SRS_BSW_00312)*

[CP_SWS_CanXL_00106] ⌈If development error detection is enabled: `CanXL_Write()` shall raise the error `CanXL.CANXL_E_UNINIT` if the driver is not yet initialized.⌋*(SRS_BSW_00369)*

[CP_SWS_CanXL_00107] ⌈If development error detection is enabled: The function shall raise the error CANXL_E_PARAM_HANDLE if the parameter Hth is not a configured CAN XL Hardware Transmit Handle.⌋*(SRS_BSW_00323, SRS_BSW_00369)*

[CP_SWS_CanXL_00109] ⌈If development error detection is enabled: The function shall raise the error `CanXL.CANXL_E_INV_PARAM` if the given SduType has the value 05h.⌋*(SRS_BSW_00323, SRS_BSW_00369)*

[CP_SWS_CanXL_00108] ⌈If development error detection is enabled: If `SDU Type` has another value than 03h, the function shall raise the error CANXL_E_PARAM_DATA_LENGTH if the length is 0 or exceeding 2048.⌋*(SRS_BSW_00323, SRS_BSW_00369)*

[CP_SWS_CanXL_00116] ⌈If development error detection is enabled: The function shall raise the error `CanXL.CANXL_E_INV_PARAM` if the `PduInfo` is inconsistent according to CiA 611-1 SDU types chapter 5.⌋*(SRS_BSW_00323, SRS_BSW_00369)*

[CP_SWS_CanXL_00119] ⌈If development error detection is enabled: The function shall raise the error `CanXL.CANXL_E_INV_PARAM` if `PduInfo->XLParams->Vcid` is larger than 255.⌋*(SRS_BSW_00323, SRS_BSW_00369)*

[CP_SWS_CanXL_00110] ⌈If development error detection is enabled: The function shall raise CANXL_E_PARAM_POINTER if the parameter PduInfo is a null pointer.⌋*(SRS_BSW_00323, SRS_BSW_00369)*

[CP_SWS_CanXL_00112] ⌈If development error detection is enabled: The function shall raise CANXL_E_PARAM_POINTER if the XLParams pointer is a null pointer.⌋*(SRS_BSW_00323, SRS_BSW_00369)*

8.4 Callback notifications

Note: `CAN XL Driver` does not have additional callback notifications.

8.5 Scheduled functions

Note: `CAN XL Driver` does not have additional scheduled functions.

8.6 Expected interfaces

In this chapter all interfaces required from other modules are listed.

8.6.1 Mandatory interfaces

Note: This section defines all interfaces, which are required to fulfill the core functionality of the module.

[CP_SWS_CanXL_10022] ⌈

API Function	Header File	Description
CanIf_XLRxIndication	CanIf_Can.h	This service indicates a successful reception of a received CAN XL Rx L-PDU to the CanIf after passing all filters and validation checks. It provides the CAN XL specific parameters besides the hardware and actual L-PDU information.
CanXLTrcv_ReportErrorState	CanXLTrcv.h	Reports each change of the CAN error state.

⌋()

8.6.2 Optional interfaces

Note: This section defines all interfaces, which are required to fulfill an optional functionality of the module.

[CP_SWS_CanXL_10021] ⌈

API Function	Header File	Description
EthIf_CtrlModeIndication	EthIf.h	Called asynchronously when mode has been read out. Triggered by previous <EthDrv>_SetController Mode call. Can directly be called within the trigger functions.
EthIf_RxIndication	EthIf.h	Handles a received frame received by the indexed controller
EthIf_TxConfirmation	EthIf.h	Confirms frame transmission by the indexed controller

⌋()

8.6.3 Configurable interfaces

Note: `CAN XL Driver` does not use configurable interfaces.

9 Sequence diagrams

There are no sequence diagrams needed. The sequences do not differ to CAN/Ethernet.

10 Configuration specification

In general, this chapter defines configuration parameters and their clustering into containers. In order to support the specification Chapter 10.1 describes fundamentals. It also specifies a template (table) you shall use for the parameter specification. We intend to leave Chapter 10.1 in the specification to guarantee comprehension.

Chapter 10.2 specifies the structure (containers) and the parameters of the module `CAN XL Driver`.

Chapter 10.4 specifies published information of the module `CAN XL Driver`.

10.1 How to read this chapter

For details refer to the chapter 10.1 “Introduction to configuration specification” in SWS_BSWGeneral.

10.2 Containers and configuration parameters

The following chapters summarize all configuration parameters. The detailed meanings of the parameters are described in Chapter 7 and Chapter 8.

10.2.1 CanXLGeneral

SWS Item	[ECUC_Can_00524]		
Container Name	CanXLGeneral		
Parent Container	CanGeneral		
Description	This container is specified in the SWS CAN XL Driver and contains global parameters of the CAN XL Driver.		
Post-Build Variant Multiplicity	false		
Multiplicity Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Configuration Parameters			

SWS Item	[ECUC_Can_00525]
Parameter Name	CanXLEthGlobalTimeSupport
Parent Container	CanXLGeneral
Description	Enables/Disables the Global Time APIs for the Ethernet Interface used when hardware timestamping is supported by CAN controller.
Multiplicity	1
Type	EcucBooleanParamDef

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Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

No Included Containers

10.2.2 CanXLController

SWS Item	**[ECUC_Can_00499]**		
Container Name	CanXLController		
Parent Container	CanController		
Description	This container is specified in the SWS CAN XL Driver and represents a CAN XL channel. If this container is present, the CAN driver will provide the extended CanXL API.		
Post-Build Variant Multiplicity	false		
Multiplicity Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Configuration Parameters			

SWS Item	**[ECUC_Can_00500]**		
Parameter Name	CanXLCtrlEthDefaultPriority		
Parent Container	CanXLController		
Description	Defines the default CAN XL Priority ID to be used for outgoing tunneled Ethernet frames.		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00501]**
Parameter Name	CanXLEthDefaultQueue
Parent Container	CanXLController

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Description	Defines the default CAN XL Queue to be used for outgoing tunneled Ethernet frames.		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00506]**		
Parameter Name	CanXLEthPhysAddress		
Parent Container	CanXLController		
Description	Specifies the unique 48-bit physical address (MAC address) of the controller in network byte order. Regular Expression: [0-9a-fA-F]{2}[[:-][0-9a-fA-F]{2}]{5}		
Multiplicity	0..1		
Type	EcucStringParamDef		
Default value	–		
Length	17-17		
Regular Expression	[0-9a-fA-F]{2}[[:-][0-9a-fA-F]{2}]{5}		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00511]**		
Parameter Name	CanXLEthEcucPartitionRef		
Parent Container	CanXLController		
Description	Maps the Ethernet Interface access to the CAN XL controller to zero or one ECUC partitions.		
Multiplicity	0..1		
Type	Reference to EcucPartition		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	

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	Post-build time	–	
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
CanXLEthEgressFifo	0..*	Represents a Fifo at the egress side.
CanXLEthIngressFifo	0..*	Represents a Fifo at the ingress side.

[CP_SWS_CanXL_00120] ⌈The module shall operate as an independent instance in each of the partitions, means the called API will only target the partition it is called in.⌋ *()*

[CP_SWS_CanXL_CONSTR_00001] ⌈If `CanEcucPartitionRef` references one or more ECUC partitions, `CanXLEthControllerEcucPartitionRef` shall have a multiplicity of one and reference an ECUC partition as well.⌋ *()*

Note: `CanXLEthControllerEcucPartitionRef` may reference a different partition than any reference in `CanEcucPartitionRef`.

10.2.3 CanXLEthEgressFifo

SWS Item	**[ECUC_Can_00502]**		
Container Name	CanXLEthEgressFifo		
Parent Container	CanXLController		
Description	Represents a Fifo at the egress side.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_Can_00503]**		
Parameter Name	CanXLEthEgressFifoCanXLPriority		
Parent Container	CanXLEthEgressFifo		
Description	Defines the CAN XL Priority ID to be used for outgoing tunneled Ethernet frames using this FIFO.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE

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	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00504]**		
Parameter Name	CanXLEthEgressFifoCanXLQueue		
Parent Container	CanXLEthEgressFifo		
Description	Defines the CAN XL Queue to be used for outgoing tunneled Ethernet frames using this FIFO.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00505]**		
Parameter Name	CanXLEthEgressFifoIdx		
Parent Container	CanXLEthEgressFifo		
Description	Egress Fifo index.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

No Included Containers

10.2.4 CanXLEthIngressFifo

SWS Item	**[ECUC_Can_00507]**		
Container Name	CanXLEthIngressFifo		
Parent Container	CanXLController		
Description	Represents a Fifo at the ingress side.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	

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	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_Can_00509]**		
Parameter Name	CanXLEthIngressFifoCanXLQueue		
Parent Container	CanXLEthIngressFifo		
Description	Defines the CAN XL Queue to be used for incoming tunneled Ethernet frames using this FIFO.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00508]**		
Parameter Name	CanXLEthIngressFifoIdx		
Parent Container	CanXLEthIngressFifo		
Description	Ingress Fifo index.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00510]**		
Parameter Name	CanXLEthIngressFifoVcid		
Parent Container	CanXLEthIngressFifo		
Description	Configures a VCID to be accepted by this FIFO. If not present, all VCIDs shall be accepted.		
Multiplicity	0..*		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE

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	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

No Included Containers

10.2.5 CanXLBaudrateConfig

SWS Item	**[ECUC_Can_00512]**		
Container Name	CanXLBaudrateConfig		
Parent Container	CanControllerBaudrateConfig		
Description	This container is specified in the SWS CAN XL Driver and contains bit timing related configuration parameters of the CAN controller(s) for payload and CRC of a CAN XL frame.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_Can_00513]**		
Parameter Name	CanXLBaudRate		
Parent Container	CanXLBaudrateConfig		
Description	Specifies the data segment baud rate of the controller in kbps. Note: The CAN XL baudrate should be at least twice the nominal bitrate so that an error flag can safely destroy a CAN XL frame.		
Multiplicity	1		
Type	EcucFloatParamDef		
Range	[0 .. 20000]		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local dependency: Has to be at least twice as high as CanControllerBaudRate.		

SWS Item	**[ECUC_Can_00523]**
Parameter Name	CanXLErrorSignaling
Parent Container	CanXLBaudrateConfig
Description	Specifies if error signaling shall be enabled.
Multiplicity	1
Type	EcucBooleanParamDef
Default value	–
Post-Build Variant Value	true

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Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local dependency: Only relevant if CanXLTrcvPwmMode is disabled.		

SWS Item	**[ECUC_Can_00517]**		
Parameter Name	CanXLPropSeg		
Parent Container	CanXLBaudrateConfig		
Description	Specifies propagation delay in time quantas.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00514]**		
Parameter Name	CanXLPwmL		
Parent Container	CanXLBaudrateConfig		
Description	Specifies the PWM long phase length.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00516]**		
Parameter Name	CanXLPwmO		
Parent Container	CanXLBaudrateConfig		
Description	Specifies the PWM time offset.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_Can_00515]		
Parameter Name	CanXLPwmS		
Parent Container	CanXLBaudrateConfig		
Description	Specifies the PWM short phase length.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_Can_00518]		
Parameter Name	CanXLSeg1		
Parent Container	CanXLBaudrateConfig		
Description	Specifies phase segment 1 in time quantas.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_Can_00519]		
Parameter Name	CanXLSeg2		
Parent Container	CanXLBaudrateConfig		
Description	Specifies phase segment 2 in time quantas.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_Can_00521]
Parameter Name	CanXLSspOffset
Parent Container	CanXLBaudrateConfig

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Description	Specifies the Transmitter Delay Compensation Offset in minimum time quanta. If this parameter is configured, the Transmitter Delay Compensation is done by measurement of the CAN controller. If not specified, Transmitter Delay Compensation is disabled. See ECUC_Can_00494 for details.		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00520]**		
Parameter Name	CanXLSyncJumpWidth		
Parent Container	CanXLBaudrateConfig		
Description	Specifies the synchronization jump width for the controller in time quantas.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_Can_00522]**		
Parameter Name	CanXLTrcvPwmMode		
Parent Container	CanXLBaudrateConfig		
Description	Specifies if the transceiver shall be set to the PWM mode.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

No Included Containers

10.2.6 CanXLHardwareObject

SWS Item	[ECUC_Can_00526]		
Container Name	CanXLHardwareObject		
Parent Container	CanConfigSet		
Description	This container is specified in the SWS CAN XL Driver and contains the configuration (parameters) of CAN XL Hardware Objects.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	[ECUC_Can_00327]		
Parameter Name	CanObjectType		
Parent Container	CanXLHardwareObject		
Description	Specifies if the HardwareObject is used as Transmit or as Receive object		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	RECEIVE	Receive HOH	
	TRANSMIT	Transmit HOH	
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_Can_00527]		
Parameter Name	CanXLObjectId		
Parent Container	CanXLHardwareObject		
Description	Holds the handle ID of CAN XL HRH or HTH.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	[ECUC_Can_00322]
Parameter Name	CanControllerRef
Parent Container	CanXLHardwareObject
Description	Reference to CAN Controller to which the HOH is associated to.
Multiplicity	1
Type	Reference to CanController

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Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local dependency: The referenced CanController has to contain a CanXLController.		

SWS Item	**[ECUC_Can_00438]**		
Parameter Name	CanMainFunctionRWPeriodRef		
Parent Container	CanXLHardwareObject		
Description	Reference to CanMainFunctionPeriod. If configured, this hardware object will be polled.		
Multiplicity	0..1		
Type	Reference to CanMainFunctionRWPeriods		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
CanXLHwFilter	0..*	This container is only valid for CAN XL HRHs and contains the configuration (parameters) of one hardware filter. This container is intentionally left empty, because the parameters are very hardware specific and shall be filled in by the VSMD.

10.2.7 CanXLHwFilter

SWS Item	**[ECUC_Can_00528]**		
Container Name	CanXLHwFilter		
Parent Container	CanXLHardwareObject		
Description	This container is only valid for CAN XL HRHs and contains the configuration (parameters) of one hardware filter. This container is intentionally left empty, because the parameters are very hardware specific and shall be filled in by the VSMD.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

No Included Containers

10.3 Configuration Hints

The CAN XL bus is expected to be controlled only via the CAN stack, while the Ethernet stack switches the CAN XL bus like a virtual bus, and the real bus state is only visible as Link State on the Ethernet side.

The ComM has support for this kind of connection between different ComM Channels, the pattern being mainly used for VLANs that shall not have separate network management. This support comes in the form of a managing channel (here the ComM Channel linked to the CanController) and one or more managed channels (here all Ethernet channels, including all VLANs). The managed channels refer to the managing channel via the ComMManageReference.

10.4 Published Information

For details refer to the chapter 10.3 “Published Information” in SWS_BSWGeneral.

A Not applicable requirements

[CP_SWS_CanXL_00999] ⌈These requirements are not applicable to this specification.⌋ *()*