Document Title	Specification of CAN Transceiver Driver
Document Owner	AUTOSAR
Document Responsibility	AUTOSAR
Document Identification No	71
Document Status	published
Part of AUTOSAR Standard	Classic Platform
Part of Standard Release	R20-11

Document Change History

Date	Release	Changed by	Change Description
2020-11-30	R20-11	AUTOSAR Release Management	• Modeling of Development Errors, Runtime Errors, and Transient Faults. • SOME/IP transformation props missing is added. • Clean up of APIs with return type void, that specify a return value. • CanTrcv Operation Mode Inconsistencies corrected.
2019-11-28	R19-11	AUTOSAR Release Management	• Sequence diagram De-Initialization (SPI Synchronous) and De-Initialization (SPI Asynchronous) split into different pages. • Minor correction in CanTrcv initialization functionality. • Changed Document Status from Final to published
2018-10-31	4.4.0	AUTOSAR Release Management	• Removed DET reporting behavior for the APIs CanTrcv_MainFunctionDiagnostics and CanTrcv_MainFunction during un-initialized state.
2017-12-08	4.3.1	AUTOSAR Release Management	• CanTrcv_DeInit API added in state machine diagram • Editorial changes 'Runtime errors' added

Document Change History

Date	Release	Changed by	Change Description
2016-11-30	4.3.0	AUTOSAR Release Management	• Added CanTrcv_DeInit API • Sequence diagram updated • CanTrcvGetVersionInfo renamed to CanTrcvVersionInfoApi • Updated Configuration class for configuration parameters • Minor corrections in the MainFunction periods
2014-10-31	4.2.1	AUTOSAR Release Management	• Revised the configuration of CAN Transceiver. • Minor corrections in wait state functionality. • Clarification regarding the wakeup sources.
2014-03-31	4.1.3	AUTOSAR Release Management	• Revised configuration for SPI interface. • Revised naming convention for transceiver driver
2013-10-31	4.1.2	AUTOSAR Release Management	• Removed 'Timing' row from scheduled functions API table. • Editorial changes • Removed chapter(s) on change documentation
2013-03-15	4.1.1	AUTOSAR Administration	• Updated sequence diagrams • Reworked according to the new SWS_BSWGeneral
2011-12-22	4.0.3	AUTOSAR Administration	• Added support for Partial Networking • Implemented Production error concept • Updated Baud rate configuration parameter handling • Added support to detect that power-on was caused by CAN communication • Reentrancy attribute is corrected for APIs • Corrections in few requirements • Optional Interfaces Table is corrected

Document Change History

Date	Release	Changed by	Change Description
2009-12-18	4.0.1	AUTOSAR Administration	• CanTrcv state names changed and state diagram modified • Usage of SBCs are no longer restricted • Mode switch requests to the current mode are allowed • CanTrvc driver has to invoke CanIf_TrcvModeIndication after each mode switch request, when the requested mode has been reached
2010-02-02	3.1.4	AUTOSAR Administration	• Wakeup event reporting: In R4.0, CanTrcv stores wakeup events. CanIf invokes function CanTrcv_CheckWakeup() periodically to check for wakeup events. • Wakeup modes: In R4.0, wakeup through interrupt mechanism is not supported. Only POLLING and NOT_SUPPORTED wakeup modes are available in CanTrcv. • Sleep Wait Count added: Wait count for transitioning into sleep mode (CanTrcvSleepWaitCount) added. • Legal disclaimer revised
2008-08-13	3.1.1	AUTOSAR Administration	• Legal disclaimer revised
2007-12-21	3.0.1	AUTOSAR Administration	• Changed API name CanIf_TrcvWakeupByBus to CanIf_SetWakeupEvent • New error code CANTRCV_E_PARAM_TRCV_WAKEUP_MODE has been added. • Output parameter in the API's CanTrcv_GetOpMode, CanTrcv_GetBusWuReason and CanTrcv_GetVersionInfo is changed to pointer type. • API CanTrcv_CB_WakeupByBus has been modified • Document meta information extended • Small layout adaptations made

Document Change History

Date	Release	Changed by	Change Description
2007-01-24	2.1.15	AUTOSAR Administration	• CAN transceiver driver is below CAN interface. All API access from higher layers are routed through CAN interface. • One CAN transceiver driver used per CAN transceiver hardware type. For different CAN transceiver hardware types different CAN transceiver drivers are used. One CAN transceiver driver supports all CAN transceiver hardware of same type • Legal disclaimer revised • Release Notes added • “Advice for users” revised • “Revision Information” added
2006-05-16	2.0	AUTOSAR Administration	• Initial release

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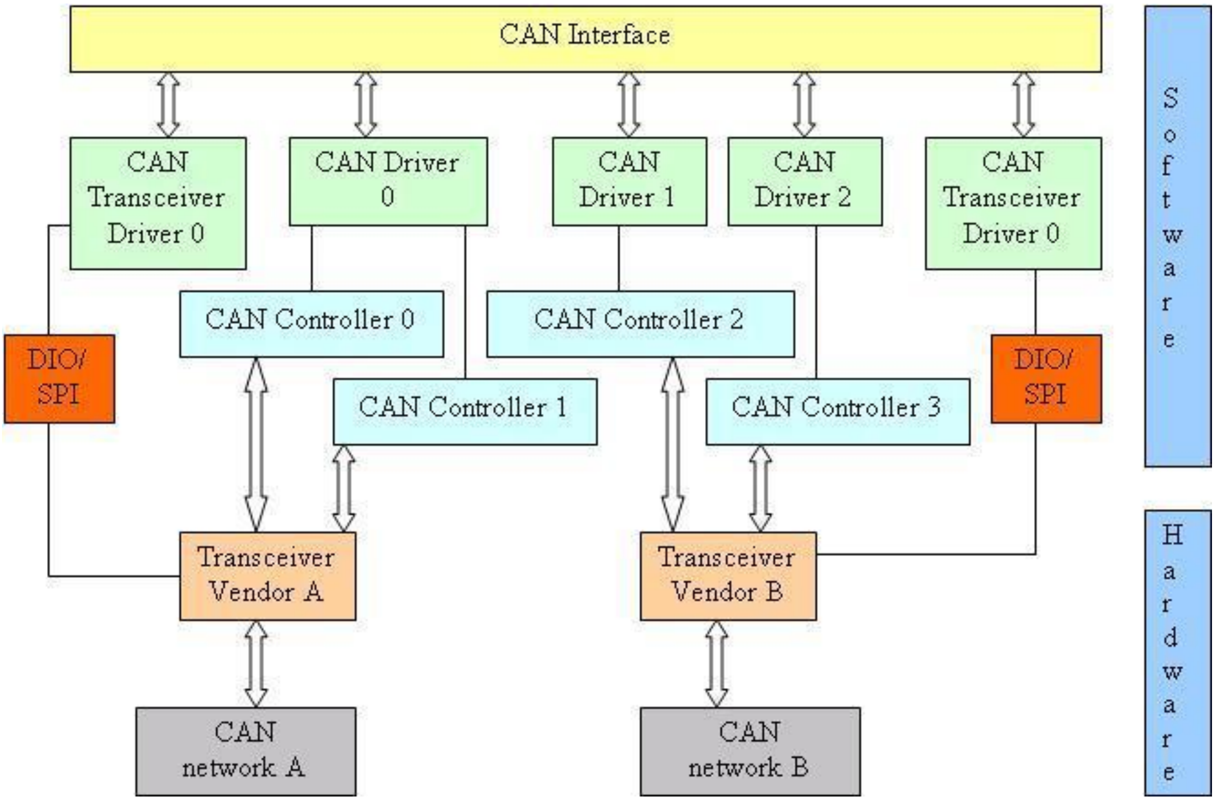
1 Introduction

This specification describes the functionality, APIs and configuration of CAN Transceiver Driver module. The CAN Transceiver Driver module is responsible for handling the CAN transceiver hardware chips on an ECU.
The CAN Transceiver is a hardware device, which adapts the signal levels that are used on the CAN bus to the logical (digital) signal levels recognised by a microcontroller.
In addition, the transceivers are able to detect electrical malfunctions like wiring issues, ground offsets or transmission of long dominant signals. Depending on the interfacing with the microcontroller, they flag the detected error summarized by a single port pin or very detailed by SPI.
Some transceivers support power supply control and wake up via the CAN bus. Different wake up/sleep and power supply concepts are usual on the market.
Within the automotive environment, there are mainly three different CAN bus physics used. These are ISO11898 for high-speed CAN (up to 1Mbits/s), ISO11519 for low-speed CAN (up to 125Kbits/s) and SAE J2411 for single-wire CAN.
Latest developments include System Basis Chips (SBCs) where power supply control and advanced watchdogs are implemented in addition to CAN. These are enclosed in one housing and controlled through single interface (e.g. via SPI).


CAN Interface
CAN Transceiver Driver 0
CAN Driver 0
CAN Driver 1
CAN Driver 2
CAN Transceiver Driver 0
CAN Controller 0
CAN Controller 2
CAN Controller 1
CAN Controller 3
DIO/ SPI
DIO/ SPI
Transceiver Vendor A
Transceiver Vendor B
CAN network A
CAN network B
Software
Hardware

1.1 Goal of CAN Transceiver Driver

The target of this document is to specify the interfaces and behavior which are applicable to most current and future CAN transceiver devices.
The CAN transceiver driver abstracts the CAN transceiver hardware. It offers a hardware independent interface to the higher layers. It abstracts from the ECU layout by using APIs of MCAL layer to access the CAN transceiver hardware.

1.2 Explicitly uncovered CAN transceiver functionality

Some CAN bus transceivers offer additional functionality, for example, ECU self test or error detection capability for diagnostics.
ECU self test and error detection are not defined within AUTOSAR and requiring such functionality would lock out most currently used transceiver hardware chips. Therefore, features like “ground shift detection”, “selective wake up”, “slope control” are not supported.

1.3 Single wire CAN transceivers according SAE J2411

Single wire CAN according SAE J2411 is not supported by AUTOSAR.

2 Acronyms and abbreviations

Abbreviation	***Description***
ComM	Communication Manager
DEM	Diagnostic Event Manager
DET	Default Error Tracer
DIO	Digital Input Output (SPAL module)
EB	Externally Buffered channels. Buffers containing data to transfer are outside the SPI Handler/Driver.
EcuM	ECU State Manager
IB	Internally Buffered channels. Buffers containing data to transfer are inside the SPI Handler/Driver.
ISR	Interrupt Service Routine
MCAL	Micro Controller Abstraction Layer
Port	Port module (SPAL module)
n/a	Not Applicable
SBC	System Basis Chip; a device, which integrates e.g. CAN and/or LIN transceiver, watchdog and power control.
SPAL	Standard Peripheral Abstraction Layer
SPI Channel	A channel is a software exchange medium for data that are defined with the same criteria: configuration parameters, number of data elements with same size and data pointers (source & destination) or location. See specification of SPI driver for more details.
SPI Job	A job is composed of one or several channels with the same chip select. A job is considered to be atomic and therefore cannot be interrupted. A job has also an assigned priority. See specification of SPI driver for more details.
SPI Sequence	A sequence is a number of consecutive jobs to be transmitted. A sequence depends on a static configuration. See specification of SPI driver for more details.
CAN Channel	A physical channel which is connected to a CAN network from a CAN controller through a CAN transceiver.
API	Application Programming Interface

3 Related documentation

3.1 Input documents

[1] List of Basic Software Modules
AUTOSAR_TR_BSWModuleList.pdf

[2] Layered Software Architecture
AUTOSAR_EXP_LayeredSoftwareArchitecture.pdf

[3] Specification of ECU Configuration
AUTOSAR_TPS_ECUConfiguration.pdf

[4] General Requirements on Basic Software
AUTOSAR_SRS_BSWGeneral.pdf

[5] Specification of Specification of CAN Interface
AUTOSAR_SWS_CANInterface.pdf

[6] Basic Software Module Description Template,
AUTOSAR_TPS_BSWModuleDescriptionTemplate.pdf

[7] General Specification of Basic Software Modules
AUTOSAR_SWS_BSWGeneral.pdf

3.2 Related standards and norms

[8] ISO11898 – Road vehicles - Controller area network (CAN)

3.3 Related specification

AUTOSAR provides a General Specification on Basic Software modules [7] (SWS BSW General), which is also valid for CAN Transceiver Driver.

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

4 Constraints and assumptions

4.1 Limitations

[SWS_CanTrcv_00098]⌈ The CAN bus transceiver hardware shall provide the functionality and an interface which can be mapped to the operation mode model of the AUTOSAR CAN transceiver driver. ⌋(SRS_BSW_00172)
See also Chapter 7.1.

4.2 Applicability to car domains

This driver might be applicable in all car domains using CAN for communication.

5 Dependencies to other modules

Module	Dependencies
CanIf	All CAN transceiver drivers are arranged below CanIf.
ComM	ComM steers CAN transceiver driver communication modes via CanIf. Each CAN transceiver driver is steered independently.
DET	DET gets development error information from CAN transceiver driver.
DEM	DEM gets production error information from CAN transceiver driver.
DIO	DIO module is used to access CAN transceiver device connected via ports.
EcuM	EcuM gets information about wake up events from CAN transceiver driver via CanIf.
SPI	SPI module is used to access CAN transceiver device connected via SPI.

5.1 File structure

5.1.1 Code file structure

[SWS_CanTrcv_00064]⌈The naming convention prescribed by AUTOSAR is applied to all files of the CanTrcv module. ⌋(SRS_BSW_00300)

[SWS_CanTrcv_00065] ⌈The CanTrcv module consists of the following files:

File name	***Requirements***	***Description***
CanTrcv.c	SWS_CanTrcv_00069	The implementation general c file. It does not contain interrupt routines.
CanTrcv.h	SWS_CanTrcv_00052	It contains only information relevant for other BSW modules (API). Differences in API depending in configuration are encapsulated.

6 Requirements Traceability

Requirement	Description	Satisfied by
SRS_BSW_00005	Modules of the µC Abstraction Layer (MCAL) may not have hard coded horizontal interfaces	SWS_CanTrcv_00999
SRS_BSW_00006	The source code of software modules above the µC Abstraction Layer (MCAL) shall not be processor and compiler dependent.	SWS_CanTrcv_00999
SRS_BSW_00007	All Basic SW Modules written in C language shall conform to the MISRA C 2012 Standard.	SWS_CanTrcv_00999
SRS_BSW_00009	All Basic SW Modules shall be documented according to a common standard.	SWS_CanTrcv_00999
SRS_BSW_00010	The memory consumption of all Basic SW Modules shall be documented for a defined configuration for all supported platforms.	SWS_CanTrcv_00999
SRS_BSW_00101	The Basic Software Module shall be able to initialize variables and hardware in a separate initialization function	SWS_CanTrcv_00001
SRS_BSW_00160	Configuration files of AUTOSAR Basic SW module shall be readable for human beings	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_BSW_00161	The AUTOSAR Basic Software shall provide a microcontroller abstraction layer which provides a standardized interface to higher software layers	SWS_CanTrcv_00999
SRS_BSW_00164	The Implementation of interrupt service routines shall be done by the Operating System, complex drivers or modules	SWS_CanTrcv_00999
SRS_BSW_00168	SW components shall be tested by a function defined in a common API in the Basis-SW	SWS_CanTrcv_00999
SRS_BSW_00171	Optional functionality of a Basic-SW component that is not required in the ECU shall be configurable at pre-compile-time	SWS_CanTrcv_00013
SRS_BSW_00172	The scheduling strategy that is built inside the Basic Software Modules shall be compatible with the strategy used in the system	SWS_CanTrcv_00001, SWS_CanTrcv_00013, SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00098, SWS_CanTrcv_00099

SRS_BSW_00300	All AUTOSAR Basic Software Modules shall be identified by an unambiguous name	SWS_CanTrcv_00064
SRS_BSW_00304	All AUTOSAR Basic Software Modules shall use the following data types instead of native C data types	SWS_CanTrcv_00999
SRS_BSW_00305	Data types naming convention	SWS_CanTrcv_00999
SRS_BSW_00306	AUTOSAR Basic Software Modules shall be compiler and platform independent	SWS_CanTrcv_00999
SRS_BSW_00307	Global variables naming convention	SWS_CanTrcv_00999
SRS_BSW_00308	AUTOSAR Basic Software Modules shall not define global data in their header files, but in the C file	SWS_CanTrcv_00999
SRS_BSW_00309	All AUTOSAR Basic Software Modules shall indicate all global data with read-only purposes by explicitly assigning the const keyword	SWS_CanTrcv_00999
SRS_BSW_00310	API naming convention	SWS_CanTrcv_00001, SWS_CanTrcv_00002, SWS_CanTrcv_00005, SWS_CanTrcv_00007, SWS_CanTrcv_00008, SWS_CanTrcv_00009, SWS_CanTrcv_00013
SRS_BSW_00312	Shared code shall be reentrant	SWS_CanTrcv_00999
SRS_BSW_00321	The version numbers of AUTOSAR Basic Software Modules shall be enumerated according specific rules	SWS_CanTrcv_00999
SRS_BSW_00325	The runtime of interrupt service routines and functions that are running in interrupt context shall be kept short	SWS_CanTrcv_00999
SRS_BSW_00327	Error values naming convention	SWS_CanTrcv_00050, SWS_CanTrcv_00206, SWS_CanTrcv_00227
SRS_BSW_00328	All AUTOSAR Basic Software Modules shall avoid the duplication of code	SWS_CanTrcv_00999
SRS_BSW_00330	It shall be allowed to use macros instead of functions where source code is used and runtime is critical	SWS_CanTrcv_00999
SRS_BSW_00331	All Basic Software Modules shall strictly separate error and status information	SWS_CanTrcv_00206, SWS_CanTrcv_00227
SRS_BSW_00333	For each callback function it shall be specified if it is called from interrupt context or not	SWS_CanTrcv_00999

SRS_BSW_00334	All Basic Software Modules shall provide an XML file that contains the meta data	SWS_CanTrcv_00999
SRS_BSW_00336	Basic SW module shall be able to shutdown	SWS_CanTrcv_00999, SWS_CanTrcv_91001
SRS_BSW_00337	Classification of development errors	SWS_CanTrcv_00206, SWS_CanTrcv_00227
SRS_BSW_00339	Reporting of production relevant error status	SWS_CanTrcv_00228
SRS_BSW_00341	Module documentation shall contains all needed informations	SWS_CanTrcv_00999
SRS_BSW_00342	It shall be possible to create an AUTOSAR ECU out of modules provided as source code and modules provided as object code, even mixed	SWS_CanTrcv_00999
SRS_BSW_00343	The unit of time for specification and configuration of Basic SW modules shall be preferably in physical time unit	SWS_CanTrcv_00112
SRS_BSW_00344	BSW Modules shall support link-time configuration	SWS_CanTrcv_00999
SRS_BSW_00347	A Naming seperation of different instances of BSW drivers shall be in place	SWS_CanTrcv_00016
SRS_BSW_00350	All AUTOSAR Basic Software Modules shall allow the enabling/disabling of detection and reporting of development errors.	SWS_CanTrcv_00050
SRS_BSW_00357	For success/failure of an API call a standard return type shall be defined	SWS_CanTrcv_00002
SRS_BSW_00358	The return type of init() functions implemented by AUTOSAR Basic Software Modules shall be void	SWS_CanTrcv_00001
SRS_BSW_00359	All AUTOSAR Basic Software Modules callback functions shall avoid return types other than void if possible	SWS_CanTrcv_00999
SRS_BSW_00360	AUTOSAR Basic Software Modules callback functions are allowed to have parameters	SWS_CanTrcv_00999
SRS_BSW_00369	All AUTOSAR Basic Software Modules shall not return specific development error codes via the API	SWS_CanTrcv_00001, SWS_CanTrcv_00002, SWS_CanTrcv_00005, SWS_CanTrcv_00007, SWS_CanTrcv_00008, SWS_CanTrcv_00009, SWS_CanTrcv_00013, SWS_CanTrcv_91004, SWS_CanTrcv_91005
SRS_BSW_00371	The passing of function pointers as API parameter is forbidden for	SWS_CanTrcv_00001, SWS_CanTrcv_00002,

	all AUTOSAR Basic Software Modules	SWS_CanTrcv_00005, SWS_CanTrcv_00007, SWS_CanTrcv_00008, SWS_CanTrcv_00009, SWS_CanTrcv_00013
SRS_BSW_00373	The main processing function of each AUTOSAR Basic Software Module shall be named according the defined convention	SWS_CanTrcv_00013
SRS_BSW_00375	Basic Software Modules shall report wake-up reasons	SWS_CanTrcv_00007
SRS_BSW_00377	A Basic Software Module can return a module specific types	SWS_CanTrcv_00005, SWS_CanTrcv_00007
SRS_BSW_00378	AUTOSAR shall provide a boolean type	SWS_CanTrcv_00999
SRS_BSW_00383	The Basic Software Module specifications shall specify which other configuration files from other modules they use at least in the description	SWS_CanTrcv_00999
SRS_BSW_00384	The Basic Software Module specifications shall specify at least in the description which other modules they require	SWS_CanTrcv_00999
SRS_BSW_00385	List possible error notifications	SWS_CanTrcv_00050, SWS_CanTrcv_00206, SWS_CanTrcv_00227, SWS_CanTrcv_00228
SRS_BSW_00386	The BSW shall specify the configuration for detecting an error	SWS_CanTrcv_00050
SRS_BSW_00388	Containers shall be used to group configuration parameters that are defined for the same object	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_BSW_00389	Containers shall have names	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_BSW_00390	Parameter content shall be unique within the module	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_BSW_00392	Parameters shall have a type	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_BSW_00393	Parameters shall have a range	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_BSW_00394	The Basic Software Module specifications shall specify the scope of the configuration parameters	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093,

		SWS_CanTrcv_00095
SRS_BSW_00395	The Basic Software Module specifications shall list all configuration parameter dependencies	SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_BSW_00398	The link-time configuration is achieved on object code basis in the stage after compiling and before linking	SWS_CanTrcv_00999
SRS_BSW_00399	Parameter-sets shall be located in a separate segment and shall be loaded after the code	SWS_CanTrcv_00999
SRS_BSW_00400	Parameter shall be selected from multiple sets of parameters after code has been loaded and started	SWS_CanTrcv_00999
SRS_BSW_00401	Documentation of multiple instances of configuration parameters shall be available	SWS_CanTrcv_00999
SRS_BSW_00404	BSW Modules shall support post-build configuration	SWS_CanTrcv_00999
SRS_BSW_00405	BSW Modules shall support multiple configuration sets	SWS_CanTrcv_00999
SRS_BSW_00406	A static status variable denoting if a BSW module is initialized shall be initialized with value 0 before any APIs of the BSW module is called	SWS_CanTrcv_00002, SWS_CanTrcv_00005, SWS_CanTrcv_00007, SWS_CanTrcv_00008, SWS_CanTrcv_00009, SWS_CanTrcv_00013
SRS_BSW_00407	Each BSW module shall provide a function to read out the version information of a dedicated module implementation	SWS_CanTrcv_00008
SRS_BSW_00408	All AUTOSAR Basic Software Modules configuration parameters shall be named according to a specific naming rule	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_BSW_00410	Compiler switches shall have defined values	SWS_CanTrcv_00999
SRS_BSW_00411	All AUTOSAR Basic Software Modules shall apply a naming rule for enabling/disabling the existence of the API	SWS_CanTrcv_00008
SRS_BSW_00413	An index-based accessing of the instances of BSW modules shall be done	SWS_CanTrcv_00016
SRS_BSW_00414	Init functions shall have a pointer to a configuration structure as single parameter	SWS_CanTrcv_00001
SRS_BSW_00416	The sequence of modules to be initialized shall be configurable	SWS_CanTrcv_00999
SRS_BSW_00417	Software which is not part of the SW-C shall report error events only after the DEM is fully operati-	SWS_CanTrcv_00999

	onal.	
SRS_BSW_00422	Pre-de-bouncing of error status information is done within the DEM	SWS_CanTrcv_00999
SRS_BSW_00423	BSW modules with AUTOSAR interfaces shall be describable with the means of the SW-C Template	SWS_CanTrcv_00999
SRS_BSW_00424	BSW module main processing functions shall not be allowed to enter a wait state	SWS_CanTrcv_00013
SRS_BSW_00425	The BSW module description template shall provide means to model the defined trigger conditions of schedulable objects	SWS_CanTrcv_00090
SRS_BSW_00426	BSW Modules shall ensure data consistency of data which is shared between BSW modules	SWS_CanTrcv_00999
SRS_BSW_00427	ISR functions shall be defined and documented in the BSW module description template	SWS_CanTrcv_00999
SRS_BSW_00428	A BSW module shall state if its main processing function(s) has to be executed in a specific order or sequence	SWS_CanTrcv_00013
SRS_BSW_00429	Access to OS is restricted	SWS_CanTrcv_00999
SRS_BSW_00432	Modules should have separate main processing functions for read/receive and write/transmit data path	SWS_CanTrcv_00999
SRS_BSW_00433	Main processing functions are only allowed to be called from task bodies provided by the BSW Scheduler	SWS_CanTrcv_00999
SRS_Can_01090	The bus transceiver driver package shall offer configuration parameters that are needed to configure the driver for a given bus and the supported notifications	SWS_CanTrcv_00090, SWS_CanTrcv_00091, SWS_CanTrcv_00093, SWS_CanTrcv_00095
SRS_Can_01091	The CAN bus transceiver driver shall support the configuration for more than one bus	SWS_CanTrcv_00002, SWS_CanTrcv_00005, SWS_CanTrcv_00007, SWS_CanTrcv_00009, SWS_CanTrcv_00016
SRS_Can_01092	-	SWS_CanTrcv_00091
SRS_Can_01095	The bus transceiver driver shall support the compile time configuration of one notification to an upper layer for change notification for "wakeup by bus" events	SWS_CanTrcv_00007
SRS_Can_01096	The bus transceiver driver shall provide an API to initialize the driver internally	SWS_CanTrcv_00001

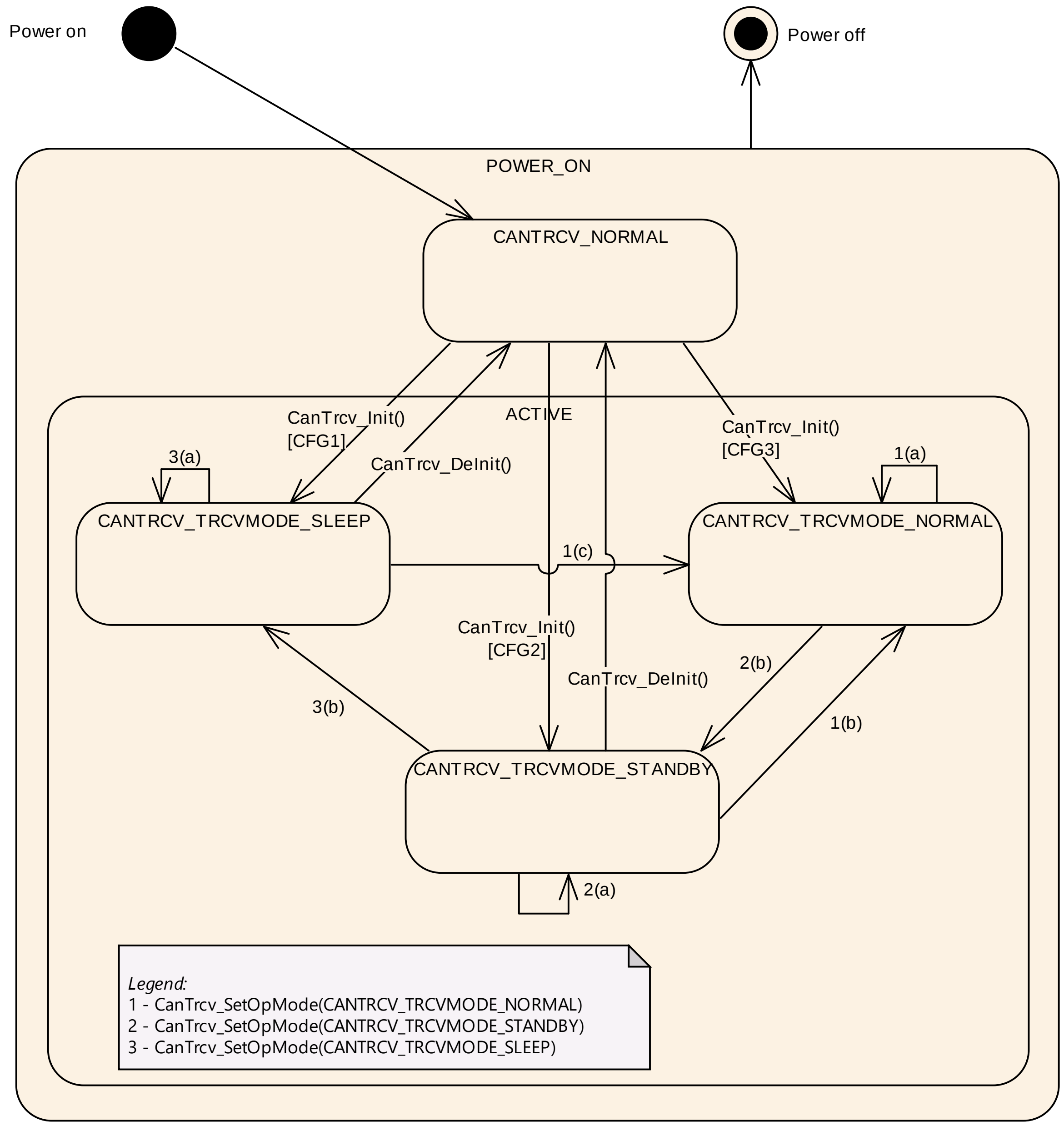
SRS_Can_01097	CAN Bus Transceiver driver API shall be synchronous	SWS_CanTrcv_00001, SWS_CanTrcv_00002, SWS_CanTrcv_00005, SWS_CanTrcv_00007, SWS_CanTrcv_00009, SWS_CanTrcv_00013
SRS_Can_01098	The bus transceiver driver shall support an API to send the addressed transceiver into its Standby mode	SWS_CanTrcv_00002, SWS_CanTrcv_00055
SRS_Can_01099	The bus transceiver driver shall support an API to send the addressed transceiver into its Sleep mode	SWS_CanTrcv_00002, SWS_CanTrcv_00055
SRS_Can_01100	The bus transceiver driver shall support an API to send the addressed transceiver into its Normal mode	SWS_CanTrcv_00002, SWS_CanTrcv_00055
SRS_Can_01101	The bus transceiver driver shall support an API to read out the current operation mode of the transceiver of a specified bus within the ECU	SWS_CanTrcv_00005
SRS_Can_01103	The bus transceiver driver shall support an API to read out the reason of the last wakeup of a specified bus within the ECU	SWS_CanTrcv_00007
SRS_Can_01106	The bus transceiver driver shall call the appropriate callback function of EcuM in case a wakeup by bus event is detected	SWS_CanTrcv_00007
SRS_Can_01107	The CAN Transceiver Driver shall support the situation where a wakeup by bus occurs during the same time the transition to standby/sleep is in progress	SWS_CanTrcv_00999
SRS_Can_01108	The bus transceiver driver shall support the AUTOSAR ECU state manager in a way that a safe system startup and shutdown is possible	SWS_CanTrcv_00001, SWS_CanTrcv_00002, SWS_CanTrcv_91001, SWS_CanTrcv_91002, SWS_CanTrcv_91003
SRS_Can_01109	The bus transceiver driver shall check the control communication to the transceiver and the reaction of the transceiver for correctness	SWS_CanTrcv_00001, SWS_CanTrcv_00002, SWS_CanTrcv_00005, SWS_CanTrcv_00007, SWS_CanTrcv_00009, SWS_CanTrcv_00013
SRS_Can_01110	CAN Bus Transceiver driver shall handle the transceiver specific timing requirements internally	SWS_CanTrcv_00001, SWS_CanTrcv_00002, SWS_CanTrcv_00005, SWS_CanTrcv_00007, SWS_CanTrcv_00009, SWS_CanTrcv_00013
SRS_Can_01115	The bus transceiver driver shall support an API to enable and	SWS_CanTrcv_00009

	disable the wakeup notification for each bus separately	
SRS_Can_01138	The CAN Bus Transceiver Driver shall provide one callback function for lower layer ICU Driver for wake up by bus events	SWS_CanTrcv_00999
SRS_Can_01157	The bus transceiver driver shall provide an API for clearing the WUF bit in the tranceiver hardware	SWS_CanTrcv_00214

7 Functional specification

7.1 CAN transceiver driver operation modes

[SWS_CanTrcv_00055]「The CanTrcv module shall implement the state diagram shown below, independently for each configured transceiver. 」(SRS_Can_01098, SRS_Can_01099, SRS_Can_01100)


Power on
Power off
POWER_ON
CANTRCV_NORMAL
ACTIVE
CanTrcv_Init()
[CFG1]
CanTrcv_DeInit()
CanTrcv_Init()
[CFG3]
3(a)
1(a)
CANTRCV_TRCVMODE_SLEEP
CANTRCV_TRCVMODE_NORMAL
1(c)
CanTrcv_Init()
[CFG2]
CanTrcv_DeInit()
2(b)
3(b)
1(b)
CANTRCV_TRCVMODE_STANDBY
2(a)
Legend:
1 - CanTrcv_SetOpMode(CANTRCV_TRCVMODE_NORMAL)
2 - CanTrcv_SetOpMode(CANTRCV_TRCVMODE_STANDBY)
3 - CanTrcv_SetOpMode(CANTRCV_TRCVMODE_SLEEP)

The main idea intended by this diagram, is to support a lot of up to now available CAN bus transceivers in a generic view. Depending on the CAN transceiver hardware, the model may have one or two states more than necessary for a given CAN transceiver hardware but this will clearly decouple the ComM and EcuM from the used hardware.

[SWS_CanTrcv_00148] ⌈ The function `CanTrcv_Init` causes a state change to either CANTRCV_TRCVMODE_SLEEP or CANTRCV_TRCVMODE _STANDBY. This depends on the configuration and is independently configurable for each transceiver. ⌋()

State	Description
POWER_ON	ECU is fully powered.
NOT_ACTIVE	State of CAN transceiver hardware depends on ECU hardware and on Dio and Port driver configuration. CAN transceiver driver is not initialized and therefore not active.
ACTIVE	The function CanTrcv_Init has been called. It carries CAN transceiver driver to active state. Depending on configuration CAN transceiver driver enters the state CANTRCV_TRCVMODE_SLEEP or CANTRCV_TRCVMODE_STANDBY.
CANTRCV_TRCVMODE_NORMAL	Full bus communication. If CAN transceiver hardware controls ECU power supply, ECU is fully powered. The CAN transceiver driver detects no further wake up information.
CANTRCV_TRCVMODE_STANDBY	No communication is possible. ECU is still powered if CAN transceiver hardware controls ECU power supply. A transition to CANTRCV_TRCVMODE_SLEEP is only valid from this mode. A wake up by bus or by a local wake up event is possible.
CANTRCV_TRCVMODE_SLEEP	No communication is possible. ECU may be unpowered depending on responsibility to handle power supply. A wake up by bus or by a local wake up event is possible.

If a CAN transceiver driver covers more than one CAN transceiver (configured as channels), all transceivers (channels) are either in the state NOT_ACTIVE or in the state ACTIVE.

In state ACTIVE, each transceiver may be in a different sub state.

7.1.1 Operation mode switching

A mode switch is requested with a call to the function `CanTrcv_SetOpMode`.

[SWS_CanTrcv_00161] ⌈ A mode switch request to the current mode is allowed and shall not lead to an error, even if DET is enabled. ⌋()

[SWS_CanTrcv_00158] ⌈ The CanTrcv module shall invoke the callback function `CanIf_TrcvModeIndication`, for each mode switch request with call to `CanTrcv_SetOpMode`, after the requested mode has been reached referring to the corresponding CAN transceiver with the abstract CanIf TransceiverId.⌋()

7.2 CAN transceiver hardware operation modes

The CAN transceiver hardware may support more mode transitions than shown in the state diagram above. The dependencies and the recommended implementations behaviour are explained in this chapter.
It is implementation specific to decide which CAN transceiver hardware state is covered by which CAN transceiver driver software state. An implementation has to guarantee that the whole functionality of the described CAN transceiver driver software state is realized by the implementation.

7.2.1 Example for temporary “Go-To-Sleep” mode

The mode often referred to as “Go-to-sleep” is a temporary mode when switching from Normal to Sleep. The driver encapsulates such a temporary mode within one of the CAN transceiver driver software states. In addition, the CAN transceiver driver switches first from Normal to Standby and then with an additional API call from Standby to Sleep.

7.2.2 Example for “PowerOn/ListenOnly” mode

The mode often referred to as “PowerOn“ or “ListenOnly” is a mode where the CAN transceiver hardware is only able to receive messages but not able to send messages. Also, transmission of the acknowledge bit during reception of a message is suppressed. This mode is not supported because it is outside of the CAN standard and not supported by all CAN transceiver hardware chips.

7.3 CAN transceiver wake up types

There are three different scenarios which are often called wake up:

Scenario 1:

MCU is not powered.
Parts of ECU including CAN transceiver hardware are powered.
The considered CAN transceiver is in SLEEP mode.
A wake up event on CAN bus is detected by CAN transceiver hardware.
The CAN transceiver hardware causes powering of MCU.

In terms of AUTOSAR, this is kept as a cold start and NOT as a wake up.

Scenario 2:

- MCU is in low power mode.
- Parts of ECU including CAN transceiver hardware are powered.
- The considered CAN transceiver is in STANDBY mode.
- A wake up event on CAN bus is detected by CAN transceiver hardware.
- The CAN transceiver hardware causes a SW interrupt for waking up.

In terms of AUTOSAR, this is kept as a wake up of the CAN channel and of the MCU.

Scenario 3:

- MCU is in full power mode.
- At least parts of ECU including CAN transceiver hardware are powered.
- The considered CAN transceiver is in STANDBY mode.
- A wake up event on CAN is detected by CAN transceiver hardware.
- The CAN transceiver hardware either causes a SW interrupt for waking up or is polled cyclically for wake up events.

In terms of AUTOSAR, this is kept as a wake up of the CAN channel.

7.4 Enabling/Disabling wakeup notification

[SWS_CanTrcv_00171] ⌈ CanTrcv driver shall use the following APIs provided by ICU driver, to enable and disable the wakeup event notification:

- Icu_EnableNotification
- Icu_DisableNotification

CanTrcv driver shall enable/disable ICU channels only if reference is configured for the parameter `CanTrcvIcuChannelRef`.⌋()

CanTrcv driver shall ensure the following to avoid the loss of wakeup events:

[SWS_CanTrcv_00172] ⌈ It shall enable the ICU channels when the transceiver transitions to the Standby mode (`CANTRCV_STANDBY`). ⌋()

[SWS_CanTrcv_00173] ⌈ It shall disable the ICU channels when the transceiver transitions to the Normal mode (`CANTRCV_NORMAL`). ⌋()

7.5 CAN transceiver wake up modes

CAN transceiver driver offers two wake up modes:

[SWS_CanTrcv_00090] ⌈ **NOT_SUPPORTED mode** ⌋(SRS_BSW_00388, SRS_BSW_00389, SRS_BSW_00390, SRS_BSW_00392, SRS_BSW_00393, SRS_BSW_00394, SRS_BSW_00408, SRS_BSW_00425, SRS_BSW_00160, SRS_BSW_00172, SRS_Can_01090)
In mode NOT_SUPPORTED, no wake ups are generated by CAN transceiver driver. This mode is supported by all CAN transceiver hardware types.

[SWS_CanTrcv_00091] ⌈ **POLLING mode** ⌋(SRS_BSW_00388, SRS_BSW_00389, SRS_BSW_00390, SRS_BSW_00392, SRS_BSW_00393, SRS_BSW_00394, SRS_BSW_00395, SRS_BSW_00408, SRS_BSW_00160, SRS_BSW_00172, SRS_Can_01090, SRS_Can_01092)
In mode POLLING, wake ups generated by CAN transceiver driver may cause CAN channel wake ups. In this mode, no MCU wake ups are possible. This mode presumes a support by used CAN transceiver hardware type. Wake up mode POLLING requires function `CanTrcv_CheckWakeup` and main function `CanTrcv_MainFunction` to be present in source code.

The main function `CanTrcv_MainFunction` shall be called by BSW scheduler and `CanTrcv_CheckWakeup` by CanIf.

The selection of the wake up mode is done by the configuration parameter `CanTrcvWakeUpSupport`. The support of wake ups may be switched on and off for each CAN transceiver individually by the configuration parameter `CanTrcvWakeupByBusUsed`.
Note: In both modes the function `CanTrcv_CheckWakeup` shall be present, but the functionality shall be based on the configured wakeup mode (NOT_SUPPORTED OR POLLING).
Implementation Hint:
If a CAN transceiver needs a specific state transition (e.g. Sleep -> Normal) initiated by the software after detection of a wake-up, this may be accomplished by the CanTrcv module, during the execution of `CanTrcv_CheckWakeup`. This behaviour is implementation specific.
It has to be assured by configuration of modules, which are involved in wake-up process (EcuM, CanIf, ICU etc…) that `CanTrcv_CheckWakeup` is called, when a transceiver needs a specific state transition.

7.6 Error classification

Section 7.6 "Error Handling" of the document "General Specification of Basic Software Modules" 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.

7.6.1 Development Errors

[SWS_CanTrcv_00050]⌈

Type of error	***Related error code***	***Error value***
API called with wrong parameter for the CAN transceiver	CANTRCV_E_INVALID_TRANSCEIVER	1
API called with null pointer parameter	CANTRCV_E_PARAM_POINTER	2
API service used without initialization	CANTRCV_E_UNINIT	11
API service called in wrong transceiver operation mode (STANDBY expected)	CANTRCV_E_TRCV_NOT_STANDBY	21
API service called in wrong transceiver operation mode (NORMAL expected)	CANTRCV_E_TRCV_NOT_NORMAL	22
API service called with invalid parameter for Trcv WakeupMode	CANTRCV_E_PARAM_TRCV_WAKEUP_MODE	23
API service called with invalid parameter for OpMode	CANTRCV_E_PARAM_TRCV_OPMODE	24
Configured baud rate is not supported by the transceiver	CANTRCV_E_BAUDRATE_NOT_SUPPORTED	25

Module initialization has failed, e.g. CanTrcv_Init() called with an invalid pointer in postbuild.	CANTRCV_E_INIT_FAILED	27

⌋(SRS_BSW_00327, SRS_BSW_00350, SRS_BSW_00385, SRS_BSW_00386)

7.6.2 Runtime Errors

[SWS_CanTrcv_91006]⌈

Type of error	*Related error code*	*Error value*
No/incorrect communication to transceiver.	CANTRCV_E_NO_TRCV_CONTROL	26

⌋()

7.6.3 Transient Faults

There are no transient faults.

7.6.4 Production Errors

There are no production errors.

7.6.5 Extended Production Errors

[SWS_CanTrcv_00228]

⌈

Error Name:	`CANTRCV_E_BUS_ERROR`	
Short Description:	A CAN bus error occured during communication	
Long Description:	This Extended Production Error shall be issued when a bus failure is detected by the transceiver during the CAN communication..	
Detection Criteria:	Fail	When the flag corresponding to bus failure is set, `Dem_SetEventStatus` shall be reported with parameters EventId as `CANTRCV_E_BUS_ERROR` and EventStatus as `DEM_EVENT_STATUS_FAILED`. SWS_CanTrcv_00206, SWS_CanTrcv_00229
	Pass	When the flag corresponding to bus failure is not set, `Dem_SetEventStatus` shall be reported with parameters EventId as `CANTRCV_E_BUS_ERROR` and EventStatus as `DEM_EVENT_STATUS_PASSED`. SWS_CanTrcv_00227, SWS_CanTrcv_00229
Secondary Parameters:	N/A	
Time Required:	N/A	
Monitor Frequency	continuous	

⌋(SRS_BSW_00339, SRS_BSW_00385)

[SWS_CanTrcv_00229] ⌈The extended production error `CANTRCV_E_BUS_ERROR` (value assigned by DEM) shall be detectable by the CAN tranceiver module when Bus Error (BUSERR) flag is set, depending on whether it is configured and supported by hardware. ⌋()

7.7 Preconditions for driver initialization

[SWS_CanTrcv_00099] ⌈ The environment of the CanTrcv module shall make sure that all necessary BSW drivers (used by the CanTrcv module) have been initialized and are usable before `CanTrcv_Init` is called. ⌋(SRS_BSW_00172)
The CAN bus transceiver driver uses drivers for Spi and Dio to control the CAN bus transceiver hardware. Thus, these drivers must be available and ready to operate before the CAN bus transceiver driver is initialized.
The CAN transceiver driver may have timing requirements for the initialization sequence and the access to the transceiver device which must be fulfilled by these used underlying drivers.
The timing requirements might be that

1) The call of the CAN bus transceiver driver initialization has to be performed very early after power up to be able to read all necessary information out of the transceiver hardware in time for all other users within the ECU.
2) The runtime of the used underlying services is very short and synchronous to enable the driver to keep his own timing requirements limited by the used hardware device.
3) The runtime of the driver may be enlarged due to some hardware devices configuring the port pin level to be valid for e.g. 50µs before changing it again to reach a specific state (e.g. sleep).

7.8 Instance concept

[SWS_CanTrcv_00016] ⌈ For each different CAN transceiver hardware type, an ECU has one CAN transceiver driver instance. One instance serves all CAN transceiver hardware of same type. ⌋(SRS_BSW_00347, SRS_BSW_00413, SRS_Can_01091)

7.9 Wait states

For changing operation modes, the CAN transceiver hardware may have to perform wait states.

[SWS_CanTrcv_00230] ⌈The CAN Tranceiver Driver shall use the Time service `Tm_BusyWait1us16bit` to realize the wait time for transceiver state changes.⌋()

7.10 Transceivers with selective wakeup functionality

This section describes requirements for CAN transceivers with selective wakeup functionality.
Partial Networking is a state in a CAN system where some nodes are in low power mode while other nodes are communicating. This reduces the power consumption by

the entire network. Nodes in the low-power modes are woken up by pre-defined wakeup frames.
Transceivers which support selective wakeup can be woken up by Wake Up Frame/ Frames (WUF), in addition to the wakeup by Wake Up Pattern (WUP) offered by normal transceivers.

[SWS_CanTrcv_00174] ⌈ If selective wakeup is supported by the transceiver hardware, it shall be indicated with the configuration parameter `CanTrcvHwPnSupport`. ⌋()

[SWS_CanTrcv_00175] ⌈ The configuration container for selective wakeup functionality (`CanTrcvPartialNetwork`) and for the following APIs:

- 8.4.7 CanTrcv_GetTrcvSystemData,
- 8.4.8 CanTrcv_ClearTrcvWufFlag,
- 8.4.9 CanTrcv_ReadTrcvTimeoutFlag,
- 8.4.10 CanTrcv_ClearTrcvTimeoutFlag and
- 8.4.11 CanTrcv_ReadTrcvSilenceFlag

shall exist only if CanTrcvHwPnSupport = TRUE. ⌋()

[SWS_CanTrcv_00177] ⌈ If selective wakeup is supported, CAN transceivers shall be configured to wake up on a particular CAN frame or a group of CAN frames using the parameters `CanTrcvPnFrameCanId`, `CanTrcvPnFrameCanIdMask` and `CanTrcvPnFrameDataMask`. ⌋()

[SWS_CanTrcv_00178] ⌈ If the transceiver has the ability to identify bus failures (and distinguish between bus failures and other hardware failures), it shall be indicated using the configuration parameter `CanTrcvBusErrFlag` for bus diagnostic purposes. ⌋()
Note:
For CAN transceivers supporting selective wakeup functionality, detection of wakeup frames is possible during Normal mode (`CANTRCV_TRCVMODE_NORMAL`). Detected wakeup frames are signaled by the transceiver WUF flag. This ensures that no wakeup frame is lost during a transition to Standby mode (CANTRCV_TRCVMODE_STANDBY).

8 API specification

8.1 Imported types

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

[SWS_CanTrcv_00084]⌈

Module	***Header File***	***Imported Type***
Dem	Rte_Dem_Type.h	Dem_EventIdType
	Rte_Dem_Type.h	Dem_EventStatusType
Dio	Dio.h	Dio_ChannelGroupType
	Dio.h	Dio_ChannelType
	Dio.h	Dio_LevelType
	Dio.h	Dio_PortLevelType
	Dio.h	Dio_PortType
EcuM	EcuM.h	EcuM_WakeupSourceType
Icu	Icu.h	Icu_ChannelType
Spi	Spi.h	Spi_ChannelType
	Spi.h	Spi_DataBufferType
	Spi.h	Spi_NumberOfDataType
	Spi.h	Spi_SequenceType
	Spi.h	Spi_StatusType
Std	Std_Types.h	Std_ReturnType
	Std_Types.h	Std_VersionInfoType

⌋()

8.2 Type definitions

[SWS_CanTrcv_00209]⌈

Name	CanTrcv_ConfigType	
Kind	Structure	
Elements	Implementation specific	
	Type	--
	Comment	--

Description	This is the type of the external data structure containing the overall initialization data for the CAN transceiver driver and settings affecting all transceivers. Furthermore it contains pointers to transceiver configuration structures. The contents of the initialization data structure are CAN transceiver hardware specific.
Available via	CanTrcv.h

⌋()

[SWS_CanTrcv_00210]⌈

Name	CanTrcv_PNActivationType		
Kind	Enumeration		
Range	PN_ENABLED	--	PN wakeup functionality in CanTrcv is enabled.
	PN_DISABLED	--	PN wakeup functionality in CanTrcv is disabled.
Description	Datatype used for describing whether PN wakeup functionality in CanTrcv is enabled or disabled.		
Available via	CanTrcv.h		

⌋()

[SWS_CanTrcv_00211]⌈

Name	CanTrcv_TrcvFlagStateType		
Kind	Enumeration		
Range	CANTRCV_FLAG_SET	--	The flag is set in the transceiver hardware.
	CANTRCV_FLAG_CLEARED	--	The flag is cleared in the transceiver hardware.
Description	Provides the state of a flag in the transceiver hardware.		
Available via	CanTrcv.h		

⌋()

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[SWS_CanTrcv_00163]⌈

Name	CanTrcv_TrcvModeType		
Kind	Enumeration		
Range	CANTRCV_TRCVMODE_SLEEP	--	Transceiver mode SLEEP
	CANTRCV_TRCVMODE_STANDBY	--	Transceiver mode STANDBY
	CANTRCV_TRCVMODE_NORMAL	0x00	Transceiver mode NORMAL
Description	Operating modes of the CAN Transceiver Driver.		
Available via	Can_GeneralTypes.h		

⌋()

[SWS_CanTrcv_00164]⌈

Name	CanTrcv_TrcvWakeupModeType		
Kind	Enumeration		
Range	CANTRCV_WUMODE_ENABLE	0x00	The notification for wakeup events is enabled on the addressed transceiver.
	CANTRCV_WUMODE_DISABLE	0x01	The notification for wakeup events is disabled on the addressed transceiver.
	CANTRCV_WUMODE_CLEAR	0x02	A stored wakeup event is cleared on the addressed transceiver.
Description	This type shall be used to control the CAN transceiver concerning wake up events and wake up notifications.		
Available via	Can_GeneralTypes.h		

⌋()

[SWS_CanTrcv_00165]⌈

Name	CanTrcv_TrcvWakeupReasonType		
Kind	Enumeration		
Range	CANTRCV_WU_ERROR	0x00	Due to an error wake up reason was not detected. This value may only be reported when error was reported to DEM before.
	CANTRCV_WU_NOT_SUPPORTED	0x01	The transceiver does not support any information for the wake up reason.
	CANTRCV_WU_BY_BUS	0x02	The transceiver has detected, that the network has caused the wake up of the ECU.
	CANTRCV_WU_INTERNALLY	0x03	The transceiver has detected, that the network has woken up by the ECU via a request to NORMAL mode.
	CANTRCV_WU_RESET	0x04	The transceiver has detected, that the "wake up" is due to an ECU reset.
	CANTRCV_WU_POWER_ON	0x05	The transceiver has detected, that the "wake up" is due to an ECU reset after power on.
	CANTRCV_WU_BY_PIN	0x06	The transceiver has detected a wake-up event at one of the transceiver's pins (not at the CAN bus).
	CANTRCV_WU_BY_SYSERR	0x07	The transceiver has detected, that the wake up of the ECU was caused by a HW related device failure.
Description	This type denotes the wake up reason detected by the CAN transceiver in detail.		

Available via	Can_GeneralTypes.h

⌋()

8.3 Function definitions

8.3.1 CanTrcv_Init

[SWS_CanTrcv_00001]⌈

Service Name	CanTrcv_Init	

Syntax	`void CanTrcv_Init (`
	`  const CanTrcv_ConfigType* ConfigPtr`
	`)`	

Service ID [hex]	0x00	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	ConfigPtr	Pointer to driver configuration.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Initializes the CanTrcv module.	
Available via	CanTrcv.h	

⌋(SRS_BSW_00310, SRS_BSW_00358, SRS_BSW_00369, SRS_BSW_00371, SRS_BSW_00414, SRS_BSW_00101, SRS_BSW_00172, SRS_Can_01096, SRS_Can_01097, SRS_Can_01109, SRS_Can_01110, SRS_Can_01108)

[SWS_CanTrcv_00180] ⌈ The function `CanTrcv_Init` shall initialize all the connected CAN transceivers based on their initialization sequences and configuration (provided by parameter `ConfigPtr`). Meanwhile, it shall support the configuration sequence of the AUTOSAR stack also. ⌋()

Note that in the time span between power up and the call to `CanTrcv_Init`, the CAN transceiver hardware may be in a different state. This depends on hardware and SPAL driver configuration.
The initialization sequence after reset (e.g. power up) is a critical phase for the CAN transceiver driver.
This API shall store the wake up event, if any, during initialization time.
See also requirement SWS_CanTrcv_00099.

[SWS_CanTrcv_00167] ⌈ If supported by hardware, `CanTrcv_Init` shall validate whether there has been a wake up due to transceiver activity and if TRUE, reporting shall be done to EcuM via API `EcuM_SetWakeupEvent` with the wakeup source referenced in `CanTrcvWakeupSourceRef`. ⌋()

[SWS_CanTrcv_00181] ⌈ If selective wakeup is enabled and supported by hardware: POR and SYSERR flags of the transceiver status shall be checked by `CanTrcv_Init` API. ⌋()

[SWS_CanTrcv_00182] ⌈ If the POR flag or SYSERR flag is set, transceiver shall be re-configured for selective wakeup functionality by running the configuration sequence.
If the POR flag or SYSERR flag is not set, the configuration stored in the transceiver memory will be still valid and re-configuration is not necessary. ⌋()

[SWS_CanTrcv_00183] ⌈ If the POR flag is set, wakeup shall be reported to EcuM through API `EcuM_SetWakeupEvent` with a wakeup source value, which has a "1" at the bit position according to the symbolic name value referred by CanTrcvPorWakeupsourceRef, and "0" on all others. ⌋()

[SWS_CanTrcv_00184] ⌈ If the SYSERR flag is set, wakeup shall be reported to EcuM through API `EcuM_SetWakeupEvent` with a wakeup source value, which has a "1" at the bit position according to the symbolic name value referred by `CanTrcvSyserrWakeupSourceRef`, and "0" on all others. ⌋()

[SWS_CanTrcv_00113] ⌈ If there is no/incorrect communication towards the transceiver, the function `CanTrcv_Init` shall report the runtime error code `CANTRCV_E_NO_TRCV_CONTROL` to the Default Error Trace.
For Eg., there are different transceiver types and different access ways (port connection, SPI). This development error should be signalled if you detect any miscommunication with your hardware. Depending on connection type and depending on your transceiver hardware you may not run in situations where you have to signal this error. ⌋()

[SWS_CanTrcv_00168] ⌈ If development error detection is enabled for CanTrcv module: the function `CanTrcv_Init` shall raise the development error `CANTRCV_E_BAUDRATE_NOT_SUPPORTED`, if the configured baud rate is not supported by the transceiver. ⌋()

[SWS_CanTrcv_00226] ⌈ In order to implement the AUTOSAR Partial Networking mechanism CAN transceivers shall support the definition of a data mask for the Wake Up Frame (the configuration structure of `CanTrcvPnFrameDataMask` is mandatory). ⌋()

8.3.2 CanTrcv_SetOpMode

[SWS_CanTrcv_00002]⌈

Service Name	CanTrcv_SetOpMode
Syntax	

```
Std_ReturnType CanTrcv_SetOpMode (
  uint8 Transceiver,
```

	`CanTrcv_TrcvModeType OpMode` `)`	
Service ID [hex]	0x01	
Sync/Async	Asynchronous	
Reentrancy	Reentrant for different transceivers	
Parameters (in)	Transceiver	CAN transceiver to which API call has to be applied.
	OpMode	This parameter contains the desired operating mode
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: will be returned if the request for transceiver mode change has been accepted. E_NOT_OK: will be returned if the request for transceiver mode change has not been accepted or any parameter is out of the allowed range.
Description	Sets the mode of the Transceiver to the value OpMode.	
Available via	CanTrcv.h	

⌋(SRS_BSW_00310, SRS_BSW_00357, SRS_BSW_00369, SRS_BSW_00371, SRS_BSW_00406, SRS_Can_01091, SRS_Can_01097, SRS_Can_01098, SRS_Can_01099, SRS_Can_01100, SRS_Can_01109, SRS_Can_01110, SRS_Can_01108)

[SWS_CanTrcv_00102] ⌈ The function `CanTrcv_SetOpMode` shall switch the internal state of Transceiver to the value of the parameter OpMode, which can be CANTRCV_TRCVMODE_NORMAL, CANTRCV_TRCVMODE_STANDBY or CANTRCV_TRCVMODE_SLEEP. ⌋()

[SWS_CanTrcv_00103] ⌈ The user of the CanTrcv module shall call the function `CanTrcv_SetOpMode` with OpMode = CANTRCV_TRCVMODE_STANDBY or CANTRCV_TRCVMODE_NORMAL, if the Transceiver is in mode CANTRCV_TRCVMODE_NORMAL. ⌋()

[SWS_CanTrcv_00104] ⌈ The user of the CanTrcv module shall call the function `CanTrcv_SetOpMode` with OpMode = CANTRCV_TRCVMODE_SLEEP or CANTRCV_TRCVMODE_STANDBY, if the Transceiver is in mode CANTRCV_TRCVMODE_STANDBY. ⌋()

This API is applicable to each transceiver with each value for parameter `CanTrcv_SetOpMode`, regardless of whether the transceiver hardware supports these modes or not. This is to simplify the view of the CanIf to the assigned bus.

[SWS_CanTrcv_00105]⌈ If the requested mode is not supported by the underlying transceiver hardware, the function `CanTrcv_SetOpMode` shall return E_NOT_OK. ⌋()

The number of supported busses is set up in the configuration phase.

[SWS_CanTrcv_00186]⌈ If selective wakeup is supported by hardware: the flags POR and SYSERR of the transceiver status shall be checked by `CanTrcv_SetOpMode` API. ⌋()

[SWS_CanTrcv_00187]⌈ If the POR flag is set, transceiver shall be re-initialized to run the transceiver's configuration sequence.⌋ ()

[SWS_CanTrcv_00188]⌈ If the SYSERR flag is NOT set and the requested mode is `CANTRCV_NORMAL`, transceiver shall call the API `CanIf_ConfirmPnAvailability`() for the corresponding abstract CanIf TransceiverId. `CanIf_ConfirmPnAvailability` informs CanNm (through CanIf and CanSm) that selective wakeup is enabled.⌋()

[SWS_CanTrcv_00114] ⌈ If there is no/incorrect communication to the transceiver, the function `CanTrcv_SetOpMode` shall report runtime error code CANTRCV`_E_NO_TRCV_CONTROL to` the Default Error Tracer and return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00120]⌈ If development error detection for the module CanTrcv is enabled:
If the function `CanTrcv_SetOpMode` is called with OpMode = CANTRCV_TRCVMODE_STANDBY, and the Transceiver is not in mode CANTRCV_TRCVMODE_NORMAL or CANTRCV_TRCVMODE_STANDBY, the function `CanTrcv_SetOpMode` shall raise the development error `CANTRCV_E_TRCV_NOT_NORMAL` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00121]⌈ If development error detection for the module CanTrcv is enabled:
If the function `CanTrcv_SetOpMode` is called with OpMode = CANTRCV_TRCVMODE_SLEEP, and the Transceiver is not in mode CANTRCV_TRCVMODE_STANDBY or CANTRCV_TRCVMODE_SLEEP, the function `CanTrcv_SetOpMode` shall raise the development error `CANTRCV_E_TRCV_NOT_STANDBY` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00122]⌈ If development error detection for the module CanTrcv is enabled:
If called before the CanTrcv module has been initialized, the function `CanTrcv_SetOpMode` shall raise the development error `CANTRCV_E_UNINIT` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00123]⌈ If development error detection for the module CanTrcv is enabled: If called with an invalid Transceiver number, the function

`CanTrcv_SetOpMode` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00087] ⌈ If development error detection for the module CanTrcv is enabled: If called with an invalid OpMode, the function `CanTrcv_SetOpMode` shall raise the development error `CANTRCV_E_PARAM_TRCV_OPMODE` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

8.3.3 CanTrcv_GetOpMode

[SWS_CanTrcv_00005]⌈

Service Name	CanTrcv_GetOpMode	

Syntax	`Std_ReturnType CanTrcv_GetOpMode (`
	`uint8 Transceiver,`
	`CanTrcv_TrcvModeType* OpMode`
	`)`	

Service ID [hex]	0x02	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	Transceiver	CAN transceiver to which API call has to be applied.
Parameters (inout)	None	
Parameters (out)	OpMode	Pointer to operation mode of the bus the API is applied to.
Return value	Std_Return-Type	E_OK: will be returned if the operation mode was detected. E_NOT_OK: will be returned if the operation mode was not detected.
Description	Gets the mode of the Transceiver and returns it in OpMode.	
Available via	CanTrcv.h	

⌋(`SRS_BSW_00310, SRS_BSW_00369, SRS_BSW_00371, SRS_BSW_00377, SRS_BSW_00406, SRS_Can_01091, SRS_Can_01097, SRS_Can_01101, SRS_Can_01109, SRS_Can_01110`)

[SWS_CanTrcv_00106] ⌈ The function `CanTrcv_GetOpMode` shall collect the actual state of the CAN transceiver driver in the out parameter OpMode. ⌋()
See function `CanTrcv_Init` for the provided state after the CAN transceiver driver initialization till the first operation mode change request.
The number of supported busses is statically set in the configuration phase.

[SWS_CanTrcv_00115] ⌈ If there is no/incorrect communication to the transceiver, the function `CanTrcv_GetOpMode` shall report the runtime error code

`CANTRCV_E_NO_TRCV_CONTROL` to the Default Error Tracer and return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00124] ⌈ If development error detection for the module CanTrcv is enabled: If called before the CanTrcv module has been initialized, the function `CanTrcv_GetOpMode` shall raise the development error `CANTRCV_E_UNINIT` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00129] ⌈ If development error detection for the module CanTrcv is enabled: If called with an invalid Transceiver number, the function `CanTrcv_GetOpMode` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00132] ⌈ If development error detection for the module CanTrcv is enabled: If called with OpMode = NULL, the function `CanTrcv_GetOpMode` shall raise the development error `CANTRCV_E_PARAM_POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

8.3.4 CanTrcv_GetBusWuReason

[SWS_CanTrcv_00007]⌈

Service Name	CanTrcv_GetBusWuReason	
Syntax	`Std_ReturnType CanTrcv_GetBusWuReason ( uint8 Transceiver, CanTrcv_TrcvWakeupReasonType* reason )`	
Service ID [hex]	0x03	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	Transceiver	CAN transceiver to which API call has to be applied.
Parameters (inout)	None	
Parameters (out)	reason	Pointer to wake up reason of the bus the API is applied to.
Return value	Std_Return-Type	E_OK: will be returned if the transceiver wakeup reason was provided. E_NOT_OK: will be returned if no wake up reason is available or if the service request failed due to development errors.
Description	Gets the wakeup reason for the Transceiver and returns it in parameter Reason.	
Available via	CanTrcv.h	

⌋(`SRS_BSW_00310, SRS_BSW_00369, SRS_BSW_00371, SRS_BSW_00375,` `SRS_BSW_00377`, `SRS_BSW_00406`, `SRS_Can_01091`, `SRS_Can_01095`, `SRS_Can_01097`, `SRS_Can_01103`, `SRS_Can_01106`, `SRS_Can_01109`, `SRS_Can_01110`)

[SWS_CanTrcv_00107] ⌈ The function `CanTrcv_GetBusWuReason` shall collect the reason for the wake up that the CAN transceiver has detected in the parameter Reason. ⌋()
The ability to detect and differentiate the possible wake up reasons depends strongly on the CAN transceiver hardware.
Be aware if more than one bus is available, each bus may report a different wake up reason. E.g. if an ECU has CAN, a wake up by CAN may occur and the incoming data may cause an internal wake up for another CAN bus.
The CAN transceiver driver has a “per bus” view and does not vote the more important reason or sequence internally. The same may be true if e.g. one transceiver controls the power supply and the other is just powered or un-powered.
The number of supported busses is statically set in the configuration phase.

[SWS_CanTrcv_00116] ⌈ If there is no/incorrect communication to the transceiver, the function `CanTrcv_GetBusWuReason` shall report the runtime error code `CANTRCV_E_NO_TRCV_CONTROL` to the Default Error Tracer and return `E_OK`. ⌋()

[SWS_CanTrcv_00125] ⌈ If development error detection for the module CanTrcv is enabled: If called before the CanTrcv module has been initialized, the function `CanTrcv_GetBusWuReason` shall raise development error `CANTRCV_E_UNINIT` `POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00130] ⌈ If development error detection for the module CanTrcv is enabled: If called with an invalid Transceiver number, the function `CanTrcv_GetBusWuReason` shall raise development error `CANTRCV_E_INVALID_TRANSCEIVER POINTER` otherwise (if DET is disabled) return `E_NOT_OK.` ⌋()

[SWS_CanTrcv_00133] ⌈ If development error detection for the module CanTrcv is enabled: If called with Reason = NULL, the function `CanTrcv_GetBusWuReason` shall raise the development error `CANTRCV_E_PARAM_POINTER POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

8.3.5 CanTrcv_VersionInfo

[SWS_CanTrcv_00008]⌈

Service Name	CanTrcv_GetVersionInfo

Syntax	`void CanTrcv_GetVersionInfo (`
	`  Std_VersionInfoType* versioninfo`
	`)`

Service ID [hex]	0x04
Sync/Async	Synchronous
Reentrancy	Reentrant

Parameters (in)	None	
Parameters (inout)	None	
Parameters (out)	versioninfo	Pointer to version information of this module.
Return value	None	
Description	Gets the version of the module and returns it in VersionInfo.	
Available via	CanTrcv.h	

⌋(`SRS_BSW_00310, SRS_BSW_00369, SRS_BSW_00371, SRS_BSW_00406, SRS_BSW_00407, SRS_BSW_00411`)

8.3.6 CanTrcv_ SetWakeupMode

[SWS_CanTrcv_00009]⌈

Service Name	CanTrcv_SetWakeupMode	

Syntax

```
Std_ReturnType CanTrcv_SetWakeupMode (
  uint8 Transceiver,
  CanTrcv_TrcvWakeupModeType TrcvWakeupMode
)
```

Service ID [hex]	0x05	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different transceivers	
Parameters (in)	Transceiver	CAN transceiver to which API call has to be applied.
	TrcvWakeup Mode	Requested transceiver wakeup reason
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_Return-Type	E_OK: Will be returned, if the wakeup state has been changed to the requested mode. E_NOT_OK: Will be returned, if the wakeup state change has failed or the parameter is out of the allowed range. The previous state has not been changed.
Description	Enables, disables or clears wake-up events of the Transceiver according to Trcv WakeupMode.	
Available via	CanTrcv.h	

⌋(`SRS_BSW_00310, SRS_BSW_00369, SRS_BSW_00371, SRS_BSW_00406, SRS_Can_01091, SRS_Can_01097, SRS_Can_01109, SRS_Can_01110, SRS_Can_01115`)

[SWS_CanTrcv_00111] ⌈ **Enabled:** If the function `CanTrcv_SetWakeupMode` is called with TrcvWakupMode = CANTRCV_ WUMODE_ENABLE and if the CanTrcv module has a stored wakeup event pending for the addressed bus, the CanTrcv module shall update its wakeup event as ‘present’. ⌋()

[SWS_CanTrcv_00093] ⌈ **Disabled:** If the function `CanTrcv_SetWakeupMode` is called with TrcvWakeupMode = CANTRCV_ WUMODE_DISABLE, the wakeup events are disabled on the addressed transceiver. It is required by the transceiver device and the transceiver driver to detect the wakeup events and store it internally, in order to raise the wakeup events when the wakeup mode is enabled again. ⌋(SRS_BSW_00388, SRS_BSW_00389, SRS_BSW_00390, SRS_BSW_00392, SRS_BSW_00393, SRS_BSW_00394, SRS_BSW_00395, SRS_BSW_00408, SRS_BSW_00160, SRS_Can_01090)

[SWS_CanTrcv_00094] ⌈ **Clear:** If the function `CanTrcv_SetWakeupMode` is called with TrcvWakeupMode = CANTRCV_ WUMODE_CLEAR, then a stored wakeup event is cleared on the addressed transceiver. ⌋()

[SWS_CanTrcv_00150] ⌈ Clearing of wakeup events have to be used when the wake up notification is disabled to clear all stored wake up events under control of the higher layer. ⌋()

[SWS_CanTrcv_00095] ⌈ The implementation can enable, disable or clear wake up events from the last communication cycle. It is very important not to lose wake up events during the disabled period. ⌋(SRS_BSW_00388, SRS_BSW_00389, SRS_BSW_00390, SRS_BSW_00392, SRS_BSW_00393, SRS_BSW_00394, SRS_BSW_00395, SRS_BSW_00408, SRS_BSW_00160, SRS_Can_01090)
The number of supported busses is statically set in the configuration phase.

[SWS_CanTrcv_00117] ⌈ If there is no/incorrect communication to the transceiver, the function `CanTrcv_SetWakeupMode` shall report the runtime error code `CANTRCV_E_NO_TRCV_CONTROL` to the Default Error Tracer and return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00127] ⌈ If development error detection for the module CanTrcv is enabled: If called before the CanTrcv has been initialized, the function `CanTrcv_SetWakeupMode` shall raise development error `CANTRCV_E_UNINIT` `POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00131] ⌈ If development error detection for the module CanTrcv is enabled: If called with an invalid Transceiver number, the function `CanTrcv_SetWakeupMode` shall raise development error `CANTRCV_E_INVALID_TRANSCEIVER POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00089] ⌈ If development error detection for the module CanTrcv is enabled: If called with an invalid TrcvWakeupMode, the function `CanTrcv_SetWakeupMode` shall raise the development error CANTRCV_E_PARAM_TRCV_WAKEUP_MODE
`POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

8.3.7 CanTrcv_GetTrcvSystemData

[SWS_CanTrcv_00213]⌈

Service Name	CanTrcv_GetTrcvSystemData	

Syntax	`Std_ReturnType CanTrcv_GetTrcvSystemData (`
	`uint8 Transceiver,`
	`uint32* TrcvSysData`
	`)`	

Service ID [hex]	0x09	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	Transceiver	CAN transceiver ID.
Parameters (inout)	None	
Parameters (out)	TrcvSysData	Configuration/Status data of the transceiver.
Return value	Std_Return-Type	E_OK: will be returned if the transceiver status is successfully read. E_NOT_OK: will be returned if the transceiver status data is not available or a development error occurs.
Description	Reads the transceiver configuration/status data and returns it through parameter TrcvSysData. This API shall exist only if CanTrcvHwPnSupport = TRUE.	
Available via	CanTrcv.h	

⌋()

[SWS_CanTrcv_00189] ⌈ The function `CanTrcv_GetTrcvSystemData` shall read the configuration/status of the CAN transceiver and store the read data in the out parameter `TrcvSysData`. If this is successful, `E_OK` shall be returned.
Hint: This API can be invoked through diagnostic services or during initialization to determine the transceiver status and its availability.
Note: Currently an agreement on the parameter set for the transceiver HW specification has not been reached. For this reason, the diagnostic data is now returned as a uint32 (as stored in the transceiver registers). When a definitive and standard parameter set is defined, a data structure may be defined for abstracting the diagnostic data. ⌋()

[SWS_CanTrcv_00190] ⌈If there is no/incorrect communication to the transceiver, the function `CanTrcv_GetTrcvSystemData` shall report the runtime error code `CANTRCV_E_NO_TRCV_CONTROL` to the default Error Tracer and return `E_NOT_OK`.
⌋()

[SWS_CanTrcv_00191] ⌈ If development error detection is enabled for the CanTrcv module: if called before the CanTrcv has been initialized, the function

`CanTrcv_GetTrcvSystemData` shall raise development error `CANTRCV_E_UNINIT` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00192] ⌈ If development error detection is enabled for the CanTrcv module: if called with an invalid transceiver ID for parameter `Transceiver`, function `CanTrcv_GetTrcvSystemData` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00193] ⌈ If development error detection is enabled for the CanTrcv module: if called with NULL pointer for parameter `TrcvSysData`, function `CanTrcv_GetTrcvSystemData` shall raise the development error `CANTRCV_E_PARAM_POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

8.3.8 CanTrcv_ClearTrcvWufFlag

[SWS_CanTrcv_00214]⌈

Service Name	CanTrcv_ClearTrcvWufFlag	

Syntax	`Std_ReturnType CanTrcv_ClearTrcvWufFlag (`
	`  uint8 Transceiver`
	`)`	

Service ID [hex]	0x0a	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different transceivers	
Parameters (in)	Transceiver	CAN Transceiver ID.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_Return-Type	E_OK: will be returned if the WUF flag has been cleared. E_NOT_OK: will be returned if the WUF flag has not been cleared or a development error occurs.
Description	Clears the WUF flag in the transceiver hardware. This API shall exist only if CanTrcvHwPnSupport = TRUE.	
Available via	CanTrcv.h	

⌋(`SRS_Can_01157`)

[SWS_CanTrcv_00194] ⌈ The function `CanTrcv_ClearTrcvWufFlag` shall clear the wakeup flag in the CAN transceiver. If successful, `E_OK` shall be returned.
Implementation Hints:
This API shall be used by the CanSM module for ensuring that no frame wakeup event is lost, during entering a low-power mode. This API clears the WUF flag.
The CAN transceiver shall be shall be put into Standby mode (`CANTRCV_STANDBY`) after clearing of the WUF flag.

If a system error (SYSERR, e.g. configuration error) occurs while selective wakeup functionality is being enabled, transceiver will disable the functionality. Transceiver will wake up on the next CAN wake pattern (WUP).
In case of any other hardware error (e.g. frame detection error), transceiver will wake up if the error counter inside the transceiver overflows. ⌋()

[SWS_CanTrcv_00195] ⌈CanTrcv shall inform CanIf that the wakeup flag has been cleared for the requested Transceiver, through the callback notification `CanIf_ClearTrcvWufFlagIndication` referring to the corresponding CAN transceiver with the abstract CanIf TransceiverId. ⌋()

[SWS_CanTrcv_00196] ⌈⌈ If there is no/incorrect communication to the transceiver, the function `CanTrcv_ClearTrcvWufFlag` shall report the runtime error `CANTRCV_E_NO_TRCV_CONTROL` to the Default Error Tracer and return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00197] ⌈ If development error detection is enabled for the CanTrcv module: if called before the CanTrcv has been initialized, the function `CanTrcv_ClearTrcvWufFlag` shall raise development error `CANTRCV_E_UNINIT` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00198] ⌈ If development error detection is enabled for the CanTrcv module: if called with an invalid transceiver ID for parameter `Transceiver`, function `CanTrcv_ClearTrcvWufFlag` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

8.3.9 CanTrcv_ReadTrcvTimeoutFlag

[SWS_CanTrcv_00215]⌈

Service Name	CanTrcv_ReadTrcvTimeoutFlag	

Syntax	`Std_ReturnType CanTrcv_ReadTrcvTimeoutFlag (`
	`uint8 Transceiver,`
	`CanTrcv_TrcvFlagStateType* FlagState`
	`)`	

Service ID [hex]	0x0b	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	Transceiver	CAN transceiver ID.
Parameters (inout)	None	
Parameters (out)	FlagState	State of the timeout flag.
Return value	Std_ReturnType	E_OK: Will be returned, if status of the timeout flag is

		success-fully read. E_NOT_OK: Will be returned, if status of the timeout flag could not be read.
Description	Reads the status of the timeout flag from the transceiver hardware. This API shall exist only if CanTrcvHwPnSupport = TRUE.	
Available via	CanTrcv.h	

⌋()

[SWS_CanTrcv_00199] ⌈ If development error detection is enabled for the module CanTrcv: If called with an invalid transceiver ID `Transceiver`, the function `CanTrcv_ReadTrcvTimeoutFlag` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK.` ⌋()

[SWS_CanTrcv_00200] ⌈ If development error detection is enabled for the module CanTrcv: If called with `FlagState = NULL`, the function `CanTrcv_ReadTrcvTimeoutFlag` shall raise the development error `CANTRCV_E_PARAM_POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

8.3.10 CanTrcv_ClearTrcvTimeoutFlag

[SWS_CanTrcv_00216]⌈

Service Name	CanTrcv_ClearTrcvTimeoutFlag	

Syntax

```
Std_ReturnType CanTrcv_ClearTrcvTimeoutFlag (
  uint8 Transceiver
)
```

Service ID [hex]	0x0c	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	Transceiver	CAN transceiver ID.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: Will be returned, if the timeout flag is successfully cleared. E_NOT_OK: Will be returned, if the timeout flag could not be cleared.
Description	Clears the status of the timeout flag in the transceiver hardware. This API shall exist only if CanTrcvHwPnSupport = TRUE.	
Available via	CanTrcv.h	

⌋()

[SWS_CanTrcv_00201] ⌈ If development error detection is enabled for the module CanTrcv: If called with an invalid transceiver ID `Transceiver`, the function `CanTrcv_ClearTrcvTimeoutFlag` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK.` ⌋()

8.3.11 CanTrcv_ReadTrcvSilenceFlag

[SWS_CanTrcv_00217]⌈

Service Name	CanTrcv_ReadTrcvSilenceFlag	

Syntax	`Std_ReturnType CanTrcv_ReadTrcvSilenceFlag (`
	`uint8 Transceiver,`
	`CanTrcv_TrcvFlagStateType* FlagState`
	`)`	

Service ID [hex]	0x0d	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	Transceiver	CAN transceiver ID.
Parameters (inout)	None	
Parameters (out)	FlagState	State of the silence flag.
Return value	Std_ReturnType	E_OK: Will be returned, if status of the silence flag is successfully read. E_NOT_OK: Will be returned, if status of the silence flag could not be read.
Description	Reads the status of the silence flag from the transceiver hardware. This API shall exist only if CanTrcvHwPnSupport = TRUE.	
Available via	CanTrcv.h	

⌋()

[SWS_CanTrcv_00202] ⌈ If development error detection is enabled for the module CanTrcv: If called with an invalid transceiver ID `Transceiver`, the function `CanTrcv_ReadTrcvSilenceFlag` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK.` ⌋()

[SWS_CanTrcv_00203] ⌈ If development error detection is enabled for the module CanTrcv: If called with `FlagState = NULL`, the function

`CanTrcv_ReadTrcvSilenceFlag` shall raise the development error `CANTRCV_E_PARAM_POINTER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

8.3.12 CanTrcv_CheckWakeup

[SWS_CanTrcv_00143]⌈

Service Name	CanTrcv_CheckWakeup	

Syntax	`Std_ReturnType CanTrcv_CheckWakeup (`
	`uint8 Transceiver`
	`)`	

Service ID [hex]	0x07	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	Transceiver	CAN transceiver to which API call has to be applied.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: API call has been accepted E_NOT_OK: API call has not been accepted
Description	Service is called by underlying CANIF in case a wake up interrupt is detected.	
Available via	CanTrcv.h	

⌋()

EcuM_EndCheckWakeup(WakeupSource) is called by CanTrcv_CheckWakeup for checking the wakeup source asynchronously.

[SWS_CanTrcv_00144] ⌈ If development error detection for the module CanTrcv is enabled: If called before the CanTrcv module has been initialized, the function `CanTrcv_CheckWakeup` shall raise the development error `CANTRCV_E_UNINIT` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00145] ⌈ If development error detection for the module CanTrcv is enabled: If called with an invalid Transceiver number, the function `CanTrcv_CheckWakeup` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00146] ⌈ If supported by hardware, `CanTrcv_CheckWakeup` shall validate whether there has been a wake up due to transceiver activity and if TRUE, reporting shall be done to EcuM via API `EcuM_SetWakeupEvent` with the wakeup source referenced in `CanTrcvWakeupSourceRef`.⌋()

8.3.13 CanTrcv_SetPNActivationState

[SWS_CanTrcv_00219]⌈

Service Name	CanTrcv_SetPNActivationState	

Syntax	`Std_ReturnType CanTrcv_SetPNActivationState (`
	`CanTrcv_PNActivationType ActivationState`
	`)`	

Service ID [hex]	0x0f	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	Activation State	PN_ENABLED: PN wakeup functionality in CanTrcv shall be enabled. PN_DIABLED: PN wakeup functionality in CanTrcv shall be disabled.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_Return-Type	E_OK: Will be returned, if the PN has been changed to the requested configuration. E_NOT_OK: Will be returned, if the PN configuration change has failed. The previous configuration has not been changed.
Description	The API configures the wake-up of the transceiver for Standby and Sleep Mode: Either the CAN transceiver is woken up by a remote wake-up pattern (standard CAN wake-up) or by the configured remote wake-up frame.	
Available via	CanTrcv.h	

⌋()

[SWS_CanTrcv_00220] ⌈ If development error detection for the module CanTrcv is enabled: If called before the CanTrcv module has been initialized, the function `CanTrcv_SetPNActivationState` shall raise the development error `CANTRCV_E_UNINIT` otherwise (if DET is disabled) return `E_NOT_OK`. ⌋()

[SWS_CanTrcv_00221] ⌈ CanTrcv shall enable the PN wakeup functionality when function `CanTrcv_SetPNActivationState` is called with `ActivationState=` PN_ENABLED and return `E_OK`. ⌋()

[SWS_CanTrcv_00222] ⌈ CanTrcv shall disable the PN wakeup functionality when function `CanTrcv_SetPNActivationState` is called with `ActivationState=` PN_DISABLED and return `E_OK`. ⌋()

8.3.14 CanTrcv_CheckWakeFlag

[SWS_CanTrcv_00223]⌈

Service Name	CanTrcv_CheckWakeFlag	

Syntax	`Std_ReturnType CanTrcv_CheckWakeFlag (`
	`  uint8 Transceiver`
	`)`	

Service ID [hex]	0x0e	
Sync/Async	Asynchronous	
Reentrancy	Non Reentrant	
Parameters (in)	Transceiver	CAN transceiver ID.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_Return-Type	E_OK: Will be returned, if the request for checking the wakeup flag has been accepted. E_NOT_OK: Will be returned, if the request for checking the wakeup flag has not been accepted.
Description	Requests to check the status of the wakeup flag from the transceiver hardware.	
Available via	CanTrcv.h	

⌋()

[SWS_CanTrcv_00224] ⌈ CanTrcv shall inform the CanIf with the callback notification `CanIf_CheckTrcvWakeFlagIndication`, that the wake flag of the CAN Transceiver with the corresponding TransceiverId has been checked.⌋()

[SWS_CanTrcv_00225] ⌈ If development error detection is enabled for the module CanTrcv: If called with an invalid transceiver ID Transceiver, the function `CanTrcv_CheckWakeFlag` shall raise the development error `CANTRCV_E_INVALID_TRANSCEIVER` otherwise (if DET is disabled) return `E_NOT_OK`.⌋()

8.3.15 CanTrcv_DeInit

[SWS_CanTrcv_91001]⌈

Service Name	CanTrcv_DeInit

Syntax	`void CanTrcv_DeInit (`
	`  void`
	`)`

Service ID [hex]	0x10
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in)	None

Parameters (inout)	None
Parameters (out)	None
Return value	None
Description	De-initializes the CanTrcv module.
Available via	CanTrcv.h

⌋(SRS_Can_01108, SRS_BSW_00336)

[SWS_CanTrcv_91002] ⌈The function CanTrcv_DeInit shall de-initialize all the connected CAN transceivers based on their de-initialization sequences.⌋(SRS_Can_01108)

[SWS_CanTrcv_91003] ⌈The function CanTrcv_DeInit shall set the CAN transceiver hardware to the state NOT_ACTIVE.⌋(SRS_Can_01108)

In the state NOT_ACTIVE, the CAN transceiver hardware allows to be re-configured with a new configuration sequence

[SWS_CanTrcv_91004] ⌈ If there is no/incorrect communication towards the transceiver, the function CanTrcv_DeInit shall report the runtime error CANTRCV_E_NO_TRCV_CONTROL code to the Default Error Tracer.

For Eg., there are different transceiver types and different access ways (port connection, SPI). This development error should be signaled if you detect any miscommunication with your hardware. Depending on connection type and depending on your transceiver hardware you may not run in situations where you have to signal this error. ⌋(SRS_BSW_00369)

[SWS_CanTrcv_91005] ⌈If development error detection for the CanTrcv module is enabled: The function CanTrcv_DeInit shall raise the error CANTRCV_E_TRCV_NOT_NORMAL if the transceiver is not in state CANTRCV_TRCVMODE_NORMAL.⌋(SRS_BSW_00369)

8.4 Scheduled functions

This chaper lists all functions provided by the CanTrcv module and called directly by the Basic Software Module Scheduler.

8.4.1 CanTrcv_MainFunction

[SWS_CanTrcv_00013]⌈

Service Name	CanTrcv_MainFunction

Syntax

```
void CanTrcv_MainFunction (
  void
)
```

Service ID [hex]	0x06
Description	Service to scan all busses for wake up events and perform these event.
Available via	SchM_CanTrcv.h

⌋(SRS_BSW_00310, SRS_BSW_00369, SRS_BSW_00371, SRS_BSW_00373, SRS_BSW_00406, SRS_BSW_00424, SRS_BSW_00428, SRS_BSW_00171, SRS_BSW_00172, SRS_Can_01097, SRS_Can_01109, SRS_Can_01110)

The CAN bus transceiver driver may have cyclic jobs like polling for wake up events (if configured).

[SWS_CanTrcv_00112] ⌈ The `CanTrcv_MainFunction` shall scan all busses in STANDBY and SLEEP for wake up events.
This function shall set a wake-up event flag to perform these events. ⌋(SRS_BSW_00343)

According to [SRS_BSW_00424], main processing functions shall be allocated by basic tasks. No special call order to be kept. This function is directly called by Basic Software Scheduler.
See configuration parameter `CanTrcvWakeUpSupport`.

8.4.2 CanTrcv_MainFunctionDiagnostics

[SWS_CanTrcv_00218]⌈

Service Name	CanTrcv_MainFunctionDiagnostics
Syntax	`void CanTrcv_MainFunctionDiagnostics ( void )`
Service ID [hex]	0x08
Description	Reads the transceiver diagnostic status periodically and sets product/development accordingly.
Available via	SchM_CanTrcv.h

⌋()

[SWS_CanTrcv_00204] ⌈ The cyclic function `CanTrcv_MainFunctionDiagnostics` shall read the transceiver status periodically and report production/development errors accordingly. ⌋()

[SWS_CanTrcv_00205] ⌈ The cyclic function `CanTrcv_MainFunctionDiagnostics` shall exist only if `CanTrcvBusErrFlag = TRUE`. ⌋()

[SWS_CanTrcv_00206] ⌈If configured and supported by hardware: if the BUSERR flag reported from BSW is set, function `CanTrcv_MainFunctionDiagnostics` shall call the API `Dem_SetEventStatus` with parameters EventId as `CANTRCV_E_BUS_ERROR` and EventStatus as `DEM_EVENT_STATUS_FAILED`. ⌋(SRS_BSW_00337, SRS_BSW_00385, SRS_BSW_00327, SRS_BSW_00331)

[SWS_CanTrcv_00227] ⌈If configured and supported by hardware: if the BUSERR flag reported from BSW is reset, function `CanTrcv_MainFunctionDiagnostics` shall call the API `Dem_SetEventStatus` with parameters EventId as `CANTRCV_E_BUS_ERROR` and EventStatus as `DEM_EVENT_STATUS_PASSED`.⌋ (SRS_BSW_00337, SRS_BSW_00385, SRS_BSW_00327, SRS_BSW_00331)

8.5 Call-back notifications

Since the CanTrcv is a driver module, it doesn't provide any callback functions for lower layer modules.

8.6 Expected Interfaces

This chapter lists all functions the module CanTrcv requires from other modules.

8.6.1 Mandatory Interfaces

This chapter defines all interfaces which are required to fulfill the core functionality of the module.

[SWS_CanTrcv_00085]⌈

API Function	***Header File***	***Description***
CanIf_Trcv-ModeIndication	CanIf_CanTrcv.h	This service indicates a transceiver state transition referring to the corresponding CAN transceiver with the abstract CanIf Transceiver Id.
Det_Report-RuntimeError	Det.h	Service to report runtime errors. If a callout has been configured then this callout shall be called.

⌋()

8.6.2 Optional Interfaces

This chapter defines all interfaces which are required to fulfill an optional functionality of the module.

[SWS_CanTrcv_00086]⌈

API Function	***Header File***	***Description***
CanIf_Check-TrcvWakeFlag-Indication	CanIf_CanTrcv.h	This service indicates that the check of the transceiver's wake-up flag has been finished by the corresponding CAN transceiver with the abstract CanIf TransceiverId. This indication is used to cope with the asynchronous transceiver communication.
CanIf_ClearTrcv-WufFlag-Indication	CanIf_CanTrcv.h	This service indicates that the transceiver has cleared the WufFlag referring to the corresponding CAN transceiver with the abstract CanIf TransceiverId.
CanIf_Confirm-	CanIf_	This service indicates that the transceiver is running in PN

PnAvailability	CanTrcv.h	communication mode referring to the corresponding CAN transceiver with the abstract CanIf TransceiverId.
Dem_SetEventStatus	Dem.h	Called by SW-Cs or BSW modules to report monitor status information to the Dem. BSW modules calling Dem_SetEventStatus can safely ignore the return value. This API will be available only if ({Dem/DemConfigSet/DemEventParameter/DemEventReporting Type} == STANDARD_REPORTING)
Det_ReportError	Det.h	Service to report development errors.
Dio_ReadChannel	Dio.h	Returns the value of the specified DIO channel.
Dio_ReadChannelGroup	Dio.h	This Service reads a subset of the adjoining bits of a port.
Dio_ReadPort	Dio.h	Returns the level of all channels of that port.
Dio_WriteChannel	Dio.h	Service to set a level of a channel.
Dio_WriteChannelGroup	Dio.h	Service to set a subset of the adjoining bits of a port to a specified level.
Dio_WritePort	Dio.h	Service to set a value of the port.
EcuM_SetWakeupEvent	EcuM.h	Sets the wakeup event.
Icu_DisableNotification	Icu.h	This function disables the notification of a channel.
Icu_EnableNotification	Icu.h	This function enables the notification on the given channel.
Spi_GetStatus	Spi.h	Service returns the SPI Handler/Driver software module status.
Spi_ReadIB	Spi.h	Service for reading synchronously one or more data from an IB SPI Handler/Driver Channel specified by parameter.
Spi_SetupEB	Spi.h	Service to setup the buffers and the length of data for the EB SPI Handler/Driver Channel specified.
Spi_SyncTransmit	Spi.h	Service to transmit data on the SPI bus
Spi_WriteIB	Spi.h	Service for writing one or more data to an IB SPI Handler/Driver Channel specified by parameter.
Tm_BusyWait1us16bit	Tm.h	Performs busy waiting by polling with a guaranteed minimum waiting time.

⌋()

check of the transceiver's wake-up flag has been finished by the corresponding CAN transceiver with the abstract CanIf TransceiverId. This indication is used to cope with the asynchronous transceiver communication.

1. The interfaces of the SPI module are used by the CanTrcv module if there are instances of the container CanTrcvSpiSequence.

2. The interfaces of the DIO module are used by the CanTrcv module if there are instances of the container CanTransceiverDIOAccess.

Note: If the Can transceiver is controlled via Dio/Spi, the Dio/Spi interfaces are required to fulfill the core functionality of the module. Which interfaces are needed exactly shall not be detailed further in this specification

8.6.3 Configurable interfaces

There are no configurable interfaces for CAN transceiver driver.

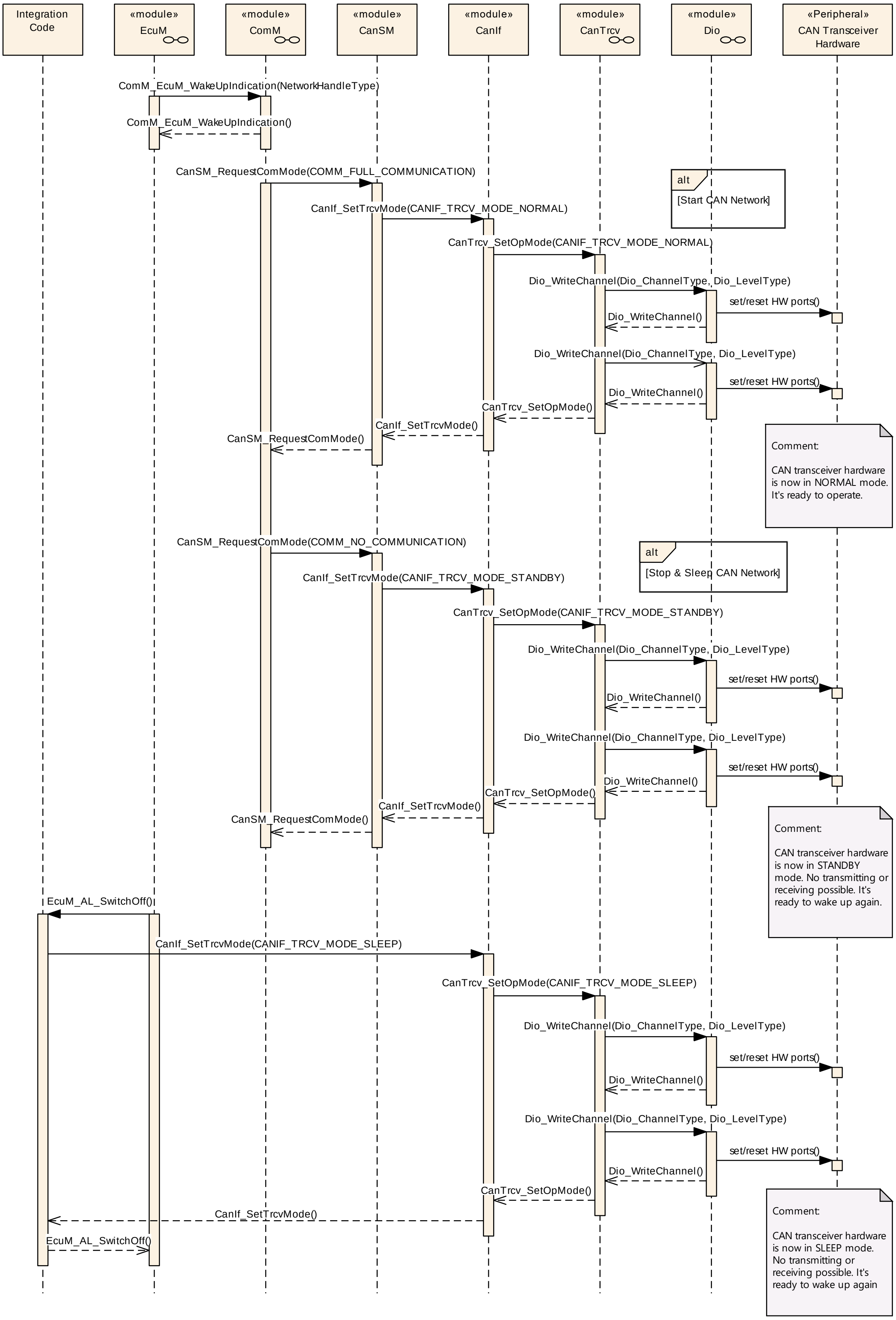
9 Sequence diagram

The focus of the following diagrams is on the interaction between the CAN transceiver driver and the BSW modules CanIf, ComM, EcuM and Dio. Depending on the CAN transceiver hardware, one or more calls to `Dio_WriteChannels` may be necessary.
Depending on the transceiver hardware, there may be a need of wait states for some transitions.

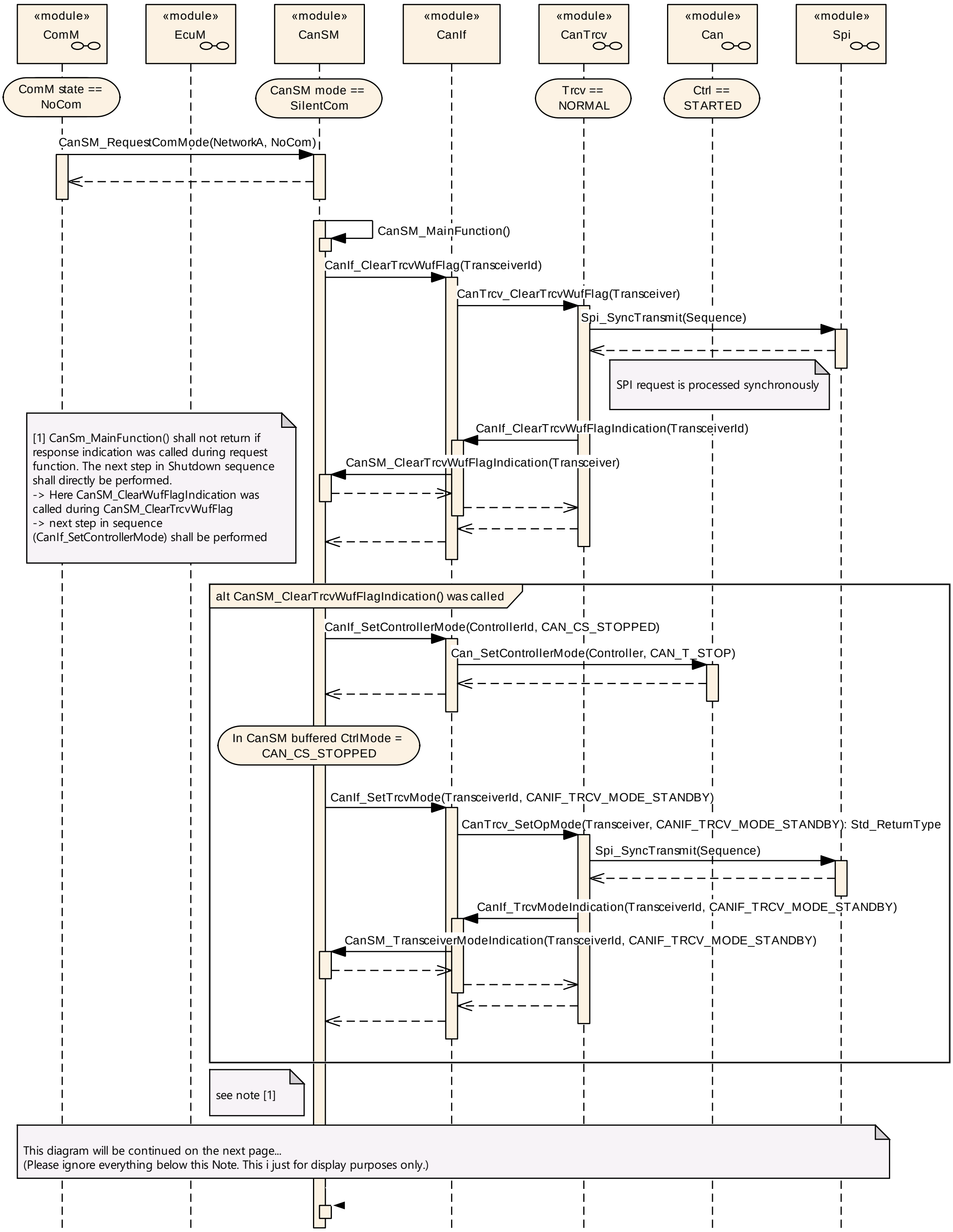
9.1 Wake up with valid validation

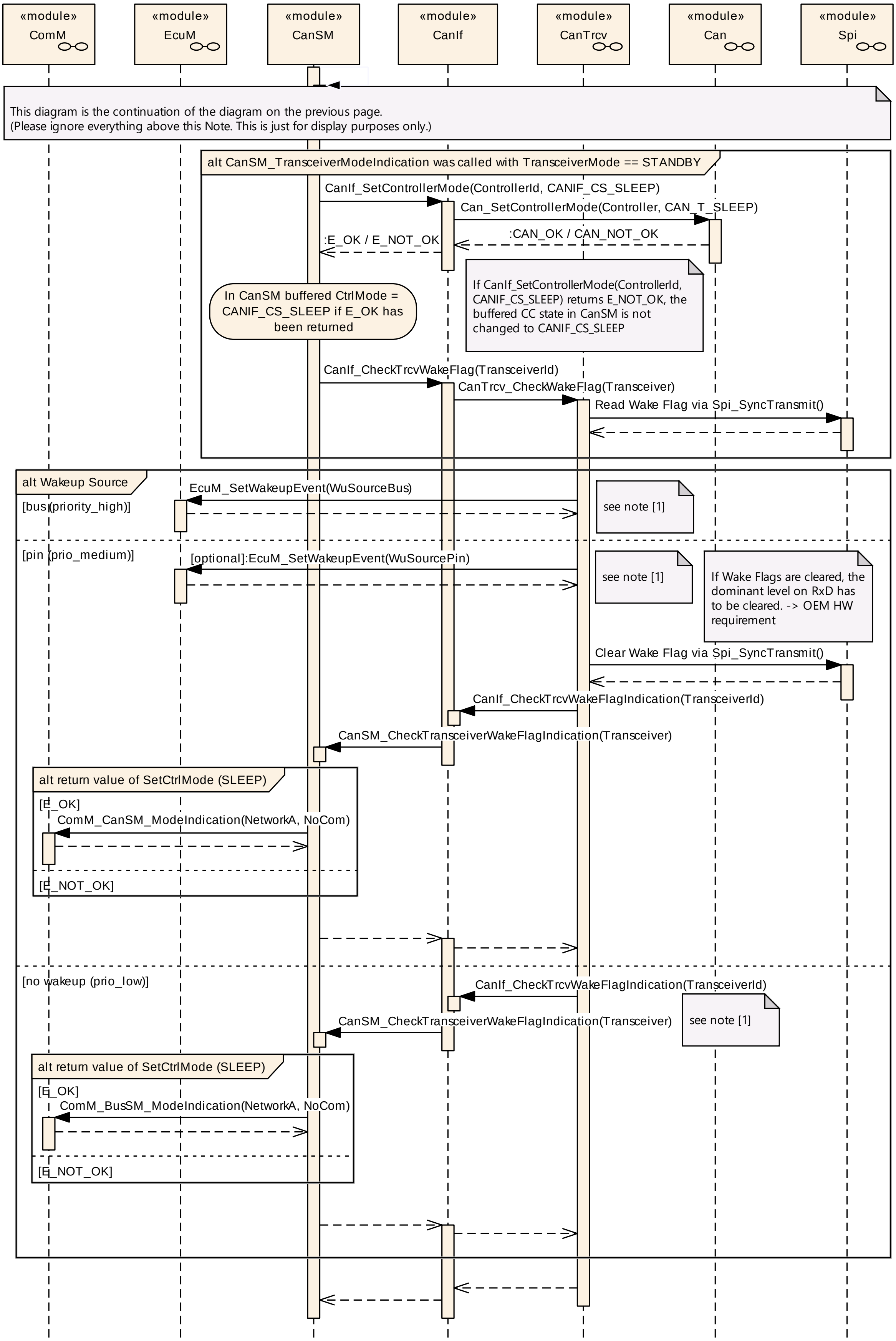
For all wakeup related sequence diagrams please refer to chapter 9 of ECU State Manager.

9.2 Interaction with DIO module

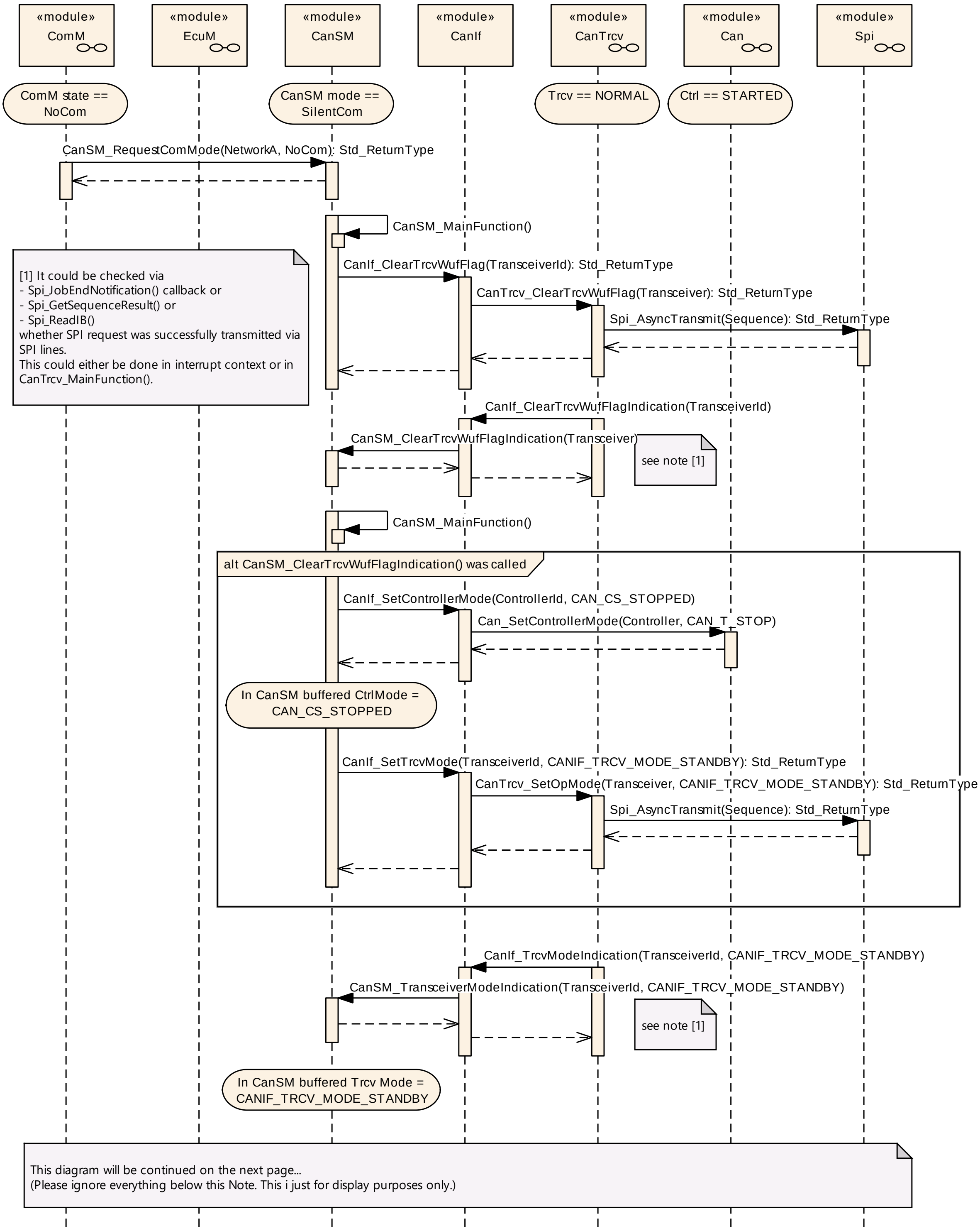

Integration Code
«module» EcuM
«module» ComM
«module» CanSM
«module» CanIf
«module» CanTrcv
«module» Dio
«Peripheral» CAN Transceiver Hardware
ComM_EcuM_WakeUpIndication(NetworkHandleType)
ComM_EcuM_WakeUpIndication()
CanSM_RequestComMode(COMM_FULL_COMMUNICATION)
alt
[Start CAN Network]
CanIf_SetTrcvMode(CANIF_TRCV_MODE_NORMAL)
CanTrcv_SetOpMode(CANIF_TRCV_MODE_NORMAL)
Dio_WriteChannel(Dio_ChannelType, Dio_LevelType)
set/reset HW ports()
Dio_WriteChannel()
Dio_WriteChannel(Dio_ChannelType, Dio_LevelType)
set/reset HW ports()
Dio_WriteChannel()
CanTrcv_SetOpMode()
CanIf_SetTrcvMode()
CanSM_RequestComMode()
Comment:
CAN transceiver hardware is now in NORMAL mode. It's ready to operate.
CanSM_RequestComMode(COMM_NO_COMMUNICATION)
alt
[Stop & Sleep CAN Network]
CanIf_SetTrcvMode(CANIF_TRCV_MODE_STANDBY)
CanTrcv_SetOpMode(CANIF_TRCV_MODE_STANDBY)
Dio_WriteChannel(Dio_ChannelType, Dio_LevelType)
set/reset HW ports()
Dio_WriteChannel()
Dio_WriteChannel(Dio_ChannelType, Dio_LevelType)
set/reset HW ports()
Dio_WriteChannel()
CanTrcv_SetOpMode()
CanIf_SetTrcvMode()
CanSM_RequestComMode()
Comment:
CAN transceiver hardware is now in STANDBY mode. No transmitting or receiving possible. It's ready to wake up again.
EcuM_AL_SwitchOff()
CanIf_SetTrcvMode(CANIF_TRCV_MODE_SLEEP)
CanTrcv_SetOpMode(CANIF_TRCV_MODE_SLEEP)
Dio_WriteChannel(Dio_ChannelType, Dio_LevelType)
set/reset HW ports()
Dio_WriteChannel()
Dio_WriteChannel(Dio_ChannelType, Dio_LevelType)
set/reset HW ports()
Dio_WriteChannel()
CanTrcv_SetOpMode()
CanIf_SetTrcvMode()
EcuM_AL_SwitchOff()
Comment:
CAN transceiver hardware is now in SLEEP mode. No transmitting or receiving possible. It's ready to wake up again

9.3 De-Initialization (SPI Synchronous)


«module» ComM
«module» EcuM
«module» CanSM
«module» CanIf
«module» CanTrcv
«module» Can
«module» Spi
ComM state == NoCom
CanSM mode == SilentCom
Trcv == NORMAL
Ctrl == STARTED
CanSM_RequestComMode(NetworkA, NoCom)
CanSM_MainFunction()
CanIf_ClearTrcvWufFlag(TransceiverId)
CanTrcv_ClearTrcvWufFlag(Transceiver)
Spi_SyncTransmit(Sequence)
SPI request is processed synchronously
CanIf_ClearTrcvWufFlagIndication(TransceiverId)
CanSM_ClearTrcvWufFlagIndication(Transceiver)
[1] CanSm_MainFunction() shall not return if response indication was called during request function. The next step in Shutdown sequence shall directly be performed.
-> Here CanSM_ClearWufFlagIndication was called during CanSM_ClearTrcvWufFlag
-> next step in sequence (CanIf_SetControllerMode) shall be performed
alt CanSM_ClearTrcvWufFlagIndication() was called
CanIf_SetControllerMode(ControllerId, CAN_CS_STOPPED)
Can_SetControllerMode(Controller, CAN_T_STOP)
In CanSM buffered CtrlMode = CAN_CS_STOPPED
CanIf_SetTrcvMode(TransceiverId, CANIF_TRCV_MODE_STANDBY)
CanTrcv_SetOpMode(Transceiver, CANIF_TRCV_MODE_STANDBY): Std_ReturnType
Spi_SyncTransmit(Sequence)
CanIf_TrcvModeIndication(TransceiverId, CANIF_TRCV_MODE_STANDBY)
CanSM_TransceiverModeIndication(TransceiverId, CANIF_TRCV_MODE_STANDBY)
see note [1]
This diagram will be continued on the next page...
(Please ignore everything below this Note. This i just for display purposes only.)

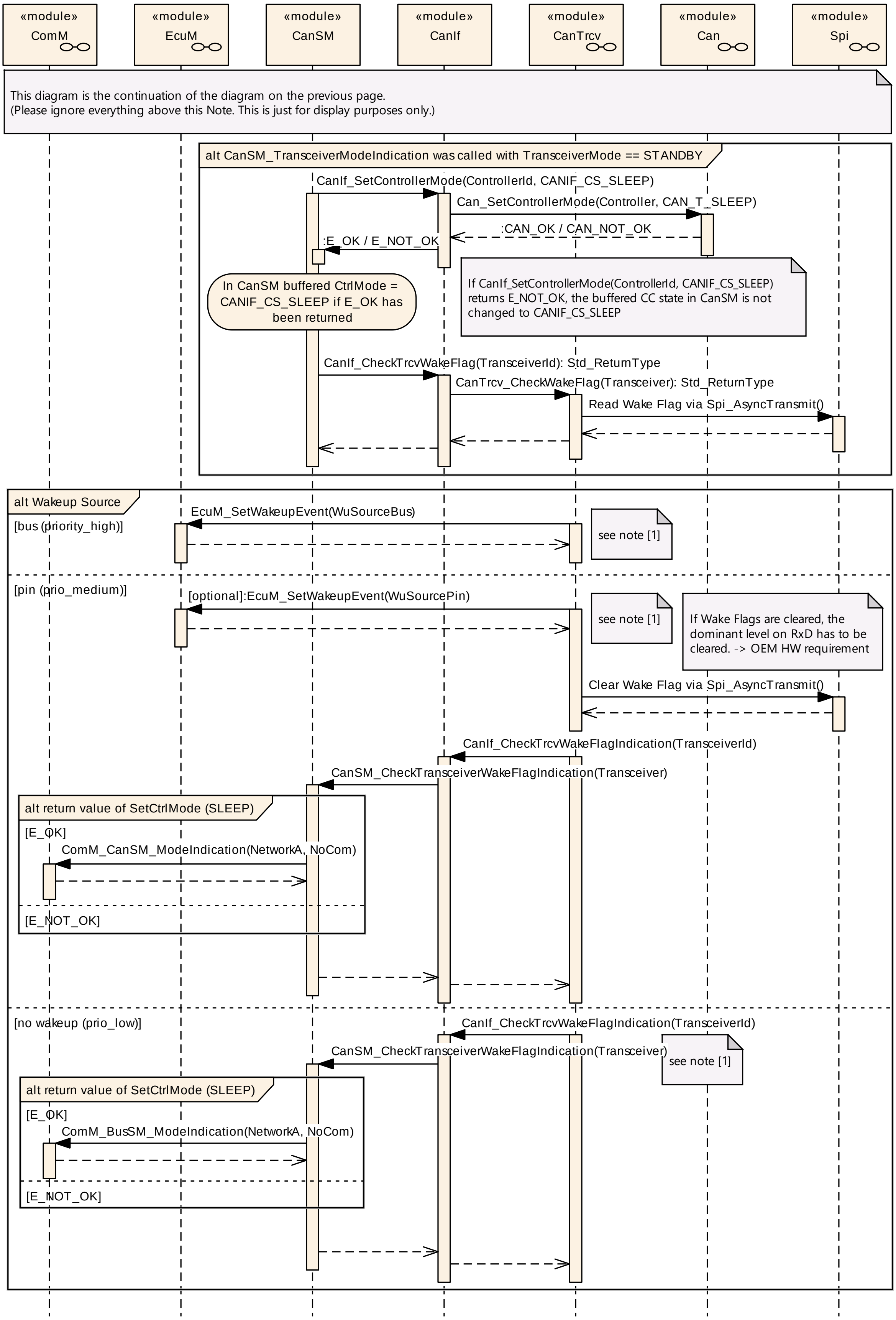

«module» ComM
«module» EcuM
«module» CanSM
«module» CanIf
«module» CanTrcv
«module» Can
«module» Spi
This diagram is the continuation of the diagram on the previous page.
(Please ignore everything above this Note. This is just for display purposes only.)
alt CanSM_TransceiverModeIndication was called with TransceiverMode == STANDBY
CanIf_SetControllerMode(ControllerId, CANIF_CS_SLEEP)
Can_SetControllerMode(Controller, CAN_T_SLEEP)
:CAN_OK / CAN_NOT_OK
:E_OK / E_NOT_OK
In CanSM buffered CtrlMode = CANIF_CS_SLEEP if E_OK has been returned
If CanIf_SetControllerMode(ControllerId, CANIF_CS_SLEEP) returns E_NOT_OK, the buffered CC state in CanSM is not changed to CANIF_CS_SLEEP
CanIf_CheckTrcvWakeFlag(TransceiverId)
CanTrcv_CheckWakeFlag(Transceiver)
Read Wake Flag via Spi_SyncTransmit()
alt Wakeup Source
[bus (priority_high)]
EcuM_SetWakeupEvent(WuSourceBus)
see note [1]
[pin (prio_medium)]
[optional]:EcuM_SetWakeupEvent(WuSourcePin)
see note [1]
If Wake Flags are cleared, the dominant level on RxD has to be cleared. -> OEM HW requirement
Clear Wake Flag via Spi_SyncTransmit()
CanIf_CheckTrcvWakeFlagIndication(TransceiverId)
CanSM_CheckTransceiverWakeFlagIndication(Transceiver)
alt return value of SetCtrlMode (SLEEP)
[E_OK]
ComM_CanSM_ModeIndication(NetworkA, NoCom)
[E_NOT_OK]
[no wakeup (prio_low)]
CanIf_CheckTrcvWakeFlagIndication(TransceiverId)
CanSM_CheckTransceiverWakeFlagIndication(Transceiver)
see note [1]
alt return value of SetCtrlMode (SLEEP)
[E_OK]
ComM_BusSM_ModeIndication(NetworkA, NoCom)
[E_NOT_OK]

9.4 De-Initialization (SPI Asynchronous)


«module»
ComM
«module»
EcuM
«module»
CanSM
«module»
CanIf
«module»
CanTrcv
«module»
Can
«module»
Spi
ComM state == NoCom
CanSM mode == SilentCom
Trcv == NORMAL
Ctrl == STARTED
CanSM_RequestComMode(NetworkA, NoCom): Std_ReturnType
CanSM_MainFunction()
CanIf_ClearTrcvWufFlag(TransceiverId): Std_ReturnType
CanTrcv_ClearTrcvWufFlag(Transceiver): Std_ReturnType
Spi_AsyncTransmit(Sequence): Std_ReturnType
CanIf_ClearTrcvWufFlagIndication(TransceiverId)
CanSM_ClearTrcvWufFlagIndication(Transceiver)
see note [1]
CanSM_MainFunction()
alt CanSM_ClearTrcvWufFlagIndication() was called
CanIf_SetControllerMode(ControllerId, CAN_CS_STOPPED)
Can_SetControllerMode(Controller, CAN_T_STOP)
In CanSM buffered CtrlMode = CAN_CS_STOPPED
CanIf_SetTrcvMode(TransceiverId, CANIF_TRCV_MODE_STANDBY): Std_ReturnType
CanTrcv_SetOpMode(Transceiver, CANIF_TRCV_MODE_STANDBY): Std_ReturnType
Spi_AsyncTransmit(Sequence): Std_ReturnType
CanIf_TrcvModeIndication(TransceiverId, CANIF_TRCV_MODE_STANDBY)
CanSM_TransceiverModeIndication(TransceiverId, CANIF_TRCV_MODE_STANDBY)
see note [1]
In CanSM buffered Trcv Mode = CANIF_TRCV_MODE_STANDBY

[1] It could be checked via
- Spi_JobEndNotification() callback or
- Spi_GetSequenceResult() or
- Spi_ReadIB()
whether SPI request was successfully transmitted via SPI lines.
This could either be done in interrupt context or in CanTrcv_MainFunction().

This diagram will be continued on the next page...
(Please ignore everything below this Note. This i just for display purposes only.)


«module» ComM
«module» EcuM
«module» CanSM
«module» CanIf
«module» CanTrcv
«module» Can
«module» Spi
This diagram is the continuation of the diagram on the previous page.
(Please ignore everything above this Note. This is just for display purposes only.)
alt CanSM_TransceiverModeIndication was called with TransceiverMode == STANDBY
CanIf_SetControllerMode(ControllerId, CANIF_CS_SLEEP)
Can_SetControllerMode(Controller, CAN_T_SLEEP)
:CAN_OK / CAN_NOT_OK
:E_OK / E_NOT_OK
In CanSM buffered CtrlMode = CANIF_CS_SLEEP if E_OK has been returned
If CanIf_SetControllerMode(ControllerId, CANIF_CS_SLEEP) returns E_NOT_OK, the buffered CC state in CanSM is not changed to CANIF_CS_SLEEP
CanIf_CheckTrcvWakeFlag(TransceiverId): Std_ReturnType
CanTrcv_CheckWakeFlag(Transceiver): Std_ReturnType
Read Wake Flag via Spi_AsyncTransmit()
alt Wakeup Source
[bus (priority_high)]
EcuM_SetWakeupEvent(WuSourceBus)
see note [1]
[pin (prio_medium)]
[optional]:EcuM_SetWakeupEvent(WuSourcePin)
see note [1]
If Wake Flags are cleared, the dominant level on RxD has to be cleared. -> OEM HW requirement
Clear Wake Flag via Spi_AsyncTransmit()
CanIf_CheckTrcvWakeFlagIndication(TransceiverId)
CanSM_CheckTransceiverWakeFlagIndication(Transceiver)
alt return value of SetCtrlMode (SLEEP)
[E_OK]
ComM_CanSM_ModeIndication(NetworkA, NoCom)
[E_NOT_OK]
[no wakeup (prio_low)]
CanIf_CheckTrcvWakeFlagIndication(TransceiverId)
CanSM_CheckTransceiverWakeFlagIndication(Transceiver)
see note [1]
alt return value of SetCtrlMode (SLEEP)
[E_OK]
ComM_BusSM_ModeIndication(NetworkA, NoCom)
[E_NOT_OK]

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.

Chapter 10.2 specifies the structure (containers) and the parameters of the module CanTrcv.

Chapter 10.2.1 specifies published information of the module CanTrcv.

10.1 How to read this chapter

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

[SWS_CanTrcv_00231] ⌈The Can Transceiver Driver module shall reject configurations with partition mappings which are not supported by the implementation. ⌋()

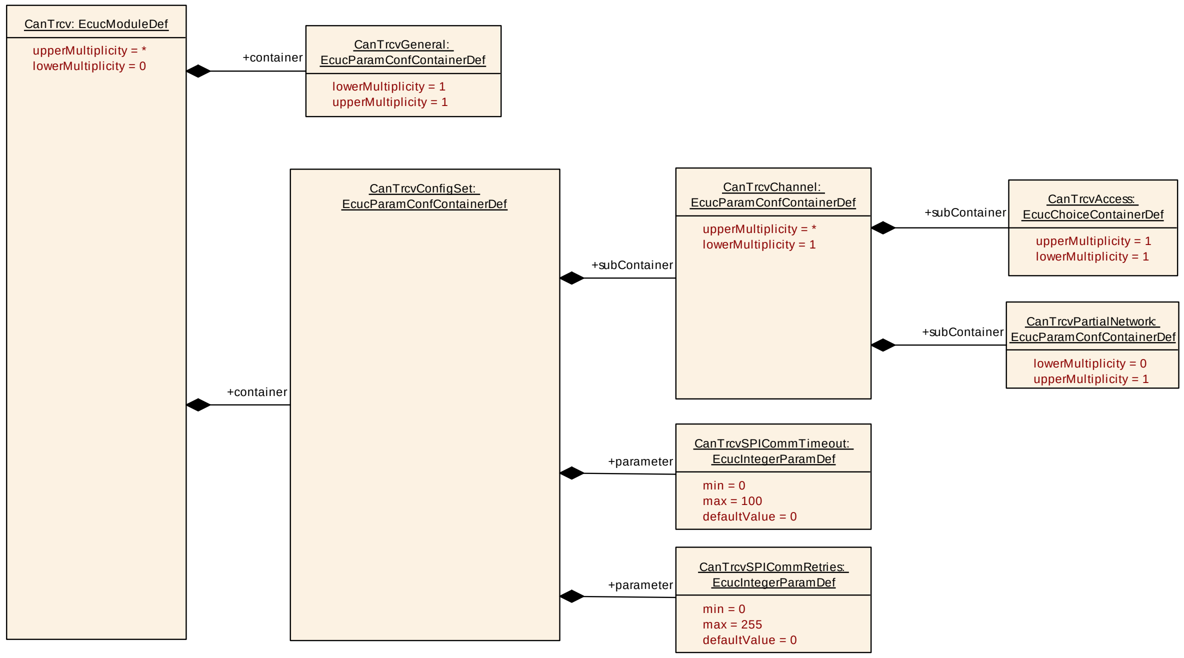
10.2 Containers and configuration parameters

The following chapters summarize all configuration parameters. The detailed meanings of the parameters are described in preceding chapters.

10.2.1 CanTrcv

SWS Item	**ECUC_CanTrcv_00192 :**
Module Name	*CanTrcv*
Module Description	Configuration of the CanTrcv (CAN Transceiver driver) module.
Post-Build Variant Support	true
Supported Config Variants	VARIANT-LINK-TIME, VARIANT-POST-BUILD, VARIANT-PRE-COMPILE

Included Containers		
Container Name	***Multiplicity***	***Scope / Dependency***
CanTrcvConfigSet	1	This container contains the configuration parameters and sub containers of the AUTOSAR WdgM module.
CanTrcvGeneral	1	Container gives CAN transceiver driver basic information.


CanTrcv: EcucModuleDef
upperMultiplicity = *
lowerMultiplicity = 0
+container
CanTrcvGeneral: EcucParamConfContainerDef
lowerMultiplicity = 1
upperMultiplicity = 1
CanTrcvConfigSet: EcucParamConfContainerDef
+container
+subContainer
CanTrcvChannel: EcucParamConfContainerDef
upperMultiplicity = *
lowerMultiplicity = 1
+subContainer
CanTrcvAccess: EcucChoiceContainerDef
upperMultiplicity = 1
lowerMultiplicity = 1
+subContainer
CanTrcvPartialNetwork: EcucParamConfContainerDef
lowerMultiplicity = 0
upperMultiplicity = 1
+parameter
CanTrcvSPICommTimeout: EcucIntegerParamDef
min = 0
max = 100
defaultValue = 0
+parameter
CanTrcvSPICommRetries: EcucIntegerParamDef
min = 0
max = 255
defaultValue = 0

10.2.2 CanTrcvGeneral

SWS Item	**ECUC_CanTrcv_00090 :**
Container Name	CanTrcvGeneral
Parent Container	CanTrcv
Description	Container gives CAN transceiver driver basic information.
Configuration Parameters	

SWS Item	**ECUC_CanTrcv_00152 :**
Name	CanTrcvDevErrorDetect
Parent Container	CanTrcvGeneral
Description	Switches the development error detection and notification on or off. • true: detection and notification is enabled.

	• false: detection and notification is disabled.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
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_CanTrcv_00184 :**		
Name	CanTrcvIndex		
Parent Container	CanTrcvGeneral		
Description	Specifies the InstanceId of this module instance. If only one instance is present it shall have the Id 0.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
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_CanTrcv_00187 :**		
Name	CanTrcvMainFunctionDiagnosticsPeriod		
Parent Container	CanTrcvGeneral		
Description	This parameter describes the period for cyclic call to CanTrcv_MainFunctionDiagnostics. Unit is seconds.		
Multiplicity	0..1		
Type	EcucFloatParamDef		
Range	]0 .. INF[		
Default value	--		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**ECUC_CanTrcv_00186 :**
Name	CanTrcvMainFunctionPeriod
Parent Container	CanTrcvGeneral
Description	This parameter describes the period for cyclic call to CanTrcv_MainFunction. Unit is seconds.
Multiplicity	0..1
Type	EcucFloatParamDef
Range	]0 .. INF[
Default value	--
Post-Build Variant Multi-	false

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

SWS Item	**ECUC_CanTrcv_00190 :**		
Name	CanTrcvTimerType		
Parent Container	CanTrcvGeneral		
Description	Type of the Time Service Predefined Timer.		
Multiplicity	0..1		
Type	EcucEnumerationParamDef		
Range	None	None	
	Timer_1us16bit	16 bit 1us timer	
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**ECUC_CanTrcv_00153 :**		
Name	CanTrcvVersionInfoApi		
Parent Container	CanTrcvGeneral		
Description	Switches version information API on and off. If switched off, function need not be present in compiled code.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

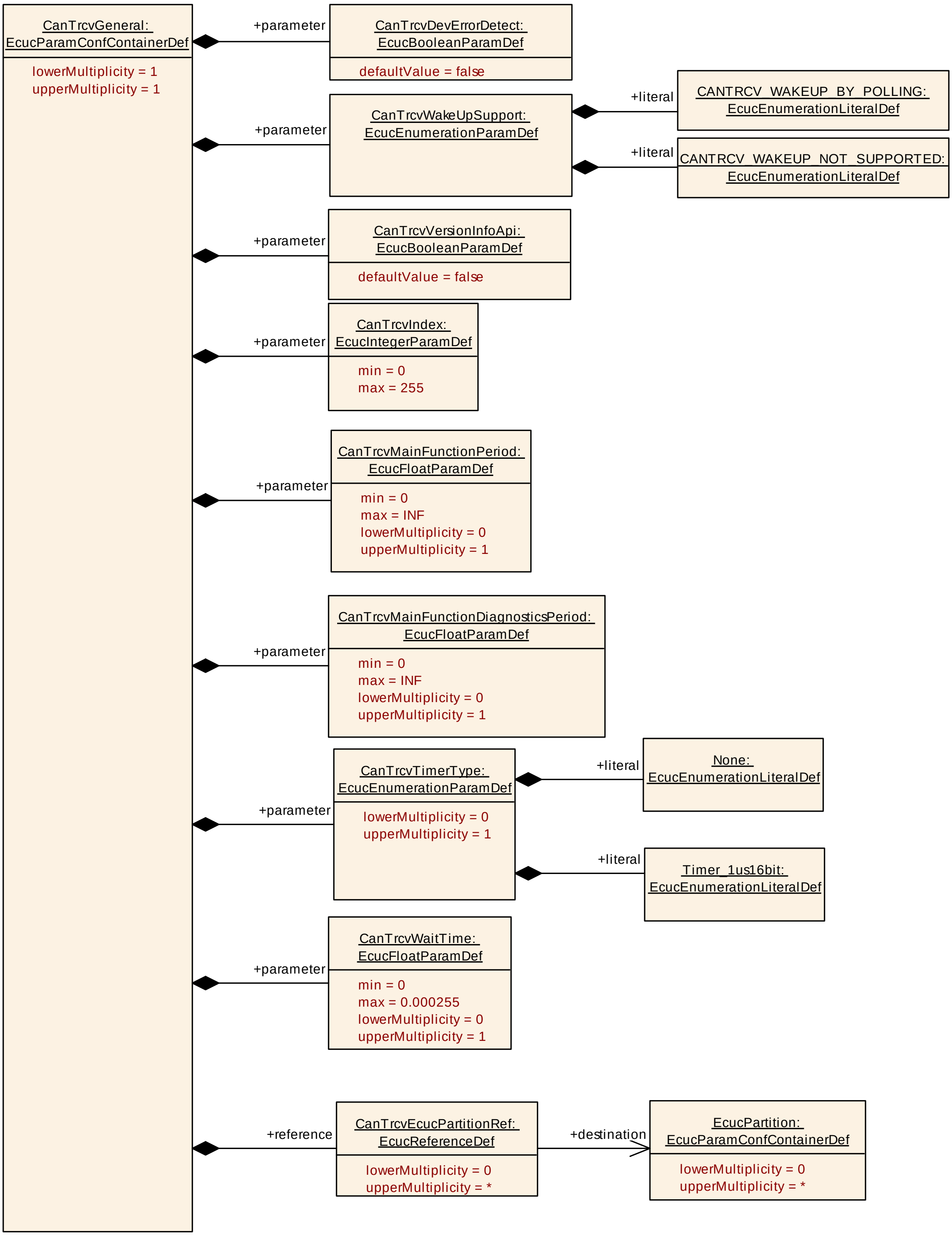
SWS Item	**ECUC_CanTrcv_00191 :**	
Name	CanTrcvWaitTime	
Parent Container	CanTrcvGeneral	
Description	Wait time for transceiver state changes in seconds.	
Multiplicity	0..1	
Type	EcucFloatParamDef	
Range	[0 .. 2.55E-4]	
Default value	--	
Post-Build Variant Multiplicity	false	
Post-Build Variant Value	false	

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

SWS Item	**ECUC_CanTrcv_00154 :**		
Name	CanTrcvWakeUpSupport		
Parent Container	CanTrcvGeneral		
Description	Informs whether wake up is supported by polling or not supported. In case no wake up is supported by the hardware, setting has to be NOT_SUPPORTED. Only in the case of wake up supported by polling, function CanTrcv_MainFunction has to be present and to be invoked by the scheduler.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	CANTRCV_WAKEUP_BY_POLLING	Wake up by polling	
	CANTRCV_WAKEUP_NOT_SUPPORTED	Wake up is not supported	
Post-Build Variant Value	false		
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local dependency: CanTrcvWakeupByBusUsed		

SWS Item	**ECUC_CanTrcv_00193 :**		
Name	CanTrcvEcucPartitionRef		
Parent Container	CanTrcvGeneral		
Description	Maps the CAN transceiver driver to zero or multiple ECUC partitions to make the modules API available in this partition. The module will operate as an independent instance in each of the partitions.		
Multiplicity	0..*		
Type	Reference to [EcucPartition]		
Post-Build Variant Multiplicity	true		
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	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: ECU		

No Included Containers


CanTrcvGeneral: EcucParamConfContainerDef
lowerMultiplicity = 1
upperMultiplicity = 1
+parameter
CanTrcvDevErrorDetect: EcucBooleanParamDef
defaultValue = false
+parameter
CanTrcvWakeUpSupport: EcucEnumerationParamDef
+literal
CANTRCV_WAKEUP_BY_POLLING: EcucEnumerationLiteralDef
+literal
CANTRCV_WAKEUP_NOT_SUPPORTED: EcucEnumerationLiteralDef
+parameter
CanTrcvVersionInfoApi: EcucBooleanParamDef
defaultValue = false
+parameter
CanTrcvIndex: EcucIntegerParamDef
min = 0
max = 255
+parameter
CanTrcvMainFunctionPeriod: EcucFloatParamDef
min = 0
max = INF
lowerMultiplicity = 0
upperMultiplicity = 1
+parameter
CanTrcvMainFunctionDiagnosticsPeriod: EcucFloatParamDef
min = 0
max = INF
lowerMultiplicity = 0
upperMultiplicity = 1
+parameter
CanTrcvTimerType: EcucEnumerationParamDef
lowerMultiplicity = 0
upperMultiplicity = 1
+literal
None: EcucEnumerationLiteralDef
+literal
Timer_1us16bit: EcucEnumerationLiteralDef
+parameter
CanTrcvWaitTime: EcucFloatParamDef
min = 0
max = 0.000255
lowerMultiplicity = 0
upperMultiplicity = 1
+reference
CanTrcvEcucPartitionRef: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = *
+destination
EcucPartition: EcucParamConfContainerDef
lowerMultiplicity = 0
upperMultiplicity = *

10.2.3 CanTrcvConfigSet

SWS Item	**ECUC_CanTrcv_00173 :**
Container Name	CanTrcvConfigSet
Parent Container	CanTrcv
Description	This container contains the configuration parameters and sub containers of the AUTOSAR WdgM module.

Configuration Parameters

SWS Item	**ECUC_CanTrcv_00175 :**		
Name	CanTrcvSPICommRetries		
Parent Container	CanTrcvConfigSet		
Description	Indicates the maximum number of communication retries in case of a failed SPI communication (applies both to timed out communication and to errors/NACK in the response data). If configured value is '0', no retry is allowed (communication is expected to succeed at first try).		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	0		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local dependency: This parameter exists only if atleast one SPI Sequence is referenced in CanTrcvSpiSequence.		

SWS Item	**ECUC_CanTrcv_00174 :**		
Name	CanTrcvSPICommTimeout		
Parent Container	CanTrcvConfigSet		
Description	Indicates the maximum time allowed to the CanTrcv for replying (either positively or negatively) to a SPI command. Timeout is configured in milliseconds. Timeout value of '0' means that no specific timeout is to be used by CanTrcv and the communication is executed at the best of the SPI HW capacity.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 100		
Default value	0		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local dependency: This parameter exists only if atleast one SPI Sequence is referenced in CanTrcvSpiSequence.		

Included Containers		
Container Name	***Multiplicity***	***Scope / Dependency***
CanTrcvChannel	1..*	Container gives CAN transceiver driver information about a single CAN transceiver (channel).

10.2.4 CanTrcvChannel

SWS Item	**ECUC_CanTrcv_00143 :**
Container Name	CanTrcvChannel
Parent Container	CanTrcvConfigSet
Description	Container gives CAN transceiver driver information about a single CAN transceiver (channel).
Configuration Parameters	

SWS Item	**ECUC_CanTrcv_00155 :**		
Name	CanTrcvChannelId		
Parent Container	CanTrcvChannel		
Description	Unique identifier of the CAN Transceiver Channel.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 255		
Default value	--		
Post-Build Variant Value	false		
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: ECU		

SWS Item	**ECUC_CanTrcv_00096 :**		
Name	CanTrcvChannelUsed		
Parent Container	CanTrcvChannel		
Description	Shall the related CAN transceiver channel be used?		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	true		
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_CanTrcv_00097 :**		
Name	CanTrcvControlsPowerSupply		
Parent Container	CanTrcvChannel		
Description	Is ECU power supply controlled by this transceiver? TRUE = Controlled by transceiver. FALSE = Not controlled by transceiver.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
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_CanTrcv_00160 :**		
Name	CanTrcvHwPnSupport		
Parent Container	CanTrcvChannel		
Description	Indicates whether the HW supports the selective wake-up function TRUE = Selective wakeup feature is supported by the transceiver FALSE = Selective wakeup functionality is not available in transceiver		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

	dependency: CanTrcvWakeUpSupport

SWS Item	**ECUC_CanTrcv_00146 :**		
Name	CanTrcvInitState		
Parent Container	CanTrcvChannel		
Description	State of CAN transceiver after call to CanTrcv_Init.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	CANTRCV_OP_MODE_SLEEP	Sleep operation mode	
	CANTRCV_OP_MODE_STANDBY	Standby operation mode	
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_CanTrcv_00147 :**		
Name	CanTrcvMaxBaudrate		
Parent Container	CanTrcvChannel		
Description	Indicates the data transfer rate in kbps. Maximum data transfer rate in kbps for transceiver hardware type. Only used for validation purposes. This value can be used by configuration tools.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 12000		
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_CanTrcv_00148 :**		
Name	CanTrcvWakeupByBusUsed		
Parent Container	CanTrcvChannel		
Description	Is wake up by bus supported? If CAN transceiver hardware does not support wake up by bus value is always FALSE. If CAN transceiver hardware supports wake up by bus value is TRUE or FALSE depending whether it is used or not. TRUE = Is used. FALSE = Is not used.		
Multiplicity	0..1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	**Pre-compile time**	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

	dependency: CanTrcvWakeUpSupport		

SWS Item	**ECUC_CanTrcv_00194 :**		
Name	CanTrcvChannelEcucPartitionRef		
Parent Container	CanTrcvChannel		
Description	Maps the CAN transceiver channel to zero or one ECUC partitions. The ECUC partition referenced is a subset of the ECUC partitions where the CAN transceiver driver is mapped to.		
Multiplicity	0..1		
Type	Reference to [EcucPartition]		
Post-Build Variant Multiplicity	true		
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	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: ECU		

SWS Item	**ECUC_CanTrcv_00185 :**		
Name	CanTrcvIcuChannelRef		
Parent Container	CanTrcvChannel		
Description	Reference to the IcuChannel to enable/disable the interrupts for wakeups.		
Multiplicity	0..1		
Type	Symbolic name reference to [IcuChannel]		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency			

SWS Item	**ECUC_CanTrcv_00181 :**		
Name	CanTrcvPorWakeupSourceRef		
Parent Container	CanTrcvChannel		
Description	Symbolic name reference to specify the wakeup sources that should be used in the calls to EcuM_SetWakeupEvent as specified in [SWS_CanTrcv_00183] and [SWS_CanTrcv_00184]. This reference is mandatory if the HW supports POR or SYSERR flags		
Multiplicity	0..1		
Type	Symbolic name reference to [EcuMWakeupSource]		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	

Scope / Dependency	scope: ECU

SWS Item	**ECUC_CanTrcv_00182 :**		
Name	CanTrcvSyserrWakeupSourceRef		
Parent Container	CanTrcvChannel		
Description	Symbolic name reference to specify the wakeup sources that should be used in the calls to EcuM_SetWakeupEvent as specified in [SWS_CanTrcv_00183] and [SWS_CanTrcv_00184] This reference is mandatory if the HW supports POR or SYSERR flags		
Multiplicity	0..1		
Type	Symbolic name reference to [EcuMWakeupSource]		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: ECU		

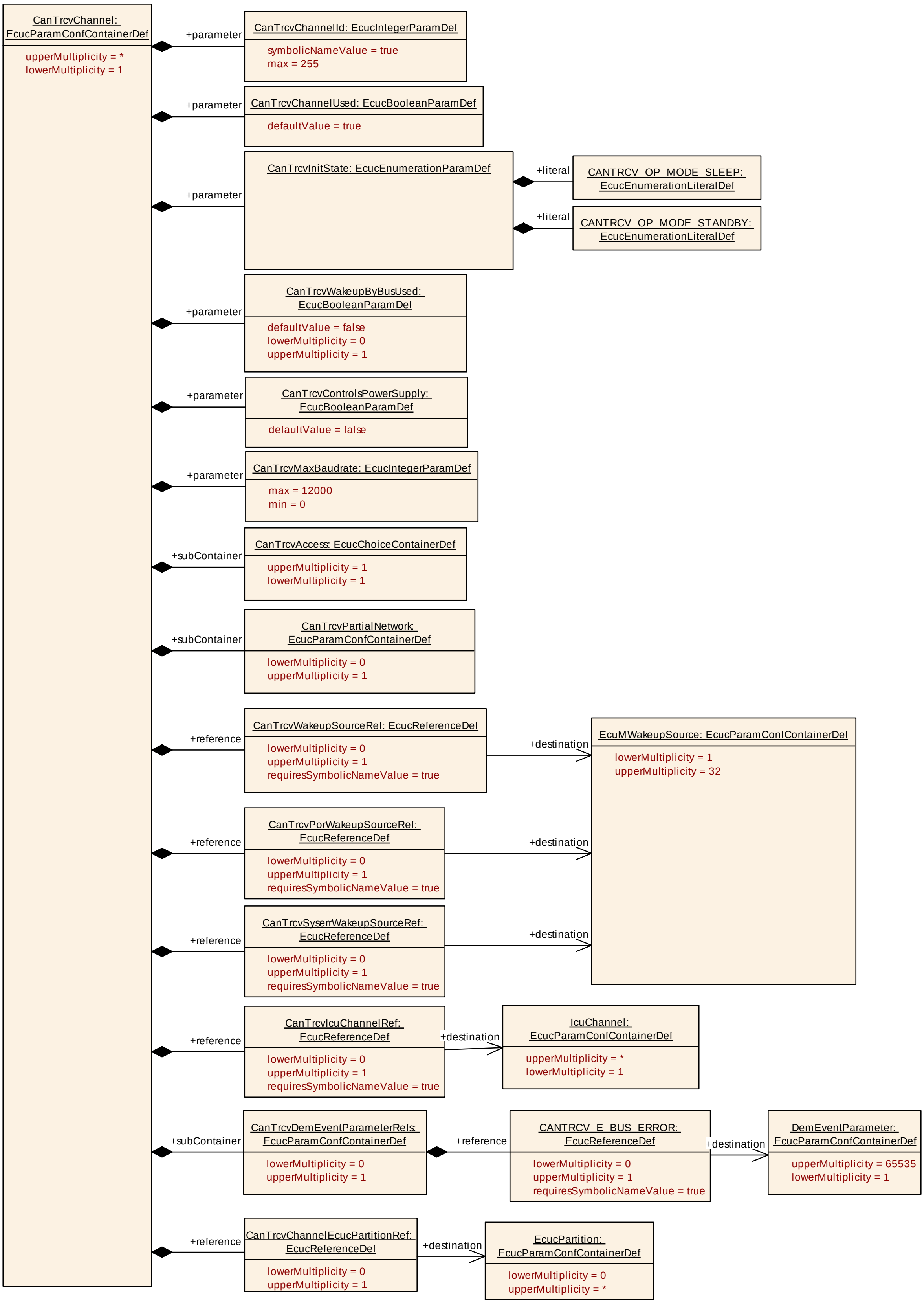
SWS Item	**ECUC_CanTrcv_00177 :**		
Name	CanTrcvWakeupSourceRef		
Parent Container	CanTrcvChannel		
Description	Reference to a wakeup source in the EcuM configuration. This reference is only needed if CanTrcvWakeupByBusUsed is true.		
Multiplicity	0..1		
Type	Symbolic name reference to [EcuMWakeupSource]		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: ECU dependency: CanTrcvWakeupByBusUsed		

Included Containers		
Container Name	***Multiplicity***	***Scope / Dependency***
CanTrcvAccess	1	Container gives CanTrcv Driver information about access to a single CAN transceiver.
CanTrcvDemEventParameterRefs	0..1	Container for the references to DemEventParameter elements which shall be invoked using the API Dem_SetEventStatus in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId symbolic value. The standardized errors are provided in this container and can be extended by vendor-specific error references.
CanTrcvPartialNetwork	0..1	Container gives CAN transceiver driver information about the configuration of Partial Networking functionality.

[SWS_CanTrcv_00233]⌈ The ECUC partitions referenced by CanTrcvChannelEcucPartitionRef shall be a subset of the ECUC partitions referenced by CanTrcvEcucPartitionRef.⌋()

[**SWS_CanTrcv_CONSTR_00235**]⌈ If CanTrcvEcucPartitionRef references one or more ECUC partitions, CanTrcvChannelEcucPartitionRef shall have a multiplicity of one and reference one of these ECUC partitions as well.⌋()

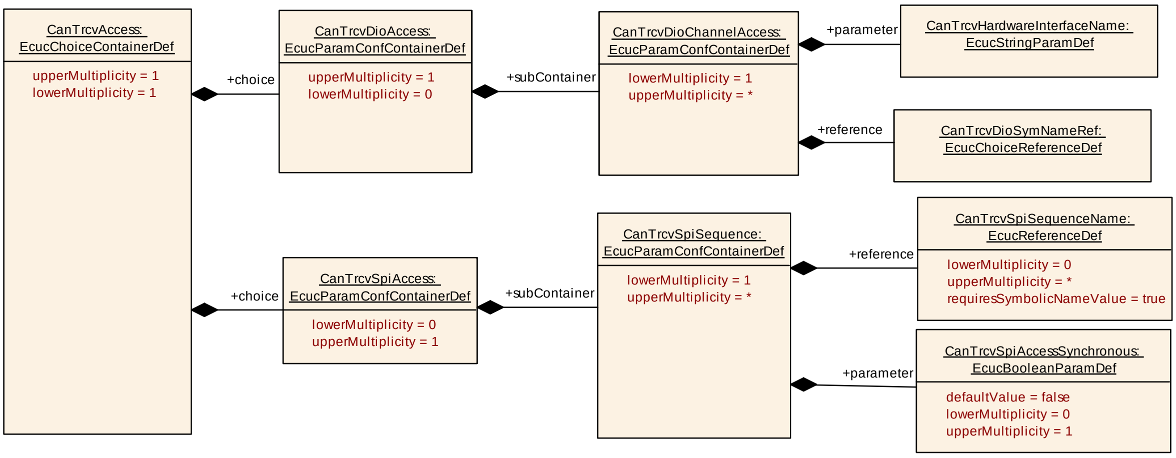
[SWS_CanTrcv_00234] ⌈ CanTrcvChannel and CanController of one communication channel shall all reference the same ECUC partition.⌋()


CanTrcvChannel: EcucParamConfContainerDef
upperMultiplicity = *
lowerMultiplicity = 1
+parameter
CanTrcvChannelId: EcucIntegerParamDef
symbolicNameValue = true
max = 255
+parameter
CanTrcvChannelUsed: EcucBooleanParamDef
defaultValue = true
+parameter
CanTrcvInitState: EcucEnumerationParamDef
+literal
CANTRCV_OP_MODE_SLEEP: EcucEnumerationLiteralDef
+literal
CANTRCV_OP_MODE_STANDBY: EcucEnumerationLiteralDef
+parameter
CanTrcvWakeupByBusUsed: EcucBooleanParamDef
defaultValue = false
lowerMultiplicity = 0
upperMultiplicity = 1
+parameter
CanTrcvControlsPowerSupply: EcucBooleanParamDef
defaultValue = false
+parameter
CanTrcvMaxBaudrate: EcucIntegerParamDef
max = 12000
min = 0
+subContainer
CanTrcvAccess: EcucChoiceContainerDef
upperMultiplicity = 1
lowerMultiplicity = 1
+subContainer
CanTrcvPartialNetwork: EcucParamConfContainerDef
lowerMultiplicity = 0
upperMultiplicity = 1
+reference
CanTrcvWakeupSourceRef: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = 1
requiresSymbolicNameValue = true
+destination
EcuMWakeupSource: EcucParamConfContainerDef
lowerMultiplicity = 1
upperMultiplicity = 32
+reference
CanTrcvPorWakeupSourceRef: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = 1
requiresSymbolicNameValue = true
+destination
+reference
CanTrcvSyserrWakeupSourceRef: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = 1
requiresSymbolicNameValue = true
+destination
+reference
CanTrcvIcuChannelRef: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = 1
requiresSymbolicNameValue = true
+destination
IcuChannel: EcucParamConfContainerDef
upperMultiplicity = *
lowerMultiplicity = 1
+subContainer
CanTrcvDemEventParameterRefs: EcucParamConfContainerDef
lowerMultiplicity = 0
upperMultiplicity = 1
+reference
CANTRCV_E_BUS_ERROR: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = 1
requiresSymbolicNameValue = true
+destination
DemEventParameter: EcucParamConfContainerDef
upperMultiplicity = 65535
lowerMultiplicity = 1
+reference
CanTrcvChannelEcucPartitionRef: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = 1
+destination
EcucPartition: EcucParamConfContainerDef
lowerMultiplicity = 0
upperMultiplicity = *

10.2.5 CanTrcvAccess

SWS Item	ECUC_CanTrcv_00101 :
Choice container Name	CanTrcvAccess
Parent Container	CanTrcvChannel
Description	Container gives CanTrcv Driver information about access to a single CAN transceiver.

Container Choices		
Container Name	**Multiplicity**	**Scope / Dependency**
CanTrcvDioAccess	0..1	Container gives CAN transceiver driver information about accessing ports and port pins. In addition relation between CAN transceiver hardware pin names and Dio port access information is given. If a CAN transceiver hardware has no Dio interface, there is no instance of this container.
CanTrcvSpiAccess	0..1	Container gives CAN transceiver driver information about accessing Spi. If a CAN transceiver hardware has no Spi interface, there is no instance of this container.


CanTrcvAccess: EcucChoiceContainerDef
upperMultiplicity = 1
lowerMultiplicity = 1
+choice
CanTrcvDioAccess: EcucParamConfContainerDef
upperMultiplicity = 1
lowerMultiplicity = 0
+subContainer
CanTrcvDioChannelAccess: EcucParamConfContainerDef
lowerMultiplicity = 1
upperMultiplicity = *
+parameter
CanTrcvHardwareInterfaceName: EcucStringParamDef
+reference
CanTrcvDioSymNameRef: EcucChoiceReferenceDef
+choice
CanTrcvSpiAccess: EcucParamConfContainerDef
lowerMultiplicity = 0
upperMultiplicity = 1
+subContainer
CanTrcvSpiSequence: EcucParamConfContainerDef
lowerMultiplicity = 1
upperMultiplicity = *
+reference
CanTrcvSpiSequenceName: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = *
requiresSymbolicNameValue = true
+parameter
CanTrcvSpiAccessSynchronous: EcucBooleanParamDef
defaultValue = false
lowerMultiplicity = 0
upperMultiplicity = 1

10.2.6 CanTrcvDioAccess

SWS Item	ECUC_CanTrcv_00145 :
Container Name	CanTrcvDioAccess
Parent Container	CanTrcvAccess
Description	Container gives CAN transceiver driver information about accessing ports and port pins. In addition relation between CAN transceiver hardware pin names and Dio port access information is given. If a CAN transceiver hardware has no Dio interface, there is no instance of this container.
Configuration Parameters	

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
CanTrcvDioChannelAccess	1..*	Container gives DIO channel access by single Can transceiver channel.

10.2.7 CanTrcvDioChannelAccess

SWS Item	ECUC_CanTrcv_00157 :
Container Name	CanTrcvDioChannelAccess

Parent Container	CanTrcvDioAccess
Description	Container gives DIO channel access by single Can transceiver channel.
Configuration Parameters	

SWS Item	**ECUC_CanTrcv_00150 :**		
Name	CanTrcvHardwareInterfaceName		
Parent Container	CanTrcvDioChannelAccess		
Description	CAN transceiver hardware interface name. It is typically the name of a pin. From a Dio point of view it is either a port, a single channel or a channel group. Depending on this fact either CANTRCV_DIO_PORT_SYMBOLIC_NAME or CANTRCV_DIO_CHANNEL_SYMBOLIC_NAME or CANTRCV_DIO_CHANNEL_GROUP_SYMBOLIC_NAME shall reference a Dio configuration. The CAN transceiver driver implementation description shall list up this name for the appropriate CAN transceiver hardware.		
Multiplicity	1		
Type	EcucStringParamDef		
Default value	--		
maxLength	--		
minLength	--		
regularExpression	--		
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_CanTrcv_00149 :**		
Name	CanTrcvDioSymNameRef		
Parent Container	CanTrcvDioChannelAccess		
Description	Choice Reference to a DIO Port, DIO Channel or DIO Channel Group. This reference replaces the CANTRCV_DIO_PORT_SYM_NAME, CANTRCV_DIO_CHANNEL_SYM_NAME and CANTRCV_DIO_GROUP_SYM_NAME references in the Can Trcv SWS.		
Multiplicity	1		
Type	Choice reference to [DioChannel , DioChannelGroup , DioPort]		
Post-Build Variant Value	false		
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency			

No Included Containers

10.2.8 CanTrcvSpiAccess

SWS Item	**ECUC_CanTrcv_00183 :**
Container Name	CanTrcvSpiAccess
Parent Container	CanTrcvAccess
Description	Container gives CAN transceiver driver information about accessing Spi. If a CAN transceiver hardware has no Spi interface, there is no instance of this container.
Configuration Parameters	

Included Containers

Container Name	***Multiplicity***	***Scope / Dependency***
CanTrcvSpiSequence	1..*	Container gives CAN transceiver driver information about one SPI sequence. One SPI sequence used by CAN transceiver driver is in exclusive use for it. No other driver is allowed to access this sequence. CAN transceiver driver may use one sequence to access n CAN transceiver hardwares chips of the same type or n sequences are used to access one single CAN transceiver hardware chip. If a CAN transceiver hardware has no SPI interface, there is no instance of this container.

10.2.9 CanTrcvSpiSequence

SWS Item	**ECUC_CanTrcv_00144 :**
Container Name	CanTrcvSpiSequence
Parent Container	CanTrcvSpiAccess
Description	Container gives CAN transceiver driver information about one SPI sequence. One SPI sequence used by CAN transceiver driver is in exclusive use for it. No other driver is allowed to access this sequence. CAN transceiver driver may use one sequence to access n CAN transceiver hardwares chips of the same type or n sequences are used to access one single CAN transceiver hardware chip. If a CAN transceiver hardware has no SPI interface, there is no instance of this container.
Configuration Parameters	

SWS Item	**ECUC_CanTrcv_00176 :**		
Name	CanTrcvSpiAccessSynchronous		
Parent Container	CanTrcvSpiSequence		
Description	This parameter is used to define whether the access to the Spi sequence is synchronous or asynchronous. true: SPI access is synchronous. false: SPI access is asynchronous.		
Multiplicity	0..1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**ECUC_CanTrcv_00151 :**
Name	CanTrcvSpiSequenceName
Parent Container	CanTrcvSpiSequence
Description	Reference to a Spi sequence configuration container.
Multiplicity	0..*
Type	Symbolic name reference to [SpiSequence]
Post-Build Variant Multiplicity	false

Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local dependency: SpiSequence		

No Included Containers

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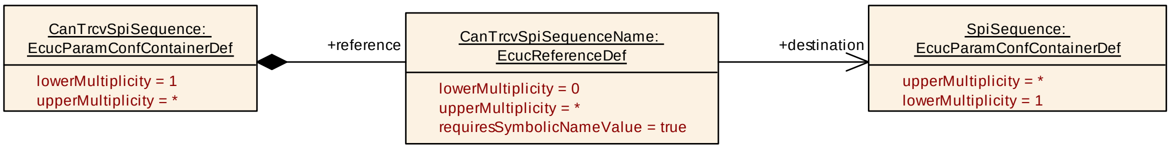
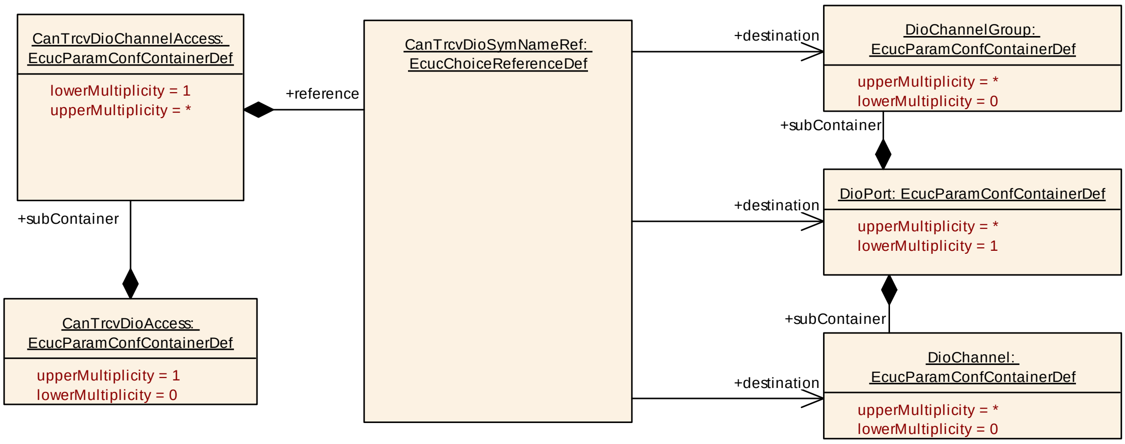

CanTrcvSpiSequence: EcucParamConfContainerDef
lowerMultiplicity = 1
upperMultiplicity = *
+reference
CanTrcvSpiSequenceName: EcucReferenceDef
lowerMultiplicity = 0
upperMultiplicity = *
requiresSymbolicNameValue = true
+destination
SpiSequence: EcucParamConfContainerDef
upperMultiplicity = *
lowerMultiplicity = 1


CanTrcvDioChannelAccess: EcucParamConfContainerDef
lowerMultiplicity = 1
upperMultiplicity = *
+reference
CanTrcvDioSymNameRef: EcucChoiceReferenceDef
+destination
DioChannelGroup: EcucParamConfContainerDef
upperMultiplicity = *
lowerMultiplicity = 0
+subContainer
+destination
DioPort: EcucParamConfContainerDef
upperMultiplicity = *
lowerMultiplicity = 1
+subContainer
+subContainer
CanTrcvDioAccess: EcucParamConfContainerDef
upperMultiplicity = 1
lowerMultiplicity = 0
+destination
DioChannel: EcucParamConfContainerDef
upperMultiplicity = *
lowerMultiplicity = 0

10.2.10 CanTrcvDemEventParameterRefs

SWS Item	**ECUC_CanTrcv_00188 :**
Container Name	CanTrcvDemEventParameterRefs
Parent Container	CanTrcvChannel
Description	Container for the references to DemEventParameter elements which shall be invoked using the API Dem_SetEventStatus in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId symbolic value. The standardized errors are provided in this container and can be extended by vendor-specific error references.
Configuration Parameters	

SWS Item	**ECUC_CanTrcv_00189 :**
Name	CANTRCV_E_BUS_ERROR
Parent Container	CanTrcvDemEventParameterRefs
Description	Reference to the DemEventParameter which shall be issued when bus error has occurred.
Multiplicity	0..1

Type	Symbolic name reference to [DemEventParameter]		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Value Configuration Class	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: ECU dependency: DEM		

No Included Containers

10.2.11 CanTrcvPartialNetwork

SWS Item	**ECUC_CanTrcv_00161 :**
Container Name	CanTrcvPartialNetwork
Parent Container	CanTrcvChannel
Description	Container gives CAN transceiver driver information about the configuration of Partial Networking functionality.
Configuration Parameters	

SWS Item	**ECUC_CanTrcv_00169 :**		
Name	CanTrcvBaudRate		
Parent Container	CanTrcvPartialNetwork		
Description	Indicates the data transfer rate in kbps.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 12000		
Default value	--		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local dependency: Although WUF with DLC=0 is technically possible, it is explicitly not wanted.		

SWS Item	**ECUC_CanTrcv_00171 :**		
Name	CanTrcvBusErrFlag		
Parent Container	CanTrcvPartialNetwork		
Description	Indicates if the Bus Error (BUSERR) flag is managed by the BSW. This flag is set if a bus failure is detected by the transceiver. TRUE = Supported by transceiver and managed by BSW. FALSE = Not managed by BSW.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**ECUC_CanTrcv_00164 :**		
Name	CanTrcvPnCanIdIsExtended		
Parent Container	CanTrcvPartialNetwork		
Description	Indicates whether extended or standard ID is used. TRUE = Extended Can identifier is used. FALSE = Standard Can identifier is used		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**ECUC_CanTrcv_00172 :**		
Name	CanTrcvPnEnabled		
Parent Container	CanTrcvPartialNetwork		
Description	Indicates whether the selective wake-up function is enabled or disabled in HW. TRUE = Selective wakeup feature is enabled in the transceiver hardware FALSE = Selective wakeup feature is disabled in the transceiver hardware		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**ECUC_CanTrcv_00163 :**		
Name	CanTrcvPnFrameCanId		
Parent Container	CanTrcvPartialNetwork		
Description	CAN ID of the Wake-up Frame (WUF).		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 4294967295		
Default value	--		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

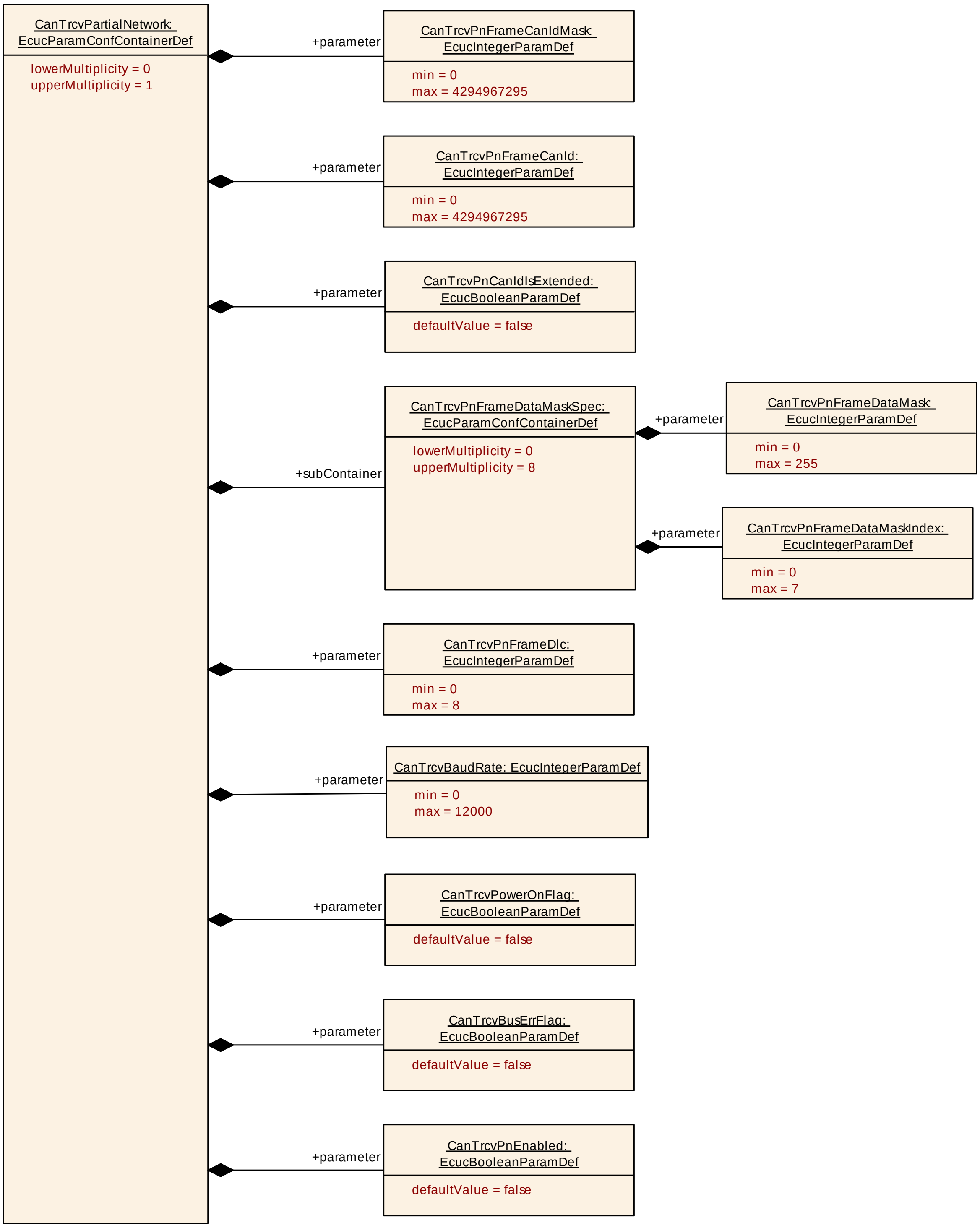
SWS Item	**ECUC_CanTrcv_00162 :**		
Name	CanTrcvPnFrameCanIdMask		
Parent Container	CanTrcvPartialNetwork		
Description	ID Mask for the selective activation of the transceiver. It is used to enable-Frame Wake-up (WUF) on a group of IDs.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 4294967295		
Default value	--		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE

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

SWS Item	**ECUC_CanTrcv_00168 :**		
Name	CanTrcvPnFrameDlc		
Parent Container	CanTrcvPartialNetwork		
Description	Data Length of the Wake-up Frame (WUF).		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 8		
Default value	--		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**ECUC_CanTrcv_00170 :**		
Name	CanTrcvPowerOnFlag		
Parent Container	CanTrcvPartialNetwork		
Description	Description: Indicates if the Power On Reset (POR) flag is available and is managed by the transceiver. TRUE = Supported by Hardware. FALSE = Not supported by Hardware		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

Included Containers		
Container Name	***Multiplicity***	***Scope / Dependency***
CanTrcvPnFrameDataMaskSpec	0..8	Defines data payload mask to be used on the received payload in order to determine if the transceiver must be woken up by the received Wake-up Frame (WUF).


CanTrcvPartialNetwork: EcucParamConfContainerDef
lowerMultiplicity = 0
upperMultiplicity = 1
+parameter
CanTrcvPnFrameCanIdMask: EcucIntegerParamDef
min = 0
max = 4294967295
+parameter
CanTrcvPnFrameCanId: EcucIntegerParamDef
min = 0
max = 4294967295
+parameter
CanTrcvPnCanIdIsExtended: EcucBooleanParamDef
defaultValue = false
+subContainer
CanTrcvPnFrameDataMaskSpec: EcucParamConfContainerDef
lowerMultiplicity = 0
upperMultiplicity = 8
+parameter
CanTrcvPnFrameDataMask: EcucIntegerParamDef
min = 0
max = 255
+parameter
CanTrcvPnFrameDataMaskIndex: EcucIntegerParamDef
min = 0
max = 7
+parameter
CanTrcvPnFrameDlc: EcucIntegerParamDef
min = 0
max = 8
+parameter
CanTrcvBaudRate: EcucIntegerParamDef
min = 0
max = 12000
+parameter
CanTrcvPowerOnFlag: EcucBooleanParamDef
defaultValue = false
+parameter
CanTrcvBusErrFlag: EcucBooleanParamDef
defaultValue = false
+parameter
CanTrcvPnEnabled: EcucBooleanParamDef
defaultValue = false

10.2.12 CanTrcvPnFrameDataMaskSpec

SWS Item	**ECUC_CanTrcv_00165 :**
Container Name	CanTrcvPnFrameDataMaskSpec
Parent Container	CanTrcvPartialNetwork
Description	Defines data payload mask to be used on the received payload in order to determine if the transceiver must be woken up by the received Wake-up Frame (WUF).
Configuration Parameters	

SWS Item	**ECUC_CanTrcv_00166 :**

Name	CanTrcvPnFrameDataMask		
Parent Container	CanTrcvPnFrameDataMaskSpec		
Description	Defines the n byte (Byte0 = LSB) of the data payload mask to be used on the received payload in order to determine if the transceiver must be woken up by the received Wake-up Frame (WUF).		
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	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**ECUC_CanTrcv_00167 :**		
Name	CanTrcvPnFrameDataMaskIndex		
Parent Container	CanTrcvPnFrameDataMaskSpec		
Description	holds the position n in frame of the mask-part		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 7		
Default value	--		
Post-Build Variant Value	true		
Value Configuration Class	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

No Included Containers

10.3 Published Information

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

11 Not applicable requirements

[SWS_CanTrcv_00999]⌈These requirements are not applicable to this specification. ⌋ (SRS_BSW_00304, SRS_BSW_00305, SRS_BSW_00306, SRS_BSW_00307, SRS_BSW_00308, SRS_BSW_00309, SRS_BSW_00312, SRS_BSW_00321, SRS_BSW_00325, SRS_BSW_00328, SRS_BSW_00330, SRS_BSW_00333, SRS_BSW_00334, SRS_BSW_00336, SRS_BSW_00341, SRS_BSW_00342, SRS_BSW_00344, SRS_BSW_00359, SRS_BSW_00360, SRS_BSW_00378, SRS_BSW_00383, SRS_BSW_00384, SRS_BSW_00398, SRS_BSW_00399, SRS_BSW_00400, SRS_BSW_00401, SRS_BSW_00404, SRS_BSW_00405, SRS_BSW_00410, SRS_BSW_00416, SRS_BSW_00417, SRS_BSW_00422, SRS_BSW_00423, SRS_BSW_00426, SRS_BSW_00427, SRS_BSW_00429, SRS_BSW_00432, SRS_BSW_00433, SRS_BSW_00005, SRS_BSW_00006, SRS_BSW_00007, SRS_BSW_00009, SRS_BSW_00010, SRS_BSW_00161, SRS_BSW_00164, SRS_BSW_00168, SRS_Can_01107, SRS_Can_01138)