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2016-11-30	4.3.0	AUTOSAR Release Management	• New feature to get the “TxConflictState” • Introduce reliable TxConfirmation • Unused bit handling reworked • Several bug fixes
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2010-02-02	3.1.4	AUTOSAR Release Management	• Added support for FlexRay 3.0 hardware (CCs and transceivers) • Added functionalities to get detailed (error) information of the communications bus • Added support for single/key-slot mode • Added “cancel transmission” support • Legal disclaimer revised
2008-08-13	3.1.1	AUTOSAR Release Management	• Legal disclaimer revised
2008-02-01	3.0.2	AUTOSAR Release Management	• Correction of Figure 5.1
2007-12-21	3.0.1	AUTOSAR Release Management	• Simplification of the FlexRay Interface State Machine due to the introduction of the new AUTOSAR SWS FlexRay State Manager • Cluster-based APIs were removed due to the introduced AUTOSAR SWS FlexRay State Manager • The FlexRay Interface does not initialize any other modules any more due to the introduction of the “flat initialization” for AUTOSAR release 3.0Document meta information extended • Small layout adaptations made
2007-01-24	2.1.15	AUTOSAR Release Management	• “Advice” for users revised • Legal disclaimer added • “Revision Information” added • Release Notes added
2006-05-16	2.0	AUTOSAR Release Management	• Second Release
2005-05-31	1.0	AUTOSAR Release Management	• Initial Release

Disclaimer

Contents

1 Introduction and functional overview

This specification specifies the functionality, API and the configuration of the AUTOSAR Basic Software module "FlexRay Interface".

In the AUTOSAR Layered Software Architecture Layered Software Architecture, the FlexRay Interface belongs to the ECU Abstraction Layer, or more precisely, to the Communication Hardware Abstraction. This indicates the main task of the FlexRay Interface:

Provide to upper layers an abstract interface to the FlexRay Communication System. At least as far as data transmission (i.e. data sending and reception) is concerned, this interface shall be uniform for all bus systems in Autosar (FlexRay, CAN, LIN). Thus, the upper layer (Communication Services like PDU Router, Transport Protocol, and Network Management and others) may access all underlying bus systems for data transmission in a uniform manner. The configuration of the FlexRay Interface however is bus-specific, since it takes into account the specific features of the communication system.

The FlexRay Interface does not directly access the FlexRay hardware (FlexRay Communication Controller and FlexRay Transceiver), but by means of one or more hardware-specific Driver modules.

In order to access the FlexRay Communication Controller(s), the FlexRay Interface uses one or multiple FlexRay Driver modules, which abstract the specific features and interfaces (CHI) of the respective FlexRay Communication Controller(s).

Likewise, in order to access the FlexRay Transceiver(s), the FlexRay Interface shall use one or multiple FlexRay Transceiver Driver module(s), which abstract the specific features and interfaces of the respective FlexRay Transceiver(s)

Therefore, the FlexRay Interface executable code (however, not the configuration used during runtime) shall be completely independent of the FlexRay Communication Controller(s) and the FlexRay Transceiver(s).

Note: The FlexRay Interface is specified in a way that allows for object code delivery of the code module, following the "one-fits-all" principle, i.e. the entire configuration of the FlexRay Interface can be carried out without modifying any source code. Thus, the configuration of the FlexRay Interface can be carried out largely without detailed knowledge of the underlying hardware.

The FlexRay Interface provides to upper layer AUTOSAR BSW modules the following groups of functions:

- initialization
- data transmission (sending and reception)
- start/halt/abort communication
- FlexRay specific functions (e.g. send wake-up pattern)

- set operation mode
- get status information
- various timer functions

1.1 General Hints

In general, the FlexRay Interface has no knowledge of the origin of a PDU passed to it in an API service call.

Therefore, throughout this document, the term "PDU" is being used for PDUs originating from or sent to:

- AUTOSAR Com (I-PDU) via the PDU-Router, or
- AUTOSAR FlexRay TP (N-PDU), or
- AUTOSAR FlexRay NM
- AUTOSAR XCP

In addition to the above-mentioned AUTOSAR BSW modules, the FrIf shall, with the functionality described within the specification in hand, also support other non-AUTOSAR upper layer software modules (Complex Drivers), provided that these modules interact with the FrIf in the same manner as the upper layer AUTOSAR BSW modules.

Throughout this document, several scenarios for changing configuration data are mentioned. They are being used as follows:

- "pre compile time" = carried out before compiling the code of the FlexRay Interface, since the code generation depends on this setting.
- "at system configuration time" = static configuration parameters stored in the Flex Ray Interface; may be defined after compilation of the code of the FlexRay Interface ("link time" or "post build time"), but have to be defined before the first execution of the FlexRay Interface code.
- "during runtime" = dynamically switching (in POC:normal active state of the Flex Ray CC, if supported) between different configuration parameter sets stored in the static configuration of the FlexRay Interface, or the FlexRay Driver, respectively.

Everything not explicitly mentioned in this document, should be considered as implementation-specific.

2 Acronyms and Abbreviations

The following acronyms and abbreviations are used throughout this document:

Acronym:	Description:
BSW	(AUTOSAR) Basic Software
CAS	Collision Avoidance Symbol
CC	(FlexRay) Communication Controller
CDD	Complex Driver
CHI	Controller Host Interface of a FlexRay CC
COM	Communication (AUTOSAR BSW module)
ComM	Communication Manager (AUTOSAR BSW module)
DEM	Diagnostic Event Manager (AUTOSAR BSW module)
DET	Default Error Tracer (AUTOSAR BSW module)
FrIf	FlexRay Interface (AUTOSAR BSW module)
FrNm	FlexRay Network Management (AUTOSAR BSW module)
FrTp	FlexRay Transport Layer (AUTOSAR BSW module)
ISR	Interrupt Service Routine
MCG	Module Configuration Generator
PduR	PDU Router (AUTOSAR BSW module)
POC	Protocol Operation Control
WUDOP	Wake-Up During Operation
WUP	Wake-Up Pattern
WUS	Wake-Up Symbol
System Designer	The person responsible for the configuration of all system parameters that do not influence the executable code itself (i.e. the sequence of instructions executed during runtime), but the data used to configure which operations this executable code performs on which data and at which points in time.

Abbreviation:	Description:
i.e.	[lat.] id est = [eng.] that is
e.g.	[lat.] exempli gratia = [eng.] for example
N/A	not applicable

3 Related documentation

3.1 Input documents & related standards and norms

[1] General Specification of Basic Software Modules
AUTOSAR_CP_SWS_BSWGeneral

[2] FlexRay Communications System Protocol Specification V3.0

[3] General Requirements on Basic Software Modules
AUTOSAR_CP_SRS_BSWGeneral

[4] Requirements on FlexRay
AUTOSAR_CP_SRS_FlexRay

[5] Layered Software Architecture
AUTOSAR_CP_EXP_LayeredSoftwareArchitecture

[6] FlexRay Communications System Protocol Specification V2.1
http://www.flexray.com/

3.2 Related specification

AUTOSAR provides a General Specification on Basic Software modules [1, SWS BSW General], which is also valid for FrIf.

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

4 Constraints and assumptions

4.1 Limitations

The FlexRay BSW modules are only able to handle a single thread of execution per Cluster. The execution for a particular Cluster must not be pre-empted by itself for the same Cluster. The same applies to the execution of the FlexRay Job List Execution Function.

It is not possible to transmit signals, PDUs, and/or L-SDUs, which exceed the available buffer size of the used FlexRay CC during normal operation. Longer signals, PDUs, and/or L-SDUs have to be transmitted using the FlexRay Transport Protocol.

Note: The FlexRay Interface does not make any PDU payload-dependent routing decisions.

Note: In order for the AUTOSAR FlexRay BSW (FrIf and FlexRay Driver) modules to be able to control a FlexRay CC, this CC must allow for configuring its transmit/ receive buffers to support the Cycle Counter Filter Criterion / (Support of Slot/Cycle Muliplexing)

For 2.1 FlexRay Hardware, the following Cycle Counter Filtering is possible

Cycle Number = (B + n * 2R)mod64

with exactly one tuple of values for B and 2R, where:

- Base Cycle B $\in$ [0 ... 63]
- Cycle Repetition 2R ; R $\in$ [0 ... 6]
- Variable n = 0 ... 63
- B < 2R

For 3.0 FlexRay Hardware, the Cycle Counter Filtering shall be possible as described in [2, FlexRay Communications System Protocol Specification V3.0]

4.2 Applicability to car domains

The FlexRay BSW Stack can be used wherever high data rates and fault tolerant communication (in conjunction with AUTOSAR COM) are required. Of course, it can also be used for less-demanding use cases, i.e. for low data rates or non-fault-tolerant communication. Furthermore, it enables the synchronized operation of several ECUs within a car.

5 Dependencies to other modules

5.1 AUTOSAR Operating System

[SWS_FrIf_05099] ⌈There is one dedicated FlexRay Job List Execution Function for each FlexRay Cluster.⌋ *(SRS_BSW_00432)*

[SWS_FrIf_05100] ⌈The FlexRay Interface module shall execute the Flexray Job List Execution Function.⌋ *(SRS_BSW_00432)*

Note: It is up to the implementer whether the FlexRay Job List Execution Functions run in a task context or in an ISR.

5.2 All Upper Layer AUTOSAR BSW Modules

[SWS_FrIf_05050] ⌈The calling of the FlexRay Job List Execution Function by the Flex Ray Interface module synchronously to the FlexRay Global Time shall ensure that both the indication (to an upper layer BSW module) of received data and the request (to an upper layer BSW module) for data to be sent occur synchronously to the FlexRay Global Time.⌋ *(SRS_Fr_05000)*

[SWS_FrIf_05148] ⌈The FlexRay Interface module shall ensure data consistency in its buffers.⌋ *(SRS_BSW_00426)*

Rationale for [SWS_FrIf_05148]: If the respective upper layer BSW module does not operate synchronously to the FlexRay Global Time, these occurrences are asynchronous to the code execution of this BSW module.

5.3 AUTOSAR PDU-Router

The FrIf module declares and calls some callback functions of the PDU-Router in order to confirm transmission and notify reception of PDUs.

5.4 AUTOSAR FlexRay Network Management

The FrIf module declares and calls some callback functions of the FlexRay Network Management in order to confirm transmission and notify reception of PDUs.

5.5 AUTOSAR FlexRay Transport Protocol

The FrIf module declares and calls some callback functions of the FlexRay Transport Protocol in order to confirm transmission and notify reception of PDUs.

5.6 AUTOSAR Bus Mirroring

The FrIf module calls a callback function of the Bus Mirroring module in order to report received and transmitted frames, which in turn calls some service functions of the FrIf module to acquire the network state.

5.7 AUTOSAR FlexRay Driver

The FrIf module has a tight relation to the FlexRay Driver since many of the FlexRay-related services offered by the FrIf module to upper layer BSW modules are actually carried out by the FlexRay Driver BSW module. For those services, the FrIf module mainly performs only an abstraction of the communication hardware specific information (e.g. the topology of the FlexRay Communication System) and then calls the respective FlexRay Driver with the appropriate parameters.

The FlexRay Driver module has to be the only BSW module which has to run necessarily synchronous to the FlexRay Interface.

5.8 AUTOSAR FlexRay Transceiver Driver

The FrIf module has a tight relation to the FlexRay Transceiver Driver since calls of API services of the FlexRay Transceiver Driver are also routed through the FrIf module in order to abstract the communication hardware specific information (e.g. the topology of the FlexRay Communication System).

5.9 File Structure

5.9.1 Header File Structure

Please refer to the chapter "Header file structure" in [1, General Specification of Basic Software Modules].

[SWS_FrIf_05087] ⌈The FrIf module source code file(s) shall include SchM_FrIf.h if data consistency mechanisms of the BSW scheduler are required as described in [1, General Specification of Basic Software Modules].⌋*(SRS_BSW_00426)*

[SWS_FrIf_05090] ⌈The header file FrIf.h shall contain a software and specification version number.⌋*(SRS_BSW_00004)*

[SWS_FrIf_05095] ⌈Mirror.h contains the declaration of the API service the Bus Mirroring module offers to the FlexRay Interface. This header is only included if Bus Mirroring is enabled (see FrIfBusMirroringSupport).⌋*(SRS_BSW_00004)*

6 Requirements Tracing

The following tables reference the requirements specified in [3, SRS BSW General] and [4, SRS Flex Ray] and links to the fulfillment of these. Please note that if column “Satisfied by” is empty for a specific requirement this means that this requirement is not fulfilled by this document.

Requirement	Description	Satisfied by
[SRS_BSW_00004]	All Basic SW Modules shall perform a pre-processor check of the versions of all imported include files	[SWS_FrIf_05090] [SWS_FrIf_05095]
[SRS_BSW_00101]	The Basic Software Module shall be able to initialize variables and hardware in a separate initialization function	[SWS_FrIf_05003]
[SRS_BSW_00162]	The AUTOSAR Basic Software shall provide a hardware abstraction layer	[SWS_FrIf_05107]
[SRS_BSW_00170]	The AUTOSAR SW Components shall provide information about their dependency from faults, signal qualities, driver demands	[SWS_FrIf_05089]
[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_FrIf_05089]
[SRS_BSW_00304]	All AUTOSAR Basic Software Modules shall use only AUTOSAR data types instead of native C data types	[SWS_FrIf_05001]
[SRS_BSW_00334]	All Basic Software Modules shall provide an XML file that contains the meta data	[SWS_FrIf_05089]
[SRS_BSW_00336]	Basic SW module shall be able to shutdown	[SWS_FrIf_05006]
[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_FrIf_05078]
[SRS_BSW_00345]	BSW Modules shall support pre-compile configuration	[SWS_FrIf_05069]
[SRS_BSW_00348]	All AUTOSAR standard types and constants shall be placed and organized in a standard type header file	[SWS_FrIf_05001]
[SRS_BSW_00353]	All integer type definitions of target and compiler specific scope shall be placed and organized in a single type header	[SWS_FrIf_05001]
[SRS_BSW_00358]	The return type of init() functions implemented by AUTOSAR Basic Software Modules shall be void	[SWS_FrIf_05003]
[SRS_BSW_00361]	No description	[SWS_FrIf_05001]
[SRS_BSW_00373]	The main processing function of each AUTOSAR Basic Software Module shall be named according the defined convention	[SWS_FrIf_05283]

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Requirement	Description	Satisfied by
[SRS_BSW_00375]	Basic Software Modules shall report wake-up reasons	[SWS_FrIf_05036]
[SRS_BSW_00378]	AUTOSAR shall provide a boolean type	[SWS_FrIf_05001]
[SRS_BSW_00404]	BSW Modules shall support post-build configuration	[SWS_FrIf_05069]
[SRS_BSW_00405]	BSW Modules shall support multiple configuration sets	[SWS_FrIf_05003]
[SRS_BSW_00407]	Each BSW module shall provide a function to read out the version information of a dedicated module implementation	[SWS_FrIf_05002]
[SRS_BSW_00411]	All AUTOSAR Basic Software Modules shall apply a naming rule for enabling/disabling the existence of the API	[SWS_FrIf_05002]
[SRS_BSW_00414]	Init functions shall have a pointer to a configuration structure as single parameter	[SWS_FrIf_05003]
[SRS_BSW_00426]	BSW Modules shall ensure data consistency of data which is shared between BSW modules	[SWS_FrIf_05087] [SWS_FrIf_05148]
[SRS_BSW_00432]	Modules should have separate main processing functions for read/receive and write/transmit data path	[SWS_FrIf_05099] [SWS_FrIf_05100] [SWS_FrIf_05119]
[SRS_Fr_05000]	Synchronous SW Modules shall be supported	[SWS_FrIf_05050]
[SRS_Fr_05007]	The FlexRay Interface shall be able to communicate with at least four Flex Ray CCs via the appropriate FlexRay Driver(s)	[SWS_FrIf_05053] [SWS_FrIf_05111] [SWS_FrIf_05112] [SWS_FrIf_05113]
[SRS_Fr_05010]	Each PDU shall have one PDU-ID	[SWS_FrIf_05052]
[SRS_Fr_05013]	The local Memory Space shall be initialized	[SWS_FrIf_05003]
[SRS_Fr_05015]	The FlexRay Interface shall provide a software interface to start-up a specific FlexRay CC	[SWS_FrIf_05005]
[SRS_Fr_05016]	A FlexRay CC Communication shall be aborted when wanted	[SWS_FrIf_05007]
[SRS_Fr_05018]	The FlexRay Interface shall provide a software interface to send a wake-up pattern on a channel or CC	[SWS_FrIf_05011]
[SRS_Fr_05022]	FlexRay CC POC Status shall be available	[SWS_FrIf_05014]
[SRS_Fr_05027]	A PDU shall be transmitted via the FlexRay communication system	[SWS_FrIf_05063]
[SRS_Fr_05031]	A FlexRay CC shall be initialized and configured	[SWS_FrIf_05004] [SWS_FrIf_05117]
[SRS_Fr_05039]	The Operation Mode of a FlexRay Transceiver shall be set	[SWS_FrIf_05034]
[SRS_Fr_05042]	The FlexRay Interface shall allow switching from one configuration to another one in Normal Active Mode	[SWS_FrIf_05061]

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Requirement	Description	Satisfied by
[SRS_Fr_05056]	Configuration of the FlexRay Interface shall be done at System Configuration Time	[SWS_FrIf_05054]
[SRS_Fr_05063]	A FlexRay CC Communication shall be halted when wanted	[SWS_FrIf_05006]
[SRS_Fr_05096]	Communication controllers shall be assigned to FlexRay Driver.	[SWS_FrIf_05060]
[SRS_Fr_05097]	The FlexRay Interface shall be able to communicate with at least four Flex Ray Drivers	[SWS_FrIf_05057]
[SRS_Fr_05126]	PDU Update/Valid Information shall be handled	[SWS_FrIf_05056]
[SRS_Fr_05130]	The FlexRay Interface shall support PDU transmission buffer queues	[SWS_FrIf_05058]
[SRS_Fr_05157]	The Operation Mode of a FlexRay Transceiver shall be available	[SWS_FrIf_05035]
[SRS_Fr_05158]	The wake-up reason of a specific FlexRay Transceiver device shall be available	[SWS_FrIf_05036]
[SRS_Fr_05161]	Pending Wake-up Events of a Transceiver shall be cleared if necessary	[SWS_FrIf_05039]
[SRS_Fr_05170]	PDUs received via the FlexRay communication system shall be retrieved	[SWS_FrIf_05062]

Table 6.1: RequirementsTracing

7 Functional specification

7.1 FlexRay BSW Stack

As part of the AUTOSAR Layered Software Architecture according to Figure 7.1, the FlexRay BSW modules also form a layered software stack. [5, AUTOSAR_EXP_LayeredSoftwareArchitecture] depicts the basic structure of this FlexRay BSW stack. The FrIf module accesses several CCs using the FlexRay Driver layer, which can be made up of several FlexRay Drivers modules. The FlexRay Transceivers are not shown in this figure; however, the structure that applies to the FlexRay Drivers and the FlexRay CCs analogously applies to the FlexRay Transceiver Drivers and the FlexRay Transceivers.

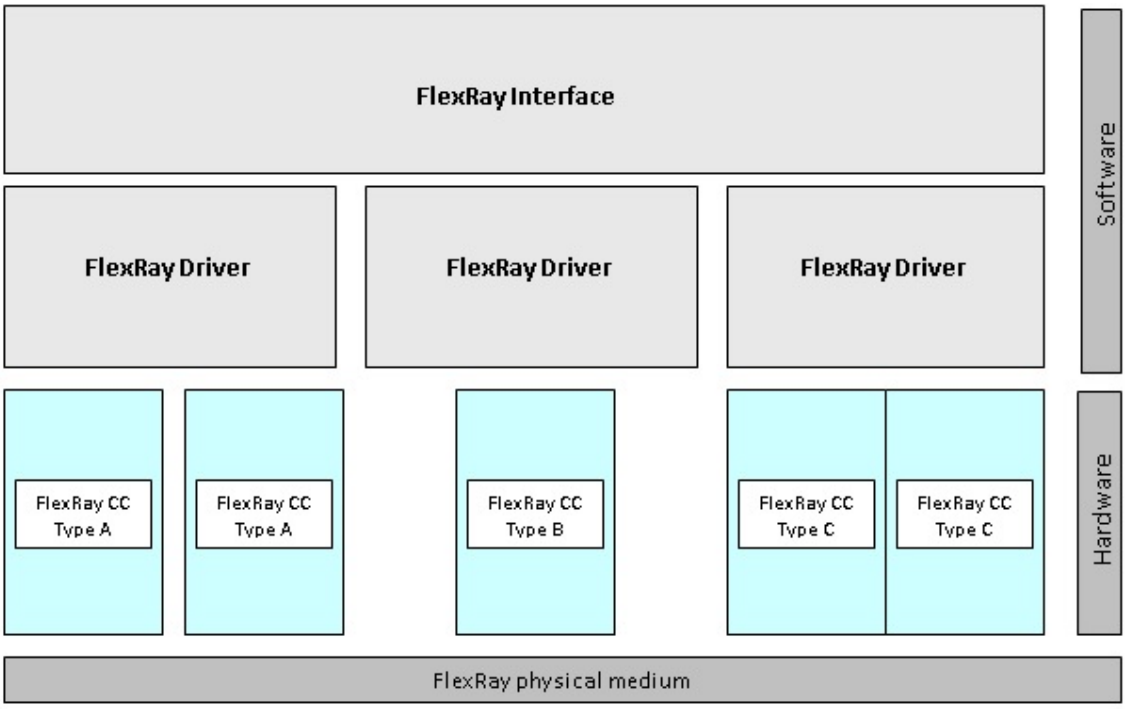

Figure 7.1: Basic Structure of the FlexRay Bsw Stack

7.2 Indexing Scheme

7.2.1 Principle

Most of the FrIf module's API services used for accessing the numerous (hardware and software) resources [1] map to corresponding API services of the underlying Flex Ray Driver(s), or FlexRay Transceiver Driver(s), respectively.

[1] E.g. timers, configuration data sets, etc.

In order to select those resources spread over the various entities [2] accessed via the FrIf module, the FlexRay-related AUTOSAR BSW modules use an indexing scheme that is exemplarily described in Figure 7.2 and Figure 7.3.

Definition ControllerIndex: The ConctrollerIndex is an abstract, unique, zero-based consecutive index to achieve the abstraction of the FlexRay Communication Controllers, independent of their type, location, and access method.

Definition ClusterIndex: The ClusterIndex is an abstract, unique, zero-based consecutive index to achieve the abstraction of the FlexRay Clusters, independent of their type, location, and access method.

Definition ChannelIndex: The ChannelIndex has either the value FR_CHANNEL_A or FR_CHANNEL_B. In combination with the ControlerIndex, the corresponding FlexRay Transceiver is identified.

[SWS_FrIf_05052] ⌈The FrIf module shall achieve the abstraction (of the CCs and Drivers) by providing to the upper layer BSW modules an abstract, unique, zero-based consecutive index for each sort of resource, independent of their type, location, and access method.⌋ *(SRS_Fr_05010)*

Rationale: The FrIf module achieves the abstraction (of the CCs and Drivers) by providing these abstract indices to the upper layer BSW modules.

The FrIf module API service uses the abstract index passed to it by the upper layer BSW module to retrieve:

- the function pointer to a corresponding lower layer BSW module's API service from a static configuration data table containing function pointers to all API services of all lower layer BSW modules called by the FrIf module, and
- the translated index used in the call to the lower layer BSW module's API service from a static configuration data table.

Since this static configuration data table contains function pointers to the lower layer BSW module's API services, it obviously has to be linked against the linked and located code of the lower layer BSW modules.

The FrIf module then calls the corresponding lower layer BSW module's API service via the function pointer and passes the translated index in the API call.

The function descriptions in chapter 8 specify the required calls of corresponding lower layer BSW module's API services in detail.

[2] FlexRay Drivers, FlexRay Communication Controllers, FlexRay Transceiver Drivers, and FlexRay Transceivers

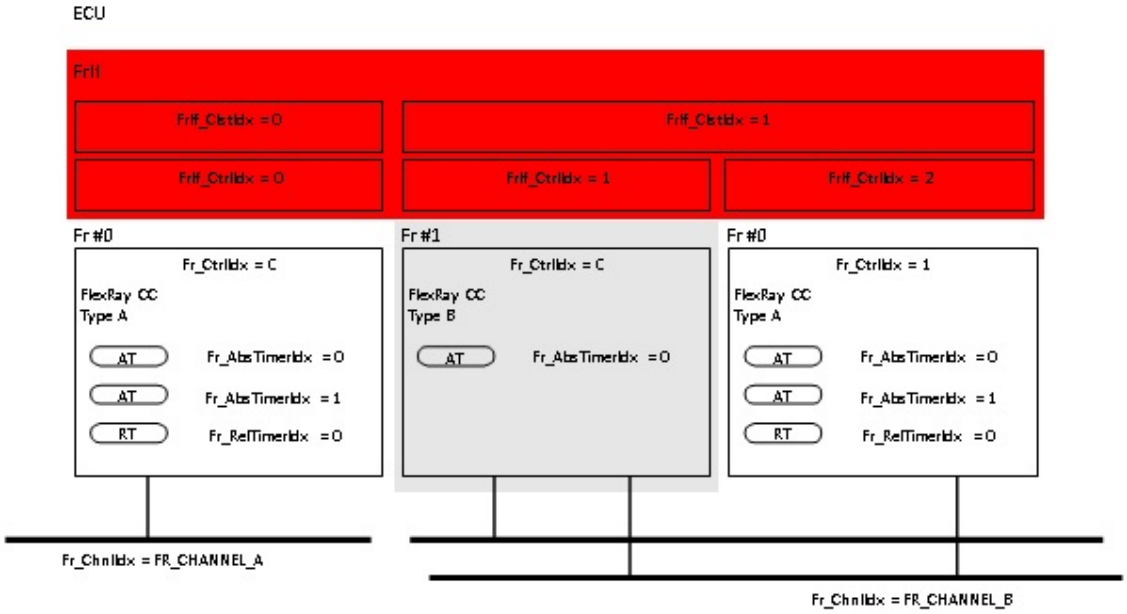

Figure 7.2: CC Indexing Scheme of the FlexRay Interface

[SWS_FrIf_05060] ⌈In order to abstract for upper layer BSW modules the various CCs, which the FrIf module controls via the FlexRay Driver modules, the FrIf module offers an abstract, unique, zero-based consecutive index FrIfCtrlIdx as configuration parameter, which maps to a tuple of FlexRay Driver API Service function pointer and CC index Fr_CtrlIdx.⌋*(SRS_Fr_05096)*

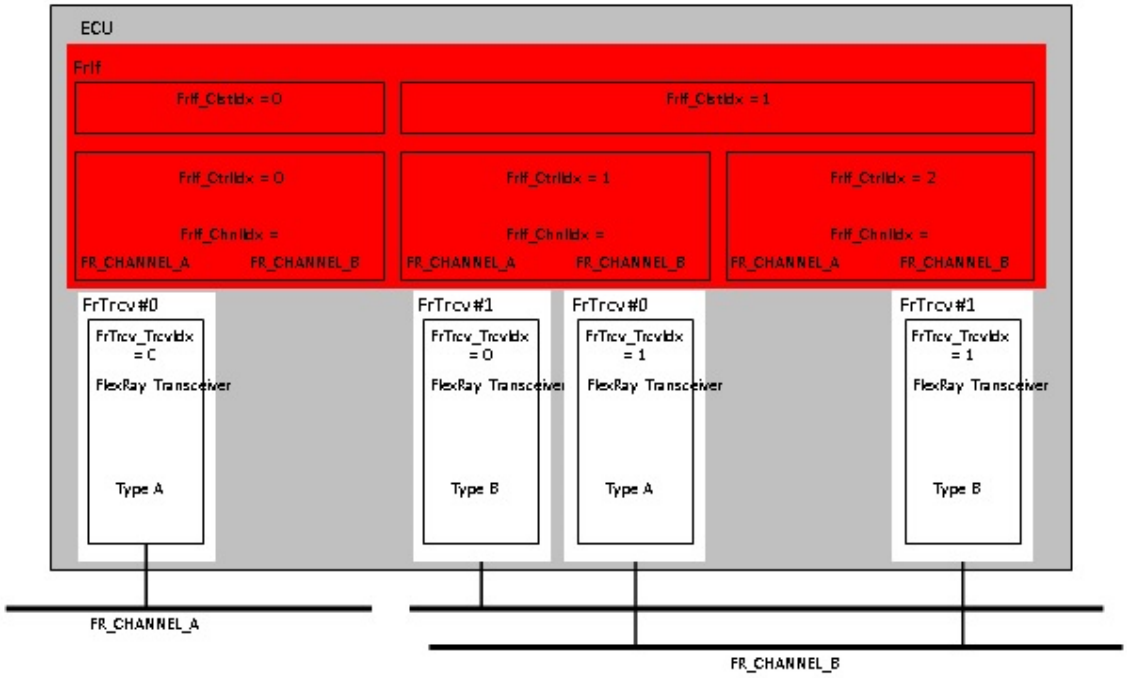

Figure 7.3: Flexray Transceiver Indexing Scheme of the FlexRay Interface

In order to abstract for upper layer BSW modules the various FlexRay Transceiver modules, which the FrIf module accesses via the FlexRay Transceiver Driver modules, the FrIf module takes advantage of the fact that each FlexRay Transceiver module is unambiguously assigned to a specific Channel on a specific FlexRay CC.

Therefore, the FrIf module abstracts the various FlexRay Transceivers by a combination of the two indices FrIf_CtrlIdx (Controller Index) and FrIf_ChnlIdx (Channel Index) and maps this to a tuple of FlexRay Transceiver Driver API Service function pointer and FlexRay Transceiver index FrTrcv_TrcvIdx. (Transceiver Index)

The function descriptions in chapter 8 specify the required mapping of upper layer BSW module's parameters to corresponding lower layer BSW module's API services in detail."

[SWS_FrIf_05107] ⌈Besides hardware and software resources, the FrIf module also numbers the logical structure elements presented by FlexRay with an abstract, unique, zero-based consecutive index.

The static configuration data of the FrIf module contains a data structure that specifies which FlexRay CC modules and which FlexRay Transceiver modules are connected to which Clusters, or in other words, that maps each value of FrIf_ClstIdx to (one, or in general) a set of values for FrIf_CtrlIdx and tuples of (FrIfCtrlIIdx, FrIf_ChnlIdx).⌋ *(SRS_BSW_00162)*

[SWS_FrIf_05110] ⌈The FrIf module shall number all PDUs to be transmitted with an abstract, unique, zero-based consecutive index TxPduId.⌋ *()*

Note:This index is used in the FrIf API service FrIf_Transmit() and allows the FrIf module to quickly identify (e.g. by a table look-up) the PDU that is passed to it by an upper layer BSW module, and to process it accordingly.

7.2.2 Supported Indexed Resources

[SWS_FrIf_05057] ⌈It shall be possible that the FrIf module can be configured to support at least four (possibly different) FlexRay Drivers to access the FlexRay Communication Controllers.⌋*(SRS_Fr_05097)*

[SWS_FrIf_05053] ⌈It shall be possible that the FrIf module can be configured using the parameter FRIF_CTRL_IDX to support at least four (possibly different) FlexRay CCs.⌋*(SRS_Fr_05007)*

[SWS_FrIf_05111] ⌈It shall be possible that the FrIf module can be configured to support one of both or both FlexRay Channels as specified in [6, FlexRay Communications System Protocol Specification V2.1].⌋*(SRS_Fr_05007)*

[SWS_FrIf_05112] ⌈It shall be possible that the FrIf module can be configured using the parameter FRIF_CLST_IDX to support at least four FlexRay Clusters.⌋*(SRS_Fr_05007)*

[SWS_FrIf_05113] ⌈It shall be possible that the FrIf module can be configured using the parameter FRIF_ABS_TIMER_IDX to support at least one absolute timer per Flex Ray CCs.⌋*(SRS_Fr_05007)*

7.3 FlexRay Interface State Machine

[SWS_FrIf_05115] ⌈In order to allow to control the communication operations of the FlexRay system, the FrIf module shall implement a behavior, which is defined using a simple state machine (one per FlexRay cluster), called FlexRay Interface State Machine⌋*()*

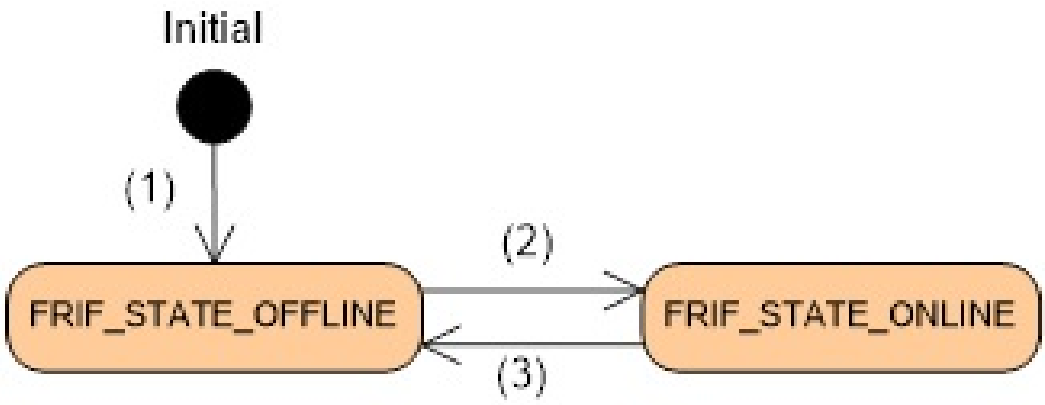

Figure 7.4: FlexRay Interface State Machine

State	Description
FRIF_STATE_OFFLINE	No communication services are executed (see section 7.6 for details)
FRIF_STATE_ONLINE	All communication services (reception, transmission, transmission confirmation) are executed (see section 7.6 for details).

Table 7.1: FlexRay State Machine Transitions (1)

[SWS_FrIf_05117] ⌈During initialization of the FrIf by executing FrIf_Init() the FrIf_State for each cluster shall be initialized with state 'FRIF_STATE_OFFLINE'.

The transitions are requested by an API service FrIf_SetState() which takes the Cluster to process on and the Transistion name to invoke.⌋*(SRS_Fr_05031)*

[SWS_FrIf_05118] ⌈If the FrIf module's environment calls the function FrIf_SetState with parameter FrIf_StateTransition = FRIF_GOTO_ONLINE and if the current state for the requested cluster is FRIF_STATE_OFFLINE, the FrIf module shall take the current state of the requested cluster to FRIF_STATE_ONLINE.".

If the FrIf module's environment calls the function FrIf_SetState with parameter FrIf_ StateTransition = FRIF_GOTO_ OFFLINE and if the current state for the requested cluster is FRIF_STATE_ONLINE, the FrIf module shall take the current state of the requested cluster to FRIF_STATE_OFFLINE.".

Otherwise, do not perform a state transition.⌋*()* For details see Figure 7.4 and Table 7.2

Transition Name	Transitions (see Figure 7.4)	Description
FRIF_GOTO_ONLINE	(2)	Transition resulting in FrIf_State FRIF_STATE_ONLINE
FRIF_GOTO_OFFLINE	(3)	Transition resulting in FrIf_State FRIF_STATE_OFFLINE

Table 7.2: FlexRay State Machine Transitions (2)

[SWS_FrIf_05501] ⌈If the API FrIf_SetState with parameter FRIF_STATE_OFFLINE is called, the FlexRay Interface module shall check the parameter "TxConfCounter" for every PDU. If the value for the corresponding PDU is greater than 0, the FlexRay Interface shall call the upper layer using the API <UL>_TxConfirmation(id, E_NOT_OK).⌋*()*

Note: It has to be ensured that the FlexRay Interface does not lose the TxConfCounter values at the point in time the API FrIf_SetState with parameter FRIF_STATE_OFFLINE is called.

7.3.1 FlexRay Interface Main Function

The FlexRay Interface Main Function needs to be called cyclically from a task body provided by the BSW Scheduler with a calling period (FRIF_MAINFUNCTION_PERIOD) depending on the FlexRay Cycle length and configurable at system configuration time.

Since the Cycle length of each Cluster is independent, the desired calling period of the FlexRay Interface Main Function might differ from Cluster to Cluster, except for "Transmission with Immediate Buffer Access".

[SWS_FrIf_05119] ⌈The FrIf module shall provide one dedicated FlexRay Interface Main Function for each FlexRay Cluster that is controlled by that FrIf module.⌋*(SRS_BSW_00432)*

[SWS_FrIf_05283] ⌈The API names of the FlexRay Interface Main Functions shall obey the following pattern:

FrIf_MainFunction_<FrIfCluster.ShortName> where FrIfCluster.ShortName is the Short Name of the corresponding FrIfCluster.⌋*(SRS_BSW_00373)*

[SWS_FrIf_15120] ⌈The Main Function monitors and controls the continuous execution of the FlexRay Job List Execution Function including the (re)synchronization if the current FlexRay Interface State Machine is FRIF_STATE_ONLINE.⌋*()*

[SWS_FrIf_01124] ⌈If Bus Mirroring is enabled globally (see FrIfBusMirroringSupport), then call Fr_GetChannelStatus for all controllers of each FlexRay cluster for which mirroring has been activated with a call to FrIf_EnableBusMirroring(), merge the states reported for the controllers of one cluster with a binary OR, and then call Mirror_ReportFlexRayChannelStatus() with the cluster, Fr_ChannelAStatusPtr, and Fr_ChannelBStatusPtr to report the aggregated channel states to the Bus Mirroring module.⌋*()*

[SWS_FrIf_25120] ⌈If one of the optional cluster-specific configuration parameters FRIF_E_NIT_CH_A, FRIF_E_NIT_CH_B, FRIF_E_SW_CH_A, FRIF_E_SW_CH_B or FRIF_E_ACS_CH_A, FRIF_E_ACS_CH_B exists, then call FrIf_GetChannelStatus for each FlexRay controller of the cluster and report the status to DEM as described below.⌋*()*

[SWS_FrIf_35120] ⌈If the optional configuration parameter FRIF_E_NIT_CH_A exists, then the channel status information shall be reported to DEM as Dem_Set EventStatus (FRIF_E_NIT_CH_A, DEM_EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel A NIT status data vSS!SyntaxError, v SS!Bviolation) is set or as Dem_SetEventStatus (FRIF_E_NIT_CH_A, DEM_EVENT_ STATUS_PREPASSED) when none of these error bits is set.⌋*()*

[SWS_FrIf_45120] ⌈If the optional configuration parameter FRIF_E_NIT_CH_B exists, then the channel status information shall be reported to DEM as Dem_Set EventStatus (FRIF_E_NIT_CH_B, DEM_EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel B NIT status data vSS!SyntaxError, v SS!Bviolation) is set or as Dem_SetEventStatus (FRIF_E_NIT_CH_B, DEM_EVENT_ STATUS_PREPASSED) when none of these error bits is set.⌋*()*

[SWS_FrIf_55120] ⌈If the optional configuration parameter FRIF_E_SW_CH_A exists, then the channel status information shall be reported to DEM as Dem_SetEventStatus (FRIF_E_SW_CH_A, DEM_EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel A symbol window status data vSS!SyntaxError, v SS!Bviolation, vSS!TxConflict) is set or as Dem_SetEventStatus (FRIF_E_SW_CH_A, DEM_EVENT_STATUS_PREPASSED) when none of these error bits is set.⌋*()*

[SWS_FrIf_65120] ⌈If the optional configuration parameter FRIF_E_SW_CH_B exists, then the channel status information shall be reported to DEM as Dem_SetEventStatus (FRIF_E_SW_CH_B, DEM_EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel B symbol window status data vSS!SyntaxError, v SS!Bviolation vSS!TxConflict) is set or as Dem_SetEventStatus (FRIF_E_SW_CH_B, DEM_EVENT_STATUS_PREPASSED) when none of these error bits is set.⌋*()*

[SWS_FrIf_75120] ⌈If the optional configuration parameter FRIF_E_ACS_CH_A exists, then the channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_ACS_CH_A , DEM_EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel A aggregated channel status vSS!SyntaxError, vSS!ContentError, vSS!Bviolation, vSS!TxConflict) is set or as Dem_SetEventStatus (FRIF_E_ACS_CH_A, DEM_EVENT_STATUS_PREPASSED) when none of these error bits is set.⌋*()*

[SWS_FrIf_85120] ⌈If the optional configuration parameter FRIF_E_ACS_CH_B exists, then the channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_ACS_CH_B, DEM_EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel B aggregated channel status vSS!SyntaxError, vSS!ContentError, vSS!Bviolation, vSS!TxConflict) is set or as Dem_SetEventStatus (FRIF_E_ACS_CH_B, DEM_EVENT_STATUS_PREPASSED) when none of these error bits is set.⌋*()*

[SWS_FrIf_95120] ⌈If a loss of the JobList's synchronization (see JobListAsyncFlag) or a miss of execution was detected, the following steps shall be performed:

1. Get the global time (FrIf_GetGlobalTime())
   - If FrIf_GetGlobalTime() returns E_NOT_OK, stop here
   - If FrIf_GetGlobalTime() returns E_OK, continue with step 2
2. add some 'time buffer' (i.e. some timespan which takes jitter into account)
3. search the FlexRay Job List for the next job, i.e. that job with an invocation time greater than the current global time + 'time buffer'.
4. set the JobListPointer to that job and program the absolute timer with this job's invocation time (now the FlexRay Job List is synchronized again)
5. clear the JobListAsyncFlag
6. Enable the absolute timer interrupt

⌋*()*

7.4 Implementation Requirements

[SWS_FrIf_05096] ⌈The FlexRay Interface executable code (however, not the configuration used during runtime) shall be completely independent of the FlexRay Communication Controller(s) and the FlexRay Transceiver(s).⌋*()*

[SWS_FrIf_05069] ⌈The FrIf module shall support pre-compile time, link-time and post-build-time configuration.⌋*(SRS_BSW_00404, SRS_BSW_00345)*

[SWS_FrIf_05284] ⌈The FrIf module shall implement link-time and post-build-time configuration data as read-only data structures.⌋*()*

[SWS_FrIf_05285] ⌈The FrIf module shall immediately reference link-time configuration data by the implementation,⌋*()*

[SWS_FrIf_05078] ⌈The FrIf module shall implement the API functions specified by the FrIf SWS as real C code functions and shall not implement the API functions as macros.⌋*(SRS_BSW_00342)*

Note:The rationale of SWS_FrIf_05078 is to allow object code module integration.

[SWS_FrIf_05244] ⌈The FrIf module shall pad transmitted PDUs that are located on a FrIf L-Sdu where FrIfAllowDynamicLSduLength is set to false, if the size is smaller than the configured size of the PDU. Padding shall be done with the configured FrIfUnused BitValue.⌋*()*

7.5 Configuration description

[SWS_FrIf_05089] ⌈The FrIf module shall provide an XML file that contains the data which is required for the SW identification (it shall contain the vendor identification, module ID and software version information), configuration and integration process. This file should describe vendor specific configuration parameters as well as it should contain recommended configuration parameter values.

The description of the configuration and initialization data itself is not part of this specification but very implementation specific.⌋*(SRS_BSW_00171, SRS_BSW_00170, SRS_BSW_00334)*

7.6 Data Communication via FlexRay

FlexRay in general is a deterministic time-driven communication system.

Each datum that should be transmitted or received has to be scheduled at system configuration time.

This even holds true for data that - from the application's point of view - are considered event-driven.

Note: When looking only at specific instances of the AUTOSAR FlexRay software modules running on a specific ECU it is not possible to "anticipate" the exact point in time when a certain FlexRay frame is being sent (or received, respectively) in the Dynamic Segment of the FlexRay Cycle.

[SWS_FrIf_05054] ⌈The FrIf module shall define the resources (e.g. a buffer in the FlexRay Communication Controller or FlexRay Driver) needed for data transmission (or reception, respectively) at system configuration time specifically for data transmission (or reception, respectively).⌋*(SRS_Fr_05056)*

Note: There is no true spontaneous event-driven data communication on FlexRay. Even application data that occur at unpredictable points in time (i.e. "event-driven"), and that should be transmitted via FlexRay, have to be scheduled for transmission at system configuration time.

7.6.1 PDU Packing, PDU update bits, and Frame Construction Plans

In accordance with basic AUTOSAR rules, the API services that the FrIf module provides to upper layer BSW modules for data transmission and data reception are PDU-based.

[SWS_FrIf_05121] ⌈The FrIf module shall be capable of packing multiple PDUs into one FlexRay Frame.⌋*()*

Rationale for SWS_FrIf_05121: Bus-independent AUTOSAR PDUs have a maximal length of 8 bytes, but according to [6, FlexRay Communications System Protocol Specification V2.1] a FlexRay Frame can contain as many as 254 bytes of payload data.

Note: It is also allowed to define PDUs which are larger than 8 bytes. Please be aware that PDUs greater than 8 bytes are not bus independent any more!

[SWS_FrIf_05122] ⌈The FrIf module shall take the information on how to pack PDUs into FlexRay Frames from the so-called Frame Construction Plans. The rules defining how to pack PDUs into FlexRay Frames are defined at system configuration time⌋*()*

[SWS_FrIf_05123] ⌈The Frame Construction Plan shall be stored in the static configuration of the FrIf module (configuration parameter FrIfFrameStructure, see FrIf05370).⌋ *()*

[SWS_FrIf_05124] ⌈If multiple PDUs are packed into a single FlexRay Frame and if the FrIf module recognizes the update of at least one of the contained PDUs, then the FrIf module shall transmit this FlexRay Frame.⌋*()*

Note: As a result, the space associated with PDUs in this FlexRay Frame that have not been updated by the upper layer BSW module will also be transmitted. This does not necessarily mean that the previous values of those PDUs are transmitted. On the contrary, in case the parameter 'FrIfUnusedBitValue' does not exist, arbitrary values for those PDUs will be transmitted.

[SWS_FrIf_05723] ⌈In case the parameter 'FrIfUnusedBitValue' exists, all the unused bits within the Frame Construction Plan shall be set to the configured value 'FrIfUnused BitValue' while assembling the frame on sender side.⌋*()*

[SWS_FrIf_05725] ⌈The FlexRayInterface shall ensure that unused spaces within the frame construction plan only contain deterministic values (instead of possible random data).

For this purpose, the value given by the parameter 'FrIfUnusedBitValue' shall be used to fill unused spaces with this value.⌋*()*

[SWS_FrIf_05125] ⌈It shall be possible to configure (configuration parameter FrIfPdu UpdateBitOffset, see FrIf06071) for each PDU a dedicated PDU update bits in the Flex Ray Frame.The FrIf module shall identify the position of the PDU update bits for each PDU using the information stored in configuration parameter FrIfPduUpdateBitOffset.⌋ *()*

[SWS_FrIf_05056] ⌈The receiving FrIf module shall evaluate the PDU Update-bit (if configured) to recognize the update of the PDU associated with this PDU update bits⌋ *(SRS_Fr_05126)*

Rationale: In order for the receiving FrIf module to be able to determine which of the PDUs in a received FlexRay Frame have actually been updated by the upper layer BSW module (by a call of FrIf_Transmit()) on the transmitter side, additional update information, so called PDU update bits within the FlexRay Frame, shall be transmitted to the receiving FrIf module.

Note: A details description of the update bits handling is described in the Communication Operation, subsection 7.6.3 "TransmitWithDecoupledBufferAccess"

[SWS_FrIf_05126] ⌈This PDU update bits shall be located at an arbitrary bit position in the Frame Construction Plan that is not occupied by any PDU.⌋*()*

[SWS_FrIf_05127] ⌈The configuration of update bits for the PDUs and the definition of the location of the update bits within the FlexRay Frame are performed at system configuration time [Configuration Parameter FrIfPduUpdateBitOffset, see FrIf06071]⌋*()*

[SWS_FrIf_05128] ⌈If no update bit is configured for a specific PDU, the FrIf module shall assume this PDU to be always valid and the FrIf module shall always indicate its reception to the upper layer BSW module on the receiver side.⌋*()*

[SWS_FrIf_05758] ⌈In case the parameter 'FrIfAllowDynamicLSduLength' exists and is set to TRUE for the associated frame triggering for reception, PDUs in non-received areas (PDU offset > actual L-SDU length) shall not be indicated to upper layer(s).⌋*()*

[SWS_FrIf_05129] ⌈If Transmission with Immediate Buffer Access is used, only one PDU is allowed per FlexRay Frame (L-SDU).⌋*()*

Note: Therefore, PDU update bits can be omitted for Transmission with Immediate Buffer Access.

7.6.2 Dynamic PDU length

[SWS_FrIf_05093] ⌈In case the parameter 'FrIfAllowDynamicLSduLength' (see FrIf06049) is set to true for the associated frame triggering, the FrIf module passes the actual used L-PDU length to the driver (Fr_TransmitTxLPdu()), taking into account the following parameters for each PDU:

- the position of the PDU within the L-PDU

- the position of the update-bit information (if configured)

If FrIfImmediate equals TRUE, the actual length of the respective PDU shall be as passed via FrIf_Transmit().

If FrIfImmediate equals FALSE, the actual length of the respective PDU shall be as passed via <UL_TriggerTransmit>()⌋*()*

Note: If FrIfAllowDynamicLSduLength is set to false, the FrIf module just passes the length information according to the frame construction plan to the FlexRay driver.

[SWS_FrIf_05094] ⌈The FrIf shall only indicate PDUs in received areas (PDU offset <= actual L-PDU length) to upper layer(s).⌋*()*

7.6.3 AlwaysTransmit

Note: According to [6, FlexRay Communications System Protocol Specification V2.1], a FlexRay CC might only support the so-called "continuous transmission mode" where a message is transmitted continuously until the host explicitly invalidates the transmit buffer. If such a FlexRay CC is being used for transmission, and the receiving Fr If should still be able to determine which of the PDUs in a received FlexRay Frame have actually been updated by an upper layer BSW module on the transmitter side, a special mechanism is needed in the transmitting FrIf, called AlwaysTransmit (configuration parameter FrIfAlwaysTransmit, see ECUC_FrIf_06050). If AlwaysTransmit is enabled for an L-PDU that is transmitted using the Communication Operation DECOUPLED_TRANSMISSION, the FlexRay Driver's API service Fr_TransmitTxLPdu() is always called for this L-PDU, independent from any PDUs in this L-PDU having been updated by an upper layer BSW module. This enables resetting the PDU update bits in the FlexRay CC's transmit buffer, even if none of the PDUs in the FlexRay Frame have actually been updated by an upper layer BSW module, and thus ensures the correct interpretation of the received Frame contents by the receiving FrIf.

Note: Since:

- in general, the transmit mode of a FlexRay CC can be configured ("continuous mode" / "single shot mode"), and
- AlwaysTransmit can be configured independently per L-PDU, and
- update bits can be configured independently per PDU,

the FrIf module can be tailored to exhibit exactly the behavior required by a certain use case,

however, it is the responsibility of the System Designer to select the correct configuration of all these parameters. An incorrect configuration will lead to undesired results.

7.6.4 Realization of the Time-Driven FlexRay Schedule

According to [6, FlexRay Communications System Protocol Specification V2.1], a Flex Ray CC is not required to provide mechanisms in hardware to ensure asynchronous access to its transmit and receive buffers e.g. by providing shadow buffers that may be accessed asynchronously by the AUTOSAR FlexRay software modules.

[SWS_FrIf_05130] ⌈The FrIf module shall call all functions accessing the transmit and receive buffers (i.e. performing data transmission or reception, respectively) synchronously (i.e. synchronized to the FlexRay Global Time)⌋*()*

Rationale for SWS_FrIf_05130: The access of FrIf module functions to transmit and receive buffers only at well-defined points in time [3] avoids concurrent access to the buffers by the hardware and the software.

[3] In FlexRay Global Time

Note: In order to provide this necessary synchronicity, the FrIf module defines for each Cluster a FlexRay Job List [Configuration Parameter FrIfJobList, see FrIf05367].

The Cluster's FlexRay Job List is executed by its Job List Execution Function (see subsection 8.5.1) using an absolute timer [Configuration Parameter FrIfAbsTimerRef, see FrIf06063] of a FlexRay CC connected to the respective Cluster.

7.6.4.1 FlexRay Job List

[SWS_FrIf_05131] ⌈Definition: A FlexRay Job List is a list of (maybe different) Communication Jobs sorted according to their respective execution start time.

Each Communication Job [Configuration Parameter FrIfJob, see FrIf05368] contains the following properties:

- Job start time by means of
  - FlexRay Communication Cycle [Configuration Parameter FrIfCycle, see FrIf06064]
  - Macrotick Offset within the Communication Cycle [Configuration Parameter FrIfMacrotick, see FrIf06065].
- A list of Communication Operations [Configuration Parameter FrIfCommunicationOperation, see FrIf05369] sorted according to a configurable Communication operation index [Configuration Parameter FrIfCommunicationOperationIdx, see FrIf06068]. The sorting order defines the order of execution of the Communication Operations within a FlexRay Communication Job.

⌋()

[SWS_FrIf_05133] ⌈The FrIf module shall call the respective Cluster's FlexRay Job List Execution Function to execute each FlexRay Communication Job at the execution start time assigned to that Communication Job⌋()

[SWS_FrIf_05134] ⌈The FrIf module shall process the actions determined by the Communication Operations assigned to each FlexRay Communication Job

Each Communication Operation (see FrIf05369) contains the following properties:

- Communication Operation Index [Configuration Parameter FrIfCommunicationOperationIdx, see ECUC_FrIf_06068], which determines the execution order of the Communication Operations.
- Communication Action [Configuration Parameter FrIfCommunicationAction, see FrIf06067], which specifies the actual action to perform
  - DECOUPLED_TRANSMISSION
  - TX_CONFIRMATION
  - RECEIVE_AND_STORE

  - RX_INDICATION
  - RECEIVE_AND_INDICATE
  - PREPARE_LPDU
- A reference to a frame triggering (L-PDU) which is associated with the Communication Action to perform [Configuration parameter FrIfLPduIdx, see FrIf06058] [4].

⌋()

7.6.4.2 FlexRay Job List Execution Function

Since the Communication Schedule of each FlexRay Cluster is independent, there is one dedicated FlexRay Job List and one dedicated FlexRay Job List Execution Function for each FlexRay Cluster that is controlled by the FlexRay Interface.

The Copy Operation into/from the FlexRay CCs are scheduled within the FlexRay Job Lists' communication operations

[SWS_FrIf_05136] ⌈The API names of the FlexRay Job List Execution Functions shall obey the following pattern:

FrIf_JobListExec_<FrIfCluster.ShortName> where FrIfCluster.ShortName is the Short Name of the corresponding FrIfCluster.⌋()

[SWS_FrIf_05137] ⌈The FlexRay Job List Execution Function shall execute the Cluster's FlexRay Job List Jobs synchronously to the Cluster's global time (i.e. at well-defined points in time).⌋()

[SWS_FrIf_05138] ⌈Upon invocation, the FlexRay Job List Execution Function shall perform the following steps:

1. Retrieve the FlexRay Global Time from the FlexRay CC providing the Cluster's absolute timer interrupt.
2. If the FlexRay Global Time cannot be retrieved or the global time delay compared to the jobs start time is larger than a maximum delay [Configuration Parameter Fr IfMaxIsrDelay, see FrIf06004], the execution of the FlexRay Job List is considered to be asynchronous to the FlexRay Global Time and thus the following actions are performed:
   - Either set a flag (JobListAsyncFlag) indicating that the execution of the Flex Ray Job List of this Cluster is asynchronous or directly resynchronize the Joblist as described in SWS_FrIf_95120

[4] The LPDU is identified by a LPdu Index, which has a 1:1 association to a frame triggering for historical reasons. To obtain compatibility this configuration structure is not changed here. The L-PDU index is identified with a zero-based and dense index, which shall be used as the parameter Fr_LPduIdx passed to the AUTOSAR FlexRay Driver when processing LPdus.

- If the JobListAsyncFlag was set, call the Runtime error FRIF_E_JLE_SYNC
- Disable absolute Timer Interrupt
- Terminate the execution of this FlexRay Job.

Otherwise, the FlexRay Job List Execution Function continues with step 3.

3. Retrieve the ordered list of Communication Operations of the current Job pointed to by the current job-pointer.
4. Forward the current job-pointer to the next job-list entry. If the job-pointer was pointed at the end of the job-list, wrap around and set it to the first job-list entry.
5. Retrieve the execution start time of the job marked by the job-pointer and set the absolute timer to this job's start time in order to invoke the FlexRay Job List Execution Function again.
6. Execute the retrieved Communication Operations.

⌋()

Note: In order to keep the runtime of the JLEF short, it is acceptable to implement the described functionality of the JLEF into a separate, high priority task which has to be activeded immediately in the JLEF.

7.6.5 Communication Operations

This chapter describes each Communication Operation that is executed within the Job List Execution Function.

7.6.5.1 TransmitWithDecoupledBufferAccess

[SWS_FrIf_05058] ⌈The FrIf module shall be capable of Transmit Request queuing by using the TrigTxCounter.⌋*(SRS_Fr_05130)*

Note: Only the amount of transmit requests are stored, not the data itself.

[SWS_FrIf_05063] ⌈If the related CC is in FrIf_State FRIF_STATE_ONLINE for a Communication Operation DECOUPLED_TRANSMISSION, then the Job List Execution Function shall execute this Communication Operation. Otherwise, the Job List Execution Function shall ignore this Communication Operation.⌋*(SRS_Fr_05027)*

[SWS_FrIf_05287] ⌈For a Communication Operation DECOUPLED_TRANSMISSION the Job List Execution Function shall perform the following steps

1. Iterate over all PDUs contained in the FrIfFrameStructure (see FrIf05370) of the associated frame triggering of this Communication Operation and

(a) Check whether TrigTxCounter is > 0 or FrIfNoneMode == true for the PDU. If not, clear the update-bit for this PDU [Configuration Parameter FrIfPdu UpdateBitOffset, see FrIf06071] and proceed with the next PDU, otherwise continue with the following steps:

i. Decrement TrigTxCounter only if TrigTxCounter > 0. If the value of Trig TxCounter = 0, do not decrement.

ii. Call the upper layer's function <UL>_TriggerTransmit() with the associated PDUId (defined by the upper layer) and pass a pointer to a temporary buffer within the FrIf that assembles the L-SDU. The pointer shall consider the byte offset [Configuration Parameter FrIfPduOffset, see Fr If06070]] of the PDU within the frame. If <UL>_TriggerTransmit() returns E_NOT_OK, the TrigTxCounter value has to be rolled back to the previous value.

iii. Remember that a transmission for this PDU is pending if a transmission confirmation is needed for this PDU [Configuration Parameter Fr IfConfirm, see FrIf06075] increment TxConfCounter, where the maximum value is limited by static configuration [Configuration Parameter FrIf CounterLimit, see FrIf06076]. If the FrIfCounterLimit has been reached, the FrIfCounterLimit value is kept and not incremented any more.

iv. Set the update-bit if configured for this PDU [Configuration Parameter FrIfPduUpdateBitOffset, see FrIf06071]. In case the API <UL>_Trigger Transmit() does not return E_OK, or the API FrIf_CancelTransmit ()for the corresponding PDU has been called, reset the update-bit to "not updated".

2. If at least one PDU was requested for transmission or for at least one PDU Fr IfNoneMode == true and <UL>_TriggerTransmit returned E_OK or the frame is configured to be always transmitted [Configuration Parameter FrIfAlwaysTransmit == true] then the FlexRay Driver's API service Fr_TransmitTxLPdu() is called:

(a) Fr_CtrlIdx is derived according to the indexing scheme described in chapter of indexing.

(b) Fr_LPduIdx is set to the configured L-PDU index [Configuration Parameter

(c) FrIfLPduIdx, see FrIf06058] associated with the Communication Operation

(d) Fr_LSduPtr is set to the temporary FrIf L-SDU assembling buffer.

(e) d. Fr_LSduLength is set to the L-SDU length [Configuration Parameter FrIf LSduLength, see FrIf06054]

(f) Fr_SlotAssignmentPtr is set to a temporary slot assignment buffer if Bus Mirroring is enabled globally (see FrIfBusMirroringSupport), otherwise to the NULL_PTR.

3. If Bus Mirroring is enabled globally (see FrIfBusMirroringSupport) and has

   been activated with a call to FrIf_EnableBusMirroring() for the Fr_CtrlIdx and Fr_TransmitTxLPdu() returned E_OK (indicating that the transmission succeeded), call Mirror_ReportFlexRayFrame() with "controllerId" set to Fr_CtrlIdx, , "slotId", "cycle", and "channel" taken from Fr_SlotAssignmentPtr, "frame" constructed from Fr_LSduPtr and Fr_LSduLength, and "txConflict" set to false.

4. In case the Driver's API Fr_TransmitTxLPdu() returned E_NOT_OK (indicating that the transmission failed) changes on TrigTxCounter and TxConfCounter must be rolled back (see 4. and 5.) for each PDU contained in the FlexRay L-SDU.

⌋()

Note: All described actions in SWS_FrIf_05287 are depicted in detail in the sequence chart in subsection 9.1.2.

[SWS_FrIf_05435] ⌈If FrIfAllowDynamicLSduLength exists and is set to TRUE for the associated frame triggering, the actual L-SDU length, that is passed to the driver by calling Fr_TransmitTxLPdu(), shall be determined (i.e. shortened as much as possible) by taking only those PDUs into account, which have been indicated via <UL_Trigger Transmit>() and consider the following points:

- the position of the respective PDU within the L-SDU
- the actual length of the respective PDU as passed via <UL_TriggerTransmit>()

⌋()

[SWS_FrIf_05436] ⌈A shortened L-Sdu (see [SWS_FrIf_05435]) shall always contain all configured update bits.⌋()

Note: [SWS_FrIf_05435] and [SWS_FrIf_05436] ensure that on one hand all the needed information for disassembling the L-SDU is available on receiver side (PDU(s) itself and the corresponding update-bit(s) if configured), and on the other hand that the payload can be reduced as much as possible by taking the position of all the required data for disassembling contained in the frame construction plan into account when shortening the L-SDU to be passed to the driver.

7.6.5.2 ProvideTxConfirmation

This Communication Operation provides a Tx confirmation and optionally checks the occurrence of a Tx conflict.

[SWS_FrIf_05064] ⌈If the related CC is in FrIf_State FRIF_STATE_ONLINE for a Communication Operation TX_CONFIRMATION, then the Job List Execution Function shall execute this Communication Operation. Otherwise, the Job List Execution Function shall ignore this Communication Operation.⌋()

[SWS_FrIf_05288] ⌈"For a Communication Operation TX_CONFIRMATION the Job List Execution Function shall perform the following steps:

1. Call the FlexRay Driver's API function Fr_CheckTxLPduStatus():
   - Fr_CtrlIdx is derived according to the indexing scheme described in chapter of indexing
   - Fr_LPduIdx is set to the configured L-PDU buffer index [Configuration Parameter FrIfLPduIdx, see FrIf06058] associated with the Communication Operation.
   - Fr_SlotAssignmentPtr is set to a temporary slot assignment buffer if Bus Mirroring is enabled globally (see FrIfBusMirroringSupport), otherwise to the NULL_PTR.
2. If the transmission was performed (output parameter *Fr_TxLPduStatusPtr is set to FR_TRANSMITTED) then iterate over all PDUs contained in the FrIfFrame Structure (see FrIf05370) of the associated frame triggering. If TxConfCounter for a PDU is 0 proceed with the next PDU, otherwise
   - If FrIfConfirm == true, call the upper layer's function <UL_TxConfirmation(E_OK)> with the asociated PDUId (defined by the upper layer).
   - If FrIfConfirm == true , decrement TxConfCounter.
3. If the transmission was performed but a TxConflict occurred (output parameter *Fr_TxLPduStatusPtr is set to FR_TRANSMITTED_CONFLICT) then iterate over all PDUs contained in the FrIfFrameStructure (see FrIf05370) of the associated frame triggering. If TxConfCounter for a PDU is 0 proceed with the next PDU, otherwise
   - If FrIfConfirm == true, call the upper layer's function <UL_TxConfirmation(E_NOT_OK)> with the asociated PDUId (defined by the upper layer).
   - If FrIfConfirm == true , decrement TxConfCounter.
4. If Bus Mirroring is enabled globally (see FrIfBusMirroringSupport) and has been activated with a call to FrIf_EnableBusMirroring() for the Fr_CtrlIdx and the API Fr_CheckTxLpduStatus() returns "FR_TRANSMITTED_CONFLICT", call Mirror_ReportFlexRayFrame() with "controllerId" set to Fr_CtrlIdx, "slotId", "cycle", and "channel" taken from Fr_SlotAssignmentPtr, "frame" set to the NULL_PTR, and "txConflict" set to true.

If the API Fr_CheckTxLpduStatus() returns "FR_TRANSMITTED_CONFLICT" and the <UL_TxConflictNotification> is configured via FrIfTxConflictNotificationName (ECUC_FrIf_06122), call this function for the same LPduIdx.⌋ *()*

7.6.5.3 ReceiveAndStore

[SWS_FrIf_05289] ⌈If the related CC is in FrIf_State FRIF_STATE_ONLINE for a Communication Operation RECEIVE_AND_STORE, then the Job List Execution Function shall execute this Communication Operation. Otherwise, the Job List Execution Function shall ignore this Communication Operation.⌋*()*

[SWS_FrIf_05290] ⌈For a Communication Operation RECEIVE_AND_STORE the Job List Execution Function shall perform the following steps:

1. Call the FlexRay Driver's API function Fr_ReceiveRxLPdu():
   (a) Fr_CtrlIdx is derived according to the indexing scheme described in chapter of indexing.
   (b) Fr_LPduIdx is set to the configured L-PDU index [Configuration Parameter FrIfLPduIdx, see FrIf06058] associated with the Communication Operation.
   (c) Fr_LSduPtr is set to a temporary buffer.
   (d) Fr_SlotAssignmentPtr is set to a temporary slot assignment buffer if Bus Mirroring is enabled globally (see FrIfBusMirroringSupport), otherwise to the NULL_PTR.
2. If Bus Mirroring is enabled globally (see FrIfBusMirroringSupport) and has been activated with a call to FrIf_EnableBusMirroring() for the Fr_CtrlIdx and an L-PDU was received (Output parameter *Fr_LPduStatusPtr != FR_NOT_RECEIVED), call Mirror_ReportFlexRayFrame() with "controllerId" set to Fr_CtrlIdx, "slotId", "cycle", and "channel" taken from Fr_SlotAssignmentPtr, "frame" constructed from Fr_LSduPtr and Fr_LSduLengthPtr, and "txConflict" set to false.
3. If a L-PDU was received (Output parameter *Fr_LPduStatusPtr != FR_NOT_RECEIVED) iterate over all PDUs contained in the FrIfFrameStructure (see FrIf05370) of the associated frame triggering and:
   (a) If an update bit was configured for the PDU [Configuration Parameter FrIfPduUpdateBitOffset, see FrIf06071] and the update bit for the PDU is not set, continue with the next PDU. Otherwise,
   (b) Copy the PDU Payload from the temporary buffer considering the PDU offset within the L-SDU [Configuration Parameter FrIfPduOffset, see FrIf06070] into a FrIf PDU-related static buffer.
   (c) Store the actual received PDU length
   (d) Mark the PDU-related static buffer as up-to-date.
4. if *Fr_LPduStatusPtr == FR_RECEIVED_MORE_DATA_AVAILABLE restart at number 1 again. Otherwise the communication operation has finished.

⌋*()*

7.6.5.4 ProvideRxIndication

[SWS_FrIf_05062] ⌈If the related CC is in FrIf_State FRIF_STATE_ONLINE for a Communication Operation RX_INDICATION, then the Job List Execution Function shall execute this Communication Operation. Otherwise, the Job List Execution Function shall ignore this Communication Operation.⌋*(SRS_Fr_05170)*

[SWS_FrIf_05291] ⌈For a Communication Operation RX_INDICATION the Job List Execution Function shall perform the following steps:

1. Iterate over all PDU-related static buffers of PDUs contained in the FrIfFrame Structure (see FrIf05370) of the associated frame triggering
2. If the PDU-related static buffer is marked as outdated, continue with the next PDU. Otherwise if the buffer is marked up-to-date,
   (a) Call the upper layer's function <UL>_RxIndication() with the PDU Id the receiving module expects and PduInfoPtr which contains the received data address and received data length.
   (b) Mark the PDU-related static buffer as outdated.

⌋*()*

7.6.5.5 ReceiveAndIndicate

[SWS_FrIf_05292] ⌈If the related CC is in FrIf_State FRIF_STATE_ONLINE for a Communication Operation RECEIVE_AND_INDICATE, then the Job List Execution Function shall execute this Communication Operation. Otherwise, the Job List Execution Function shall ignore this Communication Operation.⌋*()*

[SWS_FrIf_05293] ⌈For a Communication Operation RECEIVE_AND_INDICATE the Job List Execution Function shall perform the following steps:

1. Calculate values for input parameters:
   (a) Fr_CtrlIdx is derived according to the indexing scheme described in chapter of indexing.
   (b) Fr_LPduIdx is set to the configured L-PDU index [Configuration Parameter FrIfLPduIdx, see FrIf06058] associated with the Communication Operation.
   (c) Fr_LSduPtr is set to a temporary buffer.
   (d) Fr_SlotAssignmentPtr is set to a temporary slot assignment buffer if Bus Mirroring is enabled globally (see FrIfBusMirroringSupport), otherwise to the NULL_PTR.
2. Initialize ComOpLoopCounter to 0.
3. As long as ComOpLoopCounter < FrIfRxComOpMaxLoop do

(a) Call Fr_ReceiveRxLPdu with the parameters calculated in 1)

(b) If *Fr_LPduStatusPtr != FR_NOT_RECEIVED then continue at 3)c), otherwise the communication operation has finished.

(c) If Bus Mirroring is enabled globally (see FrIfBusMirroringSupport) and has been activated with a call to FrIf_EnableBusMirroring() for the Fr_CtrlIdx, call Mirror_ReportFlexRayFrame() with "controllerId" set to Fr_CtrlIdx, "slotId", "cycle", and "channel" taken from Fr_SlotAssignmentPtr, "frame" constructed from Fr_LSduPtr and Fr_LSduLengthPtr, and "txConflict" set to false.

Otherwise, continue at 3)d).

(d) For each Pdu contained in the FrIfFrameStructure (see FrIf05370) of the associated frame triggering do

-If an update bit was configured for the PDU [Configuration Parameter FrIf PduUpdateBitOffset, see FrIf06071] and the update bit for the PDU is not set, continue with the next PDU. Otherwise

-Call the upper layer's function <UL>_RxIndication() with the PDU Id the receiving module expects and a pointer to the Pdu-Info structure containing the Pdu length and a reference to the temporary buffer considering the PDU offset within the L-SDU [Configuration Parameter FrIfPduOffset, see FrIf06070]] as parameters.

(e) if *Fr_LPduStatusPtr == FR_RECEIVED_MORE_DATA_AVAILABLE then increment ComOpLoopCounter and restart at 3)a), otherwise the communication operation has finished.

⌋()

7.6.5.6 PREPARE_LPDU

The Communication Operation PREPARE_LPDU enables hardware optimization purposes (hardware buffer re-configuration)

[SWS_FrIf_05294] ⌈The Communication Operation PREPARE_LPDU performs the following steps:

1. Call the FlexRay Driver's API function Fr_PrepareLPdu():
   - Fr_CtrlIdx is derived according to the indexing scheme described in chapter of indexing.
   - Fr_LPduIdx is set to the configured L-PDU index [Configuration Parameter FrIfLPduIdx, see FrIf06058] associated with the Communication Operation.

⌋()

[SWS_FrIf_05061] ⌈The Communication Operation PREPARE_LPDU enables hardware optimization purposes. Its purpose is to enable certain FlexRay CC hardware resources (e.g. a CC's message buffer) to be prepared (configured) for the transmission/reception of a certain L-PDU.

This Communication Operation enables the FlexRay Driver to optimize the usage of hardware resources if available at appropriate point of times. However, it is the responsibility of the FlexRay Driver to decide and validate ressource allocation optimizations based on the PREPARE_LPDU Communication Operations. Practically the usage of this Communication Operation will introduce some runtime-overhead even if the Flex Ray Driver does not use the opportunity for reconfiguration.⌋*(SRS_Fr_05042)*

7.6.5.7 FREE_OP_A

User-defined communication operation in order to support hardware specific or additional communication controller features to increase performance. Use cases are communication controllers with serial connection or DMA-transfers.

7.6.5.8 FREE_OP_B

User-defined communication operation in order to support hardware specific or additional communication controller features to increase performance. Use cases are communication controllers with serial connection or DMA-transfers.

7.6.6 Transmission with Immediate Buffer Access

[SWS_FrIf_15295] ⌈The FlexRay Job List Execution Function does not initiate transmission with immediate buffer access. Instead, the actions described here are carried out in the context of the FrIf_Transmit() API service, which in turn is called by an upper layer BSW module.⌋()

[SWS_FrIf_05295] ⌈The FlexRay Interface shall perform a PDU transmission with immediate buffer access (see 9.1), only if the following restriction regarding static configuration apply:

- The PDU must be the only PDU in a FlexRay Frame (L-SDU). It is not packed into a FlexRay Frame together with other PDUs (i.e., the mapping between this PDU and the respective L-SDU is a 1:1 association).
- The PDU must be located at the beginning of the L-SDU.
- There is no update-bit for immediate PDUs configured.

⌋()

[SWS_FrIf_05296] ⌈If an upper layer module calls FrIf_Transmit() with TxPduId being configured for an immediate PDU, the AUTOSAR module FlexRay Interface shall perform the following steps for an immediate PDU transmission within the context of the FrIf_Transmit() API service Driver's API function Fr_TransmitTxLPdu():

- Fr_CtrlIdx is derived according to the indexing scheme described in chapter of indexing.
- Fr_LPduIdx is set to the configured L-PDU index [Configuration Parameter FrIf LPduIdx, see FrIf06058] associated with the TxPduId.
- Fr_LSduPtr is set to the Pdu Payload pointer contained in the PduInfoPtr passed as parameter to FrIf_Transmit.
- If the parameter FrIfAllowDynamicLSduLength=TRUE, the actual length of the respective PDU shall be as passed via FrIf_Transmit().
- Fr_SlotAssignmentPtr is set to a temporary slot assignment buffer if Bus Mirroring is enabled globally (see FrIfBusMirroringSupport), otherwise to the NULL_PTR.

In case the Driver's API Fr_TransmitTxLPdu() returned E_OK (indicating that the transmission request succeeded) the TxConfCounter is incremented for the respective PDU. The maximum value of TxConfCounter is limited by static configuration [Configuration Parameter FrIfCounterLimit, see FrIf06076]). If Bus Mirroring is enabled globally (see FrIfBusMirroringSupport) and has been activated with a call to FrIf_EnableBusMirroring() for the Fr_CtrlIdx, call Mirror_ReportFlexRayFrame() with "controllerId" set to Fr_CtrlIdx, , "slotId", "cycle", and "channel" taken from Fr_SlotAssignmentPtr, "frame" constructed from Fr_LSduPtr and Fr_LSduLength, and "txConflict" set to false.

In case the Driver's API Fr_TransmitTxLPdu() returned E_NOT_OK do not modify the current counter value of TxConfCounter.⌋*()*

7.7 Error Classification

Section "Error Handling" of the document [1] "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.

7.7.1 Development Errors

[SWS_FrIf_05145] Definiton of development errors in module FrIf ⌈

Type of error	*Related error code*	*Error value*
Invalid pointer	FRIF_E_PARAM_POINTER	0x01
Invalid Controller index	FRIF_E_INV_CTRL_IDX	0x02
Invalid Cluster index	FRIF_E_INV_CLST_IDX	0x03
Invalid Channel index	FRIF_E_INV_CHNL_IDX	0x04
Invalid timer index	FRIF_E_INV_TIMER_IDX	0x05
Invalid FrIf_TxPdu Index	FRIF_E_INV_TXPDUID	0x06
Invalid LPdu Index	FRIF_E_INV_LPDU_IDX	0x07
FrIf not initialized	FRIF_E_UNINIT	0x08
Invalid state requested	FRIF_E_INV_FRIF_STATE	0x0A
Invalid Frame ID	FRIF_E_INV_FRAME_ID	0x0B
Initialization failed	FRIF_E_INIT_FAILED	0x0C
Invalid Pdu length	FRIF_E_INV_PDULENGTH	0x0D

⌋()

7.7.2 Runtime Errors

[SWS_FrIf_05432] Definiton of runtime errors in module FrIf ⌈

Type of error	*Related error code*	*Error value*
Job List Execution lost synchronization to the Flex Ray Global Time	FRIF_E_JLE_SYNC	0x01

⌋()

7.7.3 Transient Faults

There are no transient faults.

7.7.4 Production Errors

[SWS_FrIf_05146] ⌈See table "Definition of Production Errors" below⌋()

Type or error	Related error code	Value [hex]
error detection in NIT on channel A	FRIF_E_NIT_CH_A	Assigned by DEM
error detection in NIT on channel B	FRIF_E_NIT_CH_B	Assigned by DEM
error detection in SW on channel A	FRIF_E_SW_CH_A	Assigned by DEM
error detection in SW on channel B	FRIF_E_SW_CH_B	Assigned by DEM

▽

△

Type or error	Related error code	Value [hex]
error detection in ACS on channel A	FRIF_E_ACS_CH_A	Assigned by DEM
error detection in ACS on channel B	FRIF_E_ACS_CH_B	Assigned by DEM

Table 7.3: Definition of Production Errors

[SWS_FrIf_05426] ⌈See table "Error Detection in NIT channel A" below⌋*()*

Error Name:	FRIF_E_NIT_CH_A	
Short Description:	Error detection in NIT on channel A	
Long Description:	This production error shall be issued when an error in NIT on channel A was detected	
Recommended DTC:	N/A	
Detection Criteria:	Fail	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_NIT_CH_A, DEM_ EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel A NIT status data v SS!SyntaxError, vSS!Bviolation) is set (SWS_FrIf_35120)
	Pass	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_NIT_CH_A, DEM_ EVENT_STATUS_PREPASSED) when none of the error bits of a single controller (Channel A NIT status data v SS!SyntaxError, vSS!Bviolation) is set (SWS_FrIf_35120)
Secondary Parameters:	N/A	
Time Required:	N/A	
Monitor Frequency	continuous	
MIL illumination:	N/A	

Table 7.4: Error Detection in NIT channel A

[SWS_FrIf_05427] ⌈See table "Error Detection in NIT channel B" below⌋*()*

Error Name:	FRIF_E_NIT_CH_B	
Short Description:	Error detection in NIT on channel B	
Long Description:	This production error shall be issued when an error in NIT on channel B was detected	
Recommended DTC:	N/A	
Detection Criteria:	Fail	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_NIT_CH_B, DEM_ EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel B NIT status data v SS!SyntaxError, vSS!Bviolation) is set (SWS_FrIf_45120)

▽

△

	Pass	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_NIT_CH_B, DEM_ EVENT_STATUS_PREPASSED) when none of the error bits of a single controller (Channel B NIT status data v SS!SyntaxError, vSS!Bviolation) is set (SWS_Frlf_45120)
Secondary Parameters:	N/A	
Time Required:	N/A	
Monitor Frequency	continuous	
MIL illumination:	N/A	

Table 7.5: Error Detection in NIT channel B

[SWS_Frlf_05428] ⌈See table "Error detection in SW on channel A" below⌋*()*

Error Name:	FRIF_E_SW_CH_A	
Short Description:	Error detection in SW on channel A	
Long Description:	This production error shall be issued when an error in SW on channel A was detected.	
Recommended DTC:	N/A	
Detection Criteria:	Fail	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_SW_CH_A, DEM_ EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel A symbol window status data vSS!SyntaxError, v SS!Bviolation, vSS!TxConflict) is set (SWS_Frlf_55120)
	Pass	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_SW_CH_A, DEM_ EVENT_STATUS_PREPASSED) when none of the error bits of a single controller (Channel A symbol window status data vSS!SyntaxError, v SS!Bviolation, vSS!TxConflict) is set (SWS_Frlf_55120)
Secondary Parameters:	N/A	
Time Required:	N/A	
Monitor Frequency	continuous	
MIL illumination:	N/A	

Table 7.6: Error detection in SW on channel A

[SWS_Frlf_05429] ⌈See table "Error detection in SW on channel B" below⌋*()*

Error Name:	FRIF_E_SW_CH_B
Short Description:	Error detection in SW on channel B
Long Description:	This production error shall be issued when an error in SW on channel B was detected.
Recommended DTC:	N/A

▽

△

Detection Criteria:	Fail	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_SW_CH_B, DEM_ EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel B symbol window status data vSS!SyntaxError, v SS!Bviolation, vSS!TxConflict) is set (SWS_FrIf_65120)
	Pass	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_SW_CH_B, DEM_ EVENT_STATUS_PREPASSED) when none of the error bits of a single controller (Channel B symbol window status data vSS!SyntaxError, v SS!Bviolation, vSS!TxConflict) is set (SWS_FrIf_65120)
Secondary Parameters:	N/A	
Time Required:	N/A	
Monitor Frequency	continuous	
MIL illumination:	N/A	

Table 7.7: Error detection in SW on channel B

[SWS_FrIf_05431] ⌈See table "Error detection in ACS on channel A" below⌋*()*

Error Name:	FRIF_E_ACS_CH_A	
Short Description:	Error detection in ACS on channel A	
Long Description:	This production error shall be issued when an error in ACS on channel A was detected	
Recommended DTC:	N/A	
Detection Criteria:	Fail	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_ACS_CH_A , DEM_ EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel A aggregated channel status vSS!SyntaxError, v SS!ContentError, vSS!Bviolation, v SS!TxConflict) is set (SWS_Fr If_75120)
	Pass	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_ACS_CH_A , DEM_ EVENT_STATUS_PREPASSED) when none of the error bits of a single controller (Channel A aggregated channel status vSS!SyntaxError, v SS!ContentError, vSS!Bviolation, v SS!TxConflict) is set (SWS_Fr If_75120)
Secondary Parameters:	N/A	
Time Required:	N/A	
Monitor Frequency	continuous	
MIL illumination:	N/A	

Table 7.8: Error detection in ACS on channel A

[SWS_FrIf_05430] ⌈See table "Error detection in ACS on channel B" below⌋ *()*

Error Name:	FRIF_E_ACS_CH_B	
Short Description:	Error detection in ACS on channel B	
Long Description:	This production error shall be issued when an error in ACS on channel B was detected	
Recommended DTC:	N/A	
Detection Criteria:	Fail	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_SW_CH_B, DEM_ EVENT_STATUS_PREFAILED) when any of the error bits of a single controller (Channel B symbol window status data vSS!SyntaxError, v SS!Bviolation, vSS!TxConflict) is set (SWS_FrIf_85120)
	Pass	The channel status information shall be reported to DEM as Dem_SetEvent Status (FRIF_E_ACS_CH_B , DEM_ EVENT_STATUS_PREPASSED) when none of the error bits of a single controller (Channel B aggregated channel status vSS!SyntaxError, v SS!ContentError, vSS!Bviolation, v SS!TxConflict) is set (SWS_Fr If_85120)
Secondary Parameters:	N/A	
Time Required:	N/A	
Monitor Frequency	continuous	
MIL illumination:	N/A	

Table 7.9: Error detection in ACS on channel B

7.7.5 Extended Production Errors

There are no extended production errors.

8 API specification

8.1 Imported types

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

[SWS_FrIf_05001] Definition of imported datatypes of module FrIf ⌈

Module	*Header File*	*Imported Type*
ComStack_Types	ComStack_Types.h	PduIdType
	ComStack_Types.h	PduInfoType
	ComStack_Types.h	PduLengthType
Dem	Rte_Dem_Type.h	Dem_EventIdType
	Rte_Dem_Type.h	Dem_EventStatusType
Fr	Fr_GeneralTypes.h	Fr_ChannelType
	Fr_GeneralTypes.h	Fr_ErrorModeType
	Fr_GeneralTypes.h	Fr_POCStateType
	Fr_GeneralTypes.h	Fr_POCStatusType
	Fr_GeneralTypes.h	Fr_RxLPduStatusType
	Fr_GeneralTypes.h	Fr_SlotAssignmentType
	Fr_GeneralTypes.h	Fr_SlotModeType
	Fr_GeneralTypes.h	Fr_StartupStateType
	Fr_GeneralTypes.h	Fr_TxLPduStatusType
	Fr_GeneralTypes.h	Fr_WakeupStatusType
FrTrcv	Fr_GeneralTypes.h	FrTrcv_TrcvModeType
	Fr_GeneralTypes.h	FrTrcv_TrcvWUReasonType
Std	Std_Types.h	Std_ReturnType
	Std_Types.h	Std_VersionInfoType

⌋(*SRS_BSW_00348*, *SRS_BSW_00353*, *SRS_BSW_00361*, *SRS_BSW_00304*, *SRS_BSW_00378*)

8.2 Type definitions

This chapter lists the data types that the FlexRay Interface defines.

8.2.1 FrIf_ConfigType

[SWS_FrIf_05301] Definition of datatype FrIf_ConfigType ⌈

Name	FrIf_ConfigType	
Kind	Structure	
Elements	Implementation specific	
	Type	–
	Comment	–
Description	This type contains the implementation-specific post build time configuration structure. Only pointers of this type are allowed.	
Available via	FrIf.h	

⌋()

8.2.2 FrIf_StateType

[SWS_FrIf_05755] Definition of datatype FrIf_StateType ⌈

Name	FrIf_StateType		
Kind	Enumeration		
Range	FRIF_STATE_OFFLINE	–	The FlexRay CC is not ready for communication, the FlexRay cluster is not synchronized.
	FRIF_STATE_ONLINE	–	The FlexRay CC is ready for communication, the FlexRay cluster is synchronized.
Description	Variables of this type are used to represent the FrIf_State of a FlexRay CC.		
Available via	FrIf.h		

⌋()

8.2.3 FrIf_StateTransitionType

[SWS_FrIf_05303] Definition of datatype FrIf_StateTransitionType ⌈

Name	FrIf_StateTransitionType		
Kind	Enumeration		
Range	FRIF_GOTO_OFFLINE	–	Literal for requesting transition into FRIF_STATE_OFFLINE
	FRIF_GOTO_ONLINE	–	Literal for requesting transition into FRIF_STATE_ONLINE state.
Description	Variables of this type are used to represent the FrIf_State of a FlexRay CC.		
Available via	FrIf.h		

⌋()

8.3 Function definitions

This is a list of API services (functions) the FrIf module provides to upper layer BSW modules.

8.3.1 FrIf_Init

[SWS_FrIf_05003] Definition of API function FrIf_Init ⌈

Service Name	FrIf_Init	
Syntax	`void FrIf_Init ( const FrIf_ConfigType* FrIf_ConfigPtr )`	
Service ID [hex]	0x02	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	FrIf_ConfigPtr	Base pointer to the configuration structure of the FlexRay Interface.
Parameters (inout)	None	
Parameters (out)	None	
Return value	void	–
Description	Initializes the FlexRay Interface.	
Available via	FrIf.h	

⌋*(SRS_BSW_00405, SRS_BSW_00101, SRS_BSW_00358, SRS_BSW_00414, SRS_Fr_05013)* Note:

The AUTOSAR ECU StateManager calls this FlexRay Interface API service with the address of the static configuration structure of the FrIf module in parameter FrIf_Config Ptr.

[SWS_FrIf_05156] ⌈The function FrIf_Init shall carry out the following actions:

1. Configure the FlexRay Interface module: initialize the local memory space used to store the PDU data and the PDU properties and state variables and the Flex Ray Interface State Machine.
2. The initialization of the memory space has to make sure that the PDU-related static buffer status is set to "outdated"

⌋*()*

8.3.2 FrIf_ControllerInit

[SWS_FrIf_05004] Definition of API function FrIf_ControllerInit ⌈

Service Name	FrIf_ControllerInit	
Syntax	`Std_ReturnType FrIf_ControllerInit ( uint8 FrIf_CtrlIdx )`	
Service ID [hex]	0x03	
Sync/Async	Synchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Initialized a FlexRay CC.	
Available via	FrIf.h	

⌋*(SRS_Fr_05031)*

[SWS_FrIf_05158] ⌈If parameter FrIf_CtrlIdx of FrIf_ControllerInit has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_ControllerInit shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05159] ⌈The function FrIf_ControllerInit shall wrap the FlexRay Driver API function Fr_ControllerInit() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Calling Fr_ControllerInit() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05160] ⌈Caveats of FrIf_ControllerInit: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋*()*

8.3.3 FrIf_SetAbsoluteTimer

[SWS_FrIf_05021] Definition of API function FrIf_SetAbsoluteTimer ⌈

Service Name	FrIf_SetAbsoluteTimer	
Syntax	`Std_ReturnType FrIf_SetAbsoluteTimer ( uint8 FrIf_CtrlIdx, uint8 FrIf_AbsTimerIdx, uint8 FrIf_Cycle, uint16 FrIf_Offset )`	
Service ID [hex]	0x19	
Sync/Async	Synchronous	
Reentrancy	non reentrant for the same FlexRay CC, reentrant for different FlexRay CCs	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_AbsTimerIdx	Index of the absolute timer to address.
	FrIf_Cycle	FlexRay Cycle number to be set.
	FrIf_Offset	Number of Macroticks to be set.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_SetAbsoluteTimer().	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05234] ⌈If parameter FrIf_CtrlIdx of FrIf_SetAbsoluteTimer has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_SetAbsoluteTimer shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05235] ⌈The function FrIf_SetAbsoluteTimer shall wrap This API service of the FlexRay Interface wraps the FlexRay Driver API function Fr_SetAbsoluteTimer() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters
3. Fr_AbsTimerIdx to FrIf_AbsTimerIdx
4. Fr_Cycle to FrIf_Cycle
5. Fr_Offset to FrIf_Offset
6. Calling Fr_SetAbsoluteTimer() of the determined FlexRay Driver module with the parameters determined as described above.

⌋()

[SWS_FrIf_05236] ⌈Caveats of FrIf_SetAbsoluteTimer: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.4 FrIf_EnableAbsoluteTimerIRQ

[SWS_FrIf_05025] Definition of API function FrIf_EnableAbsoluteTimerIRQ ⌈

Service Name	FrIf_EnableAbsoluteTimerIRQ	
Syntax	`Std_ReturnType FrIf_EnableAbsoluteTimerIRQ ( uint8 FrIf_CtrlIdx, uint8 FrIf_AbsTimerIdx )`	
Service ID [hex]	0x1d	
Sync/Async	Synchronous	
Reentrancy	non reentrant for the same FlexRay CC, reentrant for different FlexRay CCs	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_AbsTimerIdx	Index of the absolute timer to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_EnableAbsoluteTimerIRQ().	
Available via	FrIf.h	

⌋*()*

[SWS_FrIf_05246] ⌈If parameter FrIf_CtrlIdx of FrIf_EnableAbsoluteTimerIRQ has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_EnableAbsoluteTimerIRQ shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05247] ⌈The function FrIf_EnableAbsoluteTimerIRQ shall wrap the Flex Ray Driver API function Fr_EnableAbsoluteTimerIRQ() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters
   (a) Fr_AbsTimerIdx to FrIf_AbsTimerIdx
3. Calling Fr_EnableAbsoluteTimerIRQ() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05248] ⌈Caveats of FrIf_EnableAbsoluteTimerIRQ: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.5 FrIf_AckAbsoluteTimerIRQ

[SWS_FrIf_05029] Definition of API function FrIf_AckAbsoluteTimerIRQ ⌈

Service Name	FrIf_AckAbsoluteTimerIRQ	
Syntax	`Std_ReturnType FrIf_AckAbsoluteTimerIRQ ( uint8 FrIf_CtrlIdx, uint8 FrIf_AbsTimerIdx )`	
Service ID [hex]	0x21	
Sync/Async	Synchronous	
Reentrancy	non reentrant for the same FlexRay CC, reentrant for different FlexRay CCs	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_AbsTimerIdx	Index of the absolute timer to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_AckAbsoluteTimerIRQ()	
Available via	FrIf.h	

⌋*()*

[SWS_FrIf_05258] ⌈If parameter FrIf_CtrlIdx of FrIf_AckAbsoluteTimerIRQ has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_AckAbsoluteTimerIRQ shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05259] ⌈The function FrIf_AckAbsoluteTimerIRQ shall wrap the FlexRay Driver API function Fr_AckAbsoluteTimerIRQ() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters
   (a) Fr_AbsTimerIdx to FrIf_AbsTimerIdx
3. Calling Fr_AckAbsoluteTimerIRQ() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05260] ⌈Caveats of FrIf_AckAbsoluteTimerIRQ: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.6 FrIf_StartCommunication

[SWS_FrIf_05005] Definition of API function FrIf_StartCommunication ⌈

Service Name	FrIf_StartCommunication	
Syntax	`Std_ReturnType FrIf_StartCommunication ( uint8 FrIf_CtrlIdx )`	
Service ID [hex]	0x04	
Sync/Async	Asynchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_StartCommunication().	
Available via	FrIf.h	

⌋*(SRS_Fr_05015)*

[SWS_FrIf_05161] ⌈If parameter FrIf_CtrlIdx of FrIf_StartCommunication has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_StartCommunication shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05162] ⌈The function FrIf_StartCommunication shall wrap the FlexRay Driver API function Fr_StartCommunication() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Calling Fr_StartCommunication() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05163] ⌈Caveats of FrIf_StartCommunication: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋*()*

8.3.7 FrIf_HaltCommunication

[SWS_FrIf_05006] Definition of API function FrIf_HaltCommunication ⌈

Service Name	FrIf_HaltCommunication	
Syntax	`Std_ReturnType FrIf_HaltCommunication ( uint8 FrIf_CtrlIdx )`	
Service ID [hex]	0x05	
Sync/Async	Asynchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_HaltCommunication().	
Available via	FrIf.h	

⌋*(SRS_BSW_00336, SRS_Fr_05063)*

[SWS_FrIf_05164] ⌈If parameter FrIf_CtrlIdx of FrIf_HaltCommunication has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_HaltCommunication shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05165] ⌈The function FrIf_HaltCommunication shall wrap the FlexRay Driver API function Fr_HaltCommunication() by:

- Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
- Calling Fr_HaltCommunication() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05166] ⌈Caveats of FrIf_HaltCommunication: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋*()*

8.3.8 FrIf_AbortCommunication

[SWS_FrIf_05007] Definition of API function FrIf_AbortCommunication ⌈

Service Name	FrIf_AbortCommunication	
Syntax	`Std_ReturnType FrIf_AbortCommunication ( uint8 FrIf_CtrlIdx )`	
Service ID [hex]	0x06	
Sync/Async	Synchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_AbortCommunication().	
Available via	FrIf.h	

⌋*(SRS_Fr_05016)*

[SWS_FrIf_05167] ⌈If parameter FrIf_CtrlIdx of FrIf_AbortCommunication has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_AbortCommunication shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05168] ⌈The function FrIf_AbortCommunication shall wrap the FlexRay Driver API function Fr_AbortCommunication() by:

- Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
- Calling Fr_AbortCommunication() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05169] ⌈Caveats of FrIf_AbortCommunication: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋*()*

8.3.9 FrIf_GetState

[SWS_FrIf_05170] Definition of API function FrIf_GetState ⌈

Service Name	FrIf_GetState	
Syntax	`Std_ReturnType FrIf_GetState ( uint8 FrIf_ClstIdx, FrIf_StateType* FrIf_StatePtr )`	
Service ID [hex]	0x07	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_ClstIdx	Index of the cluster addressed.
Parameters (inout)	None	
Parameters (out)	FrIf_StatePtr	Pointer to a memory location where the retrieved FrIfState will be stored
Return value	Std_ReturnType	`E_OK`: Function was successfully executed. State transition request was accepted. `E_NOT_OK`: Function execution failed due to detected errors. State transition request was not accepted.
Description	Get current FrIf state.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05171] ⌈If parameter FrIf_ClstIdx of FrIf_GetState has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetState shall report development error code FRIF_E_INV_CLST_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05172] ⌈If parameter FrIf_StatePtr of FrIf_GetState equals NULL_PTR and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetState shall report development error code FRIF_E_PARAM_POINTER to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05173] ⌈Caveats of FrIf_GetState: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋()

8.3.10 FrIf_SetState

[SWS_FrIf_05174] Definition of API function FrIf_SetState ⌈

Service Name	FrIf_SetState
Syntax	`Std_ReturnType FrIf_SetState ( uint8 FrIf_ClstIdx, FrIf_StateTransitionType FrIf_StateTransition )`
Service ID [hex]	0x08

▽

△

Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	FrIf_ClstIdx	Index of the cluster addressed.
	FrIf_StateTransition	Requested FrIf state transition.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: Function was successfully executed. State transition request was accepted. E_NOT_OK: Function execution failed due to detected errors. State transition request was not accepted.
Description	Requests FrIf state machine transition.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05175] ⌈If parameter FrIf_ClstIdx of FrIf_SetState has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_SetState shall report development error code FRIF_E_INV_CLST_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05037] ⌈If parameter FrIf_StateTransition of FrIf_SetState has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_SetState shall report development error code FRIF_E_INV_FRIF_STATE to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05176] ⌈Caveats of FrIf_SetState: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋()

8.3.11 FrIf_SetWakeupChannel

[SWS_FrIf_05010] Definition of callback function FrIf_SetWakeupChannel ⌈

Service Name	FrIf_SetWakeupChannel	
Syntax	`Std_ReturnType FrIf_SetWakeupChannel ( uint8 FrIf_CtrlIdx, Fr_ChannelType FrIf_ChnlIdx )`	
Service ID [hex]	0x09	
Sync/Async	Synchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
Parameters (inout)	None	
Parameters (out)	None	

▽

△

Return value	Std_ReturnType	E_OK: The call of the FlexRay Driver's API service has returned E_OK. E_NOT_OK: The call of the FlexRay Driver's API service has returned E_NOT_OK, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_SetWakeupChannel(). The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05500] ⌈If parameter FrIf_CtrlIdx of FrIf_SetWakeupChannel has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_SetWakeupChannel shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05177] ⌈If parameter FrIf_ChnlIdx of FrIf_SetWakeupChannel has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_SetWakeupChannel shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05178] ⌈The function FrIf_SetWakeupChannel shall wrap the FlexRay Driver API function Fr_SetWakeupChannel() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters Fr_ChnlIdx to FrIf_ChnlIdx
3. Calling Fr_SetWakeupChannel() of the determined FlexRay Driver module with the parameters determined as described above.

⌋()

[SWS_FrIf_05179] ⌈Caveats of FrIf_SetWakeupChannel: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋()

8.3.12 FrIf_SendWUP

[SWS_FrIf_05011] Definition of API function FrIf_SendWUP ⌈

Service Name	FrIf_SendWUP
Syntax	`Std_ReturnType FrIf_SendWUP ( uint8 FrIf_CtrlIdx )`
Service ID [hex]	0x0a
Sync/Async	Asynchronous
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx

▽

△

Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_SendWUP().	
Available via	FrIf.h	

⌋*(SRS_Fr_05018)*

[SWS_FrIf_05180] ⌈If parameter FrIf_CtrlIdx of FrIf_SendWUP has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_SendWUP shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05181] ⌈The function FrIf_SendWUP shall wrap the FlexRay Driver API function Fr_SendWUP() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Calling Fr_SendWUP() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05182] ⌈Caveats of FrIf_SendWUP: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.13 FrIf_GetPOCStatus

[SWS_FrIf_05014] Definition of API function FrIf_GetPOCStatus ⌈

Service Name	FrIf_GetPOCStatus	
Syntax	`Std_ReturnType FrIf_GetPOCStatus ( uint8 FrIf_CtrlIdx, Fr_POCStatusType* FrIf_POCStatusPtr )`	
Service ID [hex]	0x0d	
Sync/Async	Synchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	FrIf_POCStatusPtr	Pointer to a memory location where output value will be stored.

▽

△

Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_GetPOCStatus().	
Available via	FrIf.h	

⌋*(SRS_Fr_05022)*

[SWS_FrIf_05190] ⌈If parameter FrIf_CtrlIdx of FrIf_GetPOCStatus has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetPOCStatus shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05192] ⌈The function FrIf_GetPOCStatus shall wrap the FlexRay Driver API function Fr_GetPOCStatus() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters Fr_POCStatusPtr to FrIf_POCStatusPtr
3. Calling Fr_GetPOCStatus() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05193] ⌈Caveats of FrIf_GetPOCStatus: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.14 FrIf_GetGlobalTime

[SWS_FrIf_05015] Definition of API function FrIf_GetGlobalTime ⌈

Service Name	FrIf_GetGlobalTime	

Syntax	`Std_ReturnType FrIf_GetGlobalTime (`
	`  uint8 FrIf_CtrlIdx,`
	`  uint8* FrIf_CyclePtr,`
	`  uint16* FrIf_MacroTickPtr`
	`)`	

Service ID [hex]	0x0e	
Sync/Async	Synchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	FrIf_CyclePtr	Pointer to a memory location where output value will be stored.
	FrIf_MacroTickPtr	Pointer to a memory location where output value will be stored.

▽

△

Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_GetGlobalTime(). Important Note: FrIf_GetGlobalTime may be called within an exclusive area.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05194] ⌈If parameter FrIf_CtrlIdx of FrIf_GetGlobalTime has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetGlobalTime shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05195] ⌈The function FrIf_GetGlobalTime shall wrap the FlexRay Driver API function Fr_GetGlobalTime() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters
3. Fr_CylcePtr to FrIf_CyclePtr

   Fr_MacroTickPtr to FrIf_MacroTickPtr
4. Calling Fr_GetGlobalTime() of the determined FlexRay Driver module with the parameters determined as described above.

⌋()

[SWS_FrIf_05196] ⌈Caveats of FrIf_GetGlobalTime: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋()

8.3.15 FrIf_AllowColdstart

[SWS_FrIf_05017] Definition of API function FrIf_AllowColdstart ⌈

Service Name	FrIf_AllowColdstart	
Syntax	`Std_ReturnType FrIf_AllowColdstart ( uint8 FrIf_CtrlIdx )`	
Service ID [hex]	0x10	
Sync/Async	Asynchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.

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Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_AllowColdstart().	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05200] ⌈If parameter FrIf_CtrlIdx of FrIf_AllowColdstart has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_AllowColdstart shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05201] ⌈The function FrIf_AllowColdstart shall wrap the FlexRay Driver API function Fr_AllowColdstart() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index FrIf_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Calling Fr_AllowColdstart() of the determined FlexRay Driver module with the parameters determined as described above.

⌋()

[SWS_FrIf_05202] ⌈Caveats: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋()

8.3.16 FrIf_GetMacroticksPerCycle

[SWS_FrIf_05018] Definition of API function FrIf_GetMacroticksPerCycle ⌈

Service Name	FrIf_GetMacroticksPerCycle	

Syntax	`uint16 FrIf_GetMacroticksPerCycle (`
	`  uint8 FrIf_CtrlIdx`
	`)`	

Service ID [hex]	0x11	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	uint16	Number of Macroticks per Cycle
Description	Retrieves the amount of Macroticks per Cycle	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05203] ⌈If parameter FrIf_CtrlIdx of FrIf_GetMacroticksPerCycle has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetMacroticksPerCycle shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.

This API service of the FlexRay Interface retrieves the number of Macroticks per Flex Ray Cycle of the FlexRay Cluster with index FrIf_CtrlIdx out of the static configuration.⌋ *()*

[SWS_FrIf_05204] ⌈Caveats of FrIf_GetMacroticksPerCycle: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋ *()*

8.3.17 FrIf_GetMacrotickDuration

[SWS_FrIf_05019] Definition of API function FrIf_GetMacrotickDuration ⌈

Service Name	FrIf_GetMacrotickDuration	
Syntax	`uint16 FrIf_GetMacrotickDuration ( uint8 FrIf_CtrlIdx )`	
Service ID [hex]	0x31	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	uint16	Duration of one Macrotick in ns
Description	Retrieves the Duration of a Macrotick in ns	
Available via	FrIf.h	

⌋ *()*

[SWS_FrIf_05191] ⌈If parameter FrIf_CtrlIdx of FrIf_GetMacrotickDuration: has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetMacrotickDuration: shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.

This API service of the FlexRay Interface retrieves duration of one Macrotick in nanoseconds of the FlexRay Cluster with index FrIf_CtrlIdx out of the static configuration.⌋ *()*

[SWS_FrIf_05754] ⌈Caveats of FrIf_GetMacrotickDuration: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋ *()*

8.3.18 FrIf_Transmit

[SWS_FrIf_05033] Definition of API function FrIf_Transmit ⌈

Service Name	FrIf_Transmit	
Syntax	`Std_ReturnType FrIf_Transmit ( PduIdType TxPduId, const PduInfoType* PduInfoPtr )`	
Service ID [hex]	0x49	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	TxPduId	Identifier of the PDU to be transmitted
	PduInfoPtr	Length of and pointer to the PDU data and pointer to MetaData.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: Transmit request has been accepted. `E_NOT_OK`: Transmit request has not been accepted.
Description	Requests transmission of a PDU.	
Available via	FrIf.h	

⌋*()*

[SWS_FrIf_05318] ⌈

FrIf_Transmit() shall return E_NOT_OK in case the FrIf's state is FRIF_STATE_OFFLINE.⌋*()*

[SWS_FrIf_05205] ⌈If parameter TxPduId of FrIf_Transmit has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_Transmit shall report development error code FRIF_E_INV_TXPDUID to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05207] ⌈If the parameter FrIfAllowedDynamicSduLength is set to false and/or if the parameter FrIfImmediate is set to true for the passed TxPduId, the passed Sdu DataPtr in parameter PduInfoPtr of FrIf_Transmit shall be checked for NULL_PTR in case development error detection is enabled (i.e. FrIfDevErrorDetect equals ON). If in this case the passed SduDataPtr equals NULL_PTR, the function FrIf_Transmit shall report the development error code FRIF_E_PARAM_POINTER to the Det_ReportError service of the DET module.

In case of decoupled transmission the PDU with index TxPduId is not yet passed to the underlying FlexRay Driver module for transmission. FrIf only remembers the PDU's transmission request (increment TrigTxCounter [5]) This decoupling mechanism between the call of FrIf_Transmit() and the execution of the FrIfCommunicationAction (see FrIf06067) has some implications:

- The upper layer BSW module may operate asynchronously to the FlexRay Communication System and thus may call FrIf_Transmit() at any point in time.

[5] Limited by static configuration see `FrIfCounterLimit`

- The upper layer BSW module must permanently buffer the PDU's payload date and must be able to handle a call of its <UL_TriggerTransmit>() API service at (from the BSW's point of view) any arbitrary point in time.

⌋()

[SWS_FrIf_05208] ⌈In case of immediate transmission the function FrIf_Transmit shall pass the PDU (single PDU, no Update bit) to the underlying FlexRay Driver module immediately for transmission.⌋()

[SWS_FrIf_05757] ⌈"If parameter TxPduId is configured for an immediate PDU, and if configuration parameter FrIfAllowDynamicLSduLength is set to FALSE, the provided length in PduInfoPtr shall be compared with the static configured length (see ECUC_FrIf_06054).

If the length information does not match, FrIf_Transmit() shall return E_NOT_OK and shall not perform the immediate PDU transmission. If development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_Transmit() shall report development error code FRIF_E_INV_PDULENGTH to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05209] ⌈Caveats of FrIf_Transmit: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋()

8.3.19 FrIf_SetTransceiverMode

[SWS_FrIf_05034] Definition of API function FrIf_SetTransceiverMode ⌈

Service Name	FrIf_SetTransceiverMode	
Syntax	`Std_ReturnType FrIf_SetTransceiverMode ( uint8 FrIf_CtrlIdx, Fr_ChannelType FrIf_ChnlIdx, FrTrcv_TrcvModeType FrIf_TrcvMode )`	
Service ID [hex]	0x13	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
	FrIf_TrcvMode	Transceiver mode to be set.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_NOT_OK`.

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Description	Wraps the FlexRay Transceiver Driver API function FrTrcv_SetTransceiverMode(). The enum value "FR_CHANNEL_AB" shall not be used.
Available via	FrIf.h

⌋*(SRS_Fr_05039)*

[SWS_FrIf_05210] ⌈If parameter FrIf_CtrlIdx of FrIf_SetTransceiverMode has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_SetTransceiverMode shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05211] ⌈If parameter FrIf_ChnlIdx of FrIf_SetTransceiverMode has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_SetTransceiverMode shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05212] ⌈The function FrIf_SetTransceiverMode shall wrap the FlexRay Transceiver Driver API function FrTrcv_SetTransceiverMode() by:

1. Translating (based on static FrIf module configuration) the tuple (FlexRay CC index FrIf_CtrlIdx | FlexRay Channel index FrIf_ChnlIdx) into a tuple (FlexRay Transceiver Driver | Driver-specific Transceiver index FrTrcv_TrcvIdx).
2. Setting parameters
   - FrTrcv_TrcvMode to FrIf_TrcvMode
3. Calling FrTrcv_SetTransceiverMode() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05213] ⌈Caveats of FrIf_SetTransceiverMode: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.20 FrIf_GetTransceiverMode

[SWS_FrIf_05035] Definition of API function FrIf_GetTransceiverMode ⌈

Service Name	FrIf_GetTransceiverMode

Syntax	`Std_ReturnType FrIf_GetTransceiverMode (`
	`  uint8 FrIf_CtrlIdx,`
	`  Fr_ChannelType FrIf_ChnlIdx,`
	`  FrTrcv_TrcvModeType* FrIf_TrcvModePtr`
	`)`

Service ID [hex]	0x14
Sync/Async	Synchronous
Reentrancy	Reentrant

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△

Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
Parameters (inout)	None	
Parameters (out)	FrIf_TrcvModePtr	Pointer to a memory location where output value will be stored.
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_NOT_OK`.
Description	Wraps the FlexRay Transceiver Driver API function FrTrcv_GetTransceiverMode(). The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋*(SRS_Fr_05157)*

[SWS_FrIf_05214] ⌈If parameter FrIf_CtrlIdx of FrIf_GetTransceiverMode has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetTransceiverMode shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05215] ⌈If parameter FrIf_ChnlIdx of FrIf_GetTransceiverMode has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetTransceiverMode shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05216] ⌈The function FrIf_GetTransceiverMode shall wrap the FlexRay Transceiver Driver API function FrTrcv_GetTransceiverMode() by:

1. Translating (based on static FrIf module configuration) the tuple (FlexRay CC index FrIf_CtrlIdx | FlexRay Channel index FrIf_ChnlIdx) into a tuple (FlexRay Transceiver Driver | Driver-specific Transceiver index FrTrcv_TrcvIdx).
2. Setting parameters
   - FrTrcv_TrcvModePtr to FrIf_TrcvModePtr
3. Calling FrTrcv_GetTransceiverMode() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05217] ⌈Caveats of FrIf_GetTransceiverMode: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.21 FrIf_GetTransceiverWUReason

[SWS_FrIf_05036] Definition of API function FrIf_GetTransceiverWUReason ⌈

Service Name	FrIf_GetTransceiverWUReason	
Syntax	`Std_ReturnType FrIf_GetTransceiverWUReason ( uint8 FrIf_CtrlIdx, Fr_ChannelType FrIf_ChnlIdx, FrTrcv_TrcvWUReasonType* FrIf_TrcvWUReasonPtr )`	
Service ID [hex]	0x15	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
Parameters (inout)	None	
Parameters (out)	FrIf_TrcvWUReasonPtr	Pointer to a memory location where output value will be stored.
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_NOT_OK`.
Description	Wraps the FlexRay Transceiver Driver API function FrTrcv_GetTransceiverWUReason(). The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋*(SRS_BSW_00375, SRS_Fr_05158)*

[SWS_FrIf_05218] ⌈If parameter FrIf_CtrlIdx of FrIf_GetTransceiverWUReason has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetTransceiverWUReason shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05219] ⌈If parameter FrIf_ChnlIdx of FrIf_GetTransceiverWUReason has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetTransceiverWUReason shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05220] ⌈The function FrIf_GetTransceiverWUReason shall wrap the Flex Ray Transceiver Driver API function FrTrcv_GetTransceiverWUReason() by:

1. Translating (based on static FrIf module configuration) the tuple (FlexRay CC index FrIf_CtrlIdx | FlexRay Channel index FrIf_ChnlIdx) into a tuple (FlexRay Transceiver Driver | Driver-specific Transceiver index FrTrcv_TrcvIdx).
2. Setting parameters
   - FrTrcv_TrcvWUReasonPtr to FrIf_WUReasonPtr
3. Calling FrTrcv_GetTransceiverWUReason() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05221] ⌈Caveats of FrIf_GetTransceiverWUReason: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.22 FrIf_ClearTransceiverWakeup

[SWS_FrIf_05039] Definition of API function FrIf_ClearTransceiverWakeup ⌈

Service Name	FrIf_ClearTransceiverWakeup	
Syntax	`Std_ReturnType FrIf_ClearTransceiverWakeup ( uint8 FrIf_CtrlIdx, Fr_ChannelType FrIf_ChnlIdx )`	
Service ID [hex]	0x18	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_NOT_OK`.
Description	Wraps the FlexRay Transceiver Driver API function FrTrcv_ClearTransceiverWakeup(). The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋*(SRS_Fr_05161)*

[SWS_FrIf_05230] ⌈If parameter FrIf_CtrlIdx of FrIf_ClearTransceiverWakeup has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_ClearTransceiverWakeup shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05231] ⌈If parameter FrIf_ChnlIdx of FrIf_ClearTransceiverWakeup has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_ClearTransceiverWakeup shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05232] ⌈The function FrIf_ClearTransceiverWakeup shall wrap the FlexRay Transceiver Driver API function FrTrcv_ClearTransceiverWakeup() by:

1. Translating (based on static FrIf module configuration) the tuple (FlexRay CC index FrIf_CtrlIdx | FlexRay Channel index FrIf_ChnlIdx) into a tuple (FlexRay Transceiver Driver | Driver-specific Transceiver index FrTrcv_TrcvIdx).
2. Calling FrTrcv_ClearTransceiverWakeup() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05233] ⌈Caveats of FrIf_ClearTransceiverWakeup: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.23 FrIf_CancelAbsoluteTimer

[SWS_FrIf_05023] Definition of API function FrIf_CancelAbsoluteTimer ⌈

Service Name	FrIf_CancelAbsoluteTimer	
Syntax	`Std_ReturnType FrIf_CancelAbsoluteTimer ( uint8 FrIf_CtrlIdx, uint8 FrIf_AbsTimerIdx )`	
Service ID [hex]	0x1b	
Sync/Async	Synchronous	
Reentrancy	non reentrant for the same FlexRay CC, reentrant for different FlexRay CCs	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_AbsTimerIdx	Index of the absolute timer to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_CancelAbsoluteTimer() .	
Available via	FrIf.h	

⌋*()*

[SWS_FrIf_05240] ⌈If parameter FrIf_CtrlIdx of FrIf_CancelAbsoluteTimer has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_CancelAbsoluteTimer shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05241] ⌈The function FrIf_CancelAbsoluteTimer shall wrap the FlexRay Driver API function Fr_CancelAbsoluteTimer() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters Fr_AbsTimerIdx to FrIf_AbsTimerIdx
3. Calling Fr_CancleAbsoluteTimer() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05242] ⌈Caveats of FrIf_CancelAbsoluteTimer: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.24 FrIf_GetAbsoluteTimerIRQStatus

[SWS_FrIf_05027] Definition of API function FrIf_GetAbsoluteTimerIRQStatus ⌈

Service Name	FrIf_GetAbsoluteTimerIRQStatus	
Syntax	`Std_ReturnType FrIf_GetAbsoluteTimerIRQStatus ( uint8 FrIf_CtrlIdx, uint8 FrIf_AbsTimerIdx, boolean* FrIf_IRQStatusPtr )`	
Service ID [hex]	0x1f	
Sync/Async	Synchronous	
Reentrancy	non reentrant for the same FlexRay CC, reentrant for different FlexRay CCs	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_AbsTimerIdx	Index of the absolute timer to address.
Parameters (inout)	None	
Parameters (out)	FrIf_IRQStatusPtr	Pointer to a memory location where output value will be stored.
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_GetAbsoluteTimerIRQStatus()	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05252] ⌈If parameter FrIf_CtrlIdx of FrIf_GetAbsoluteTimerIRQStatus has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetAbsoluteTimerIRQStatus shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05253] ⌈The function FrIf_GetAbsoluteTimerIRQStatus shall wrap the Flex Ray Driver API function Fr_GetAbsoluteTimerIRQStatus() by:

1. Translating (based on static FrIf module configuration) the FlexRay CC index Fr If_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters
   - Fr_AbsTimerIdx to FrIf_AbsTimerIdx
   - Fr_IRQStatusPtr to FrIf_IRQStatusPtr
3. Calling Fr_GetAbsoluteTimerIRQStatus() of the determined FlexRay Driver module with the parameters determined as described above.

⌋()

[SWS_FrIf_05254] ⌈Caveats of FrIf_GetAbsoluteTimerIRQStatus: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋()

8.3.25 FrIf_DisableAbsoluteTimerIRQ

[SWS_FrIf_05031] Definition of API function FrIf_DisableAbsoluteTimerIRQ ⌈

Service Name	FrIf_DisableAbsoluteTimerIRQ	
Syntax	`Std_ReturnType FrIf_DisableAbsoluteTimerIRQ ( uint8 FrIf_CtrlIdx, uint8 FrIf_AbsTimerIdx )`	
Service ID [hex]	0x23	
Sync/Async	Synchronous	
Reentrancy	non reentrant for the same FlexRay CC, reentrant for different FlexRay CCs	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_AbsTimerIdx	Index of the absolute timer to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_DisableAbsoluteTimerIRQ().	
Available via	FrIf.h	

⌋*()*

[SWS_FrIf_05264] ⌈If parameter FrIf_CtrlIdx of FrIf_DisableAbsoluteTimerIRQ has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_DisableAbsoluteTimerIRQ shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05266] ⌈Caveats of FrIf_DisableAbsoluteTimerIRQ: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.3.26 FrIf_GetCycleLength

[SWS_FrIf_05239] Definition of API function FrIf_GetCycleLength ⌈

Service Name	FrIf_GetCycleLength	
Syntax	`uint32 FrIf_GetCycleLength ( uint8 FrIf_CtrlIdx )`	
Service ID [hex]	0x3a	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same FlexRay CC, reentrant for different FlexRay CCs	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	

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Return value	uint32	Time in unit of nanoseconds
Description	This API returns the configured time of the configuration parameter "GdCycle" in nanoseconds for the FlexRay controller with index FrIf_CtrlIdx.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05237] ⌈If parameter FrIf_CtrlIdx of FrIf_GetCycleLength has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetCycleLength shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05238] ⌈Caveats of FrIf_GetCycleLength: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋()

8.4 Optional Function Definitions

8.4.1 FrIf_AllSlots

[SWS_FrIf_05020] Definition of API function FrIf_AllSlots ⌈

Service Name	FrIf_AllSlots	
Syntax	`Std_ReturnType FrIf_AllSlots ( uint8 FrIf_CtrlIdx )`	
Service ID [hex]	0x33	
Sync/Async	Synchronous	
Reentrancy	non reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_AllSlots	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05412] ⌈The function FrIf_AllSlots shall be pre compile time configurable ON/OFF by the configuration parameter FrIfAllSlotsSupport (derived from configuration parameter FrIfAllSlotsSupport, see ECUC_FrIf_06108)⌋()

[SWS_FrIf_05706] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_AllSlots is called before the FrIf was initialized successfully, the function Fr

If_AllSlots shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋ *()*

[SWS_FrIf_05707] ⌈If development error detection for the Fr module is enabled: the function FrIf_AllSlots shall check the parameter FrIf_CtrlIdx for being valid. If FrIf_CtrlIdx is invalid, the function FrIf_AllSlots shall raise the development error FRIF_E_INV_CTRL_IDX and return E_NOT_OK.⌋ *()*

8.4.2 FrIf_GetChannelStatus

[SWS_FrIf_05030] Definition of API function FrIf_GetChannelStatus ⌈

Service Name	FrIf_GetChannelStatus	
Syntax	`Std_ReturnType FrIf_GetChannelStatus ( uint8 FrIf_CtrlIdx, uint16* FrIf_ChannelAStatusPtr, uint16* FrIf_ChannelBStatusPtr )`	
Service ID [hex]	0x26	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	FrIf_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Interface.
Parameters (inout)	None	
Parameters (out)	FrIf_ChannelAStatusPtr	Address where the bitcoded channel A status information shall be stored.
	FrIf_ChannelBStatusPtr	Address where the bitcoded channel B status information shall be stored.
Return value	Std_ReturnType	`E_OK`: API call finished successfully. `E_NOT_OK`: API call aborted due to errors.
Description	Wraps the FlexRay Driver API function Fr_GetChannelStatus() and gets the channel status information.	
Available via	FrIf.h	

⌋ *()*

[SWS_FrIf_05413] ⌈The function FrIf_GetChannelStatus shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetGetChannelStatusSupport

(derived from configuration parameter FrIfGetGetChannelStatusSupport, see ECUC_FrIf_06105)⌋ *()*

[SWS_FrIf_05708] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_GetChannelStatus is called before the FrIf module was initialized successfully, the function FrIf_GetChannelStatus shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋ *()*

[SWS_FrIf_05709] ⌈If development error detection for the FrIf module is enabled: the function FrIf_GetChannelStatus shall check the parameter FrIf_CtrlIdx for being valid. If FrIf_CtrlIdx is invalid, the function FrIf_GetChannelStatus shall raise the development error FRIF_E_INV_CTRL_IDX and return E_NOT_OK.⌋ *()*

8.4.3 FrIf_GetClockCorrection

[SWS_FrIf_05071] Definition of API function FrIf_GetClockCorrection ⌈

Service Name	FrIf_GetClockCorrection	
Syntax	`Std_ReturnType FrIf_GetClockCorrection ( uint8 FrIf_CtrlIdx, sint16* FrIf_RateCorrectionPtr, sint32* FrIf_OffsetCorrectionPtr )`	
Service ID [hex]	0x29	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	FrIf_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Interface.
Parameters (inout)	None	
Parameters (out)	FrIf_RateCorrectionPtr	Address where the current rate correction value shall be stored.
	FrIf_OffsetCorrectionPtr	Address where the current offset correction value shall be stored.
Return value	Std_ReturnType	`E_OK`: API call finished successfully. `E_NOT_OK`: API call aborted due to errors.
Description	Wraps the FlexRay Driver API function Fr_GetClockCorrection () and gets the current clock correction values.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05414] ⌈The function FrIf_GetClockCorrection shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetClockCorrectionSupport

(derived from configuration parameter FrIfGetClockCorrectionSupport, see

ECUC_FrIf_06106)⌋()

[SWS_FrIf_05711] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_GetClockCorrection is called before the FrIf was initialized successfully, the function FrIf_GetClockCorrection shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋()

[SWS_FrIf_05712] ⌈If development error detection for the FrIf module is enabled: the function FrIf_GetClockCorrection shall check the parameter FrIf_CtrlIdx for being valid. If FrIf_CtrlIdx is invalid, the function FrIf_GetClockCorrection shall raise the development error FRIF_E_INV_CTRL_IDX and return E_NOT_OK.⌋()

8.4.4 FrIf_GetSyncFrameList

[SWS_FrIf_05072] Definition of API function FrIf_GetSyncFrameList ⌈

Service Name	FrIf_GetSyncFrameList	
Syntax	`Std_ReturnType FrIf_GetSyncFrameList ( uint8 FrIf_CtrlIdx, uint8 FrIf_ListSize, uint16* FrIf_ChannelAEvenListPtr, uint16* FrIf_ChannelBEvenListPtr, uint16* FrIf_ChannelAOddListPtr, uint16* FrIf_ChannelBOddListPtr )`	
Service ID [hex]	0x2a	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	FrIf_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Interface.
	FrIf_ListSize	Size of the arrays passed via parameters: FrIf_ChannelAEvenList Ptr FrIf_ChannelBEvenListPtr FrIf_ChannelAOddListPtr FrIf_ ChannelBOddListPtr. The service must ensure to not write more entries into those arrays than granted by this parameter.
Parameters (inout)	None	
Parameters (out)	FrIf_ChannelAEvenListPtr	Address the list of syncframes on channel A within the even communication cycle is written to. The exact number of elements written to the list is limited by parameter FrIf_ListSize. Unused list elements are filled with the value '0' to indicate that no more syncframe has been seen.
	FrIf_ChannelBEvenListPtr	Address the list of syncframes on channel B within the even communication cycle is written to. The exact number of elements written to the list is limited by parameter FrIf_ListSize. Unused list elements are filled with the value '0' to indicate that no more syncframe has been seen.
	FrIf_ChannelAOddListPtr	Address the list of syncframes on channel A within the odd communication cycle is written to. The exact number of elements written to the list is limited by parameter FrIf_ListSize. Unused list elements are filled with the value '0' to indicate that no more syncframe has been seen.
	FrIf_ChannelBOddListPtr	Address the list of syncframes on channel B within the odd communication cycle is written to. The exact number of elements written to the list is limited by parameter FrIf_ListSize. Unused list elements are filled with the value '0' to indicate that no more syncframe has been seen.
Return value	Std_ReturnType	`E_OK`: API call finished successfully. `E_NOT_OK`: API call aborted due to errors.
Description	Wraps the FlexRay Driver API function Fr_GetSyncFrameList and gets a list of syncframes received or transmitted on channel A and channel B via the even and odd communication cycle.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05415] ⌈The function FrIf_GetSyncFrameList shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetSyncFrameListSupport

(derived from configuration parameter FrIfGetSyncFrameListSupport, see

ECUC_FrIf_06107)⌋()

[SWS_FrIf_05715] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_GetSyncFrameList is called before the Fr was initialized successfully,

the function FrIf_GetSyncFrameList shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋()

[SWS_FrIf_05716] ⌈If development error detection for the FrIf module is enabled: the function FrIf_GetSyncFrameList shall check the parameter FrIf_CtrlIdx for being valid. If FrIf_CtrlIdx is invalid, the function FrIf_GetSyncFrameList shall raise the development error FRIF_E_INV_CTRL_IDX and return E_NOT_OK.⌋()

8.4.5 FrIf_GetNumOfStartupFrames

[SWS_FrIf_05073] Definition of API function FrIf_GetNumOfStartupFrames ⌈

Service Name	FrIf_GetNumOfStartupFrames	
Syntax	`Std_ReturnType FrIf_GetNumOfStartupFrames ( uint8 FrIf_CtrlIdx, uint8* FrIf_NumOfStartupFramesPtr )`	
Service ID [hex]	0x34	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	FrIf_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Interface.
Parameters (inout)	None	
Parameters (out)	FrIf_NumOfStartup FramesPtr	Address where the number of startup frames seen within the last even/odd cycle pair shall be stored.
Return value	Std_ReturnType	`E_OK`: API call finished successfully. `E_NOT_OK`: API call aborted due to errors.
Description	Wraps the FlexRay Driver API function Fr_GetNumOfStartupFrames and gets a list of the current number of startup frames seen on the cluster. See variable vStartupPairs of [12] for details.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05416] ⌈The function FrIf_GetNumOfStartupFrames shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetNumOfStartup FramesSupport (derived from configuration parameter FrIfGetNumOfStartupFrames Support, see ECUC_FrIf_06104)⌋()

[SWS_FrIf_05721] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_GetNumOfStartupFrames is called before the FrIf was initialized successfully, the function FrIf_GetNumOfStartupFrames shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋()

[SWS_FrIf_05722] ⌈If development error detection for the FrIf module is enabled: the function FrIf_GetNumOfStartupFrames shall check the parameter FrIf_CtrlIdx for being valid. If FrIf_CtrlIdx is invalid, the function FrIf_GetNumOfStartupFrames shall raise the development error FRIF_E_INV_CTRL_IDX and return E_NOT_OK.⌋()

8.4.6 FrIf_GetWakeupRxStatus

[SWS_FrIf_05102] Definition of API function FrIf_GetWakeupRxStatus ⌈

Service Name	FrIf_GetWakeupRxStatus	
Syntax	`Std_ReturnType FrIf_GetWakeupRxStatus ( uint8 FrIf_CtrlIdx, uint8* FrIf_WakeupRxStatusPtr )`	
Service ID [hex]	0x2b	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	FrIf_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	FrIf_WakeupRxStatusPtr	Address where bitcoded wakeup reception status shall be stored. Bit 0: Wakeup received on channel A indicator Bit 1: Wakeup received on channel B indicator Bit 2-7: Unused
Return value	Std_ReturnType	`E_OK`: API call finished successfully. `E_NOT_OK`: API call aborted due to errors.
Description	Wraps the FlexRay Driver API function Fr_GetWakeupRxStatus and gets the wakeup received information from the FlexRay controller.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05417] ⌈The function FrIf_GetWakeupRxStatus shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetWakeupRxStatusSupport (derived from configuration parameter FrIfGetWakeupRxStatusSupport, see ECUC_FrIf_06111)⌋()

[SWS_FrIf_05700] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_GetWakeupRxStatus is called before the Fr was initialized successfully, the function FrIf_GetWakeupRxStatus shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋()

[SWS_FrIf_05701] ⌈If development error detection for the FrIf module is enabled: the function FrIf_GetWakeupRxStatus shall check the parameter FrIf_CtrlIdx for being valid. If FrIf_CtrlIdx is invalid, the function FrIf_GetWakeupRxStatus shall raise the development error FRIF_E_INV_CTRL_IDX and return E_NOT_OK.⌋()

8.4.7 FrIf_CancelTransmit

[SWS_FrIf_05070] Definition of API function FrIf_CancelTransmit ⌈

Service Name	FrIf_CancelTransmit
Syntax	`Std_ReturnType FrIf_CancelTransmit ( PduIdType TxPduId )`
Service ID [hex]	0x4a

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Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	TxPduId	Identification of the PDU to be cancelled.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: Cancellation was executed successfully by the destination module. E_NOT_OK: Cancellation was rejected by the destination module.
Description	Requests cancellation of an ongoing transmission of a PDU in a lower layer communication module.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05713] ⌈The function FrIf_CancelTransmit shall be pre compile time configurable ON/OFF by the configuration parameter FrIfCancelTransmitSupport (derived from configuration parameter FrIfCancelTransmitSupport, see ECUC_FrIf_00002)⌋()

[SWS_FrIf_05703] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_CancelTransmit is called before the FrIf was initialized successfully, the function FrIf_CancelTransmit shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋()

[SWS_FrIf_05704] ⌈If development error detection for the FrIf module is enabled: the function FrIf_CancelTransmit shall check the parameter TxPduId for being valid. If Tx PduId is invalid, the function FrIf_CancelTransmit shall raise the development error FRIF_E_INV_TXPDUID and return E_NOT_OK.⌋()

[SWS_FrIf_05705] ⌈For Transmit Cancellation, the following steps are performed:

1. Decrement TrigTxCounter for the IPDU that shall be canceled.
2. If TxConfCounter > 0 for this PDU, contine with step 3). Else, stop here.
3. Call FlexRay Driver's API function Fr_CancelTxLPdu():
   (a) Fr_CtrlIdx is derived according to the indexing scheme described in chapter of indexing.
   (b) Fr_LPduIdx is set to the configured L-PDU buffer index [Configuration Parameter FrIfLPduIdx, see FrIf06058] associated with the Communication Operation.
4. Increment TrigTxCounter (limited by FrIfCounterLimit) for all other I-PDUs within that L-PDU that have a TxConfCounter > 0.
5. Decrement TxConfCounter for all other I-PDUs within that L-PDU that have a Tx ConfCounter > 0.
6. Decrement the TxConfCounter for the IPDU that has been initiated by the Cancel Transmit API call.

⌋()

8.4.8 FrIf_DisableLPdu

[SWS_FrIf_05710] Definition of API function FrIf_DisableLPdu ⌈

Service Name	FrIf_DisableLPdu	
Syntax	`Std_ReturnType FrIf_DisableLPdu ( uint8 FrIf_CtrlIdx, uint16 FrIf_LPduIdx )`	
Service ID [hex]	0x28	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	FrIf_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Interface.
	FrIf_LPduIdx	This index is used to uniquely identify a FlexRay frame
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: API call finished successfully. `E_NOT_OK`: API call aborted due to errors.
Description	Wraps the FlexRay Driver Function Fr_DisableLPdu. It disables the hardware resource of an LPdu for transmission/reception.	
Available via	FrIf.h	

⌋*()*

[SWS_FrIf_05418] ⌈The function FrIf_DisableLPdu shall be pre compile time configurable ON/OFF by the configuration parameter FrIfDisableLPduSupport (derived from configuration parameter FrIfDisableLPduSupport, see ECUC_FrIf_06110)⌋*()*

[SWS_FrIf_05717] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_DisableLPdu is called before the FrIf was initialized successfully, the function FrIf_DisableLPdu shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋*()*

[SWS_FrIf_05714] ⌈If development error detection for the FrIf module is enabled: the function FrIf_DisableLPdu shall check the parameter FrIf_CtrlIdx for being valid. If FrIf_CtrlIdx is invalid, the function FrIf_DisableLPdu shall raise the development error FRIF_E_INV_CTRL_IDX and return E_NOT_OK.⌋*()*

8.4.9 FrIf_GetTransceiverError

[SWS_FrIf_05032] Definition of API function FrIf_GetTransceiverError ⌈

Service Name	FrIf_GetTransceiverError
Syntax	`Std_ReturnType FrIf_GetTransceiverError ( uint8 FrIf_CtrlIdx, Fr_ChannelType FrIf_ChnlIdx, uint8 FrIf_BranchIdx, uint32* FrIf_BusErrorState )`

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Service ID [hex]	0x35	
Sync/Async	Synchronous	
Reentrancy	Function is non reentrant for the same channel of the same controller.	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
	FrIf_BranchIdx	This zero based index identifies the branch of the (active star) transceiver to which the API call has to be applied.
Parameters (inout)	None	
Parameters (out)	FrIf_BusErrorState	Address where the transceiver error state is stored.
Return value	Std_ReturnType	E_OK: API call finished successfully. E_NOT_OK: API call aborted due to errors
Description	Wraps the FlexRay Transceiver Driver API function FrTrcv_GetTransceiverError. The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05419] ⌈The function FrIf_GetTransceiverError shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetTransceiverErrorSupport (derived from configuration parameter FrIfGetTransceiverErrorSupport, see ECUC_FrIf_06101)⌋()

[SWS_FrIf_05718] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_GetTransceiverError is called before the FrIf was initialized successfully, the function FrIf_GetTransceiverError shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋()

[SWS_FrIf_05719] ⌈If development error detection for the FrIf module is enabled: the function FrIf_GetTransceiverError shall check the parameter FrIf_CtrlIdx for being valid. If FrIf_CtrlIdx is invalid, the function FrIf_GetTransceiverError shall raise the development error FRIF_E_INV_CTRL_IDX and return E_NOT_OK.⌋()

[SWS_FrIf_05720] ⌈If parameter FrIf_ChnlIdx of FrIf_GetTransceiverError has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetTransceiverError shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05728] ⌈The function FrIf_GetTransceiverError shall wrap the FlexRay Transceiver Driver API function FrTrcv_GetTransceiverError by:

1. Translating (based on static FrIf module configuration) the tuple (FlexRay CC index FrIf_CtrlIdx | FlexRay Channel index FrIf_ChnlIdx) into a tuple (FlexRay Transceiver Driver | Driver-specific Transceiver index FrTrcv_TrcvIdx).
2. Setting parameters
   - FrTrcv_BranchIdx to FrIf_BranchIdx
   - FrTrcv_BusErrorState to FrIf_BusErrorState

3. Calling FrTrcv_GetTransceiverError of the determined FlexRay Transceiver module with the parameters determined as described above.

⌋()

8.4.10 FrIf_EnableTransceiverBranch

[SWS_FrIf_05085] Definition of API function FrIf_EnableTransceiverBranch ⌈

Service Name	FrIf_EnableTransceiverBranch	
Syntax	`Std_ReturnType FrIf_EnableTransceiverBranch ( uint8 FrIf_CtrlIdx, Fr_ChannelType FrIf_ChnlIdx, uint8 FrIf_BranchIdx )`	
Service ID [hex]	0x36	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
	FrIf_BranchIdx	This zero based index identifies the branch of the (active star) transceiver to which the API call has to be applied.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_NOT_OK`.
Description	Wraps the FlexRay Transceiver Driver API function FrTrcv_EnableTransceiverBranch. The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05420] ⌈The function FrIf_EnableTransceiverBranch shall be pre compile time configurable ON/OFF by the configuration parameter FrIfEnableTransceiver BranchSupport (derived from configuration parameter FrIfEnableTransceiverBranch Support, see ECUC_FrIf_06103)⌋()

[SWS_FrIf_05302] ⌈If parameter FrIf_CtrlIdx of FrIf_EnableTransceiverBranch has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_EnableTransceiverBranch shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05304] ⌈If parameter FrIf_ChnlIdx of FrIf_EnableTransceiverBranch has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_EnableTransceiverBranch shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05306] ⌈The function FrIf_EnableTransceiverBranch shall wrap the Flex Ray Transceiver Driver API function FrIf_EnableTransceiverBranch by:

1. Translating (based on static FrIf module configuration) the tuple (FlexRay CC index FrIf_CtrlIdx | FlexRay Channel index FrIf_ChnlIdx) into a tuple (FlexRay Transceiver Driver | Driver-specific Transceiver index FrTrcv_TrcvIdx).
2. Setting parameter: FrTrcv_BranchIdx to FrIf_BranchIdx
3. Calling FrTrcv_EnableTransceiverBranch of the determined FlexRay Driver module with the parameters determined as described above.

⌋()

[SWS_FrIf_05307] ⌈If development error detection for the FrIf module is enabled: if the function FrIf_EnableTransceiverBranch is called before the Fr was initialized successfully, the function FrIf_EnableTransceiverBranch shall raise the development error FRIF_E_UNINIT and return E_NOT_OK.⌋()

8.4.11 FrIf_DisableTransceiverBranch

[SWS_FrIf_05028] Definition of API function FrIf_DisableTransceiverBranch ⌈

Service Name	FrIf_DisableTransceiverBranch	
Syntax	`Std_ReturnType FrIf_DisableTransceiverBranch ( uint8 FrIf_CtrlIdx, Fr_ChannelType FrIf_ChnlIdx, uint8 FrIf_BranchIdx )`	
Service ID [hex]	0x37	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
	FrIf_BranchIdx	This zero based index identifies the branch of the (active star) transceiver to which the API call has to be applied.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Transceiver Driver's API service has returned `E_NOT_OK`.
Description	Wraps the FlexRay Transceiver Driver API function FrTrcv_DisableTransceiverBranch. The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05421] ⌈The function FrIf_DisableTransceiverBranch shall be pre compile time configurable ON/OFF by the configuration parameter FrIfDisableTransceiver BranchSupport (derived from configuration parameter FrIfDisableTransceiverBranch Support, see ECUC_FrIf_06102)⌋()

[SWS_FrIf_05425] ⌈The function FrIf_DisableTransceiverBranch shall be pre compile time configurable ON/OFF by the configuration parameter FrIfDisableTransceiverBranchSupport (derived from configuration parameter FrIfDisableTransceiverBranchSupport, see ECUC_FrIf_06102)⌋*()*

[SWS_FrIf_05756] ⌈If parameter FrIf_CtrlIdx of FrIf_DisableTransceiverBranch has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_DisableTransceiverBranch shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05243] ⌈If parameter FrIf_ChnlIdx of FrIf_DisableTransceiverBranch has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_DisableTransceiverBranch shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋*()*

[SWS_FrIf_05305] ⌈The function FrIf_DisableTransceiverBranch shall wrap the Flex Ray Transceiver Driver API function FrIf_DisableTransceiverBranch by:

1. Translating (based on static FrIf module configuration) the tuple (FlexRay CC index FrIf_CtrlIdx | FlexRay Channel index FrIf_ChnlIdx) into a tuple (FlexRay Transceiver Driver | Driver-specific Transceiver index FrTrcv_TrcvIdx)
2. Setting parameter: FrTrcv_BranchIdx to FrIf_BranchIdx
3. Calling FrTrcv_DisableTransceiverBranch() of the determined FlexRay Driver module with the parameters determined as described above.

⌋*()*

[SWS_FrIf_05308] ⌈Caveats of FrIf_DisableTransceiverBranch: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋*()*

8.4.12 FrIf_ReconfigLPdu

[SWS_FrIf_05048] Definition of API function FrIf_ReconfigLPdu ⌈

Service Name	FrIf_ReconfigLPdu

Syntax	`Std_ReturnType FrIf_ReconfigLPdu (`
	`  uint8 FrIf_CtrlIdx,`
	`  uint16 FrIf_LPduIdx,`
	`  uint16 FrIf_FrameId,`
	`  Fr_ChannelType FrIf_ChnlIdx,`
	`  uint8 FrIf_CycleRepetition,`
	`  uint8 FrIf_CycleOffset,`
	`  uint8 FrIf_PayloadLength,`
	`  uint16 FrIf_HeaderCRC`
	`)`

Service ID [hex]	0x00
Sync/Async	Synchronous

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Reentrancy	Non Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	FrIf_LPduIdx	This index is used to uniquely identify a FlexRay frame.
	FrIf_FrameId	FlexRay Frame ID the FrIf_LPdu shall be configured to.
	FrIf_ChnlIdx	FlexRay Channel the FrIf_LPdu shall be configured to.
	FrIf_CycleRepetition	Cycle Repetition part of the cycle filter mechanism FrIf_LPdu shall be configured to.
	FrIf_CycleOffset	Cycle Offset part of the cycle filter mechanism FrIf_LPdu shall be configured to.
	FrIf_PayloadLength	Payloadlength in units of bytes the FrIf_LPduIdx shall be configured to.
	FrIf_HeaderCRC	Header CRC the FrIf_LPdu shall be configured to.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: API call finished successfully. `E_NOT_OK`: API call aborted due to errors.
Description	Calls the FlexRay Driver's API Fr_ReconfigLPdu. The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05422] ⌈The function FrIf_ReconfigLPdu shall be pre compile time configurable ON/OFF by the configuration parameter FrIfReconfigLPduSupport (derived from configuration parameter FrIfReconfigLPduSupport, see ECUC_FrIf_06109)⌋()

[SWS_FrIf_05309] ⌈If parameter FrIf_CtrlIdx of FrIf_ReconfigLPdu has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_ReconfigLPdu shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05310] ⌈If parameter FrIf_ChnlIdx of FrIf_ReconfigLPdu has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_ReconfigLPdu shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05311] ⌈If parameter FrIf_LPduIdx of FrIf_ReconfigLPdu has an invalid value (i.e. outside of LPdu range or if FrIfReconfigurable of this LPdu is not set to TRUE) and development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the FrIf_ReconfigLPdu shall report development error code FRIF_E_INV_LPDU_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05312] ⌈If parameter FrIf_FrameId of FrIf_ReconfigLPdu has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the FrIf_ReconfigLPdu shall report development error code FRIF_E_INV_FRAME_ID to the Det_ReportError service of the DET module.⌋()

8.4.13 FrIf_GetNmVector

[SWS_FrIf_05016] Definition of API function FrIf_GetNmVector ⌈

Service Name	FrIf_GetNmVector	
Syntax	`Std_ReturnType FrIf_GetNmVector ( uint8 FrIf_CtrlIdx, uint8* FrIf_NmVectorPtr )`	
Service ID [hex]	0x0f	
Sync/Async	Synchronous	
Reentrancy	non reentrant for identical values of FrIf_CtrlIdx, reentrant for different values of FrIf_CtrlIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
Parameters (inout)	None	
Parameters (out)	FrIf_NmVectorPtr	Pointer to a memory location where output value will be stored.
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Derives the FlexRay NM Vector.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05423] ⌈The function FrIf_GetNmVector shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetNmVectorSupport (derived from configuration parameter FrIfGetNmVectorSupport, see FrIf06100_Conf)⌋()

[SWS_FrIf_05197] ⌈If parameter FrIf_CtrlIdx of FrIf_GetNmVector has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetNmVector shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋()

[SWS_FrIf_05198] ⌈The function FrIf_GetNmVector wraps the FlexRay Driver API Fr_GetNmVector function.⌋()

[SWS_FrIf_05199] ⌈Caveats of FrIf_GetNmVector: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003]⌋()

8.4.14 FrIf_GetVersionInfo

[SWS_FrIf_05002] Definition of API function FrIf_GetVersionInfo ⌈

Service Name	FrIf_GetVersionInfo
Syntax	`void FrIf_GetVersionInfo ( Std_VersionInfoType* FrIf_VersionInfoPtr )`

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Service ID [hex]	0x01	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	None	
Parameters (inout)	None	
Parameters (out)	FrIf_VersionInfoPtr	Pointer to a memory location where the FlexRay Interface version information shall be stored.
Return value	void	–
Description	Returns the version information of this module.	
Available via	FrIf.h	

⌋*(SRS_BSW_00407, SRS_BSW_00411)*

[SWS_FrIf_05424] ⌈The function FrIf_GetVersionInfo shall be pre compile time configurable ON/OFF by the configuration parameter FrIfVersionInfoApi (derived from configuration parameter FrIfVersionInfoApi, see ECUC_FrIf_06083)⌋*()*

[SWS_FrIf_05151] ⌈If parameter FrIf_VersionInfoPtr of FrIf_GetVersionInfo equals NULL_PTR and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_GetVersionInfo shall report development error code FRIF_E_PARAM_POINTER to the Det_ReportError service of the DET module.⌋*()*

8.4.15 FrIf_ReadCCConfig

[SWS_FrIf_05313] Definition of API function FrIf_ReadCCConfig ⌈

Service Name	FrIf_ReadCCConfig	
Syntax	`Std_ReturnType FrIf_ReadCCConfig ( uint8 FrIf_CtrlIdx, uint8 FrIf_ConfigParamIdx, uint32* FrIf_ConfigParamValuePtr )`	
Service ID [hex]	0x3b	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same FlexRay CC, reentrant for different FlexRay CCs	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ConfigParamIdx	Index of the configuration parameter to read.
Parameters (inout)	None	
Parameters (out)	FrIf_ConfigParamValuePtr	Pointer to a memory location where output value will be stored.
Return value	Std_ReturnType	`E_OK`: The call of the FlexRay Driver's API service has returned `E_OK`. `E_NOT_OK`: The call of the FlexRay Driver's API service has returned `E_NOT_OK`, or an error has been detected in development mode.
Description	Wraps the FlexRay Driver API function Fr_ReadCCConfig().	
Available via	FrIf.h	

⌋*()*

[SWS_FrIf_05314] ⌈The function FrIf_ReadCCConfig wraps the FlexRay Driver API Fr_ReadCCConfig function.⌋*()*

[SWS_FrIf_05315] ⌈If parameter FrIf_CtrlIdx of FrIf_ReadCCConfig has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_ReadCCConfig shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋*()*

8.4.16 FrIf_EnableBusMirroring

[SWS_FrIf_05726] Definition of API function FrIf_EnableBusMirroring ⌈

Service Name	FrIf_EnableBusMirroring	
Syntax	`Std_ReturnType FrIf_EnableBusMirroring ( uint8 FrIf_ClstIdx, boolean FrIf_MirroringActive )`	
Service ID [hex]	0x4b	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_ClstIdx	Index of the FlexRay cluster to address.
	FrIf_MirroringActive	TRUE: Mirror_ReportFlexRayFrame will be called for each frame received or transmitted on the addressed FlexRay CC. FALSE: Mirror_ReportFlexRayFrame will not be called for the addressed FlexRay CC.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: Mirroring mode was changed. `E_NOT_OK`: Wrong FrIf_CtrlIdx, or mirroring is globally disabled (see FrIfBusMirroringSupport).
Description	Enables or disables mirroring for all FlexRay controllers connected to the addressed FlexRay cluster.	
Available via	FrIf.h	

⌋*()*

[SWS_FrIf_05727] ⌈The function FrIf_EnableBusMirroring shall be pre compile time configurable ON/OFF by the configuration parameter FrIfBusMirroringSupport (see ECUC_FrIf_06124).⌋*()*

8.5 Interrupt Service Routines

8.5.1 FrIf_JobListExec_<FrIfCluster.ShortName>

[SWS_FrIf_05040] Definition of API function FrIf_JobListExec_<FrIfCluster.ShortName> ⌈

Service Name	FrIf_JobListExec_<FrIfCluster.ShortName>
Syntax	`void FrIf_JobListExec_<FrIfCluster.ShortName> ( void )`
Service ID [hex]	0x32
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in)	None
Parameters (inout)	None
Parameters (out)	None
Return value	None
Description	Processes the FlexRay Job List of the FlexRay Cluster with index ClstIdx.
Available via	FrIf.h

⌋() Note:

For a detailed description of this API service, please refer to chapter subsubsection 7.6.4.2.

[SWS_FrIf_05270] ⌈The function FrIf_JobListExec_<FrIfCluster.ShortName> shall exist once per FlexRay Cluster of a FlexRay Interface module.⌋()

[SWS_FrIf_05271] ⌈The function name of each instance of FrIf_JobListExec_<FrIf Cluster.ShortName> shall contain the short name of the respective FlexRay Cluster (FrIfCluster).

For each FlexRay Cluster (identified by index ClstIdx), the respective API service FrIf_JobListExec_<FrIfCluster.ShortName> must be registered in the AUTOSAR OS as the ISR of an absolute timer of a FlexRay CC connected to the FlexRay Cluster with index ClstIdx, if the CC does not guarantee asynchronous buffer access.⌋()

Note: If the CC guarantees asynchronous buffer access, the execution of FrIf_JobList Exec<FrIfCluster.ShortName> can run in a regular OS task.

[SWS_FrIf_05272] ⌈Caveats of FrIf_JobListExec_<FrIfCluster.ShortName>: The Flex Ray Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see [SWS_FrIf_05003].⌋()

8.6 Callback notifications

This is a list of functions provided for other modules.

8.6.1 FrIf_CheckWakeupByTransceiver

[SWS_FrIf_05041] Definition of API function FrIf_CheckWakeupByTransceiver ⌈

Service Name	FrIf_CheckWakeupByTransceiver	
Syntax	`void FrIf_CheckWakeupByTransceiver ( uint8 FrIf_CtrlIdx, Fr_ChannelType FrIf_ChnlIdx )`	
Service ID [hex]	0x39	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_ChnlIdx	Index of the FlexRay Channel to address in scope of the FlexRay controller FrIf_CtrlIdx.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Wraps the FlexRay Transceiver Driver API function FrTrcv_CheckWakeupByTransceiver(). The enum value "FR_CHANNEL_AB" shall not be used.	
Available via	FrIf.h	

⌋()

[SWS_FrIf_05274] ⌈If parameter FrIf_CtrlIdx of FrIf_CheckWakeupByTransceiver has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_CheckWakeupByTransceiver shall report development error code FRIF_E_INV_CTRL_IDX to the Det_ReportError service of the DET module.⌋ ()

[SWS_FrIf_05275] ⌈If parameter FrIf_ChnlIdx of FrIf_CheckWakeupByTransceiver has an invalid value and if development error detection is enabled (i.e. FrIfDevErrorDetect equals ON), the function FrIf_CheckWakeupByTransceiver shall report development error code FRIF_E_INV_CHNL_IDX to the Det_ReportError service of the DET module.⌋ ()

[SWS_FrIf_05276] ⌈The function FrIf_CheckWakeupByTransceiver shall wrap the Flex Ray Transceiver Driver API function FrTrcv_CheckWakeupByTransceiver() by:

1. Translating (based on static FrIf module configuration) the tuple (FlexRay CC index FrIf_CtrlIdx | FlexRay Channel index FrIf_ChnlIdx) into a tuple (FlexRay Transceiver Driver | Driver-specific Transceiver index FrTrcv_TrcvIdx).
2. Calling FrTrcv_CheckWakeupByTransceiver() of the determined FlexRay Driver module with the parameters determined as described above.

⌋()

[SWS_FrIf_05277] ⌈Caveats of FrIf_CheckWakeupByTransceiver: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see SWS_FrIf_05003.⌋()

8.7 Scheduled functions

8.7.1 FrIf_MainFunction_<FrIfCluster.ShortName>

[SWS_FrIf_05042] Definition of scheduled function FrIf_MainFunction_<FrIfCluster.ShortName> ⌈

Service Name	FrIf_MainFunction_<FrIfCluster.ShortName>
Syntax	`void FrIf_MainFunction_<FrIfCluster.ShortName> ( void )`
Service ID [hex]	0x27
Description	This function will be called cyclically by a task body provided by the BSW Scheduler.
Available via	SchM_FrIf.h

⌋() Note:

This cyclically executed API service of the FlexRay Interface serves the following purposes:

- Program the absolute timer interrupt in order to start the execution of FrIf_JobList Exec_<FrIfCluster.ShortName>() if the CC does not support asynchronous buffer access.
- Monitoring the proper (in time) execution of the FrIf_JobListExec_<FrIfCluster.ShortName>() and resynchronize the Joblist if necessary.

Please refer to chapter section 7.3 for a detailed description.

Pre condition: The function FrIf_MainFunction_<FrIfCluster.ShortName> is cyclically called from a task body provided by the BSW Scheduler module.

Since the duration of a FlexRay Cycle may be different for two Clusters of an ECU, the calling period (parameter FrIfMainFunctionPeriod) of this API service shall be configurable independently for each Cluster at system configuration time.

The parameter FrIfMainFunctionPeriod determines for each FlexRay cluster of a Flex Ray Interface module the calling period, which is provided for the BSW scheduler module.

[SWS_FrIf_05278] ⌈The function FrIf_MainFunction_<FrIfCluster.ShortName> shall exist once per FlexRay Cluster of a FlexRay Interface module.⌋()

[SWS_FrIf_05279] ⌈The function name of each instance of FrIf_MainFunction_<FrIf Cluster.ShortName> shall contain the short name of the respective FlexRay Cluster (FrIfCluster).⌋()

8.8 Expected interfaces

This chapter lists all API services required from other BSW modules.

8.8.1 Mandatory Interfaces

This chapter defines all API services which are required from other BSW modules to fulfill the core functionality of the FlexRay Interface.

[SWS_FrIf_05043] Definition of mandatory interfaces in module FrIf ⌈

API Function	*Header File*	*Description*
Det_ReportRuntimeError	Det.h	Service to report runtime errors. If a callout has been configured then this callout shall be called.
Fr_AbortCommunication	Fr.h	Invokes the CC CHI command 'FREEZE'.
Fr_AckAbsoluteTimerIRQ	Fr.h	Resets the interrupt condition of an absolute timer.
Fr_AllowColdstart	Fr.h	Invokes the CC CHI command 'ALLOW_ COLDSTART'.
Fr_CancelAbsoluteTimer	Fr.h	Stops an absolute timer.
Fr_CheckTxLPduStatus	Fr.h	Checks the transmit status of the LSdu.
Fr_ControllerInit	Fr.h	Initialzes a FlexRay CC.
Fr_DisableAbsoluteTimerIRQ	Fr.h	Disables the interrupt line of an absolute timer.
Fr_EnableAbsoluteTimerIRQ	Fr.h	Enables the interrupt line of an absolute timer.
Fr_GetAbsoluteTimerIRQStatus	Fr.h	Gets IRQ status of an absolute timer.
Fr_GetGlobalTime	Fr.h	Gets the current global FlexRay time. Important Note: Fr_GetGlobalTime may be called within an exclusive area.
Fr_GetPOCStatus	Fr.h	Gets the POC status.
Fr_HaltCommunication	Fr.h	Invokes the CC CHI command 'DEFERRED_HALT'.
Fr_ReceiveRxLPdu	Fr.h	Receives data from the FlexRay network.
Fr_SendWUP	Fr.h	Invokes the CC CHI command 'WAKEUP'.
Fr_SetAbsoluteTimer	Fr.h	Sets the absolute FlexRay timer.
Fr_SetWakeupChannel	Fr.h	Sets a wakeup channel.
Fr_StartCommunication	Fr.h	Starts communication.
Fr_TransmitTxLPdu	Fr.h	Transmits data on the FlexRay network.
FrTrcv_CheckWakeupByTransceiver	FrTrcv.h	–
FrTrcv_ClearTransceiverWakeup	FrTrcv.h	This function clears a pending wake up event.
FrTrcv_GetTransceiverMode	FrTrcv.h	This function returns the actual state of the transceiver.
FrTrcv_GetTransceiverWUReason	FrTrcv.h	This function returns the wakeup reason.
FrTrcv_SetTransceiverMode	FrTrcv.h	This service sets the transceiver mode.

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8.8.2 Optional Interfaces

This chapter defines all API services which are required from other BSW modules to fulfill an optional functionality of the FlexRay Interface

[SWS_FrIf_05044] Definition of optional interfaces in module FrIf ⌈

API Function	*Header File*	*Description*
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/Dem ConfigSet/DemEventParameter/DemEvent ReportingType} == STANDARD_REPORTING)
Det_ReportError	Det.h	Service to report development errors.
Fr_AllSlots	Fr.h	Invokes the CC CHI command 'ALL_SLOTS'.
Fr_CancelTxLPdu	Fr.h	Cancels the already pending transmission of a LPdu contained in a controllers physical transmit resource (e.g. message buffer).
Fr_DisableLPdu	Fr.h	Disables the hardware resource of a LPdu for transmission/reception.
Fr_GetChannelStatus	Fr.h	Gets the channel status information.
Fr_GetClockCorrection	Fr.h	Gets the current clock correction values. See variables vInterimRateCorrection and vInterimOffset Correction of [12] for details.
Fr_GetNmVector	Fr.h	Gets the network management vector of the last communication cycle.
Fr_GetNumOfStartupFrames	Fr.h	Gets the current number of startup frames seen on the cluster. See variable vStartupPairs of [12] for details.
Fr_GetSyncFrameList	Fr.h	Gets a list of syncframes received or transmitted on channel A and channel B via the even and odd communication cycle. See variables vsSyncIdListA and vsSyncIdListB of [12] for details.
Fr_GetWakeupRxStatus	Fr.h	Gets the wakeup received information from the Flex Ray controller.
Fr_PrepareLPdu	Fr.h	Prepares a LPdu.
Fr_ReadCCConfig	Fr.h	Reads a FlexRay protocol configuration parameter for a particular FlexRay controller out of the module's configuration.
Fr_ReconfigLPdu	Fr.h	Reconfigures a given LPdu according to the parameters (FrameId, Channel, CycleRepetition, CycleOffset, PayloadLength, HeaderCRC) at runtime.
FrArTp_RxIndication	FrArTp.h	Indication of a received PDU from a lower layer communication interface module.
FrArTp_TriggerTransmit	FrArTp.h	Within this API, the upper layer module (called module) shall check whether the available data fits into the buffer size reported by PduInfoPtr->Sdu Length. If it fits, it shall copy its data into the buffer provided by PduInfoPtr->SduDataPtr and update the length of the actual copied data in PduInfoPtr->Sdu Length. If not, it returns E_NOT_OK without changing PduInfoPtr.
FrArTp_TxConfirmation	FrArTp.h	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU.
FrNm_RxIndication	FrNm_FrIf.h	Indication of a received PDU from a lower layer communication interface module.

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API Function	Header File	Description
FrNm_TriggerTransmit	FrNm_FrIf.h	Within this API, the upper layer module (called module) shall check whether the available data fits into the buffer size reported by PduInfoPtr->Sdu Length. If it fits, it shall copy its data into the buffer provided by PduInfoPtr->SduDataPtr and update the length of the actual copied data in PduInfoPtr->Sdu Length. If not, it returns E_NOT_OK without changing PduInfoPtr.
FrNm_TxConfirmation	FrNm_FrIf.h	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU.
FrTp_RxIndication	FrTp.h	Indication of a received PDU from a lower layer communication interface module.
FrTp_TriggerTransmit	FrTp.h	Within this API, the upper layer module (called module) shall check whether the available data fits into the buffer size reported by PduInfoPtr->Sdu Length. If it fits, it shall copy its data into the buffer provided by PduInfoPtr->SduDataPtr and update the length of the actual copied data in PduInfoPtr->Sdu Length. If not, it returns E_NOT_OK without changing PduInfoPtr.
FrTp_TxConfirmation	FrTp.h	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU.
FrTrcv_DisableTransceiverBranch	FrTrcv.h	This function disables the specified branch on the addressed (active star) transceiver.
FrTrcv_EnableTransceiverBranch	FrTrcv.h	This function enables the specified branch on the addressed (active star) transceiver.
FrTrcv_GetTransceiverError	FrTrcv.h	All mandatory errors defined by the FlexRay EPL [5] which are supported by the FlexRay transceiver hardware can be accessed via this API:In addition to errors on the physical layer and local to the ECU hardware, a global error flag is provided.
Mirror_ReportFlexRayFrame	Mirror.h	Reports a received or transmitted FlexRay frame or a Tx conflict.
PduR_FrIfRxIndication	PduR_FrIf.h	Indication of a received PDU from a lower layer communication interface module.
PduR_FrIfTriggerTransmit	PduR_FrIf.h	Within this API, the upper layer module (called module) shall check whether the available data fits into the buffer size reported by PduInfoPtr->Sdu Length. If it fits, it shall copy its data into the buffer provided by PduInfoPtr->SduDataPtr and update the length of the actual copied data in PduInfoPtr->Sdu Length. If not, it returns E_NOT_OK without changing PduInfoPtr.
PduR_FrIfTxConfirmation	PduR_FrIf.h	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU.
Xcp_FrIfRxIndication	Xcp.h	Indication of a received PDU from a lower layer communication interface module.
Xcp_FrIfTriggerTransmit	Xcp.h	Within this API, the upper layer module (called module) shall check whether the available data fits into the buffer size reported by PduInfoPtr->Sdu Length. If it fits, it shall copy its data into the buffer provided by PduInfoPtr->SduDataPtr and update the length of the actual copied data in PduInfoPtr->Sdu Length. If not, it returns E_NOT_OK without changing PduInfoPtr.

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API Function	Header File	Description
Xcp_FrIfTxConfirmation	Xcp.h	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU.

⌋()

8.8.3 Configurable Interfaces

This chapter lists all interfaces where the target API service of any upper layer, which require one or more of these mentioned interfaces to be called has to be set up by static configuration of the FlexRay Interface. The target function is usually a call-back function. The names of these kinds of interfaces are not fixed because they are configurable.

These call-back services are specified and implemented in the upper layer BSW modules, which use the FlexRay Interface according to [5, AUTOSAR_EXP_LayeredSoftwareArchitecture]. The specific call-back notification is specified in the corresponding AUTOSAR SWS document (see chapter 3).

In addition to upper layer AUTOSAR BSW modules, the FrIf can, with the functionality described within this specification, also support other non-AUTOSAR upper layer software modules (CDs), provided that these modules interact with the FrIf in the same manner as the upper layer AUTOSAR BSW modules. In particular, those non-AUTOSAR modules need to provide APIs as described in this chapter.

[SWS_FrIf_05729] ⌈Configuration of <UL_RxIndication>: If the parameter FrIfUserRx IndicationUL is set to FR_AR_TP, <UL_RxIndication> must be FrArTp_RxIndication.⌋ ()

[SWS_FrIf_05730] ⌈Configuration of <UL_RxIndication>: If the parameter FrIfUserRx IndicationUL is set to FR_NM, <UL_RxIndication> must be FrNm_RxIndication.⌋()

[SWS_FrIf_05731] ⌈Configuration of <UL_RxIndication>: If the parameter FrIfUserRx IndicationUL is set to FR_TP, <UL_RxIndication> must be FrTp_RxIndication.⌋()

[SWS_FrIf_05732] ⌈Configuration of <UL_RxIndication>: If the parameter FrIfUserRx IndicationUL is set to PDUR, <UL_RxIndication> must be PduR_FrIfRxIndication.⌋()

[SWS_FrIf_05733] ⌈Configuration of <UL_RxIndication>: If the parameter FrIfUserRx IndicationUL is set to XCP , <UL_RxIndication> must be Xcp_FrIfRxIndication.⌋()

[SWS_FrIf_05434] ⌈Configuration of <UL_RxIndication>: If the parameter FrIfUserRx IndicationUL is set to FR_TSYN, <UL_RxIndication> must be FrTSyn_RxIndication.⌋()

[SWS_FrIf_05734] ⌈Configuration of <UL_TxConfirmation>: If the parameter FrIfUser TxUL is set to FR_AR_TP, <UL_TxConfirmation> must be FrArTp_TxConfirmation.⌋()

[SWS_FrIf_05735] ⌈Configuration of <UL_TxConfirmation>: If the parameter FrIfUser TxUL is set to FR_NM, <UL_TxConfirmation> must be FrNm_TxConfirmation.⌋()

[SWS_FrIf_05736] ⌈Configuration of <UL_TxConfirmation>: If the parameter FrIfUser TxUL is set to FR_TP, <UL_TxConfirmation> must be FrTp_TxConfirmation.⌋*()*

[SWS_FrIf_05737] ⌈Configuration of <UL_TxConfirmation>: If the parameter FrIfUser TxUL is set to PDUR, <UL_TxConfirmation> must be PduR_FrIfTxConfirmation.⌋*()*

[SWS_FrIf_05738] ⌈Configuration of <UL_TxConfirmation>: If the parameter FrIfUser TxUL is set to XCP , <UL_TxConfirmation> must be Xcp_FrIfTxConfirmation.⌋*()*

[SWS_FrIf_05739] ⌈Configuration of <UL_TriggerTransmit>: If the parameter FrIfUser TxUL is set to FR_AR_TP, <UL_TriggerTransmit> must be FrArTp_TriggerTransmit.⌋*()*

[SWS_FrIf_05740] ⌈Configuration of <UL_TriggerTransmit>: If the parameter FrIfUser TxUL is set to FR_NM, <UL_TriggerTransmit> must be FrNm_TriggerTransmit.⌋*()*

[SWS_FrIf_05741] ⌈Configuration of <UL_TriggerTransmit>: If the parameter FrIfUser TxUL is set to FR_TP, <UL_TriggerTransmit> must be FrTp_TriggerTransmit.⌋*()*

[SWS_FrIf_05742] ⌈Configuration of <UL_TriggerTransmit>: If the parameter FrIfUser TxUL is set to PDUR, <UL_TriggerTransmit> must be PduR_TriggerTransmit.⌋*()*

[SWS_FrIf_05743] ⌈Configuration of <UL_TriggerTransmit>: If the parameter FrIfUser TxUL is set to XCP, <UL_TriggerTransmit> must be Xcp_TriggerTransmit.⌋*()*

[SWS_FrIf_05759] ⌈Configuration of <UL_TriggerTransmit>: If the parameter FrIfUser TxUL is set to FR_TSYN, <UL_TriggerTransmit> must be FrTSyn_TriggerTransmit.⌋*()*

8.8.3.1 <UL_RxIndication>

[SWS_FrIf_05045] Definition of configurable interface <User_RxIndication> ⌈

Service Name	<User_RxIndication>	

Syntax	`void <User_RxIndication> (`
	`  PduIdType RxPduId,`
	`  const PduInfoType* PduInfoPtr`
	`)`	

Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	RxPduId	ID of the received PDU.
	PduInfoPtr	Contains the length (SduLength) of the received PDU, a pointer to a buffer (SduDataPtr) containing the PDU, and the MetaData related to this PDU.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Indication of a received PDU from a lower layer communication interface module.	
Available via	configurable	

⌋*()* Note:

During the execution of this API service, the upper layer BSW module that is the final recipient of this PDU is expected to retrieve (i.e. copy) the SDU (i.e. the payload of the

PDU) by means of the pointer PduInfoPtr which contains the received data address and received data length.

Caveats of <UL_RxIndication>: This API service is called during the execution of the FlexRay Job List Execution Function.

8.8.3.2 <UL_TxConfirmation>

[SWS_FrIf_05046] Definition of configurable interface <User_TxConfirmation> ⌈

Service Name	<User_TxConfirmation>	

Syntax	`void <User_TxConfirmation> (`
	`  PduIdType TxPduId,`
	`  Std_ReturnType result`
	`)`	

Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	TxPduId	ID of the PDU that has been transmitted.
	result	E_OK: The PDU was transmitted. E_NOT_OK: Transmission of the PDU failed.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU.	
Available via	configurable	

⌋() Caveats of <UL_TxConfirmation>: This API service is called during the execution of the FlexRay Job List Execution Function.

8.8.3.3 <UL_TriggerTransmit>

[SWS_FrIf_05047] Definition of configurable interface <User_TriggerTransmit> ⌈

Service Name	<User_TriggerTransmit>	

Syntax	`Std_ReturnType <User_TriggerTransmit> (`
	`  PduIdType TxPduId,`
	`  PduInfoType* PduInfoPtr`
	`)`	

Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	TxPduId	ID of the SDU that is requested to be transmitted.
Parameters (inout)	PduInfoPtr	Contains a pointer to a buffer (SduDataPtr) to where the SDU data shall be copied, and the available buffer size in SduLengh. On return, the service will indicate the length of the copied SDU data in SduLength.
Parameters (out)	None	

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Return value	Std_ReturnType	E_OK: SDU has been copied and SduLength indicates the number of copied bytes. E_NOT_OK: No SDU data has been copied. PduInfoPtr must not be used since it may contain a NULL pointer or point to invalid data.
Description	Within this API, the upper layer module (called module) shall check whether the available data fits into the buffer size reported by PduInfoPtr->SduLength. If it fits, it shall copy its data into the buffer provided by PduInfoPtr->SduDataPtr and update the length of the actual copied data in PduInfoPtr->SduLength. If not, it returns E_NOT_OK without changing PduInfoPtr.	
Available via	configurable	

⌋() Caveats of <UL_TriggerTransmit>: This API service is called during the execution of the FlexRay Job List Execution Function.

8.8.3.4 <Free_Op_A>

[SWS_FrIf_05316] Definition of configurable interface <Free_Op_A> ⌈

Service Name	<Free_Op_A>	

Syntax	`void <Free_Op_A> (`
	`  uint8 FrIf_CtrlIdx,`
	`  uint16 FrIf_LPduIdx`
	`)`	

Sync/Async	Synchronous	
Reentrancy	Reentrant for different FrIf_LPduIdx, non reentrant for same FrIf_LPduIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_LPduIdx	This index is used to uniquely identify a FlexRay frame.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	User defined communication operation in order to support hardware specific or additional communication controller features to increase performance.	
Available via	FrIf_Externals.h	

⌋() Caveats of <Free_Op_A>: This API service is called during the execution of the FlexRay Job List Execution Function.

8.8.3.5 <Free_Op_B>

[SWS_FrIf_05317] Definition of configurable interface <Free_Op_B> ⌈

Service Name	<Free_Op_B>

Syntax	`void <Free_Op_B> (`
	`  uint8 FrIf_CtrlIdx,`
	`  uint16 FrIf_LPduIdx`
	`)`

Sync/Async	Synchronous

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Reentrancy	Reentrant for different FrIf_LPduIdx, non reentrant for same FrIf_LPduIdx	
Parameters (in)	FrIf_CtrlIdx	Index of the FlexRay CC to address.
	FrIf_LPduIdx	This index is used to uniquely identify a FlexRay frame.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	User defined communication operation in order to support hardware specific or additional communication controller features to increase performance.	
Available via	FrIf_Externals.h	

⌋() Caveats of <Free_Op_B>: This API service is called during the execution of the FlexRay Job List Execution Function.

8.8.3.6 <UL_TxConflictNotification>

[SWS_FrIf_91001] Definition of configurable interface <UL_TxConflictNotification> ⌈

Service Name	<UL_TxConflictNotification>	
Syntax	`void <UL_TxConflictNotification> ( uint8 FrIf_CtrlIdx, uint16 FrIf_LPduIdx )`	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different FrIf_LPduIdx. Non reentrant for the same FrIf_LPduIdx.	
Parameters (in)	FrIf_CtrlIdx	ID of the addressed FlexRay CC
	FrIf_LPduIdx	ID of the transmitted FlexRay frame
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Notification in case a TxConflict has been detected.	
Available via	FrIf_Externals.h	

⌋()

9 Sequence diagrams

The sequence diagrams in this chapter show the basic operations carried out in a FlexRay Cluster's FlexRay Job List Execution Function when executing the various Communication Operations. They also show the interaction of the FrIf with the upper layer BSW module and with the underlying FlexRay Driver.

Please note that the sequence diagrams are an extension for illustrational purposes to ease understanding of the specification.

9.1 Data Transmission

9.1.1 TransmitWithImmediateBufferAccess

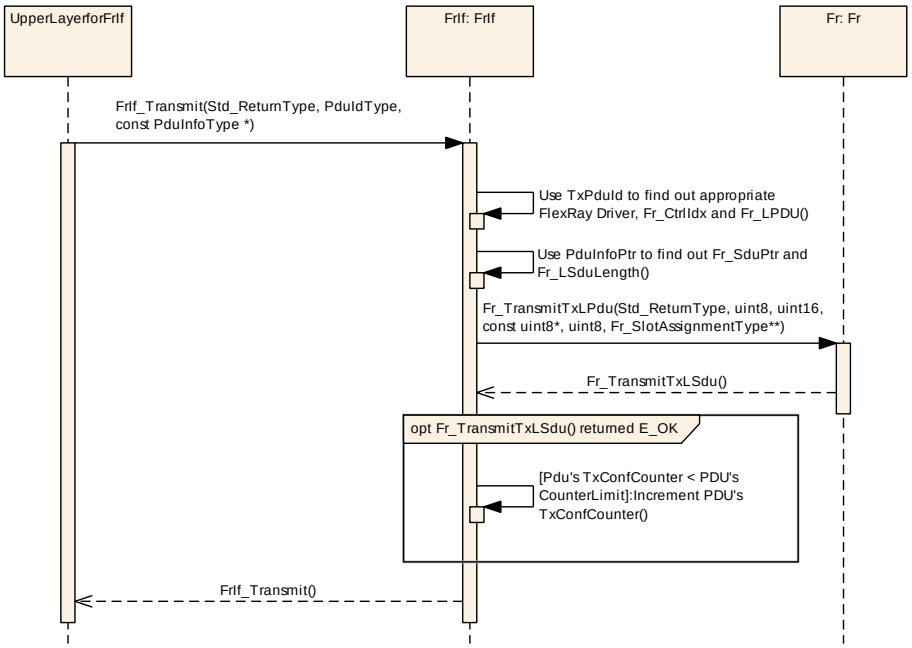

Figure 9.1: Transmit With Immediate Buffer Access

9.1.2 TransmitWithDecoupledBufferAccess

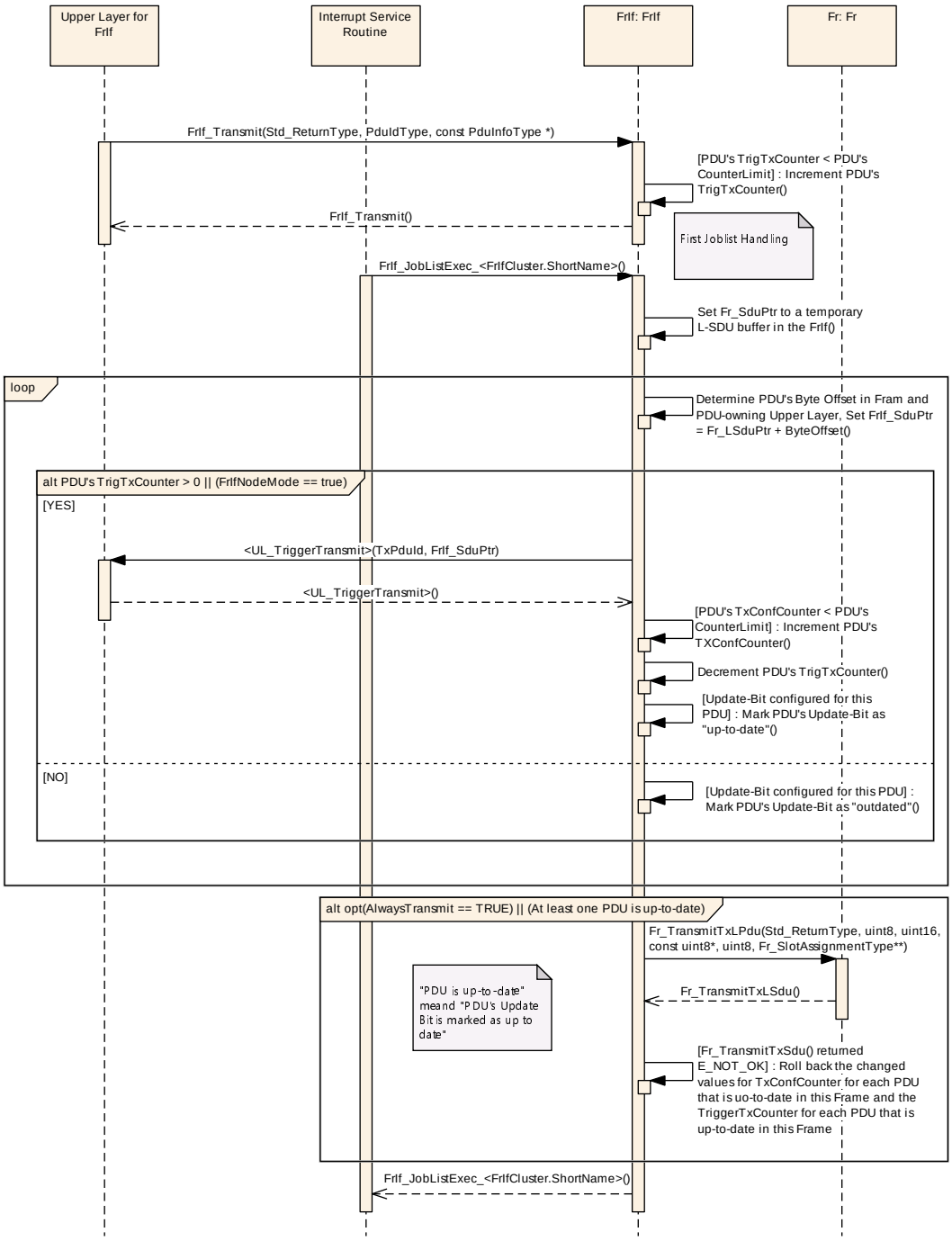

Figure 9.2: Transmit With Decoupled Buffer Access

9.1.3 ProvideTxConfirmation

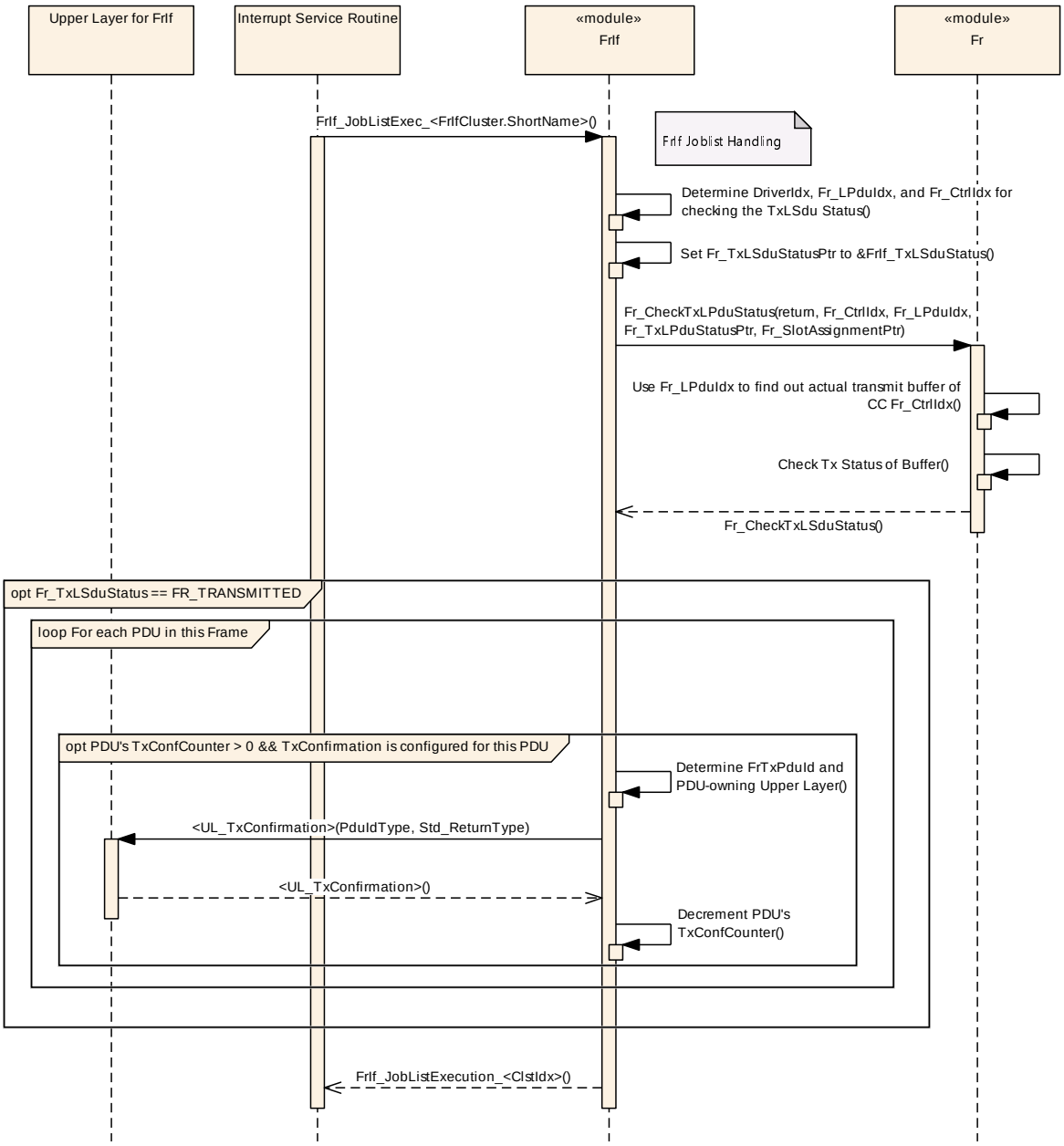

Figure 9.3: Provide TX Confirmation

9.2 Data Reception

9.2.1 ReceiveAndIndicate

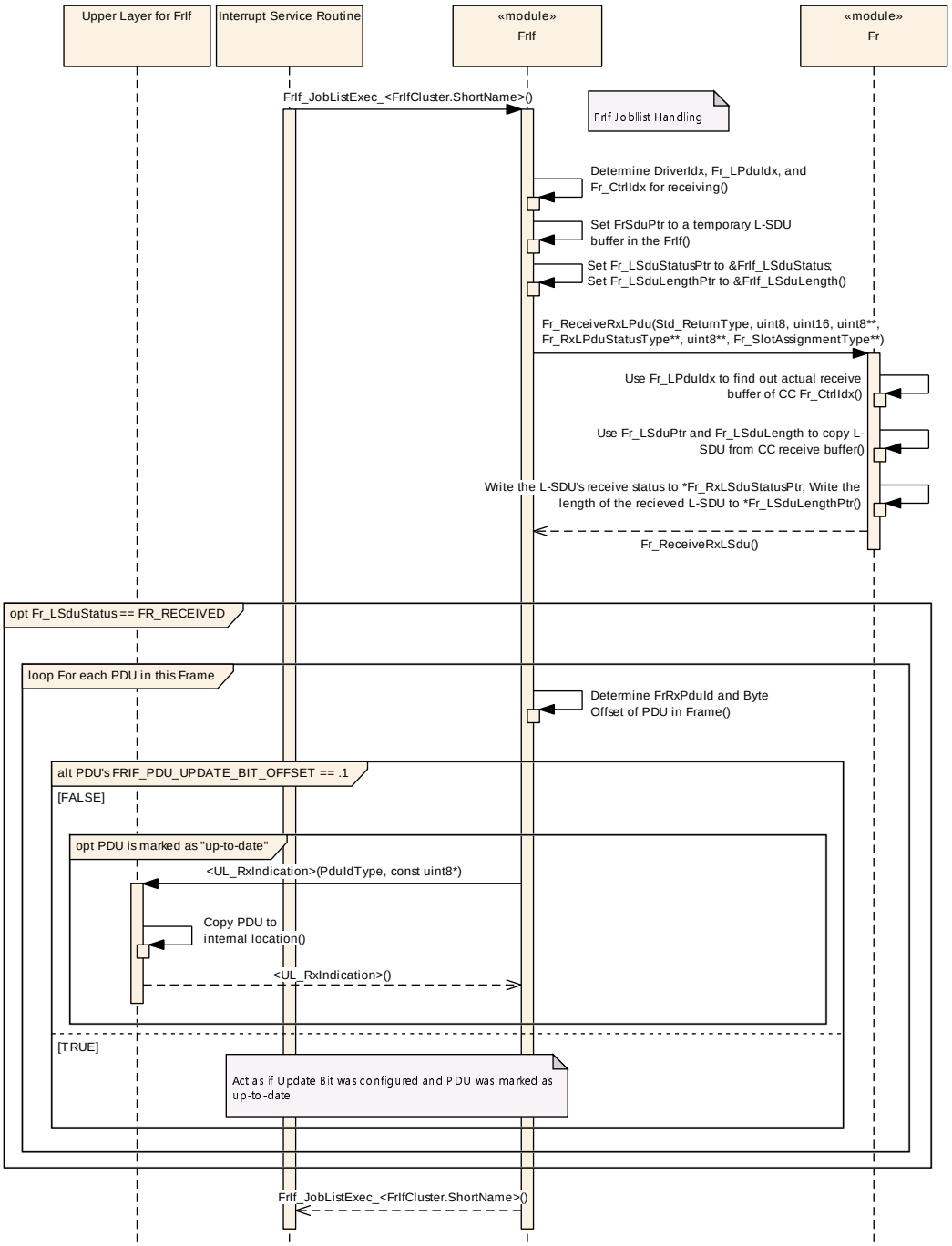

Figure 9.4: Receive and Indicate

9.2.2 ReceiveAndStore

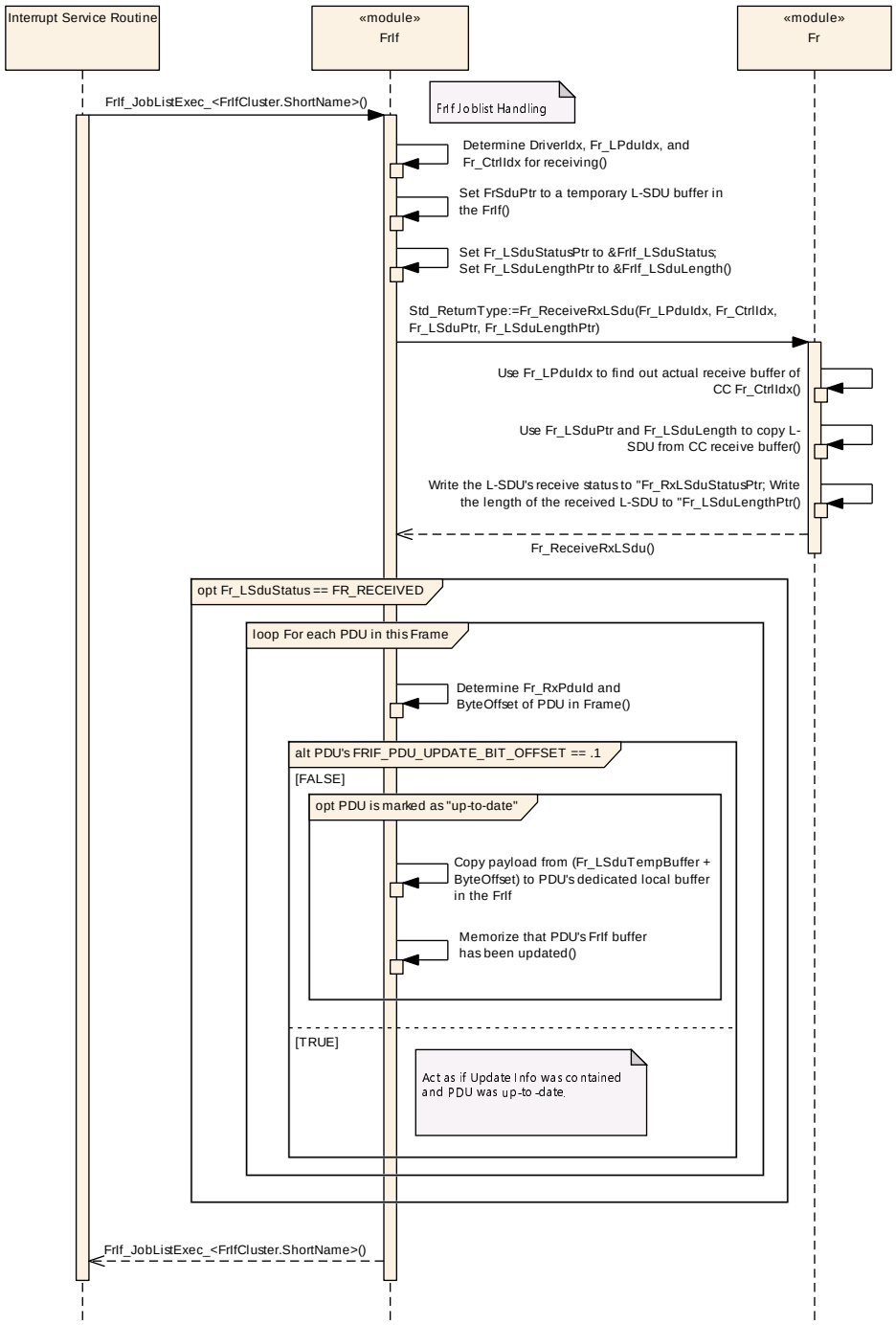

Figure 9.5: Receive and Store

9.2.3 ProvideRxIndication

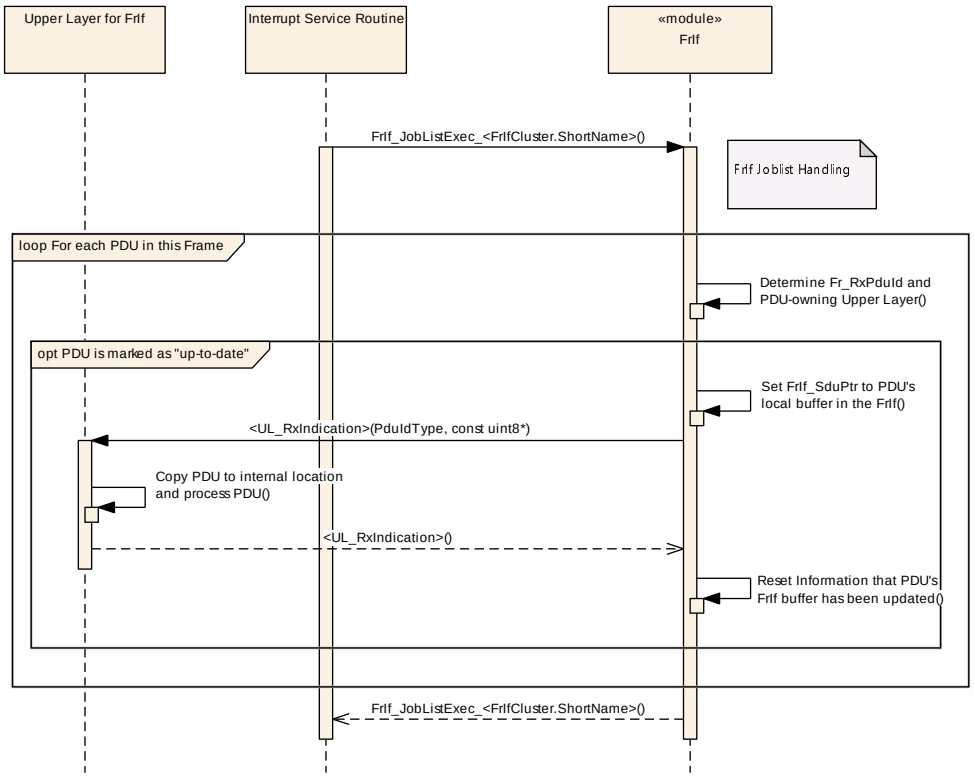

Figure 9.6: Provide Rx Indication

9.2.4 Cancel Transmission

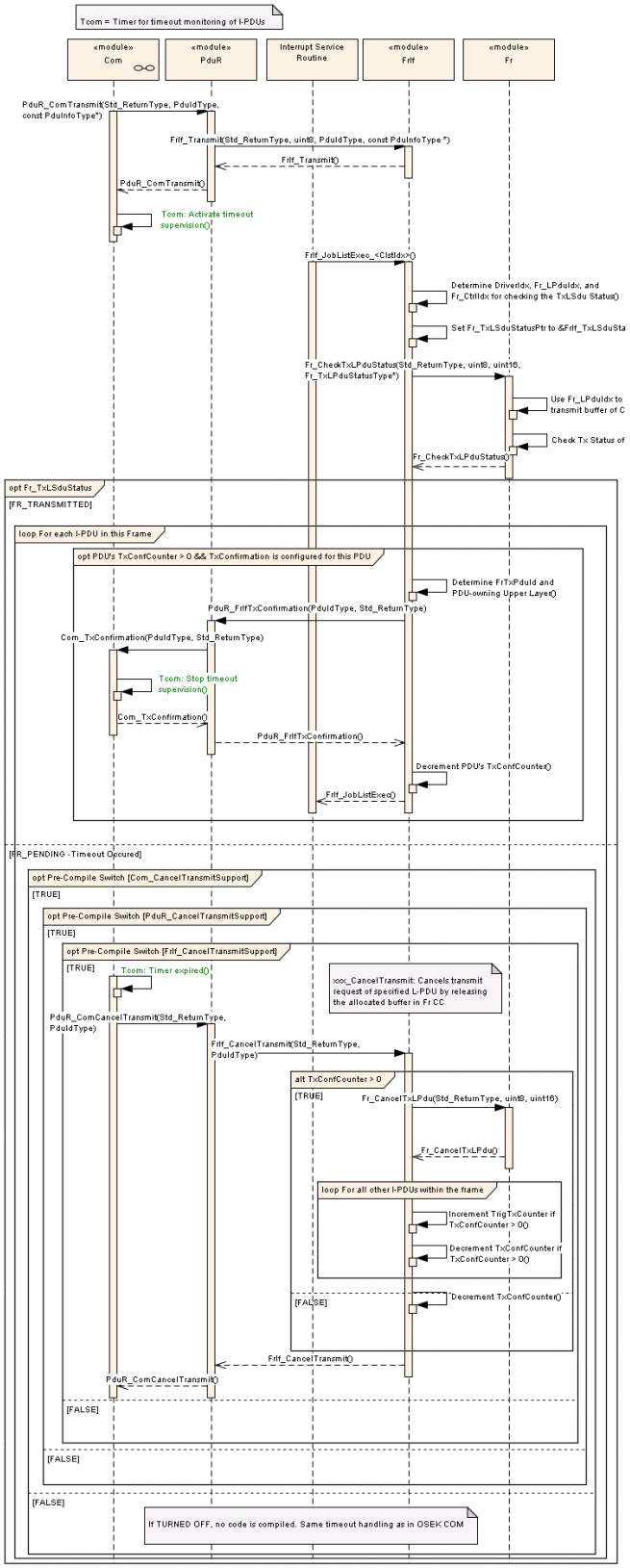

Figure 9.7: Cancel Transmission

9.3 Prepare LPDU

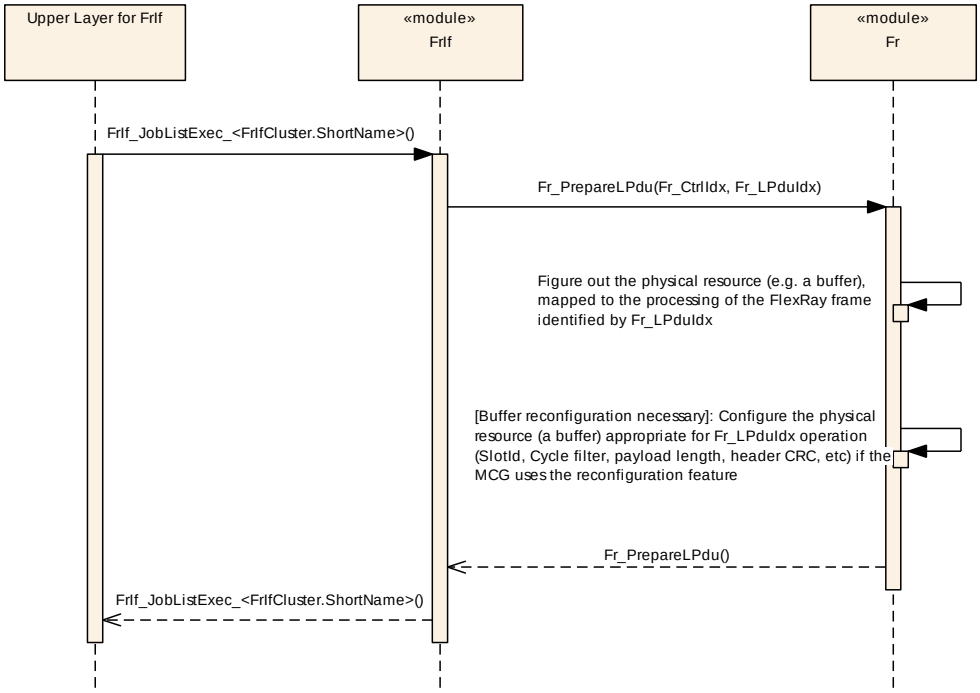

Figure 9.8: Prepare LPdu

10 Configuration specification

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

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

Chapter 10.3 specifies published information of the module FrIf.

10.1 How to read this chapter

For details refer to chapter “Introduction to configuration specification” in [1, General Specification of Basic Software Modules]. in SWS_BSWGeneral.

10.2 Containers and configuration parameters

The following chapters summarize all configuration parameters. The detailed meanings of the parameters describe chapter 7 and chapter 8.

The listed configuration items can be derived from a network description database, which is based on the EcuConfigurationTemplate. The configuration tool has to extract all information to configure the FrIf module.

Note:

The configuration tool must check the consistency of the configuration at configuration time.

Note:

These dependencies between FlexRay Interface and FlexRay Driver configuration must be provided at configuration time by the configuration tools.

10.2.1 FrIf

SWS Item	[ECUC_FrIf_06087]
Module Name	FrIf
Description	Configuration of the FrIf (FlexRay Interface) 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**
FrIfConfig	1	This container contains the configuration parameters and sub containers of the AUTOSAR FrIf module.
FrIfGeneral	1	This container contains the general configuration parameters of the FlexRay Interface.

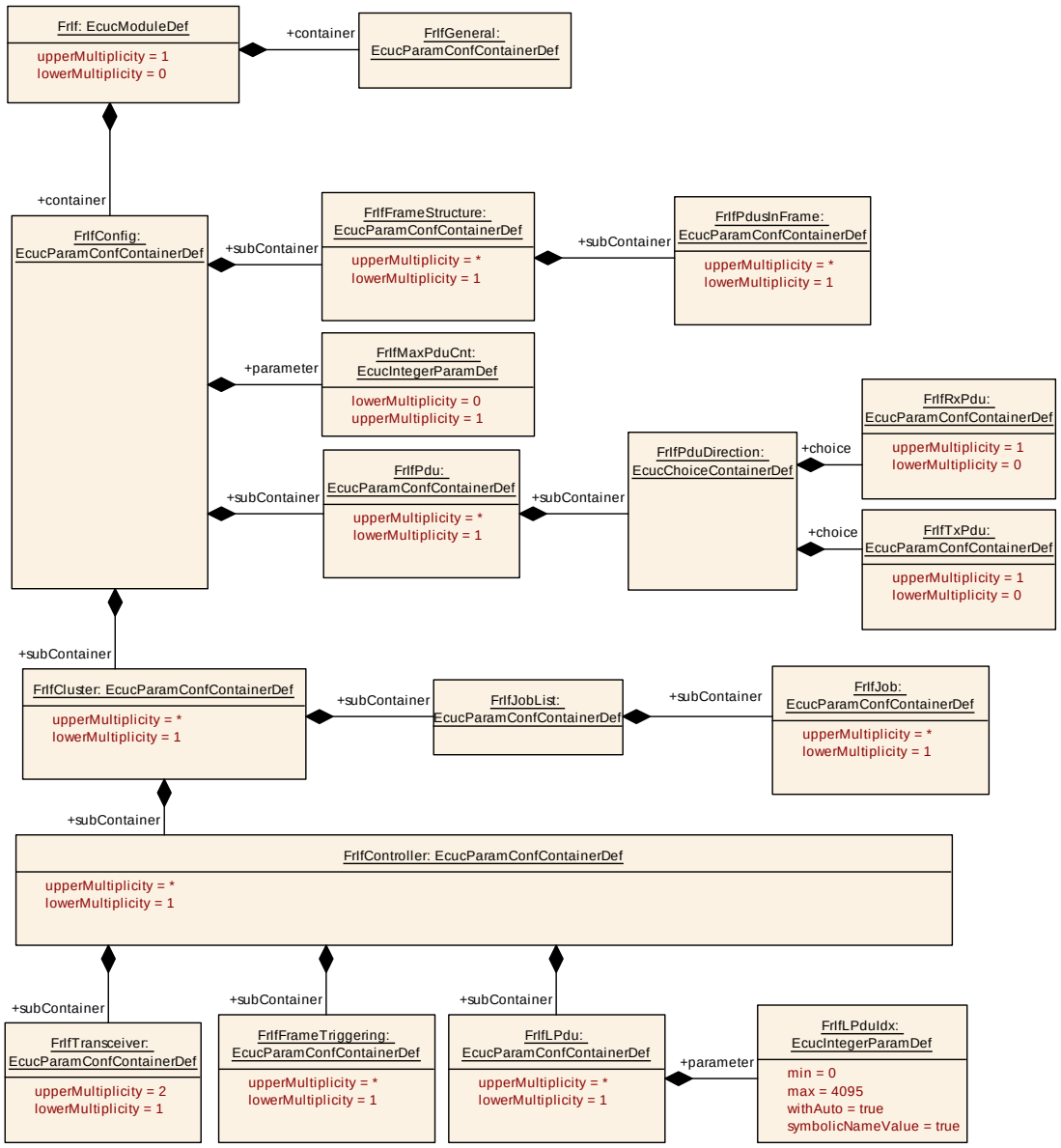

Figure 10.1: FlexRay Interface Module

10.2.2 FrIfGeneral

SWS Item	[ECUC_FrIf_05360]		
Container Name	FrIfGeneral		
Parent Container	FrIf		
Description	This container contains the general configuration parameters of the FlexRay Interface.		
Configuration Parameters			

SWS Item	[ECUC_FrIf_06112]		
Parameter Name	FrIfAbsTimerIdx		
Parent Container	FrIfGeneral		
Description	Maximum number of supported absolute timers.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 15		
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_FrIf_06108]		
Parameter Name	FrIfAllSlotsSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to enable/disable of switching from key-slot / single-slot mode to all slot mode.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06124]		
Parameter Name	FrIfBusMirroringSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to enable/disable reporting received/transmitted frames to the Bus Mirroring module.		
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	–	

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Scope / Dependency	scope: local

SWS Item	**[ECUC_FrIf_00002]**		
Parameter Name	FrIfCancelTransmitSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to request the cancellation of the I-PDU transmission to FrDrv.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06080]**		
Parameter Name	FrIfDevErrorDetect		
Parent Container	FrIfGeneral		
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_FrIf_06110]**		
Parameter Name	FrIfDisableLPduSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to disables the hardware resource of a LPdu for transmission/reception.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06102]		
Parameter Name	FrIfDisableTransceiverBranchSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to disable branches of an active star.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06103]		
Parameter Name	FrIfEnableTransceiverBranchSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to enable branches of an active star.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06118]		
Parameter Name	FrIfFreeOpAApiName		
Parent Container	FrIfGeneral		
Description	API name that is called when FREE_OP_A is selected as communication operation. See also chapter 8.8.3 Configurable Interfaces.		
Multiplicity	0..1		
Type	EcucStringParamDef		
Default value	–		
Regular Expression	–		
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_FrIf_06119]		
Parameter Name	FrIfFreeOpBApiName		
Parent Container	FrIfGeneral		
Description	API name that is called when FREE_OP_B is selected as communication operation. See also chapter 8.8.3 Configurable Interfaces.		
Multiplicity	0..1		
Type	EcucStringParamDef		
Default value	–		
Regular Expression	–		
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_FrIf_06120]		
Parameter Name	FrIfFreeOpsHeader		
Parent Container	FrIfGeneral		
Description	Defines header file for configurable FREE_OP_A / FREE_OP_B functions.		
Multiplicity	0..1		
Type	EcucStringParamDef		
Default value	–		
Regular Expression	–		
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_FrIf_06106]		
Parameter Name	FrIfGetClockCorrectionSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to enable/disable of polling the FlexRay Driver to getting CC clock correction values.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	

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	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	**[ECUC_FrIf_06105]**		
Parameter Name	FrIfGetGetChannelStatusSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to enable/disable of polling the FlexRay Driver to getting error information about the FlexRay communications bus.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06114]**		
Parameter Name	FrIfGetNmVectorSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to request the FlexRay hardware NMVector.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06104]**		
Parameter Name	FrIfGetNumOfStartupFramesSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to enable/disable of polling the FlexRay Driver for the actual number of received startup frames on the bus.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06107]		
Parameter Name	FrIfGetSyncFrameListSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to enable/disable of polling the FlexRay Driver to getting a list of actual received sync frames.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06101]		
Parameter Name	FrIfGetTransceiverErrorSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to get the FlexRay Transceiver errors by calling the FlexRay Transceiver module.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06111]		
Parameter Name	FrIfGetWakeupRxStatusSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to get the wakeup received information from the FlexRay controller.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06081]
Parameter Name	FrIfNumClstSupported
Parent Container	FrIfGeneral
Description	Maximum number of FlexRay Clusters that the FlexRay Interface supports.
Multiplicity	1
Type	EcucIntegerParamDef

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Range	1 .. 15		
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_FrIf_06082]**		
Parameter Name	FrIfNumCtrlSupported		
Parent Container	FrIfGeneral		
Description	Maximum number of FlexRay CCs that the FlexRay Interface supports		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 15		
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_FrIf_06116]**		
Parameter Name	FrIfPublicCddHeaderFile		
Parent Container	FrIfGeneral		
Description	Defines header files for callback functions which shall be included in case of CDDs. Range of characters is 1.. 32.		
Multiplicity	0..*		
Type	EcucStringParamDef		
Default value	–		
Regular Expression	–		
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_FrIf_06117]**
Parameter Name	FrIfReadCCConfigApi
Parent Container	FrIfGeneral
Description	Configuration parameter to enable/disable the optional FrIf_ReadCCConfig API.
Multiplicity	1
Type	EcucBooleanParamDef

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

SWS Item	**[ECUC_FrIf_06109]**		
Parameter Name	FrIfReconfigLPduSupport		
Parent Container	FrIfGeneral		
Description	Configuration parameter to enable/disable FrIf support to enable/disable the reconfiguration of a given LPdu according to the parameters (FrameId, Channel, Cycle Repetition, CycleOffset, PayloadLength, HeaderCRC) at runtime.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06123]**		
Parameter Name	FrIfTxConflictNotificationHeaderName		
Parent Container	FrIfGeneral		
Description	Configuration of the header file name that defines the UL_TxConflictNotification.		
Multiplicity	0..1		
Type	EcucStringParamDef		
Default value	–		
Regular Expression	–		
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: FrIfTxConflictNotificationName		

SWS Item	**[ECUC_FrIf_06122]**		
Parameter Name	FrIfTxConflictNotificationName		
Parent Container	FrIfGeneral		
Description	Configuration of the API name that is called in case a TxConflict has been detected.		
Multiplicity	0..1		
Type	EcucStringParamDef		

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Default value	–		
Regular Expression	–		
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: FrIfTxConflictNotificationHeaderName		

SWS Item	**[ECUC_FrIf_00001]**		
Parameter Name	FrIfUnusedBitValue		
Parent Container	FrIfGeneral		
Description	Set unused bits of transmitted Pdus to a defined value.		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	0 .. 1		
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_FrIf_06083]**		
Parameter Name	FrIfVersionInfoApi		
Parent Container	FrIfGeneral		
Description	Enables/disables the existence of the FrIf_GetVersionInfo() API service true: FrIf_GetVersionInfo() API service exists false: FrIf_GetVersionInfo() API service does not exist		
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		

No Included Containers

10.2.3 FrIfCluster

SWS Item	[ECUC_FrIf_05366]		
Container Name	FrIfCluster		
Parent Container	FrIfConfig		
Description	This container specifies a FrIf Cluster and all related data which is required to enable communication of the Cluster. A Cluster may consist of more than one Controller.		
Post-Build Variant Multiplicity	false		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE, VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Link time	–	
	Post-build time	–	
Configuration Parameters			

SWS Item	[ECUC_FrIf_06002]		
Parameter Name	FrIfClstIdx		
Parent Container	FrIfCluster		
Description	This parameter provides a zero-based consecutive index of the FlexRay Clusters. Upper layer BSW modules and the FrIf itself use this index to identify a FlexRay Cluster.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 63		
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 withAuto = true		

SWS Item	[ECUC_FrIf_00003]		
Parameter Name	FrIfDetectNITError		
Parent Container	FrIfCluster		
Description	Indicates whether NIT error status of each cluster shall be detected or not.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06006]
Parameter Name	FrIfGChannels
Parent Container	FrIfCluster

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Description	The channels that are used by the cluster. Implementation Type: Fr_ChannelType		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	FR_CHANNEL_A	Cluster uses channel A	
	FR_CHANNEL_AB	Cluster uses channel A and B Implementation Type: Fr_ChannelType	
	FR_CHANNEL_B	Cluster uses channel B	
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_FrIf_06008]**		
Parameter Name	FrIfGColdStartAttempts		
Parent Container	FrIfCluster		
Description	Maximum number of times a node in the cluster is permitted to attempt to start the cluster by initiating schedule synchronization		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 31		
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_FrIf_06086]**		
Parameter Name	FrIfGCycleCountMax		
Parent Container	FrIfCluster		
Description	Maximum cycle counter value in a given cluster. Remark: Set to 63 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	7 .. 63		
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_FrIf_06020]**
Parameter Name	FrIfGdActionPointOffset
Parent Container	FrIfCluster

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Description	Number of macroticks the action point is offset from the beginning of a static slot.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 63		
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: ECU		

SWS Item	**[ECUC_FrIf_06021]**		
Parameter Name	FrIfGdBit		
Parent Container	FrIfCluster		
Description	Nominal bit time in seconds		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	T100NS	–	
	T200NS	–	
	T400NS	–	
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_FrIf_06024]**		
Parameter Name	FrIfGdCasRxLowMax		
Parent Container	FrIfCluster		
Description	Upper limit of the CAS acceptance windows [gdBit] Remark: Range 67 to 99 for FlexRay Protocol 2.1 Rev. A compliance		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	28 .. 254		
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_FrIf_06025]**
Parameter Name	FrIfGdCycle
Parent Container	FrIfCluster
Description	Length of the cycle, expressed in [s] Remark: Lower limit 0.000024 for FlexRay Protocol 3.0 compliance.
Multiplicity	1

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Type	EcucFloatParamDef		
Range	[2.4E-5 .. 0.016]		
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_FrIf_06026]**		
Parameter Name	FrIfGdDynamicSlotIdlePhase		
Parent Container	FrIfCluster		
Description	Duration of the idle phase within a dynamic slot [Minislots].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2		
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_FrIf_00012]**		
Parameter Name	FrIfGdIgnoreAfterTx		
Parent Container	FrIfCluster		
Description	Duration for which the bitstrobing is paused after transmission [gdBit]. Remark: Set to 0 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 15		
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_FrIf_06027]**		
Parameter Name	FrIfGdMacrotick		
Parent Container	FrIfCluster		
Description	Duration of the cluster wide nominal macrotick, expressed in s		
Multiplicity	1		
Type	EcucFloatParamDef		
Range	[1E-6 .. 6E-6]		
Default value	–		
Post-Build Variant Value	true		

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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_FrIf_06033]**		
Parameter Name	FrIfGdMinislot		
Parent Container	FrIfCluster		
Description	Duration of a minislot [Macroticks]		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 63		
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: ECU		

SWS Item	**[ECUC_FrIf_06032]**		
Parameter Name	FrIfGdMiniSlotActionPointOffset		
Parent Container	FrIfCluster		
Description	Number of Macroticks the Minislot action point is offset from the beginning of a Minislot [Macroticks].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 31		
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_FrIf_06034]**		
Parameter Name	FrIfGdNit		
Parent Container	FrIfCluster		
Description	Duration of the Network Idle Time [Macroticks] Remark: Upper limit 805 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 15978		
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

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Scope / Dependency	scope: local

SWS Item	**[ECUC_FrIf_06035]**		
Parameter Name	FrIfGdSampleClockPeriod		
Parent Container	FrIfCluster		
Description	Sample clock period		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	T12_5NS	–	
	T25NS	–	
	T50NS	–	
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_FrIf_06036]**		
Parameter Name	FrIfGdStaticSlot		
Parent Container	FrIfCluster		
Description	Duration of a static slot [Macroticks]. Remark: Range 4-661 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	3 .. 664		
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_FrIf_06037]**		
Parameter Name	FrIfGdSymbolWindow		
Parent Container	FrIfCluster		
Description	Duration of the symbol window [Macroticks]. Remark: Range 0-142 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 162		
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_FrIf_00011]		
Parameter Name	FrIfGdSymbolWindowActionPointOffset		
Parent Container	FrIfCluster		
Description	Number of macroticks the action point offset is from the beginning of the symbol window [Macroticks]. Remark: Set to GdActionPointOffset for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 63		
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_FrIf_06038]		
Parameter Name	FrIfGdTSSTransmitter		
Parent Container	FrIfCluster		
Description	Number of bits in the Transmission Start Sequence [gdBits]. Remark: Lower limit 3 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 15		
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_FrIf_06039]		
Parameter Name	FrIfGdWakeupRxIdle		
Parent Container	FrIfCluster		
Description	Number of bits used by the node to test the duration of the 'idle' or HIGH phase of a received wakeup [gdBit]. Remarks: This parameter maps to FlexRay Protocol 2.1 Rev. A parameter gdWakeupSymbolRxIdle. Lower limit 14 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	8 .. 59		
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_FrIf_06040]		
Parameter Name	FrIfGdWakeupRxLow		
Parent Container	FrIfCluster		
Description	Number of bits used by the node to test the duration of the LOW phase of a received wakeup [gdBit]. Remarks: This parameter maps to FlexRay Protocol 2.1 Rev. A parameter gdWakeupSymbolRxLow. Lower limit 11 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	8 .. 59		
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_FrIf_06041]		
Parameter Name	FrIfGdWakeupRxWindow		
Parent Container	FrIfCluster		
Description	The size of the window used to detect wakeups [gdBit]. Remarks: This parameter maps to FlexRay Protocol 2.1 Rev. A parameter gdWakeupSymbolRxWindow. Upper limit 301 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	76 .. 485		
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_FrIf_06043]		
Parameter Name	FrIfGdWakeupTxActive		
Parent Container	FrIfCluster		
Description	Number of bits used by the node to transmit the LOW phase of awakeup symbol and the HIGH and LOW phases of a WUDOP [gdBit]. Remarks: This parameter maps to FlexRay Protocol 2.1 Rev. A parameter gdWakeup SymbolTxLow.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	15 .. 60		
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_FrIf_06042]		
Parameter Name	FrIfGdWakeupTxIdle		
Parent Container	FrIfCluster		
Description	Number of bits used by the node to transmit the 'idle' part of a wakeup symbol [gdBit]. Remarks: This parameter maps to FlexRay Protocol 2.1 Rev. A parameter gdWakeup SymbolTxIdle.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	45 .. 180		
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_FrIf_06009]		
Parameter Name	FrIfGListenNoise		
Parent Container	FrIfCluster		
Description	Upper limit for the start up listen timeout and wake up listen timeout in the presence of noise. It is used as a multiplier of the node parameter pdListenTimeout.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 16		
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_FrIf_06010]		
Parameter Name	FrIfGMacroPerCycle		
Parent Container	FrIfCluster		
Description	Number of macroticks in a communication cycle. Note: Lower limit 10 for FlexRay Protocol 2.1 Rev. A compliance		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	8 .. 16000		
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_FrIf_06011]		
Parameter Name	FrIfGMaxWithoutClockCorrectFatal		
Parent Container	FrIfCluster		
Description	Threshold used for testing the vClockCorrectionFailed counter. Defines the number of consecutive even/odd Cycle pairs with missing clock correction terms that will cause the protocol to transition from the POC:normal active or POC:normal passive state into the POC:halt state. [Even/odd cycle pairs].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 15		
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_FrIf_06012]		
Parameter Name	FrIfGMaxWithoutClockCorrectPassive		
Parent Container	FrIfCluster		
Description	Threshold used for testing the vClockCorrectionFailed counter. Defines the number of consecutive even/odd Cycle pairs with missing clock correction terms that will cause the protocol to transition from the POC:normal active state to the POC:normal passive state. [Even/Odd cycle pairs]		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 15		
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_FrIf_06013]		
Parameter Name	FrIfGNetworkManagementVectorLength		
Parent Container	FrIfCluster		
Description	Length of the Network Management vector in a cluster [bytes]		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 12		
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_FrIf_06014]		
Parameter Name	FrIfGNumberOfMinislots		
Parent Container	FrIfCluster		
Description	Number of minislots in the dynamic segment Remark: Upper limit 7986 for FlexRay Protocol 2.1 Rev. A compliance		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 7988		
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_FrIf_06015]		
Parameter Name	FrIfGNumberOfStaticSlots		
Parent Container	FrIfCluster		
Description	Number of static slots in the static segment		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 1023		
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_FrIf_06018]		
Parameter Name	FrIfGPayloadLengthStatic		
Parent Container	FrIfCluster		
Description	Payload length of a static frame [16 bit words]		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 127		
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_FrIf_06019]
Parameter Name	FrIfGSyncFrameIDCountMax
Parent Container	FrIfCluster

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Description	Maximum number of distinct syncframe identifiers present in a given cluster. This parameter maps to FlexRay Protocol 2.1 Rev. A parameter gSyncNodeMax.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 15		
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_FrIf_06003]**		
Parameter Name	FrIfMainFunctionPeriod		
Parent Container	FrIfCluster		
Description	The execution cycle of the FrIf_MainFunction_<FrIfCluster.ShortName>() in seconds. The FrIf does not require this information but the BSW scheduler, which invokes the cluster main functions, needs it in order to plan its tasks.		
Multiplicity	1		
Type	EcucFloatParamDef		
Range	]0 .. INF[		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	**[ECUC_FrIf_00004]**		
Parameter Name	FrIfSafetyMargin		
Parent Container	FrIfCluster		
Description	Additional timespan in macroticks which takes jitter into account to be able to set the JobListPointer to the next possible job which can be executed in case the FlexRay Job List Execution Function has be resynchronized.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 1024000		
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		

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
FrIfClusterDemEventParameterRefs	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.
FrIfController	1..*	This container contains the configuration of FlexRay CC.
FrIfJobList	1	This container specifies a list of all FlexRay Jobs of the Cluster to be performed by FrIf_JobListExec_<FrIfCluster.ShortName>().

10.2.4 FrIfController

SWS Item	[ECUC_FrIf_05363]		
Container Name	FrIfController		
Parent Container	FrIfCluster		
Description	This container contains the configuration of FlexRay CC.		
Post-Build Variant Multiplicity	false		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE, VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Link time	–	
	Post-build time	–	
Configuration Parameters			

SWS Item	[ECUC_FrIf_06045]		
Parameter Name	FrIfCtrlIdx		
Parent Container	FrIfController		
Description	This parameter provides a zero-based consecutive index of the FlexRay Communication Controllers. Upper layer BSW modules and the FrIf itself use this index to identify a FlexRay CC.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 31		
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 withAuto = true		

SWS Item	[ECUC_FrIf_06044]
Parameter Name	FrIfFrCtrlRef
Parent Container	FrIfController
Description	Reference to a Controller, which is handled by a specific Driver. This reference is unique for the ECU.
Multiplicity	1

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Type	Symbolic name reference to FrController		
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: ECU		

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
FrIfFrameTriggering	1..*	A Frame triggering contains the communication parameters of the FlexRay Frame as well as a reference to the Frame Construction Plan.
FrIfLPdu	1..*	Reference to a L-PDU index
FrIfTransceiver	1..2	Up to two FlexRay Transceivers may connect a Controller to a Cluster. This container realizes a Controller-Transceiver assignment.

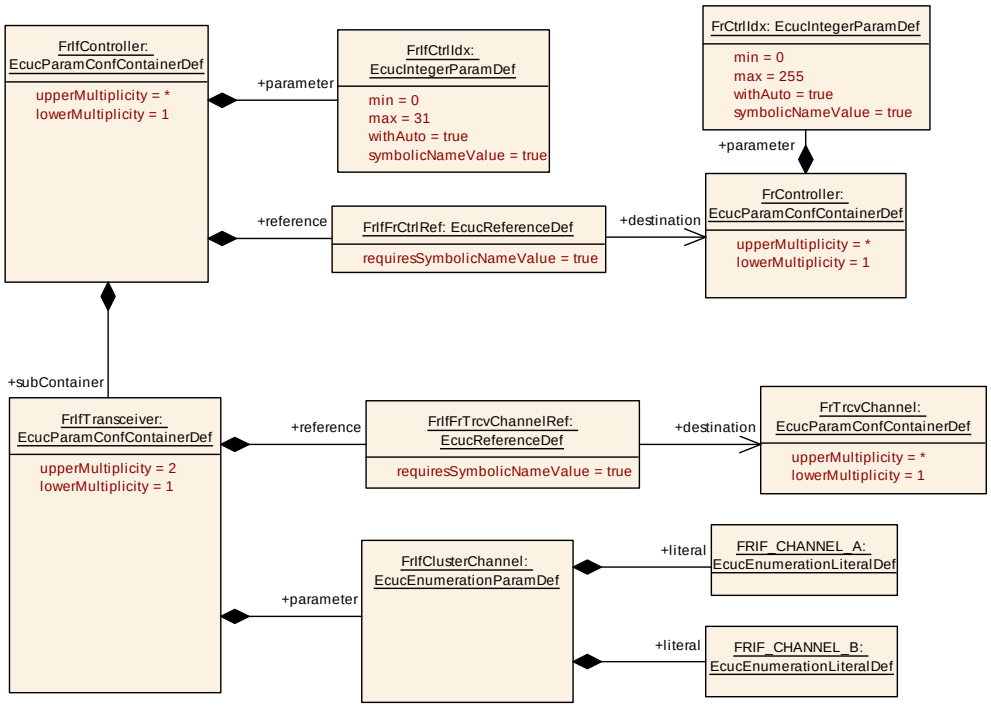

Figure 10.2: FlexRay Interface Controller (hardware reference)

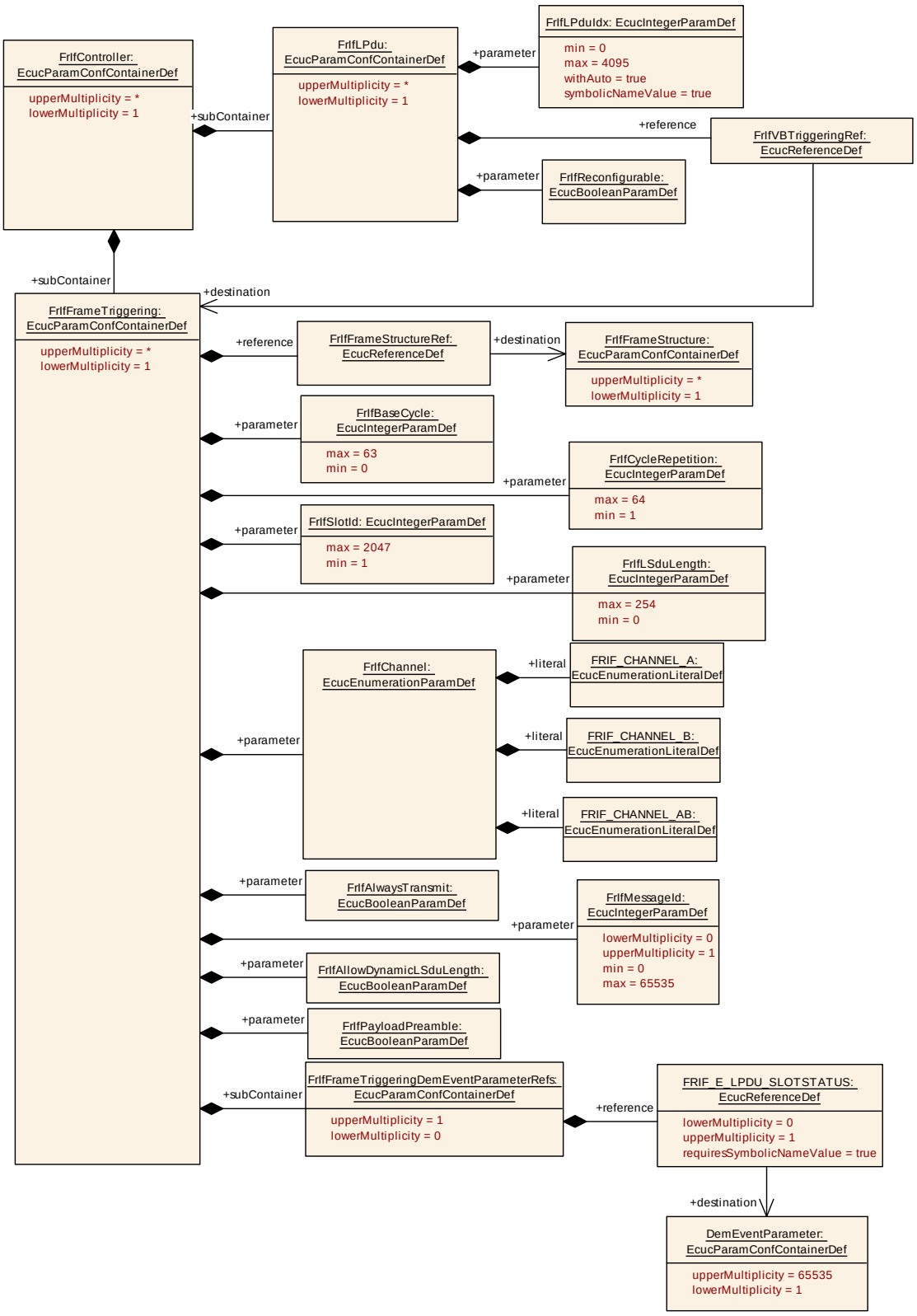

Figure 10.3: FlexRay Interface Controller (data reference)

10.2.5 FrIfTransceiver

SWS Item	[ECUC_FrIf_05391]
Container Name	FrIfTransceiver
Parent Container	FrIfController
Description	Up to two FlexRay Transceivers may connect a Controller to a Cluster. This container realizes a Controller-Transceiver assignment.
Configuration Parameters	

SWS Item	[ECUC_FrIf_06062]		
Parameter Name	FrIfClusterChannel		
Parent Container	FrIfTransceiver		
Description	This parameter identifies to which one of the two Channels (A, B, A and B) of the Cluster the Transceiver is connected. FrIfClusterChannel shall map to Fr_ChannelType: FRIF_CHANNEL_A == FR_CHANNEL_A FRIF_CHANNEL_B == FR_CHANNEL_B FR_CHANNEL_AB shall not be used.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	FRIF_CHANNEL_A	Channel A	
	FRIF_CHANNEL_B	Channel B	
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_FrIf_06061]		
Parameter Name	FrIfFrTrcvChannelRef		
Parent Container	FrIfTransceiver		
Description	Reference to a Transceiver Driver Channel. This reference is unique for the ECU.		
Multiplicity	1		
Type	Symbolic name reference to FrTrcvChannel		
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: ECU		

No Included Containers

10.2.6 FrIfLPdu

SWS Item	[ECUC_FrIf_05364]
Container Name	FrIfLPdu
Parent Container	FrIfController
Description	Reference to a L-PDU index

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Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_FrIf_06058]**		
Parameter Name	FrIfLPduIdx		
Parent Container	FrIfLPdu		
Description	This parameter identifies the L-PDU in the interaction between FlexRay Interface and FlexRay Driver.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 4095		
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 withAuto = true		

SWS Item	**[ECUC_FrIf_00008]**		
Parameter Name	FrIfReconfigurable		
Parent Container	FrIfLPdu		
Description	This parameter specifies that this LPdu is reconfigurable using FrIf_ReconfigLPdu. This means that this LPdu can be assigned to a different FrameTriggering at runtime. However, this reconfiguration is limited by hardware constraints. The direction of the LPdu cannot be reconfigured.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06057]**		
Parameter Name	FrIfVBTriggeringRef		
Parent Container	FrIfLPdu		
Description	Reference to the assigned Frame triggering.		
Multiplicity	1		
Type	Reference to FrIfFrameTriggering		
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

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Scope / Dependency	scope: local

No Included Containers

10.2.7 FrIfFrameTriggering

SWS Item	**[ECUC_FrIf_06090]**		
Container Name	FrIfFrameTriggering		
Parent Container	FrIfController		
Description	A Frame triggering contains the communication parameters of the FlexRay Frame as well as a reference to the Frame Construction Plan.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_FrIf_06049]**		
Parameter Name	FrIfAllowDynamicLSduLength		
Parent Container	FrIfFrameTriggering		
Description	Allows L-PDU length reduction ('FrIfLSduLength' defines max. length) and indicates that the related CC buffer has to be reconfigured for the actual length and Header-CRC before transmission of the L-PDU.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_00013]**		
Parameter Name	FrIfAlwaysTransmit		
Parent Container	FrIfFrameTriggering		
Description	Defines whether the driver's API function Fr_TransmitTxLPdu() shall always be called for this L-PDU.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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_FrIf_06051]		
Parameter Name	FrIfBaseCycle		
Parent Container	FrIfFrameTriggering		
Description	This parameter contains the FlexRay Base Cycle used to transmit this FlexRay Frame.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 63		
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_FrIf_06052]		
Parameter Name	FrIfChannel		
Parent Container	FrIfFrameTriggering		
Description	This parameter contains the FlexRay Channel used to transmit this FlexRay Frame.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	FRIF_CHANNEL_A	Channel A	
	FRIF_CHANNEL_AB	Channel A and B	
	FRIF_CHANNEL_B	Channel B	
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_FrIf_06053]		
Parameter Name	FrIfCycleRepetition		
Parent Container	FrIfFrameTriggering		
Description	This parameter contains the FlexRay Cycle Repetition used to transmit this FlexRay Frame. Possible values for FlexRay Protocol version 2.1: 1,2,4,8,16,32,64 Possible values for FlexRay Protocol version 3.0: 1,2,4,5,8,10,16,20,32,40,50,64		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 64		
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_FrIf_06054]		
Parameter Name	FrIfLSduLength		
Parent Container	FrIfFrameTriggering		
Description	The payload length of the Frame is given here. This parameter is required for validation if configured PDUs and update information fits into the Frame at configuration time [bytes].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 254		
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: The parameter depends on the low level parameters of the FlexRay CC.		

SWS Item	[ECUC_FrIf_00010]		
Parameter Name	FrIfMessageId		
Parent Container	FrIfFrameTriggering		
Description	The first two bytes of the payload segment of the FlexRay frame format for frames transmitted in the dynamic segment can be used as receiver filterable data called the message ID.		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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_FrIf_06055]		
Parameter Name	FrIfPayloadPreamble		
Parent Container	FrIfFrameTriggering		
Description	Switching the Payload Preamble bit.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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

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Scope / Dependency	scope: local

SWS Item	[ECUC_FrIf_06056]		
Parameter Name	FrIfSlotId		
Parent Container	FrIfFrameTriggering		
Description	This parameter contains the FlexRay Slot ID used to transmit this FlexRay Frame.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 2047		
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_FrIf_06048]		
Parameter Name	FrIfFrameStructureRef		
Parent Container	FrIfFrameTriggering		
Description	Reference to the Construction Plan of the FlexRay Frame.		
Multiplicity	1		
Type	Reference to FrIfFrameStructure		
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**
FrIfFrameTriggeringDemEvent ParameterRefs	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.

10.2.8 FrIfJobList

SWS Item	[ECUC_FrIf_05367]
Container Name	FrIfJobList
Parent Container	FrIfCluster
Description	This container specifies a list of all FlexRay Jobs of the Cluster to be performed by FrIf_JobListExec_<FrIfCluster.ShortName>().
Configuration Parameters	

SWS Item	[ECUC_FrIf_06063]		
Parameter Name	FrIfAbsTimerRef		
Parent Container	FrIfJobList		
Description	Reference to the absolute timer to be used to trigger the interrupt whose ISR contains the FrIf_JobListExec_<FrIfCluster.ShortName>() function.		
Multiplicity	1		
Type	Symbolic name reference to FrAbsoluteTimer		
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**
FrIfJob	1..*	A job may contain more than one operation that are executed at a specific point in time.

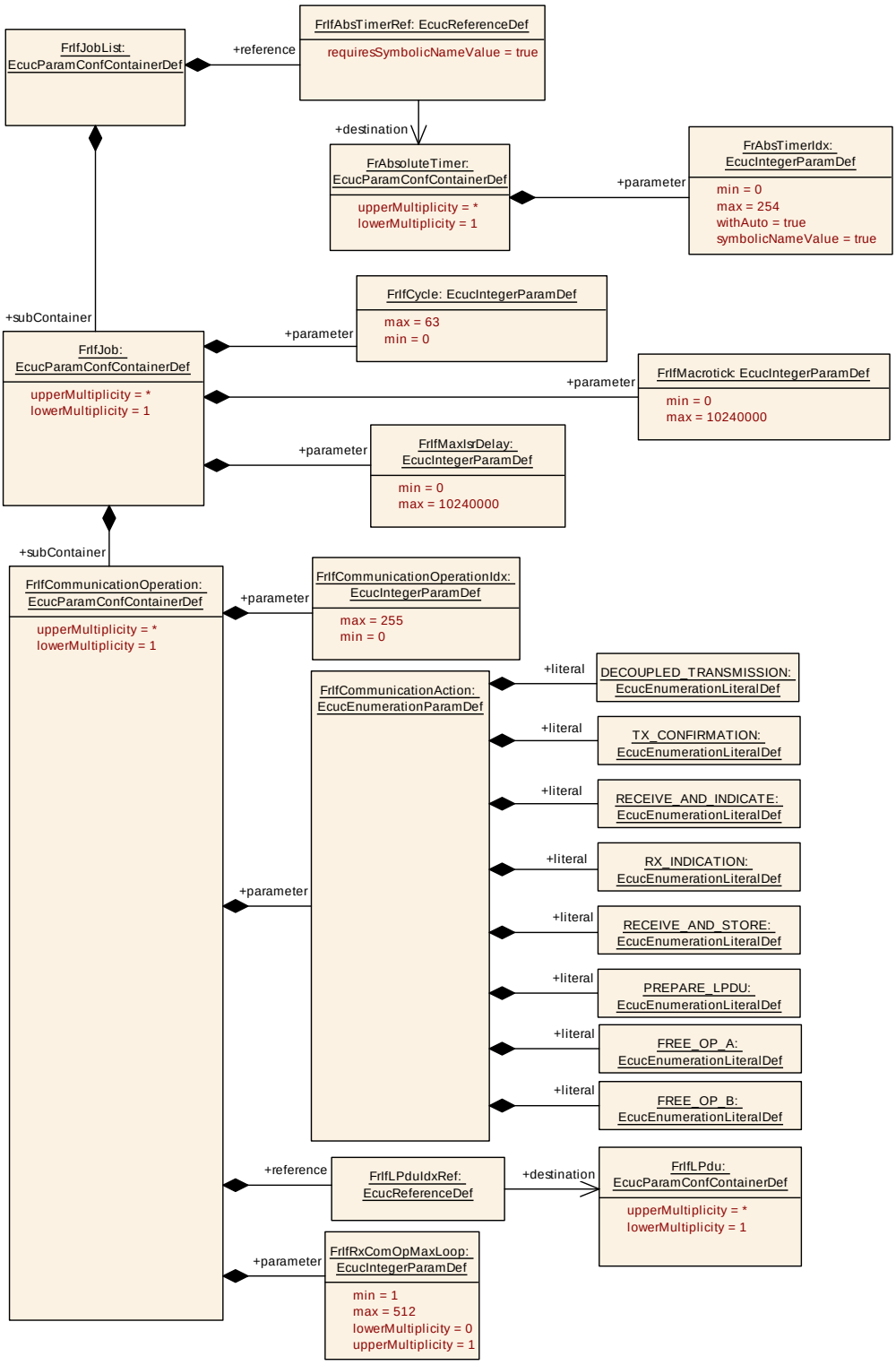

Figure 10.4: FlexRay Interface Joblist

10.2.9 FrIfJob

SWS Item	[ECUC_FrIf_05368]		
Container Name	FrIfJob		
Parent Container	FrIfJobList		
Description	A job may contain more than one operation that are executed at a specific point in time.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	[ECUC_FrIf_06064]		
Parameter Name	FrIfCycle		
Parent Container	FrIfJob		
Description	The FlexRay Cycle in which the communication operation will execute this job		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 63		
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_FrIf_06065]		
Parameter Name	FrIfMacrotick		
Parent Container	FrIfJob		
Description	Macrotick offset in the Cycle [Macrotick]		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 10240000		
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_FrIf_06004]
Parameter Name	FrIfMaxIsrDelay
Parent Container	FrIfJob
Description	The maximum delay in macroticks the FrIf_JobListExec_<FrIfCluster.ShortName>() function is processed after the absolute timer interrupt was triggered.
Multiplicity	1
Type	EcucIntegerParamDef

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Range	0 .. 10240000		
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		

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
FrIfCommunicationOperation	1..*	A separate operation which is part of a FlexRay Job and defines what type of action is executed.

10.2.10 FrIfCommunicationOperation

SWS Item	**[ECUC_FrIf_05369]**		
Container Name	FrIfCommunicationOperation		
Parent Container	FrIfJob		
Description	A separate operation which is part of a FlexRay Job and defines what type of action is executed.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_FrIf_06067]**		
Parameter Name	FrIfCommunicationAction		
Parent Container	FrIfCommunicationOperation		
Description	The action to be performed in the FlexRay Operation		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	DECOUPLED_TRANSMISSION	Decoupled transmission	
	FREE_OP_A	User defined communication operation.	
	FREE_OP_B	User defined communication operation.	
	PREPARE_LPDU	Prepare message buffer of CC	
	RECEIVE_AND_INDICATE	Immediate reception	
	RECEIVE_AND_STORE	Decoupled reception	
	RX_INDICATION	Reception indication	
	TX_CONFIRMATION	Transmission confirmation with optional Tx Conflict check	
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

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Scope / Dependency	scope: local dependency: FrIfCommunicationAction can be configured as PREPARE_LPDU only if FrPrepareLPduSupport (ECUC_Fr_00453) is configured as TRUE.

SWS Item	**[ECUC_FrIf_06068]**		
Parameter Name	FrIfCommunicationOperationIdx		
Parent Container	FrIfCommunicationOperation		
Description	For each FlexRay Communication Job, this index spans a range of zero-based consecutive values and thus defines the order of the FlexRay Communication Operation in the respective FlexRay Communication Job.		
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_FrIf_00007]**		
Parameter Name	FrIfRxComOpMaxLoop		
Parent Container	FrIfCommunicationOperation		
Description	Defines the maximum number of loops for the receive RECEIVE_AND_INDICATE (Use case: emptying a FIFO). Please note that the parameter is mandatory if FrIf CommunicationAction parameter is set to RECEIVE_AND_INDICATE. For all other operations this parameter can be ignored.		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	1 .. 512		
Default value	–		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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_FrIf_06066]**
Parameter Name	FrIfLPduIdxRef
Parent Container	FrIfCommunicationOperation
Description	Reference to a L-PDu index
Multiplicity	1
Type	Reference to FrIfLPdu
Post-Build Variant Value	true

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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

10.2.11 FrIfFrameStructure

SWS Item	**[ECUC_FrIf_05370]**		
Container Name	FrIfFrameStructure		
Parent Container	FrIfConfig		
Description	The Frame structure specifies a Construction Plan how a Frame is assembled with PDUs and their respective Update-Bits.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_FrIf_06113]**		
Parameter Name	FrIfByteOrder		
Parent Container	FrIfFrameStructure		
Description	This parameter defines the ByteOrder of all Pdus that are mapped into the Frame. The absolute position of a Pdu in the Frame is determined by the definition of the Byte Order parameter: If BIG_ENDIAN is specified, the FrIfPduOffset indicates the position of the most significant bit in the Frame. If LITTLE_ENDIAN is specified, the FrIfPdu Offset indicates the position of the least significant bit in the Frame.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	BIG_ENDIAN	–	
	LITTLE_ENDIAN	–	
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**
FrIfPdusInFrame	1..*	This container holds all the information about a PDU in a Flex Ray Frame.

10.2.12 FrIfPdusInFrame

SWS Item	[ECUC_FrIf_05371]		
Container Name	FrIfPdusInFrame		
Parent Container	FrIfFrameStructure		
Description	This container holds all the information about a PDU in a FlexRay Frame.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	[ECUC_FrIf_06070]		
Parameter Name	FrIfPduOffset		
Parent Container	FrIfPdusInFrame		
Description	The value specifies the offset of the PDU within the Frame [bytes].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 253		
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: This parameter depends on the number of PDUs contained in the Frame, PDU length, and Update-Bits of other PDUs in the Frame. In addition, if the Frame will is sent in static segment, this parameter depends on GPayloadLengthStatic.		

SWS Item	[ECUC_FrIf_06071]		
Parameter Name	FrIfPduUpdateBitOffset		
Parent Container	FrIfPdusInFrame		
Description	This value specifies where the PDU's Update-Bit is stored in the Frame (bit location of PDU's Update-Bit in the FlexRay Frame).		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	0 .. 2031		
Default value	–		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD

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Scope / Dependency	scope: local dependency: This parameter depends on the number of PDUs contained in the Frame, PDU length, and Update-Bits of other PDUs in the Frame. In addition, if the Frame will is sent in static segment, this parameter depends on GPayloadLengthStatic.

SWS Item	**[ECUC_FrIf_06069]**		
Parameter Name	FrIfPduRef		
Parent Container	FrIfPdusInFrame		
Description	This is the reference to the local definition of a PDU.		
Multiplicity	1		
Type	Reference to FrIfPdu		
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

10.2.13 FrIfPdu

SWS Item	**[ECUC_FrIf_05372]**		
Container Name	FrIfPdu		
Parent Container	FrIfConfig		
Description	Contains PDU information. A PDU may be either a transmission PDU or a reception PDU.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
FrIfPduDirection	1	A PDU is either transmit or receive

10.2.14 FrIfTxPdu

SWS Item	**[ECUC_FrIf_05374]**
Container Name	FrIfTxPdu
Parent Container	FrIfPduDirection
Description	This container specifies transmission PDUs.
Configuration Parameters	

SWS Item	[ECUC_FrIf_06075]		
Parameter Name	FrIfConfirm		
Parent Container	FrIfTxPdu		
Description	Defines whether the transmission of a PDU should be checked and confirmed to the PDU owning BSW module. If "FrIfUserTxUL" is configured as FR_TSYN then this parameter has to be set to FALSE for this PDU.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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: FrIfUserTxUL		

SWS Item	[ECUC_FrIf_06076]		
Parameter Name	FrIfCounterLimit		
Parent Container	FrIfTxPdu		
Description	This value states the maximum number of indication of ready PDU data to the FrIf (i.e. maximum number of invocations of FrIf_Transmit) without an intermediate transmission of the PDU.		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	1 .. 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_FrIf_06077]		
Parameter Name	FrIfImmediate		
Parent Container	FrIfTxPdu		
Description	Defines whether the PDU is transmitted immediate or decoupled.		
Multiplicity	1		
Type	EcucBooleanParamDef		
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: ECU		

SWS Item	[ECUC_FrIf_06050]
Parameter Name	FrIfNoneMode
Parent Container	FrIfTxPdu

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Description	Using the "None-Mode" which means that there is no API FrIf_Transmit call of the upper layer for this PDU.		
Multiplicity	0..1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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: FrIfImmediate		

SWS Item	**[ECUC_FrIf_00014]**		
Parameter Name	FrIfTxConfirmationName		
Parent Container	FrIfTxPdu		
Description	This parameter defines the name of the <User_TxConfirmation>. This parameter depends on the parameter FrIfUserTxUL. If FrIfUserTxUL equals FR_TP, FR_AR_TP, FR_NM, PDUR or XCP, the name of the <User_TxConfirmation> is fixed. If FrIfUserTx UL equals CDD, the name of the <User_TxConfirmation> is selectable.		
Multiplicity	0..1		
Type	EcucFunctionNameDef		
Default value	–		
Regular Expression	–		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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: ECU		

SWS Item	**[ECUC_FrIf_06078]**		
Parameter Name	FrIfTxPduId		
Parent Container	FrIfTxPdu		
Description	The global PDU identifier, which has to be used by the upper layer BSW module. The identifier has to be zero based and consecutive.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants

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	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: ECU withAuto = true		

SWS Item	**[ECUC_FrIf_06084]**		
Parameter Name	FrIfUserTriggerTransmitName		
Parent Container	FrIfTxPdu		
Description	This parameter defines the name of the <User_TriggerTransmit>. This parameter depends on the parameter FrIfUserTxUL. If FrIfUserTxUL equals FR_TP, FR_AR_TP, FR_NM, PDUR, FR_TSYN or XCP the name of the <User_TriggerTransmit> is fixed. If FrIfUserTxUL equals CDD, the name of the <User_TriggerTransmit> is selectable.		
Multiplicity	0..1		
Type	EcucFunctionNameDef		
Default value	–		
Regular Expression	–		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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: ECU dependency: FrIfImmediate		

SWS Item	**[ECUC_FrIf_00015]**		
Parameter Name	FrIfUserTxUL		
Parent Container	FrIfTxPdu		
Description	This parameter defines the upper layer (UL) module to which the trigger of the Pdu to be transmitted (via the <User_TriggerTransmit>) or the confirmation of the successfully transmitted Pdu has to be routed (via the <User_TxConfirmation>). Please note that handle IDs which are used in callback functions are defined by the upper layer module.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	CDD	Complex Driver	
	FR_AR_TP	FR AUTOSAR TP	
	FR_NM	FR NM	
	FR_TP	FR ISO TP	
	FR_TSYN	Global Time Synchronization over FlexRay	
	PDUR	PDU Router	
	XCP	Extended Calibration Protocol	
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

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Scope / Dependency	scope: ECU dependency: FrIfConfirm

SWS Item	**[ECUC_FrIf_06074]**		
Parameter Name	FrIfTxPduRef		
Parent Container	FrIfTxPdu		
Description	Reference to the external PDU definition.		
Multiplicity	1		
Type	Reference to Pdu		
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: ECU		

No Included Containers

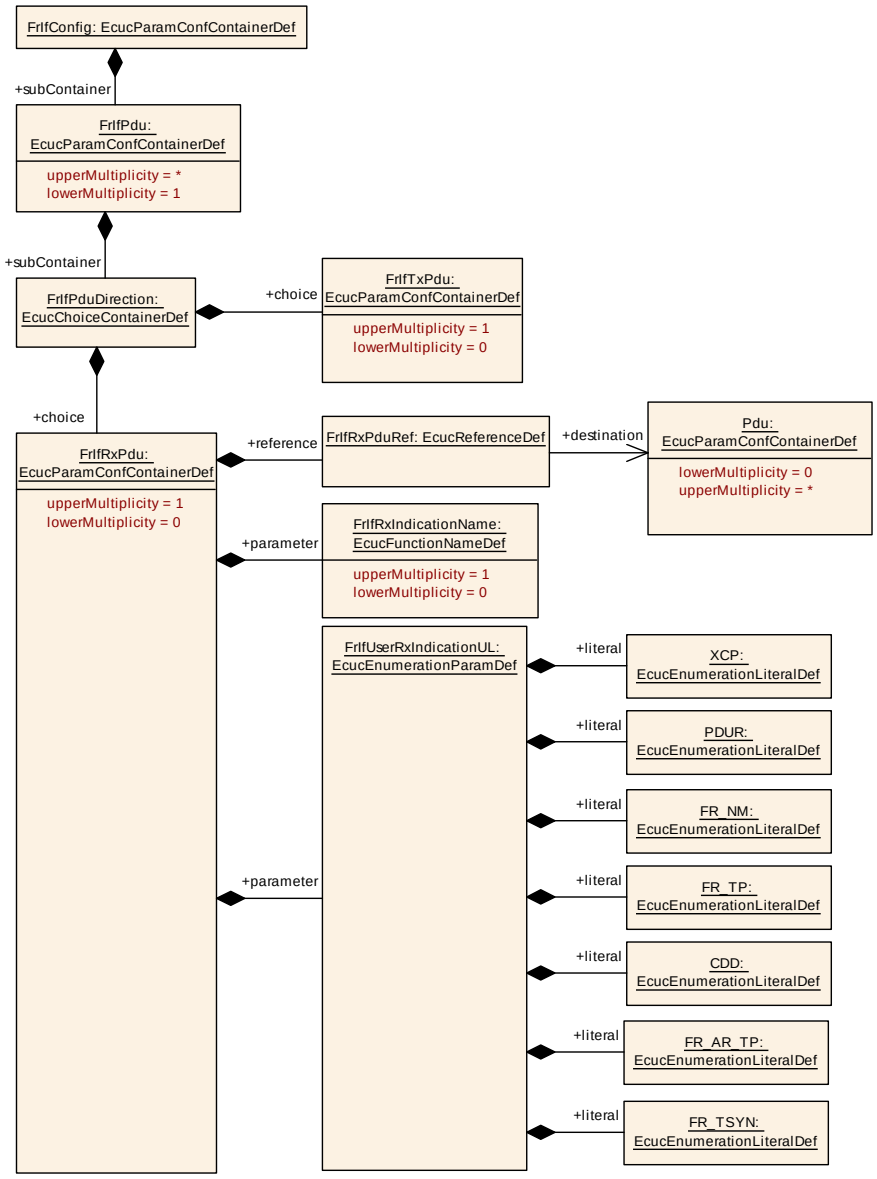

Figure 10.5: FlexRay Interface RX Pdu

10.2.15 FrIfRxPdu

SWS Item	[ECUC_FrIf_05373]
Container Name	FrIfRxPdu
Parent Container	FrIfPduDirection
Description	Receive PDU
Configuration Parameters	

SWS Item	[ECUC_FrIf_00016]		
Parameter Name	FrIfRxIndicationName		
Parent Container	FrIfRxPdu		
Description	This parameter defines the name of the <User_RxIndication>. This parameter depends on the parameter FrIfUserRxIndicationUL. If FrIfUserRxIndicationUL equals FR_TP, FR_AR_TP, FR_NM, PDUR, FR_TSYN or XCP, the name of the <User_RxIndication> is fixed. If FrIfUserRxIndicationUL equals CDD, the name of the <User_RxIndication> is selectable.		
Multiplicity	0..1		
Type	EcucFunctionNameDef		
Default value	–		
Regular Expression	–		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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: ECU		

SWS Item	[ECUC_FrIf_00017]	
Parameter Name	FrIfUserRxIndicationUL	
Parent Container	FrIfRxPdu	
Description	This parameter defines the upper layer (UL) module to which the indication of the successfully received FrIfRxPdu has to be routed via <User_RxIndication>. This <User_RxIndication> has to be invoked when the indication of the configured FrIfRx Pdu will be received by a Rx indication event from the FR Driver module. If no upper layer (UL) module is configured, no <User_RxIndication> has to be called in case of a Rx indication event of the FrIfRxPdu from the FR Driver module.	
Multiplicity	1	
Type	EcucEnumerationParamDef	
Range	CDD	Complex Driver
	FR_AR_TP	FR AR TP
	FR_NM	FR NM
	FR_TP	FR ISO TP
	FR_TSYN	Global Time Synchronization over FlexRay
	PDUR	PDU Router
	XCP	Extended Calibration Protocol
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: ECU	

SWS Item	[ECUC_FrIf_06073]
Parameter Name	FrIfRxPduRef
Parent Container	FrIfRxPdu
Description	Reference to the external PDU definition.

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Multiplicity	1		
Type	Reference to Pdu		
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: ECU		

No Included Containers

10.2.16 FrIfPduDirection

SWS Item	**[ECUC_FrIf_06072]**
Choice Container Name	FrIfPduDirection
Parent Container	FrIfPdu
Description	A PDU is either transmit or receive

Container Choices		
Container Name	**Multiplicity**	**Scope / Dependency**
FrIfRxPdu	0..1	Receive PDU
FrIfTxPdu	0..1	This container specifies transmission PDUs.

10.2.17 FrIfConfig

SWS Item	**[ECUC_FrIf_06001]**
Container Name	FrIfConfig
Parent Container	FrIf
Description	This container contains the configuration parameters and sub containers of the AUTOSAR FrIf module.
Configuration Parameters	

SWS Item	**[ECUC_FrIf_06121]**	
Parameter Name	FrIfMaxPduCnt	
Parent Container	FrIfConfig	
Description	Maximum number of Pdus. This parameter is needed only in case of post-build loadable implementation using static memory allocation.	
Multiplicity	0..1	
Type	EcucIntegerParamDef	
Range	0 .. 18446744073709551615	
Default value	–	
Post-Build Variant Multiplicity	false	
Post-Build Variant Value	false	

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Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Scope / Dependency	scope: local		

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
FrIfCluster	1..*	This container specifies a FrIf Cluster and all related data which is required to enable communication of the Cluster. A Cluster may consist of more than one Controller.
FrIfFrameStructure	1..*	The Frame structure specifies a Construction Plan how a Frame is assembled with PDUs and their respective Update-Bits.
FrIfPdu	1..*	Contains PDU information. A PDU may be either a transmission PDU or a reception PDU.

10.2.18 FrIfClusterDemEventParameterRefs

SWS Item	**[ECUC_FrIf_06091]**
Container Name	FrIfClusterDemEventParameterRefs
Parent Container	FrIfCluster
Description	Container for the references to DemEventParameter elements which shall be invoked using the API Dem_SetEventStatus in case the corresponding error occurs. The Event Id 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_FrIf_06097]**		
Parameter Name	FRIF_E_ACS_CH_A		
Parent Container	FrIfClusterDemEventParameterRefs		
Description	Reference to the DemEventParameter which shall be issued when an error in ACS on channel A was detected. If the reference is not configured the error shall not be reported.		
Multiplicity	0..1		
Type	Symbolic name reference to DemEventParameter		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD

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Scope / Dependency	scope: local

SWS Item	**[ECUC_FrIf_06098]**		
Parameter Name	FRIF_E_ACS_CH_B		
Parent Container	FrIfClusterDemEventParameterRefs		
Description	Reference to the DemEventParameter which shall be issued when an error in ACS on channel B was detected. If the reference is not configured the error shall not be reported.		
Multiplicity	0..1		
Type	Symbolic name reference to DemEventParameter		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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_FrIf_06093]**		
Parameter Name	FRIF_E_NIT_CH_A		
Parent Container	FrIfClusterDemEventParameterRefs		
Description	Reference to the DemEventParameter which shall be issued when an error in NIT on channel A was detected. If the reference is not configured the error shall not be reported.		
Multiplicity	0..1		
Type	Symbolic name reference to DemEventParameter		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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_FrIf_06094]**
Parameter Name	FRIF_E_NIT_CH_B
Parent Container	FrIfClusterDemEventParameterRefs
Description	Reference to the DemEventParameter which shall be issued when an error in NIT on channel B was detected. If the reference is not configured the error shall not be reported.
Multiplicity	0..1
Type	Symbolic name reference to DemEventParameter
Post-Build Variant Multiplicity	true
Post-Build Variant Value	true

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Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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_FrIf_06095]**		
Parameter Name	FRIF_E_SW_CH_A		
Parent Container	FrIfClusterDemEventParameterRefs		
Description	Reference to the DemEventParameter which shall be issued when an error in SW on channel A was detected. If the reference is not configured the error shall not be reported.		
Multiplicity	0..1		
Type	Symbolic name reference to DemEventParameter		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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_FrIf_06096]**		
Parameter Name	FRIF_E_SW_CH_B		
Parent Container	FrIfClusterDemEventParameterRefs		
Description	Reference to the DemEventParameter which shall be issued when an error in SW on channel B was detected. If the reference is not configured the error shall not be reported.		
Multiplicity	0..1		
Type	Symbolic name reference to DemEventParameter		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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

10.2.19 FrIfFrameTriggeringDemEventParameterRefs

SWS Item	[ECUC_FrIf_06099]
Container Name	FrIfFrameTriggeringDemEventParameterRefs
Parent Container	FrIfFrameTriggering
Description	Container for the references to DemEventParameter elements which shall be invoked using the API Dem_SetEventStatus in case the corresponding error occurs. The Event Id 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_FrIf_00009]		
Parameter Name	FRIF_E_LPDU_SLOTSTATUS		
Parent Container	FrIfFrameTriggeringDemEventParameterRefs		
Description	Reference to DEM event Id that is reported when FlexRay driver module detects slot errors. If this parameter is not configured, no event reporting happens.		
Multiplicity	0..1		
Type	Symbolic name reference to DemEventParameter		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
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.

A Not applicable requirements

[SWS_FrIf_NA_06118] ⌈These requirements are not applicable to this specification.⌋*(SRS_BSW_00159, SRS_BSW_00167, SRS_BSW_00416, SRS_BSW_00168, SRS_BSW_00423, SRS_BSW_00424, SRS_BSW_00425, SRS_BSW_00427, SRS_BSW_00428, SRS_BSW_00429, SRS_BSW_00417, SRS_BSW_00386, SRS_BSW_00161, SRS_BSW_00005, SRS_BSW_00415, SRS_BSW_00164, SRS_BSW_00325, SRS_BSW_00413, SRS_BSW_00347, SRS_BSW_00335, SRS_BSW_00410, SRS_BSW_00314, SRS_BSW_00328, SRS_BSW_00312, SRS_BSW_00006, SRS_BSW_00377, SRS_BSW_00306, SRS_BSW_00330, SRS_BSW_00331, SRS_BSW_00009, SRS_BSW_00172, SRS_BSW_00010, SRS_BSW_00333, SRS_BSW_00341, SRS_Fr_05009)*

B Change history of AUTOSAR traceable items

Please note that the lists in this chapter also include traceable items that have been removed from the specification in a later version. These items do not appear as hyperlinks in the document.

B.1 Traceable item history of this document according to AUTOSAR Release R23-11

B.1.1 Added Specification Items in R23-11

none

B.1.2 Changed Specification Items in R23-11

none

B.1.3 Deleted Specification Items in R23-11

none