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01.12.2011	3.3.0	AUTOSAR Administration	Added User-defined communication operations
06.10.2010	3.2.0	AUTOSAR Administration	• API “FrIf_GetCycleLength” added • API “FrIf_ReadCCConfig” added • APIs FrIf_EnableTransceiverWakeup / FrIf_DisableTransceiverWakeup removed • Configuration parameter “FrIfByteOrder” added
04.12.2009	3.1.0	AUTOSAR Administration	• 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
23.06.2008	3.0.2	AUTOSAR Administration	Legal disclaimer revised
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28.12.2007	3.0.0	AUTOSAR Administration	• 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

Document Change History			
Date	**Version**	**Changed by**	**Change Description**
			extended Small layout adaptations made
06.02.2007	2.0.1	AUTOSAR Administration	• "Advice for users" revised • Legal disclaimer added • "Revision Information" added • Release Notes added
30.06.2006	2.0.0	AUTOSAR Administration	Second Release
19.09.2005	1.0.0	AUTOSAR Administration	Initial Release

Disclaimer

Advice for users:

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Table of Content

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

2 Information about this Document

2.1 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 Device 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 FlexRay 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 FlexRay 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.

2.2 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 Device 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	Development 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

[1] List of Basic Software Modules
AUTOSAR_TR_BSWModuleList.pdf

[2] Layered Software Architecture
AUTOSAR_EXP_LayeredSoftwareArchitecture.pdf

[3] General Requirements on Basic Software Modules
AUTOSAR_SRS_BSWGeneral.pdf

[4] Input for API Specification of AUTOSAR COM Stack

[5] Specification of Communication Stack Types
AUTOSAR_SWS_CommunicationStackTypes.pdf

[6] Requirements on FlexRay
AUTOSAR_SRS_FlexRay.pdf

[7] Specification of FlexRay Driver
AUTOSAR_SWS_FlexRay.pdf

[8] Specification of FlexRay State Manager
AUTOSAR_SWS_FlexRayStateManager.pdf

[9] Specification of FlexRay Transceiver Driver
AUTOSAR_SWS_FlexRayTransceiverDriver.pdf

[10] Specification of FlexRay Transport Layer
AUTOSAR_SWS_FlexRayTransportLayer.pdf

[11] Specification of FlexRay Network Management
AUTOSAR_SWS_FlexRayNetworkManagement.pdf

[12] Specification of PDU Router
AUTOSAR_SWS_PDURouter

[13] Specification of BSW Scheduler
AUTOSAR_SWS_BSW_Scheduler

[14] Specification of ECU Configuration
AUTOSAR_TPS_ECUConfiguration

[15] Specification of Memory Mapping

3.2 Related Standards and Norms

[16] FlexRay Communications System Protocol Specification Version 2.1 Revision A

[17] FlexRay Communications System Electrical Physical Layer Specification Version 2.1 Revision A

[18] FlexRay Communications System Protocol Specification Version 3.0

[19] Flexray Communications System Electrical Physical Layer Specification 3.0

[20] HIS subset of the MISRA C Standard

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 = $(B + n * 2^R)_{mod64}$

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

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

For 3.0 FlexRay Hardware, the Cycle Counter Filtering shall be possible as described in [19]

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

[FrIf05074] ⌈ ⌋ (BSW00384)

5.1 AUTOSAR Operating System

[FrIf05099] ⌈There is one dedicated FlexRay Job List Execution Function for each FlexRay Cluster. ⌋ ()

[FrIf05100] ⌈The FlexRay Interface module shall execute the Flexray Job List Execution Function. ⌋ ()

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 AUTOSAR BSW Scheduler

[FrIf05101] ⌈For each FlexRay Cluster, one dedicated FlexRay Interface Main Function shall be provided to the BSW Scheduler. ⌋ (BSW00433)

Note: Each of these FlexRay Interface Main Functions must be called cyclically from a task body provided by the BSW Scheduler. The calling period must be configurable. (Refer to parameter `FrIfMainFunctionPeriod`)

5.3 All Upper Layer AUTOSAR BSW Modules

[FrIf05050] ⌈The calling of the FlexRay Job List Execution Function by the FlexRay 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. ⌋ (BSW05000)

[FrIf05148] ⌈The FlexRay Interface module shall ensure data consistency in its buffers. ⌋ ()

Rationale for FrIf05148: 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.

5.4 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.

5.5 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.

5.6 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.

5.7 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 AUTOSAR Development Error Tracer

[FrIf05065] ⌈In order to be able to report development errors, the FrIf module has to have access to the error hook of the Development Error Tracer. ⌋(BSW05102)

5.10 AUTOSAR Diagnostic Event Manager

[FrIf05066] ⌈In order to be able to report production errors, the FrIf module has to have access to the Diagnostic Event Manager. ⌋(BSW05102)

5.11 File Structure

5.11.1 Code File Structure

[FrIf05149] ⌈The code file structure shall not be defined within this specification completely. At this point it shall be pointed out that the code-file structure shall include the following files named
:
FrIf_Lcfg.c for link time configurable parameters and
FrIf_PBcfg.c for post build time configurable parameters

These files shall contain all link time and post build time configurable parameters. ⌋(BSW00380, BSW00419, BSW00381, BSW00383, BSW00346, BSW158)

[FrIf05150] ⌈Additionally, the code-file structure shall include the following files:
FrIf.c general source code file of the FlexRay Interface
FrIf_Cfg.c contains pre-compile time configurable parameters
⌋(BSW00380, BSW00419, BSW00381, BSW00383, BSW00346, BSW158)

5.11.2 Header File Structure

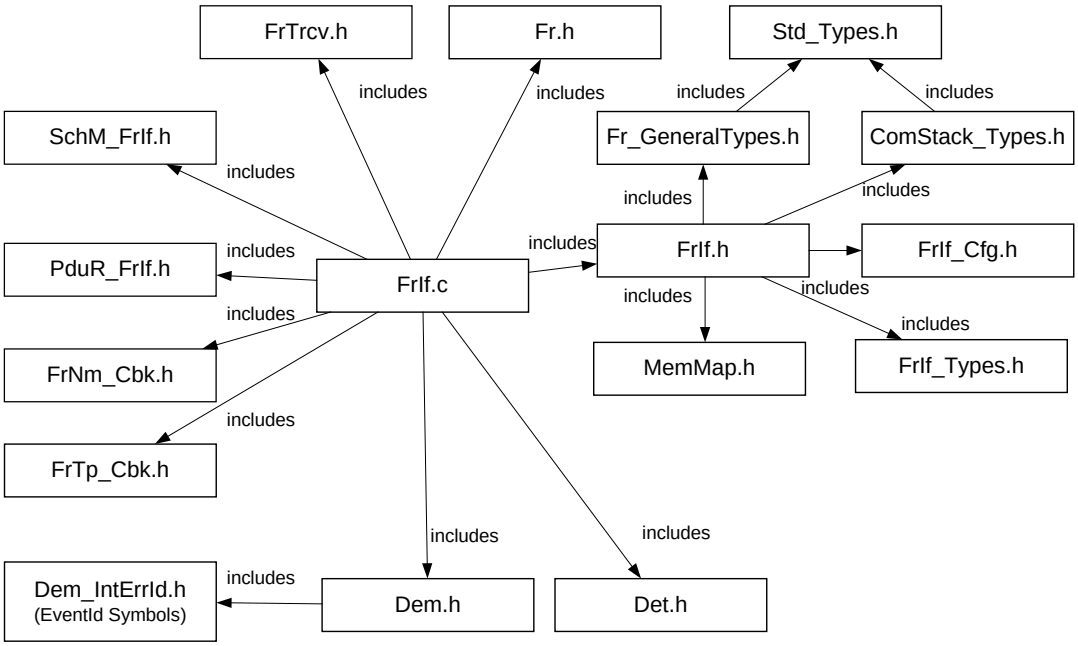

Figure 5-1: FlexRay Interface Header File Structure

[FrIf05076b] The header file structure shall contain the following header files:

FrIf_Cfg.h — contains the FrIf pre-compile-time configurable parameters (pre processor constants)

[FrIf05076d]

Fr.h — contains the declarations of the API services of the FlexRay Driver used by the FlexRay Interface

[FrIf05076e]

FrTrcv.h — contains the declarations of the API services of the FlexRay Transceiver Driver used by the FlexRay Interface.

[FrIf05076f]

Fr_GeneralTypes.h — contains declarations shared by all AUTOSAR FlexRay BSW modules

[FrIf05076g]

ComStack_Types.h — contains the communication module abstracted datatypes shared by AUTOSAR communication BSW.

[FrIf05076h]

PduR_FrIf.h — contains the declarations of API services the PDU router offers to the FlexRay Interface

[FrIf05076i]

FrNm_Cbk.h — contains the declarations of API services the FrNm offers to the FlexRay Interface

[FrIf05076j]

FrTp_Cbk.h — contains the declarations of API services the FrTp offers to the FlexRay Interface

[FrIf05076l]

Det.h — contains the declarations of the API services of the Det optionally used by the FlexRay Interface

[FrIf05076m]

SchM_FrIf.h — contains the declaration of the API services the SchM offers to the FlexRay Interface

[FrIf05076q]

MemMap.h — MemMap.h Contains the declaration of the API services to apply the memory mapping abstraction mechanisms as specified by Specification of Memory Mapping

[FrIf05076r]

FrIf_Types.h — contains the declaration of FrIf specific types.

[FrIf05081] ⌈All files related to the FrIf module shall follow the naming convention *FrIf[_<description>].<extension>*⌋ (BSW00300)

[FrIf05091a] ⌈The FrIf module shall include the *Dem.h* file. ⌋ ()

[FrIf05091b] ⌈By this inclusion the APIs to report errors as well as the required Event Id symbols are included. ⌋ ()

[FrIf05091c] ⌈This specification defines the name of the Event Id symbols, which are provided by XML to the DEM configuration tool. ⌋ ()

[FrIf05091d] ⌈The DEM configuration tool assigns ECU dependent values to the Event Id symbols and publishes the symbols in *Dem_IntErrId.h*. ⌋ ()

[FrIf05140a] ⌈The implementation of the FrIf module shall provide the header file *FrIf.h*, which is the main module interface file. ⌋ ()

[FrIf05140b] ⌈It shall contain all types and function prototypes required by the FrIf module's environment. ⌋ ()

[FrIf05141] ⌈The implementation of the FrIf module shall provide the header file *FrIf_Cfg.h* that shall contain the pre-compile-time configuration parameters. ⌋ (BSW00343, BSW00302)

[FrIf05087] ⌈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 [13]. ⌋ (BSW00435)

[FrIf05088] ⌈The FrIf module header file FrIf.h shall include *MemMap.h* and apply the memory mapping abstraction mechanisms as specified by [15]. ⌋ (BSW00436)

[FrIf05090] ⌈The header file *FrIf.h* shall contain a software and specification version number. ⌋ (BSW004)

6 Requirements Traceability

Requirement	Satisfied by
	FrIf06118
-	FrIf05220
-	FrIf05153
-	FrIf05140a
-	FrIf05304
-	FrIf05091c
-	FrIf05207
-	FrIf05423
-	FrIf05201
-	FrIf05259
-	FrIf05402
-	FrIf05209
-	FrIf05415
-	FrIf05145
-	FrIf05315
-	FrIf05213
-	FrIf05174
-	FrIf05202
-	FrIf05064
-	FrIf05247
-	FrIf05285
-	FrIf05311
-	FrIf05701
-	FrIf05171
-	FrIf05179
-	FrIf05112
-	FrIf05203
-	FrIf05156
-	FrIf05232
-	FrIf05085
-	FrIf05102
-	FrIf05072
-	FrIf05712
-	FrIf05420
-	FrIf05280
-	FrIf05294

-	FrIf05308
-	FrIf05032
-	FrIf05309
-	FrIf05716
-	FrIf05154
-	FrIf05305
-	FrIf05307
-	FrIf05048
-	FrIf05301
-	FrIf05170
-	FrIf05704
-	FrIf05419
-	FrIf05178
-	FrIf05169
-	FrIf05296
-	FrIf05047
-	FrIf05070
-	FrIf05161
-	FrIf05271
-	FrIf05120f
-	FrIf05208
-	FrIf05045
-	FrIf05137
-	FrIf05264
-	FrIf05295
-	FrIf05234
-	FrIf05414
-	FrIf05120d
-	FrIf05020
-	FrIf05123
-	FrIf05238
-	FrIf05710
-	FrIf05216
-	FrIf05115
-	FrIf05242
-	FrIf05246
-	FrIf05190
-	FrIf05129

-	FrIf05717
-	FrIf05287
-	FrIf05718
-	FrIf05233
-	FrIf05416
-	FrIf05194
-	FrIf05121
-	FrIf05306
-	FrIf05018
-	FrIf05122
-	FrIf05197
-	FrIf05177
-	FrIf05120h
-	FrIf05173
-	FrIf05401
-	FrIf05092
-	FrIf05283
-	FrIf05706
-	FrIf05159
-	FrIf05117
-	FrIf05237
-	FrIf05148
-	FrIf05713
-	FrIf05120g
-	FrIf05162
-	FrIf05274
-	FrIf05714
-	FrIf05700
-	FrIf05289
-	FrIf05424
-	FrIf05021
-	FrIf05093
-	FrIf05214
-	FrIf05107
-	FrIf05204
-	FrIf05096
-	FrIf05027
-	FrIf05243

-	FrIf05124
-	FrIf05128
-	FrIf05138
-	FrIf05193
-	FrIf05221
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-	FrIf05199
-	FrIf05094
-	FrIf05290
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-	FrIf05041
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-	FrIf05708
-	FrIf05310
-	FrIf05016
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-	FrIf05711
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-	FrIf05313
-	FrIf05073
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-	FrIf05252
-	FrIf05412
-	FrIf05284
-	FrIf05120c
-	FrIf05120a
-	FrIf05299
-	FrIf05720
-	FrIf05418
-	FrIf05211
-	FrIf05413
-	FrIf05705
-	FrIf05500
-	FrIf05277
-	FrIf05100
-	FrIf05212

-	FrIf05719
-	FrIf05158
-	FrIf05707
-	FrIf05140b
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-	FrIf05040
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-	FrIf05215
-	FrIf05160
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-	FrIf05275
-	FrIf05176
-	FrIf05715
-	FrIf05110
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-	FrIf05151
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-	FrIf05118

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-	FrIf05728
-	FrIf05131
-	FrIf05091b
-	FrIf05119
-	FrIf05010
-	FrIf05091d
-	FrIf05113
-	FrIf05302
-	FrIf05236
-	FrIf05272

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-	FrIf05017
-	FrIf05023
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-	FrIf05291
-	FrIf05270
-	FrIf05015
-	FrIf05297
-	FrIf05218
-	FrIf05120b
-	FrIf05182
-	FrIf05260
-	FrIf05028
-	FrIf05130
-	FrIf05709
-	FrIf05164
-	FrIf05295a
-	FrIf05198
-	FrIf05120e
-	FrIf05312
-	FrIf05266
-	FrIf05125
-	FrIf05200
-	FrIf05400
-	FrIf05231
BSW00300	FrIf05081
BSW00302	FrIf05141
BSW00304	FrIf05001
BSW00305	FrIf05082
BSW00306	FrIf06118
BSW00307	FrIf05083

BSW00308	FrIf05143
BSW00310	FrIf05083
BSW00312	FrIf06118
BSW00314	FrIf06118
BSW00325	FrIf06118
BSW00326	FrIf06118
BSW00327	FrIf05142
BSW00328	FrIf06118
BSW00329	FrIf06118
BSW00330	FrIf06118
BSW00331	FrIf06118
BSW00333	FrIf06118
BSW00334	FrIf05089
BSW00335	FrIf06118
BSW00336	FrIf05006
BSW00337	FrIf05139
BSW00341	FrIf06118
BSW00342	FrIf05078
BSW00343	FrIf05141
BSW00345	FrIf05069
BSW00346	FrIf05149, FrIf05150
BSW00347	FrIf06118
BSW00348	FrIf05001
BSW00350	FrIf05084
BSW00353	FrIf05001
BSW00355	FrIf05001
BSW00358	FrIf05003
BSW00361	FrIf05001
BSW00370	FrIf06118
BSW00371	FrIf06118
BSW00373	FrIf06118
BSW00375	FrIf05036
BSW00376	FrIf06118
BSW00377	FrIf06118
BSW00378	FrIf05001
BSW00380	FrIf05149, FrIf05150
BSW00381	FrIf05149, FrIf05150
BSW00383	FrIf05149, FrIf05150

BSW00384	FrIf05074
BSW00386	FrIf06118
BSW00387	FrIf06118
BSW004	FrIf05090
BSW00404	FrIf05069
BSW00405	FrIf05003
BSW00406	FrIf05298
BSW00407	FrIf05002
BSW00410	FrIf06118
BSW00411	FrIf05002
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BSW00433	FrIf05101
BSW00434	FrIf06118
BSW00435	FrIf05087
BSW00436	FrIf05088
BSW005	FrIf06118
BSW006	FrIf06118
BSW007	FrIf05080
BSW009	FrIf06118
BSW010	FrIf06118
BSW05000	FrIf05050
BSW05007	FrIf05053
BSW05009	FrIf06118
BSW05010	FrIf05052

BSW05013	FrIf05003
BSW05015	FrIf05005
BSW05016	FrIf05007
BSW05018	FrIf05011
BSW05022	FrIf05014
BSW05027	FrIf05063
BSW05031	FrIf05004
BSW05035	FrIf06118
BSW05038	FrIf06118
BSW05039	FrIf05034
BSW05042	FrIf05061
BSW05056	FrIf05054
BSW05063	FrIf05006
BSW05067	FrIf06118
BSW05068	FrIf06118
BSW05069	FrIf06118
BSW05078	FrIf06118
BSW05096	FrIf05060
BSW05097	FrIf05057
BSW05101	FrIf06118
BSW05102	FrIf05066, FrIf05065, FrIf06118
BSW05113	FrIf06118
BSW05126	FrIf05056
BSW05130	FrIf05058
BSW05153	FrIf06118
BSW05155	FrIf05005
BSW05157	FrIf05035
BSW05158	FrIf05036
BSW05161	FrIf05039
BSW05162	FrIf06118
BSW05163	FrIf06118
BSW05164	FrIf06118
BSW05165	FrIf06118
BSW05170	FrIf05062
BSW101	FrIf05003
BSW158	FrIf05149, FrIf05150
BSW159	FrIf06118
BSW160	FrIf05079

BSW161	FrIf06118
BSW162	FrIf06118
BSW164	FrIf06118
BSW167	FrIf06118
BSW168	FrIf06118
BSW170	FrIf05089
BSW171	FrIf05089
BSW172	FrIf06118

6.1 Specification Items

The following Items shall be seen as implementation hints only!

Functional Specification

Abstraction of FlexRay Transceivers	FrIf05105, FrIf05106
Usage of Controller and Channel Index	FrIf05106
Usage of zero-based index	FrIf05107
Usage of FR Cluster Index	FrIf05108
Configuration Data	FrIf05109
Usage of PDU index	FrIf05110
Support one of both or both FlexRay Channels	FrIf05111
Support of at least four FlexRay Clusters	FrIf05112
Support of at least one absolute timer per FlexRay CCs	FrIf05113

FlexRay Interface State Machine

One State Machine per Cluster	FrIf05115
FrIf_State offline during initialization	FrIf05117

FlexRay Interface Main Function

One Main Function for each FlexRay Cluster	FrIf05119
Main Function tasks	FrIf05120

Data Communication via FlexRay

Packaging of multible PDUs in one FR Frame	FrIf05121
Frame construction plan (layout)	FrIf05122
Frame construction plan (config)	FrIf05123
Transmission rule	FrIf05124
Update Information per PDU	FrIf05125
Location of Update Information	FrIf05126
Configuration of Update Information	FrIf05127
Indication in case of no update information	FrIf05128
Transmission with Immediate Buffer Access	FrIf05129
Ensure synchronous buffer access	FrIf05130
Sortation of Communication Job	FrIf05131
Communication Job properties	FrIf05368

Communication Job execution start time	FrIf05133
Actions specified by Communication Operation	FrIf05134
Communication Operation properties	FrIf05369
Job List Execution Function nameing	FrIf05136
Job List synchronously to global time	FrIf05137
Job List Execution Function actions	FrIf05138

7 Functional Specification

7.1 FlexRay BSW Stack

As part of the AUTOSAR Layered Software Architecture according to [2], the FlexRay BSW modules also form a layered software stack.
Figure 7-1 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.

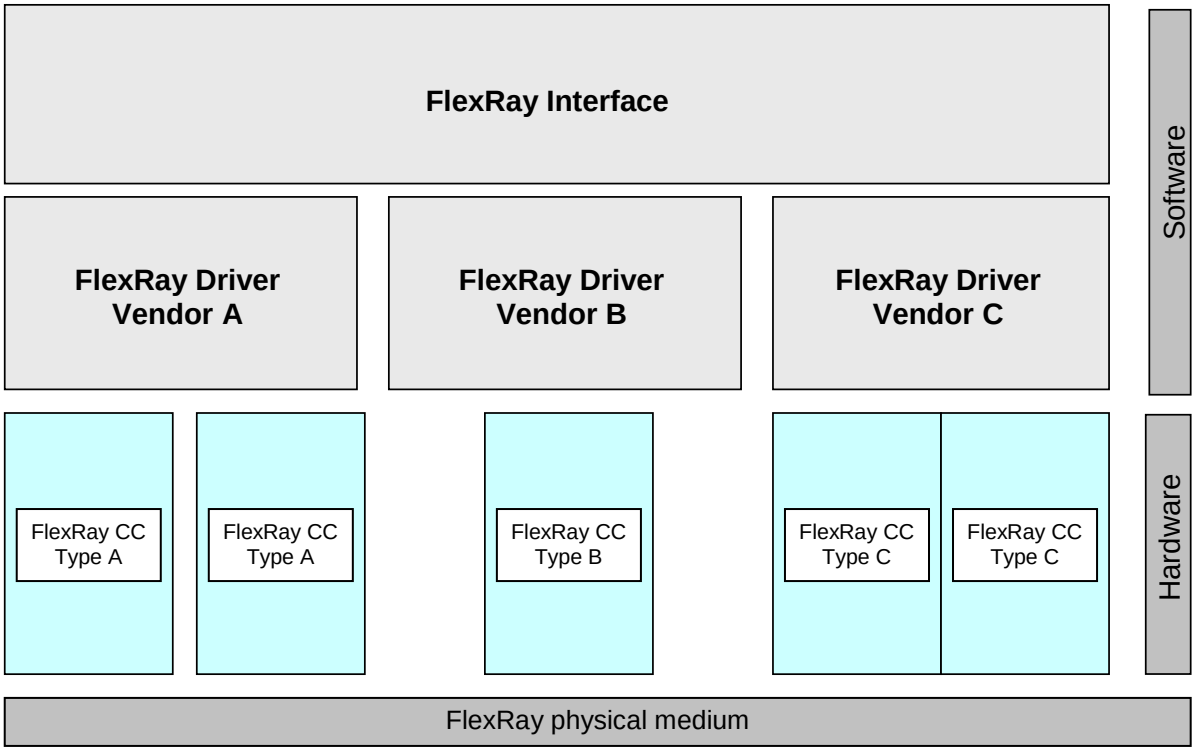


Figure 7-1: Basic Structure of the FlexRay BSW Stack

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 FlexRay 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.

[FrIf05052] ⌈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. ⌋ (BSW05010)

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:

1. **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
2. **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

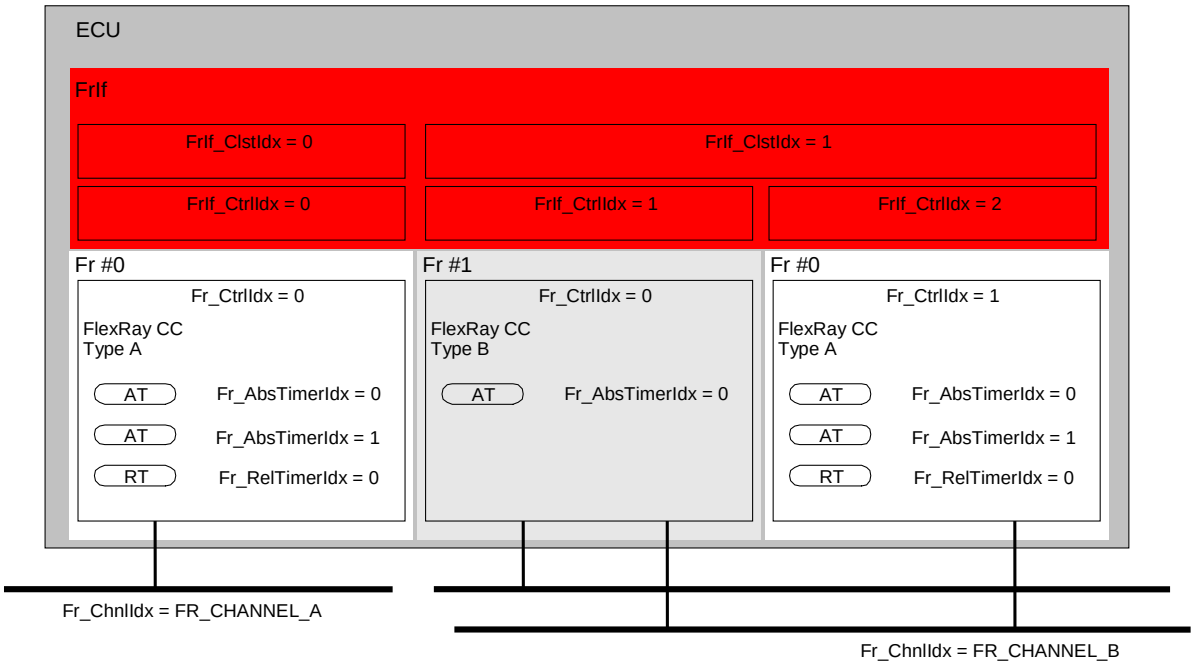


Figure 7-2: CC Indexing Scheme of the FlexRay Interface

[FrIf05060] ⌈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. ⌋ (BSW05096)

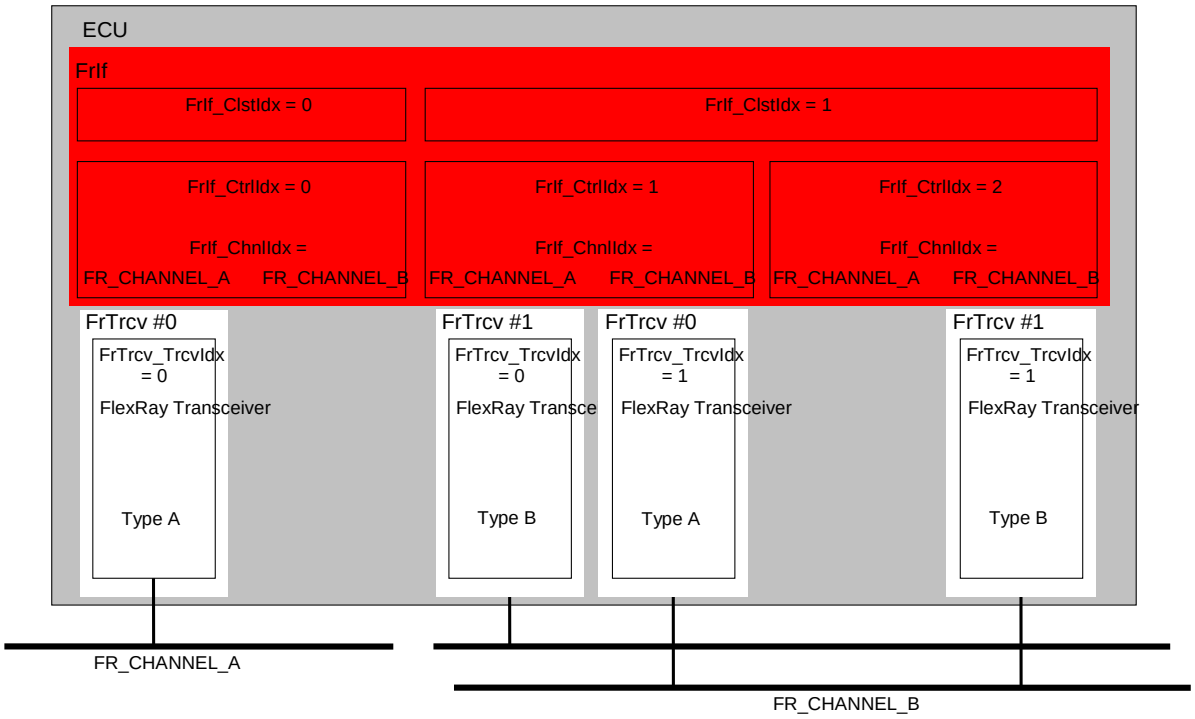


Figure 7-3: Flexray Transceiver Indexing Scheme of the FlexRay Interface

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.”

[FrIf05107] ⌈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). ⌋ ()

[FrIf05110] ⌈The FrIf module shall number all PDUs to be transmitted with an abstract, unique, zero-based consecutive index FrIf_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

[FrIf05057] ⌈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. ⌋ (BSW05097)

[FrIf05053] ⌈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**. ⌋ (BSW05007)

[FrIf05111] ⌈It shall be possible that the FrIf module can be configured to support one of both or both **FlexRay Channels** as specified in [16]. ⌋ ()

[FrIf05112] ⌈It shall be possible that the FrIf module can be configured using the parameter FRIF_CLST_IDX to support at least four **FlexRay Clusters**. ⌋ ()

[FrIf05113] ⌈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 FlexRay CCs. ⌋ ()

7.3 FlexRay Interface State Machine

[FrIf05115] ⌈
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

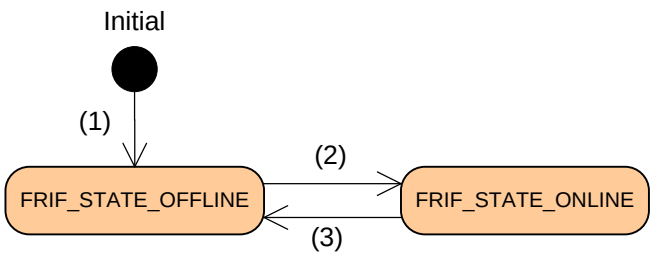


Figure 7-4: FlexRay Interface State Machine

Figure 7-4 shows the states and transistions that are visible to the user of a FrIf module. The two different states, which are defined as FrIf type FrIf_StateType (see 8.2.2), represent the communication capabilities of a FrIf module.

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

⌋()

[FrIf05117] ⌈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. ⌋()

[FrIf05118] ⌈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." (refer to figure 7-4 transsition (2)).
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." (refer to figure 7-4 transition (3)).
Otherwise, do not perform a state transition.

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

⌋()

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”.

[FrIf05119] ⌈The FrIf module shall provide one dedicated FlexRay Interface Main Function for each FlexRay Cluster that is controlled by that FrIf module. ⌋ ()

[FrIf05283] ⌈The API names of the FlexRay Interface Main Functions shall obey the following pattern:

- FrIf_MainFunction_0() for Cluster # 0 (FrIf_ClstIdx = 0)
- FrIf_MainFunction_1() for Cluster # 1 (FrIf_ClstIdx = 1)
- FrIf_MainFunction_2() for Cluster # 2 (FrIf_ClstIdx = 2)
- FrIf_MainFunction_3() for Cluster # 3 (FrIf_ClstIdx = 3)
- … and so on, if more than 4 FlexRay Clusters are supported.

⌋ ()

[FrIf05120a] ⌈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. ⌋ ()

[FrIf05120b] ⌈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. ⌋ ()

[FrIf05120c] ⌈If the optional configuration parameter FRIF_E_NIT_CH_A exists, then the channel status information shall be reported to DEM as Dem_ReportErrorStatus (FRIF_E_NIT_CH_A, DEM_EVENT_STATUS_FAILED) when any of the error bits of a single controller (Channel A NIT status data vSS!SyntaxError, vSS!Bviolation) is set or as Dem_ReportErrorStatus (FRIF_E_NIT_CH_A, DEM_EVENT_STATUS_PASSED) when none of these error bits is set. ⌋ ()

[FrIf05120d] ⌈If the optional configuration parameter FRIF_E_NIT_CH_B exists, then the channel status information shall be reported to DEM as Dem_ReportErrorStatus (FRIF_E_NIT_CH_B, DEM_EVENT_STATUS_FAILED) when any of the error bits of a single controller (Channel B NIT status data vSS!SyntaxError, vSS!Bviolation) is set or as Dem_ReportErrorStatus (FRIF_E_NIT_CH_B, DEM_EVENT_STATUS_PASSED) when none of these error bits is set. ⌋ ()

[FrIf05120e] ⌈If the optional configuration parameter FRIF_E_SW_CH_A exists, then the channel status information shall be reported to DEM as Dem_ReportErrorStatus (FRIF_E_SW_CH_A, DEM_EVENT_STATUS_FAILED) when any of the error bits of a single controller (Channel A symbol window status data vSS!SyntaxError, vSS!Bviolation, vSS!TxConflict) is set or as Dem_ReportErrorStatus (FRIF_E_SW_CH_A, DEM_EVENT_STATUS_PASSED) when none of these error bits is set. ⌋ ()

[FrIf05120f] ⌈If the optional configuration parameter FRIF_E_SW_CH_B exists, then the channel status information shall be reported to DEM as Dem_ReportErrorStatus (FRIF_E_SW_CH_B, DEM_EVENT_STATUS_FAILED) when any of the error bits of a single controller (Channel B symbol window status data vSS!SyntaxError, vSS!Bviolation vSS!TxConflict) is set or as Dem_ReportErrorStatus (FRIF_E_SW_CH_B, DEM_EVENT_STATUS_PASSED) when none of these error bits is set. ⌋ ()

[FrIf05120g] ⌈If the optional configuration parameter FRIF_E_ACS_CH_A exists, then the channel status information shall be reported to DEM as Dem_ReportErrorStatus (FRIF_E_ACS_CH_A , DEM_EVENT_STATUS_FAILED) 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_ReportErrorStatus (FRIF_E_ACS_CH_A, DEM_EVENT_STATUS_PASSED) when none of these error bits is set. ⌋ ()

[FrIf05120h] ⌈If the optional configuration parameter FRIF_E_ACS_CH_B exists, then the channel status information shall be reported to DEM as Dem_ReportErrorStatus (FRIF_E_ACS_CH_B, DEM_EVENT_STATUS_FAILED) when any of the error bits of a single controller (Channel B symbol window status data vSS!SyntaxError, vSS!ContentError, vSS!Bviolation, vSS!TxConflict) is set or as Dem_ReportErrorStatus (FRIF_E_ACS_CH_B, DEM_EVENT_STATUS_PASSED) when none of these error bits is set. ⌋ ()

[FrIf05120i] ⌈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

[FrIf05096] ⌈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). ⌋ ( )

[FrIf05069] ⌈The FrIf module shall support pre-compile time, link-time and post-build-time configuration. ⌋ (BSW00404, BSW00345)

[FrIf05284] ⌈The FrIf module shall implement link-time and post-build-time configuration data as read-only data structures. ⌋ ()

[FrIf05285] ⌈The FrIf module shall immediately reference link-time configuration data by the implementation, ⌋ ()

[FrIf05078] ⌈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. ⌋ (BSW00342)

Note:The rationale of FrIf05078 is to allow object code module integration.

[FrIf05080] ⌈The FrIf module's implementation shall conform to the HIS subset of the MISRA C Standard, according to BSW007.

If development error detection is enabled for the FrIf module, then the FrIf module should check API parameters for validity and report detected errors to the DET. This is specified in detail for each FrIf module interface function in chapter 8.3. ⌋ (BSW007)

[FrIf05092] ⌈The FrIf module shall support dynamic payload length for LPdus whose associated parameter FrIfAllowDynamicLSduLength (see FrIf06049) is set to true.

FrIfAllowDynamicLSduLength shall only be used for PDUs

- which are the only ones within the Frame Construction Plans, or
- for the last PDU within the Frame Construction Plans

⌋ ()

[FrIf05143] ⌈None of the FrIf module's header files shall define global variables. ⌋ (BSW00308)

[FrIf05400] ⌈Each variable that shall be accessible by AUTOSAR Debugging, shall be defined as global variable. ⌋ ()

[FrIf05401] ⌈All type definitions of variables which shall be debugged, shall be accessible by the header file ModuleName.h. ⌋ ()

[FrIf05402] ⌈The declaration of variables in the header file shall be such, that it is

possible to calculate the size of the variables by C-"sizeof".」()

[FrIf05403] 「Variables available for debugging shall be described in the respective Basic Software Module Description」()

7.5 Configuration description

[FrIf05089] 「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. 」(BSW171, BSW170, BSW00334)

[FrIf05079] 「The generated configuration data for the FrIf module shall be “human-readable”. 」(BSW160)

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.

[FrIf05054] 「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). 」(BSW05056)

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.

[FrIf05121] ⌈The FrIf module shall be capable of packing multiple PDUs into one FlexRay Frame. ⌋ ()

Rationale for FrIf05121: Bus-independent AUTOSAR PDUs have a maximal length of 8 bytes, but according to [16] 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!

[FrIf05122] ⌈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 ⌋ ()

[FrIf05123] ⌈The Frame Construction Plan shall be stored in the static configuration of the FrIf module (configuration parameter FrIfFrameStructure, see FrIf05370). ⌋ ()

[FrIf05124] ⌈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.

[FrIf05723] ⌈In case the parameter ‘FrIfUnusedBitValue‘ exists, all the unused bits within the Frame Construction Plan shall be set to the configured value ‘FrIfUnusedBitValue‘ while assembling the frame on sender side. ⌋ ()

[FrIf05725] ⌈Unused bits of the Frame Construction Plan are the

- spaces within the Frame Construction Plan that are reserved for PDUs
- spaces within the Frame Construction Plan that are reserved for the Update bits⌋ ()

[FrIf05125] ⌈It shall be possible to configure (configuration parameter FrIfPduUpdateBitOffset, see FrIf06071) for each PDU a dedicated PDU update bits in the FlexRay Frame.The FrIf module shall identify the position of the PDU update bits for each PDU using the information stored in configuration parameter FrIfPduUpdateBitOffset⌋ ()

[FrIf05056] ⌈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 ⌋ (BSW05126)

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, chapter 7.6.3.1 “TransmitWithDecoupledBufferAccess”

[FrIf05126] ⌈This PDU update bits shall be located at an arbitrary bit position in the Frame Construction Plan that is not occupied by any PDU. ⌋ ()

[FrIf05127] ⌈The configuration of update bitss for the PDUs and the definition of the location of the update bitss within the FlexRay Frame are performed at system configuration time [Configuration Parameter FrIfPduUpdateBitOffset, see FrIf06071] ⌋ ()

[FrIf05128] ⌈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. ⌋ ()

[FrIf05724] ⌈On reception side, if the parameter ‘FrIfUnusedBitValue‘ exists, after the FlexRay Driver has copied the L-SDU into the temporary buffer and before disassembling the L-SDU, the remaining bits in the temporary buffer according to the Frame Construction Plan shall be set to the value given by ‘FrIfUnusedBitValue’. ⌋ ()

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).

[FrIf05129] ⌈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.

7.6.1.1 Dynamic PDU length

[FrIf05093] ⌈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.

[FrIf05094] ⌈The FrIf shall only indicate PDUs in received areas (PDU offset <= actual L-PDU length) to upper layer(s). ⌋()

7.6.1.2 AlwaysTransmit

Note: According to [16], 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 FrIf 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 FrIf06050_Conf). 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.

7.6.2 Realization of the Time-Driven FlexRay Schedule

According to [16], a FlexRay 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.

[FrIf05130] ⌈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 FrIf05130: 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.

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 8.5.1) using an absolute timer [Configuration Parameter FrIfAbsTimerRef, see FrIf06063] of a FlexRay CC connected to the respective Cluster.

7.6.2.1 FlexRay Job List

[FrIf05131] ⌈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.

⌋()

[FrIf05133] ⌈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⌋()

[3] In FlexRay Global Time

[FrIf05134] ⌈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 FrIf06068_Conf], which determines the execution order of the Communication Operations.
- Communication Action [Configuration Parameter FrIfCommunicationAction, see FrIf06067], which specifies the actual action to perform (see 7.6.3):
  - 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]. ⌋()

7.6.2.2 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 JobLists' communication operations

[FrIf05136] ⌈The API names of the FlexRay Job List Execution Functions shall obey the following pattern:

- FrIf_JobListExec_0() for Cluster # 0 (FrIf_ClstIdx = 0)
- FrIf_JobListExec_1() for Cluster # 1 (FrIf_ClstIdx = 1)
- FrIf_JobListExec_2() for Cluster # 2 (FrIf_ClstIdx = 2)
- FrIf_JobListExec_3() for Cluster # 3 (FrIf_ClstIdx = 3)
- … and so on, if more than 4 FlexRay Clusters are supported. ⌋()

[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.

[FrIf05137] ⌈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). ⌋()

[FrIf05138] ⌈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 FrIfMaxIsrDelay, 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 FlexRay Job List of this Cluster is asynchronous or directly resynchronize the Joblist as described in FrIf05120i
   - If the JobListAsyncFlag was set, call the DET 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.

7.6.3 Communication Operations

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

7.6.3.1 TransmitWithDecoupledBufferAccess

[FrIf05058] ⌈The FrIf module shall be capable of Transmit Request queuing by using the TrigTxCounter. ⌋(BSW05130)

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

[FrIf05063] ⌈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. ⌋ (BSW05027)

[FrIf05287] ⌈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 FrIfPduUpdateBitOffset, see FrIf06071] and proceed with the next PDU, otherwise continue with the following steps:
        i. Call the upper layer's function <UL>_TriggerTransmit() with the associated PDUId (FrIf_TxPduId) 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 FrIf06070]] of the PDU within the frame.
        ii. Decrement TrigTxCounter only if TrigTxCounter > 0. If the value of TrigTxCounter = 0, do not decrement.
        iii. Remember that a transmission for this PDU is pending if a transmission confirmation is needed for this PDU [Configuration Parameter FrIfConfirm, see FrIf06075] increment TxConfCounter, where the maximum value is limited by static configuration [Configuration Parameter FrIfCounterLimit, 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>_TriggerTransmit() 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 the FlexRay Driver's API service Fr_TransmitTxLPdu() shall always be called for this L-PDU [Configuration Parameter FrIfAlwaysTransmit, see FrIf06050_Conf] or FrIfNoneMode == true, the FlexRay Driver's API service Fr_TransmitTxLPdu() is called:
    a. Fr_CtrlIdx is derived according to the indexing scheme descibed in 7.2
    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 the temporary FrIf L-SDU assembling buffer.
    d. Fr_LSduLength is set to the L-SDU length [Configuration Parameter FrIfLSduLength, see FrIf06054]
3. 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.

All described actions in FrIf05287 are depicted in detail in the sequence chart in chapter 9.1.2.

In case the parameter 'FrIfAllowDynamicLSduLength' exists and is set to TRUE for the associated frame triggering, the actual L-SDU length, that is passed to the driver (Fr_TransmitTxLPdu()), shall be determined (i.e. shortened as much as possible) taking into account the following for those PDUs only, which have been indicated via <UL_TriggerTransmit>():
- the position of the respective PDU within the L-SDU
- the actual length of the respective PDU as passed via <UL_TriggerTransmit>()
- the position of the update-bit of the respective PDU (if configured)

This ensures 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 talking 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. ⌋ ()

7.6.3.2 ProvideTxConfirmation

[FrIf05064] ⌈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. ⌋ ()

[FrIf05288] ⌈ "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():
   a. Fr_CtrlIdx is derived according to the indexing scheme descibed in 7.2
   b. Fr_LPduIdx is set to the configured L-PDU buffer index [Configuration Parameter FrIfLPduIdx, see FrIf06058] associated with the Communication Operation.
2. If the transmission was performed (Output parameter *Fr_TxLPduStatusPtr is successfully set to FR_TRANSMITTED) 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
   a. If FrIfConfirm == true, call the upper layer's function <UL_TxConfirmation()> with the asociated PDUId (FrIf_TxPduId).
   b. If FrIfConfirm == true ,decrement TxConfCounter. ⌋ ()

7.6.3.3 ReceiveAndStore

[FrIf05289] ⌈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. ⌋ ()

[FrIf05290] ⌈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 descibed in 7.2
   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.
2. If a L-PDU was received (Output parameter *Fr_LPduStatusPtr is set to FR_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. ⌋ ()

7.6.3.4 ProvideRxIndication

[FrIf05062] ⌈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. ⌋ (BSW05170)

[FrIf05291] ⌈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 FrIfFrameStructure (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 FrIf_PduInfoPtr which contains the received data address and received data length.
   b. Mark the PDU-related static buffer as outdated. ⌋ ()

7.6.3.5 ReceiveAndIndicate

[FrIf05292] ⌈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. ⌋ ()

[FrIf05293] ⌈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 descibed in 7.2
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.

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

⌋ ()

7.6.3.6 PREPARE_LPDU

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

[FrIf05294] ⌈The Communication Operation PREPARE_LPDU performs the following steps:

1. Call the FlexRay Driver's API function Fr_PrepareLPdu():
   a. Fr_CtrlIdx is derived according to the indexing scheme descibed in 7.2
   b. Fr_LPduIdx is set to the configured L-PDU index [Configuration Parameter FrIfLPduIdx, see FrIf06058] associated with the Communication Operation. ⌋ ()

[FrIf05061] ⌈
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 FlexRay Driver does not use the opportunity for reconfiguration. ⌋ (BSW05042)

7.6.3.7 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.

7.6.3.8 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.

7.6.4 Transmission with Immediate Buffer Access

[FrIf05295a] ⌈
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. ⌋()

[FrIf05295] ⌈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. ⌋()

[FrIf05296] ⌈If an upper layer module calls FrIf_Transmit() with FrIf_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():

a. Fr_CtrlIdx is derived according to the indexing scheme descibed in 7.2
b. Fr_LPduIdx is set to the configured L-PDU index [Configuration Parameter FrIfLPduIdx, see FrIf06058] associated with the FrIf_TxPduId.
c. Fr_LSduPtr is set to the Pdu Payload pointer contained in the PduInfoPtr passed as parameter to FrIf_Transmit.
d. If the parameter FrIfAllowDynamicLSduLength=FALSE, Fr_LSduLength is set to the L-SDU length [Configuration Parameter FrIfLSduLength, see FrIf06054]
e. If the parameter FrIfAllowDynamicLSduLength=TRUE, the actual length of the respective PDU shall be as passed via FrIf_Transmit().

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]).

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

[FrIf05139] ⌈Values for production code Event Ids are assigned externally by the configuration of the DEM. They are published in the file Dem_IntErrId.h and included via Dem.h. ⌋(BSW00337)

[FrIf05142] ⌈The error values and EventIds of the FrIf module shall be named in capital letters according to the scheme FRIF_E_<NAME>, where NAME describes

the error/EventId and may consist of several words separated by underscores. ⌋ (BSW00327)

[FrIf05145] ⌈Development error values are of type uint8.

Type or error	*Relevance*	*Related error code*	*Value [hex]*
Invalid pointer	Development	FRIF_E_INV_POINTER	0x01
Invalid Controller index	Development	FRIF_E_INV_CTRL_IDX	0x02
Invalid Cluster index	Development	FRIF_E_INV_CLST_IDX	0x03
Invalid Channel index	Development	FRIF_E_INV_CHNL_IDX	0x04
Invalid timer index	Development	FRIF_E_INV_TIMER_IDX	0x05
Invalid FrIf_TxPdu Index	Development	FRIF_E_INV_TXPDUID	0x06
Invalid LPdu Index	Development	FRIF_E_INV_LPDU_IDX	0x07
FrIf not initialized	Development	FRIF_E_NOT_INITIALIZED	0x08
Job List Execution lost synchronization to the FlexRay Global Time	Development	FRIF_E_JLE_SYNC	0x09
error detection in NIT on channel A	Production	FRIF_E_NIT_CH_A	Assigned by DEM
error detection in NIT on channel B	Production	FRIF_E_NIT_CH_B	Assigned by DEM
error detection in SW on channel A	Production	FRIF_E_SW_CH_A	Assigned by DEM
error detection in SW on channel B	Production	FRIF_E_SW_CH_B	Assigned by DEM
error detection in ACS on channel A	Production	FRIF_E_ACS_CH_A	Assigned by DEM
error detection in ACS on channel B	Production	FRIF_E_ACS_CH_B	Assigned by DEM

Table 7-1: Definition of Error Codes

⌋ ()

7.8 Error Detection

[FrIf05084] ⌈The detection of development errors is configurable (ON / OFF) at pre-compile time. The switch FRIF_DEV_ERROR_DETECT (see chapter 10) shall activate or deactivate the detection of all development errors. ⌋ (BSW00350)

[FrIf05146] ⌈If the FRIF_DEV_ERROR_DETECT switch is enabled, API parameter checking is enabled. The detailed description of the detected errors can be found in chapter 7.7 and chapter chapter 8. ⌋ ()

[FrIf05297] ⌈The detection of production code errors cannot be switched of. ⌋ ()

[FrIf05298] ⌈If the FRIF_DEV_ERROR_DETECT switch is set to ON, all FrIf module API services other than FrIf_Init() and FrIf_GetVersionInfo() shall:

- not execute their normal operation,
- report to the DET module (using FRIF_E_NOT_INITIALIZED),
- and return E_NOT_OK,

unless the FrIf module has been initialized with a preceding call of FrIf_Init().⌋ (BSW00406)

7.9 Error Notification

[FrIf05299] ⌈Detected development errors shall be reported to the Det_ReportError() service of the Development Error Tracer (DET) if the pre-processor switch FRIF_DEV_ERROR_DETECT is set to ON (see chapter 10). ⌋ ()

[FrIf05300] ⌈Production errors shall be reported to the Diagnostic Event Manager. ⌋ ()

7.10 Version checking

[FrIf05301] ⌈The FlexRay Interface SWS module shall perform Inter Module Checks to avoid integration of incompatible files. The imported included files shall be checked by preprocessing directives.

The following version numbers shall be verified:
- <MODULENAME>_AR_RELEASE_MAJOR_VERSION
- <MODULENAME>_AR_RELEASE_MINOR_VERSION

Where <MODULENAME> is the module short name of the other (external) modules which provide header files included by the FlexRay Interface SWS module. ⌋ ()

8 API Service Specification

[FrIf05083] ⌈All API functions or global variables, whether they are specified or not shall follow the naming scheme `FrIf_<name>`, where the first letter of each word in <name> is written uppercase and the remainder of the word lowercase. ⌋ (BSW00307, BSW00310)

8.1 Imported types

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

[FrIf05001] ⌈

Module	*Imported Type*
ComStack_Types	PduIdType
	PduInfoType
Dem	Dem_EventIdType
	Dem_EventStatusType
Fr	Fr_ChannelType
	Fr_POCStatusType
	Fr_RxLPduStatusType
	Fr_SyncStateType
	Fr_TxLPduStatusType
FrTrcv	FrTrcv_TrcvModeType
	FrTrcv_TrcvWUReasonType
Std_Types	Std_ReturnType
	Std_VersionInfoType

⌋ (BSW00348, BSW00353, BSW00361, BSW00304, BSW00355, BSW00378)

8.2 Type Definitions

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

[FrIf05082] ⌈All types whether they are specified or implementation dependant shall follow the naming scheme `FrIf_<name>Type`, where the first letter of each word in <name> is written uppercase and the remainder of the word is written lowercase. ⌋ (BSW00305)

8.2.1 FrIf_ConfigType

Name:	`FrIf_ConfigType`

Type:	`Structure`	
Range:	`Implementation specific`	--
Description:	This type contains the implementation-specific post build time configuration structure. Only pointers of this type are allowed.	

8.2.2 FrIf_StateType

Name:	`FrIf_StateType`	
Type:	`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.	

8.2.3 FrIf_StateTransitionType

Name:	`FrIf_StateTransitionType`	
Type:	`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.	

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

[FrIf05003] ⌈

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.	

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_ConfigPtr. ⌋ (BSW00405, BSW101, BSW00358, BSW00414, BSW05013)

[FrIf05155] ⌈If parameter FrIf_ConfigPtr of FrIf_Init equals NULL_PTR and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT equals ON), the function FrIf_Init shall report development error code FRIF_E_INV_POINTER to the Det_ReportError service of the DET module. ⌋ ()

[FrIf05156] ⌈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 FlexRay 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

[FrIf05004] ⌈

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.	

⌋ (BSW05031)

[FrIf05158] ⌈If parameter FrIf_CtrlIdx of FrIf_ControllerInit has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05159] ⌈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 FrIf_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. ⌋ ()

[FrIf05160] ⌈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 FrIf05003⌋ ()

8.3.3 FrIf_SetAbsoluteTimer

[FrIf05021] ⌈

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().	

⌋()

[FrIf05234] ⌈If parameter FrIf_CtrlIdx of FrIf_SetAbsoluteTimer has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05235] ⌈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 FrIf_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. ⌋()

[FrIf05236] ⌈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 FrIf05003. ⌋()

8.3.4 FrIf_EnableAbsoluteTimerIRQ

[FrIf05025] ⌈

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().	

⌋ ()

[FrIf05246] ⌈If parameter FrIf_CtrlIdx of FrIf_EnableAbsoluteTimerIRQ has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05247] ⌈The function FrIf_EnableAbsoluteTimerIRQ shall wrap the FlexRay Driver API function Fr_EnableAbsoluteTimerIRQ() 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. Setting parameters
   - Fr_AbsTimerIdx to FrIf_AbsTimerIdx
3. Calling Fr_EnableAbsoluteTimerIRQ() of the determined FlexRay Driver module with the parameters determined as described above. ⌋ ()

[FrIf05248] ⌈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 FrIf05003. ⌋ ()

8.3.5 FrIf_AckAbsoluteTimerIRQ

[FrIf05029] ⌈

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()	

⌋ ()

[FrIf05258] ⌈If parameter FrIf_CtrlIdx of FrIf_AckAbsoluteTimerIRQ has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05259] ⌈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 FrIf_CtrlIdx into a tuple (FlexRay Driver | Driver-specific CC index Fr_CtrlIdx).
2. Setting parameters
   - Fr_AbsTimerIdx to FrIf_AbsTimerIdx
3. Calling Fr_AckAbsoluteTimerIRQ() of the determined FlexRay Driver module with the parameters determined as described above. ⌋ ()

[FrIf05260] ⌈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 FrIf05003. ⌋ ()

8.3.6 FrIf_StartCommunication

[FrIf05005] ⌈

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().	

⌋ (BSW05015, BSW05155)

[FrIf05161] ⌈If parameter FrIf_CtrlIdx of FrIf_StartCommunication has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05162] ⌈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 FrIf_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. ⌋ ()

[FrIf05163] ⌈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 FrIf05003⌋ ()

8.3.7 FrIf_HaltCommunication

[FrIf05006] ⌈

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().	

⌋ (BSW00336, BSW05063)

[FrIf05164] ⌈If parameter FrIf_CtrlIdx of FrIf_HaltCommunication has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05165] ⌈The function FrIf_HaltCommunication shall wrap the FlexRay Driver API function Fr_HaltCommunication() 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_HaltCommunication() of the determined FlexRay Driver module with the parameters determined as described above. ⌋ ()

[FrIf05166] ⌈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 FrIf05003⌋ ()

8.3.8 FrIf_AbortCommunication

[FrIf05007] ⌈

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().	

⌋ (BSW05016)

[FrIf05167] ⌈If parameter FrIf_CtrlIdx of FrIf_AbortCommunication has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05168] ⌈The function FrIf_AbortCommunication shall wrap the FlexRay Driver API function Fr_AbortCommunication() 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_AbortCommunication() of the determined FlexRay Driver module with the parameters determined as described above. ⌋ ()

[FrIf05169] ⌈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 FrIf05003⌋ ()

8.3.9 FrIf_GetState

[FrIf05170] ⌈

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.	

⌋ ()

[FrIf05171] ⌈If parameter FrIf_ClstIdx of FrIf_GetState has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05172] ⌈If parameter FrIf_StatePtr of FrIf_GetState equals NULL_PTR and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT equals ON), the function FrIf_GetState shall report development error code FRIF_E_INV_POINTER to the Det_ReportError service of the DET module. ⌋ ()

[FrIf05173] ⌈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 FrIf05003⌋ ()

8.3.10 FrIf_SetState

[FrIf05174] ⌈

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.	

⌋ ()

[FrIf05175] ⌈If parameter FrIf_ClstIdx of FrIf_SetState has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05176] ⌈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 FrIf05003⌋ ()

8.3.11 FrIf_SetWakeupChannel

[FrIf05010] ⌈

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.	

⌋ ()

[FrIf05500] ⌈If parameter FrIf_CtrlIdx of FrIf_SetWakeupChannel has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05177] ⌈If parameter FrIf_ChnlIdx of FrIf_SetWakeupChannel has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05178] ⌈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 FrIf_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. ⌋()

[FrIf05179] ⌈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 FrIf05003. ⌋()

8.3.12 FrIf_SendWUP

[FrIf05011] ⌈

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().	

⌋(BSW05018)

[FrIf05180] ⌈If parameter FrIf_CtrlIdx of FrIf_SendWUP has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05181] ⌈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 FrIf_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.

⌋()

[FrIf05182] ⌈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 FrIf05003. ⌋()

8.3.13 FrIf_GetPOCStatus

[FrIf05014] ⌈

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().	

⌋(BSW05022)

[FrIf05190] ⌈If parameter FrIf_CtrlIdx of FrIf_GetPOCStatus has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05192] ⌈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 FrIf_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. ⌋()

[FrIf05193] ⌈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 FrIf05003. ⌋()

8.3.14 FrIf_GetGlobalTime

[FrIf05015] ⌈

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().	

⌋()

[FrIf05194] ⌈If parameter FrIf_CtrlIdx of FrIf_GetGlobalTime has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05195] ⌈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 FrIf_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. ⌋()

[FrIf05196] ⌈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 FrIf05003. ⌋ ()

8.3.15 FrIf_AllowColdstart

[FrIf05017] ⌈

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.
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().	

⌋ ()

[FrIf05200] ⌈If parameter FrIf_CtrlIdx of FrIf_AllowColdstart has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05201] ⌈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. ⌋ ()

[FrIf05202] ⌈Caveats: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see FrIf05003. ⌋ ()

8.3.16 FrIf_GetMacroticksPerCycle

[FrIf05018] ⌈

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	

⌋ ()

[FrIf05203] ⌈If parameter FrIf_CtrlIdx of FrIf_GetMacroticksPerCycle has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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 FlexRay Cycle of the FlexRay Cluster with index FrIf_CtrlIdx out of the static configuration. ⌋ ()

[FrIf05204] ⌈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 FrIf05003. ⌋ ()

8.3.17 FrIf_GetMacrotickDuration

[FrIf05019] ⌈

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	

⌋ ()

[FrIf05191] ⌈If parameter FrIf_CtrlIdx of FrIf_GetMacrotickDuration: has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05301] ⌈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 FrIf05003⌋ ()

8.3.18 FrIf_Transmit

[FrIf05033] ⌈

Service name:	FrIf_Transmit	
Syntax:	`Std_ReturnType FrIf_Transmit( PduIdType FrIf_TxPduId, const PduInfoType * FrIf_PduInfoPtr )`	
Service ID[hex]:	0x12	
Sync/Async:	Synchronous	
Reentrancy:	non reentrant for identical values of FrIf_TxPduId, reentrant for different values of FrIf_TxPduId	
Parameters (in):	FrIf_TxPduId	ID of FlexRay PDU to be transmitted.
	FrIf_PduInfoPtr	Pointer to a structure with FlexRay PDU related data.
Parameters (inout):	None	
Parameters (out):	None	
Return value:	Std_ReturnType	E_OK: No error has occurred during the execution of this API service. E_NOT_OK: An error occurred during execution of this API service: • FlexRay Driver reported an error in case of immediate transmission • An error has been detected in development mode
Description:	Requests the sending of a PDU.	

⌋ ()

[FrIf05205] ⌈If parameter FrIf_TxPduId of FrIf_Transmit has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT equals ON), the function FrIf_Transmit shall report development error code FRIF_E_INV_TXPDUID to the Det_ReportError service of the DET module. ⌋ ()

[FrIf05206] ⌈If parameter FrIf_PduInfoPtr of FrIf_Transmit equals NULL_PTR and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT equals ON), the function FrIf_Transmit shall report development error code FRIF_E_INV_POINTER to the Det_ReportError service of the DET module. ⌋ ()

[FrIf05207] ⌈If SduDataPtr in parameter FrIf_PduInfoPtr of FrIf_Transmit equals NULL_PTR and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT equals ON), the function FrIf_Transmit shall report development error code FRIF_E_INV_POINTER to the Det_ReportError service of the DET module.

In case of decoupled transmission the PDU with index FrIf_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.
- 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. ⌋ ()

[FrIf05208] ⌈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. ⌋ ()

[FrIf05209] ⌈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 FrIf05003⌋ ()

8.3.19 FrIf_SetTransceiverMode

[FrIf05034] ⌈

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

⌋ (BSW05039)

[FrIf05210] ⌈If parameter FrIf_CtrlIdx of FrIf_SetTransceiverMode has an invalid value and if development error detection is enabled (i.e.

[5] Limited by static configuration [Configuration Parameter FrIfCounterLimit, see FrIf06076]

FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05211] ⌈If parameter FrIf_ChnlIdx of FrIf_SetTransceiverMode has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05212] ⌈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. ⌋()

[FrIf05213] ⌈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 FrIf05003. ⌋()

8.3.20 FrIf_GetTransceiverMode

[FrIf05035] ⌈

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	
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.	

⌋(BSW05157)

[FrIf05214] ⌈If parameter FrIf_CtrlIdx of FrIf_GetTransceiverMode has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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.⌋ ()

[FrIf05215] ⌈If parameter FrIf_ChnlIdx of FrIf_GetTransceiverMode has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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.⌋ ()

[FrIf05216] ⌈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.⌋ ()

[FrIf05217] ⌈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 FrIf05003.⌋ ()

8.3.21 FrIf_GetTransceiverWUReason

[FrIf05036] ⌈

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.

⌋ (BSW00375, BSW05158)

[FrIf05218] ⌈If parameter FrIf_CtrlIdx of FrIf_GetTransceiverWUReason has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05219] ⌈If parameter FrIf_ChnlIdx of FrIf_GetTransceiverWUReason has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05220] ⌈The function FrIf_GetTransceiverWUReason shall wrap the FlexRay 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. ⌋ ()

[FrIf05221] ⌈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 FrIf05003. ⌋ ()

8.3.22 FrIf_ClearTransceiverWakeup

[FrIf05039] ⌈

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.	

⌋ (BSW05161)

[FrIf05230] ⌈If parameter FrIf_CtrlIdx of FrIf_ClearTransceiverWakeup has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05231] ⌈If parameter FrIf_ChnlIdx of FrIf_ClearTransceiverWakeup has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05232] ⌈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. ⌋ ()

[FrIf05233] ⌈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 FrIf05003. ⌋ ()

8.3.23 FrIf_CancelAbsoluteTimer

[FrIf05023] ⌈

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() .	

⌋ ()

[FrIf05240] ⌈If parameter FrIf_CtrlIdx of FrIf_CancelAbsoluteTimer has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05241] ⌈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 FrIf_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. ⌋ ()

[FrIf05242] ⌈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 FrIf05003. ⌋ ()

8.3.24 FrIf_GetAbsoluteTimerIRQStatus

[FrIf05027] ⌈

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()	

⌋ ()

[FrIf05252] ⌈If parameter FrIf_CtrlIdx of FrIf_GetAbsoluteTimerIRQStatus has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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.⌋ ()

[FrIf05253] ⌈The function FrIf_GetAbsoluteTimerIRQStatus shall wrap the FlexRay Driver API function Fr_GetAbsoluteTimerIRQStatus() 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. 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.⌋ ()

[FrIf05254] ⌈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 FrIf05003.⌋ ()

8.3.25 FrIf_DisableAbsoluteTimerIRQ

[FrIf05031] ⌈

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().	

⌋ ()

[FrIf05264] ⌈If parameter FrIf_CtrlIdx of FrIf_DisableAbsoluteTimerIRQ has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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.⌋ ()

[FrIf05266] ⌈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 FrIf05003. ⌋ ()

8.3.26 FrIf_GetCycleLength

[FrIf05239] ⌈

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	
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.	

⌋ ()

[FrIf05237] ⌈If parameter FrIf_CtrlIdx of FrIf_GetCycleLength has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05238] ⌈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 FrIf05003. ⌋ ()

8.4 Optional Function Definitions

8.4.1 FrIf_AllSlots

[FrIf05020] ⌈

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	

⌋ ()

[FrIf05412] ⌈The function FrIf_AllSlots shall be pre compile time configurable ON/OFF by the configuration parameter FrIfAllSlotsSupport (derived from configuration parameter FrIfAllSlotsSupport, see FrIf06108_Conf) ⌋ ()

[FrIf05706] ⌈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 FrIf_AllSlots shall raise the development error FRIF_E_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

[FrIf05707] ⌈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

[FrIf05030] ⌈

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.	

⌋ ()

[FrIf05413] ⌈The function FrIf_GetChannelStatus shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetGetChannelStatusSupport
(derived from configuration parameter FrIfGetGetChannelStatusSupport, see FrIf06105_Conf) ⌋ ()

[FrIf05708] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

[FrIf05709] ⌈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

[FrIf05071] ⌈

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.	

⌋ ()

[FrIf05414] ⌈The function FrIf_GetClockCorrection shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetClockCorrectionSupport (derived from configuration parameter FrIfGetClockCorrectionSupport, see FrIf06106_Conf) ⌋ ()

[FrIf05711] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋()

[FrIf05712] ⌈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

[FrIf05072] ⌈

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_ChannelAEvenListPtr 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.	

⌋ ()

[FrIf05415] ⌈The function FrIf_GetSyncFrameList shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetSyncFrameListSupport (derived from configuration parameter FrIfGetSyncFrameListSupport, see FrIf06107_Conf) ⌋ ()

[FrIf05715] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

[FrIf05716] ⌈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

[FrIf05073] ⌈

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.
	FrIf_NumOfStartupFramesPtr	Address where the number of startup frames seen within the last even/odd cycle pair shall be stored.
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 API function Fr_GetNumOfStartupFrames and gets a list of the the current number of startup frames seen on the cluster. See variable vStartupPairs of [12] for details.	

⌋ ()

[FrIf05416] ⌈The function FrIf_GetNumOfStartupFrames shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetNumOfStartupFramesSupport (derived from configuration parameter FrIfGetNumOfStartupFramesSupport, see FrIf06104_Conf) ⌋ ()

[FrIf05721] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

[FrIf05722] ⌈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

[FrIf05102] ⌈

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.	

⌋ ()

[FrIf05417] ⌈The function FrIf_GetWakeupRxStatus shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetWakeupRxStatusSupport (derived from configuration parameter FrIfGetWakeupRxStatusSupport, see FrIf06111_Conf) ⌋ ()

[FrIf05700] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

[FrIf05701] ⌈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

[FrIf05070] ⌈

Service name:	FrIf_CancelTransmit	
Syntax:	`Std_ReturnType FrIf_CancelTransmit( PduIdType FrIf_TxPduId )`	
Service ID[hex]:	0x30	
Sync/Async:	Synchronous	
Reentrancy:	Non reentrant for identical values of FrIf_TxPduId, reentrant for different values of FrIf_TxPduId	
Parameters (in):	FrIf_TxPduId	ID of FlexRay PDU to be cancelled.
Parameters (inout):	None	
Parameters (out):	None	
Return value:	Std_ReturnType	E_OK: No error has occurred during the execution of this API service. E_NOT_OK: An error occurred during execution of this API service: FlexRay Driver reported an error. An error has been detected in development mode
Description:	Wraps the FlexRay Driver API function Fr_CancelTxLPdu	

⌋ ()

[FrIf05713] ⌈The function FrIf_CancelTransmit shall be pre compile time configurable ON/OFF by the configuration parameter FrIfCancelTransmitSupport (derived from configuration parameter FrIfCancelTransmitSupport, see FrIf00002_Conf) ⌋ ()

[FrIf05703] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

[FrIf05704] ⌈If development error detection for the FrIf module is enabled: the function FrIf_CancelTransmit shall check the parameter FrIf_TxPduId for being valid. If FrIf_TxPduId is invalid, the function FrIf_CancelTransmit shall raise the development error FRIF_E_INV_TXPDUID and return E_NOT_OK. ⌋ ()

[FrIf05705] ⌈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 descibed in 7.2

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 TxConterLimit) 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 TxConfCounter > 0.
6. Decrement the TxConfCounter for the IPDU that has been initiated by the CancelTransmit API call. ⌋ ()

8.4.8 FrIf_DisableLPdu

[FrIf05710] ⌈

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.	

⌋ ()

[FrIf05418] ⌈The function FrIf_DisableLPdu shall be pre compile time configurable ON/OFF by the configuration parameter FrIfDisableLPduSupport (derived from configuration parameter FrIfDisableLPduSupport, see FrIf06110_Conf) ⌋ ()

[FrIf05717] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

[FrIf05714] ⌈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

[FrIf05032] ⌈

Service name:	FrIf_GetTransceiverError	

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

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.	

⌋ ()

[FrIf05419] ⌈The function FrIf_GetTransceiverError shall be pre compile time configurable ON/OFF by the configuration parameter FrIfGetTransceiverErrorSupport (derived from configuration parameter FrIfGetTransceiverErrorSupport, see FrIf06101_Conf) ⌋ ()

[FrIf05718] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

[FrIf05719] ⌈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. ⌋ ()

[FrIf05720] ⌈If parameter FrIf_ChnlIdx of FrIf_GetTransceiverError has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05728] ⌈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

[FrIf05085] ⌈

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	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_EnableTransceiverBranch. The enum value "FR_CHANNEL_AB" shall not be used.	

⌋()

[FrIf05420] ⌈The function FrIf_EnableTransceiverBranch shall be pre compile time configurable ON/OFF by the configuration parameter FrIfEnableTransceiverBranchSupport (derived from configuration parameter FrIfEnableTransceiverBranchSupport, see FrIf06103_Conf) ⌋()

[FrIf05302] ⌈If parameter FrIf_CtrlIdx of FrIf_EnableTransceiverBranch has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05304] ⌈If parameter FrIf_ChnlIdx of FrIf_EnableTransceiverBranch has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋()

[FrIf05306] ⌈The function FrIf_EnableTransceiverBranch shall wrap the FlexRay 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. ⌋ ()

[FrIf05307] ⌈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_NOT_INITIALIZED and return E_NOT_OK. ⌋ ()

8.4.11 FrIf_DisableTransceiverBranch

[FrIf05028] ⌈

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	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_DisableTransceiverBranch. The enum value "FR_CHANNEL_AB" shall not be used.	

⌋ ()

[FrIf05421] ⌈The function FrIf_DisableTransceiverBranch shall be pre compile time configurable ON/OFF by the configuration parameter FrIfDisableTransceiverBranchSupport (derived from configuration parameter FrIfDisableTransceiverBranchSupport, see FrIf06102_Conf) ⌋ ()

[FrIf05425] ⌈The function FrIf_DisableTransceiverBranch shall be pre compile time configurable ON/OFF by the configuration parameter FrIfDisableTransceiverBranchSupport (derived from configuration parameter FrIfDisableTransceiverBranchSupport, see FrIf06102_Conf) ⌋ ()

[FrIf05303] ⌈If parameter FrIf_CtrlIdx of FrIf_DisableTransceiverBranch has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05243] ⌈If parameter FrIf_ChnlIdx of FrIf_DisableTransceiverBranch has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05305] ⌈The function FrIf_DisableTransceiverBranch shall wrap the FlexRay 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. ⌋ ()

[FrIf05308] ⌈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 FrIf05003. ⌋ ()

8.4.12 FrIf_ReconfigLPdu

[FrIf05048] ⌈

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	
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.	

⌋ ()

[FrIf05422] ⌈The function FrIf_ReconfigLPdu shall be pre compile time configurable ON/OFF by the configuration parameter FrIfReconfigLPduSupport (derived from configuration parameter FrIfReconfigLPduSupport, see FrIf06109_Conf) ⌋ ()

[FrIf05309] ⌈If parameter FrIf_CtrlIdx of FrIf_ReconfigLPdu has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05310] ⌈If parameter FrIf_ChnlIdx of FrIf_ReconfigLPdu has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05311] ⌈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. FRIF_DEV_ERROR_DETECT equals ON), the FrIf_ReconfigLPdu shall report development error code FRIF_E_INV_LPDU_IDX to the Det_ReportError service of the DET module. ⌋ ()

[FrIf05312] ⌈If parameter FrIf_FrameId of FrIf_ReconfigLPdu has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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

[FrIf05016] ⌈

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.	

⌋ ()

[FrIf05423] ⌈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) ⌋ ()

[FrIf05197] ⌈If parameter FrIf_CtrlIdx of FrIf_GetNmVector has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05198] ⌈The function FrIf_GetNmVector wraps the FlexRay Driver API Fr_GetNmVector function. ⌋ ()

[FrIf05199] ⌈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 FrIf05003⌋ ()

8.4.14 FrIf_GetVersionInfo

[FrIf05002] ⌈

Service name:	FrIf_GetVersionInfo

Syntax:	`void FrIf_GetVersionInfo(`
	`  Std_VersionInfoType* FrIf_VersionInfoPtr`
	`)`

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.	

⌋ (BSW00407, BSW00411)

[FrIf05424] ⌈The function FrIf_GetVersionInfo shall be pre compile time configurable ON/OFF by the configuration parameter FrIfVersionInfoApi (derived from configuration parameter FrIfVersionInfoApi, see FrIf06083_Conf) ⌋()

[FrIf05151] ⌈If parameter FrIf_VersionInfoPtr of FrIf_GetVersionInfo equals NULL_PTR and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT equals ON), the function FrIf_GetVersionInfo shall report development error code FRIF_E_INV_POINTER to the Det_ReportError service of the DET module. ⌋()

[FrIf05152] ⌈The function FrIf_GetVersionInfo shall return the version information of this module. The version information includes:

- Module ID
- Vendor ID
- Vendor specific version numbers (BSW00407) ⌋()

[FrIf05153] ⌈The function FrIf_GetVersionInfo shall be pre compile time configurable ON/OFF by the configuration parameter FRIF_VERSION_INFO_API (derived from configuration parameter FrIfVersionInfoApi, see FrIf06083). ⌋()

Hint: If source code for caller and callee of this API service is available, this function should be realized as a macro. The macro should be defined in the file FrIf_Cfg.h.

[FrIf05154] ⌈Configuration of function FrIf_GetVersionInfo:
If pre-compile-time configuration parameter 'FRIF_VERSION_INFO_API' is 'ON' this API function is included in the compilation process.
If pre-compile-time configuration parameter 'FRIF_VERSION_INFO_API' is 'OFF' this API function is excluded from the compilation process. ⌋()

8.4.15 FrIf_ReadCCConfig

[FrIf05313] ⌈

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().	

⌋ ()

[FrIf05314] ⌈The function FrIf_ReadCCConfig wraps the FlexRay Driver API Fr_ReadCCConfig function. ⌋ ()

[FrIf05315] ⌈If parameter FrIf_CtrlIdx of FrIf_ReadCCConfig has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

8.5 Interrupt Service Routines

8.5.1 FrIf_JobListExec_<ClstIdx>

[FrIf05040] ⌈

Service name:	FrIf_JobListExec_<ClstIdx>

Syntax:	`void FrIf_JobListExec_<ClstIdx>(`
	`  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.

For a detailed description of this API service, please refer to chapter 7.6.2.2. ⌋ ()

[FrIf05270] ⌈The function FrIf_JobListExec_<ClstIdx> shall exist once per FlexRay Cluster of a FlexRay Interface module. ⌋()

[FrIf05271] ⌈The function name of each instance of FrIf_JobListExec_<ClstIdx> shall contain the index of the respective FlexRay Cluster (ClstIdx).

For each FlexRay Cluster (identified by index ClstIdx), the respective API service FrIf_JobListExec_<ClstIdx> 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_JobListExec<ClstIdx> can run in a regular OS task.

[FrIf05272] ⌈Caveats of FrIf_JobListExec_<ClstIdx>: The FlexRay Interface module has to be initialized with a call of FrIf_Init() before this API service may be called, see FrIf05003. ⌋()

8.6 Call-back Notifications

This is a list of functions provided for other modules.

8.6.1 FrIf_CheckWakeupByTransceiver

[FrIf05041] ⌈

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.	

⌋()

[FrIf05274] ⌈If parameter FrIf_CtrlIdx of FrIf_CheckWakeupByTransceiver has an invalid value and if development error detection is enabled (i.e.

FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05275] ⌈If parameter FrIf_ChnlIdx of FrIf_CheckWakeupByTransceiver has an invalid value and if development error detection is enabled (i.e. FRIF_DEV_ERROR_DETECT 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. ⌋ ()

[FrIf05276] ⌈The function FrIf_CheckWakeupByTransceiver shall wrap the FlexRay 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. ⌋ ()

[FrIf05277] ⌈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 FrIf05003. ⌋ ()

8.7 Scheduled Functions

8.7.1 FrIf_MainFunction_<ClstIdx>

[FrIf05042] ⌈

Service name:	FrIf_MainFunction_<ClstIdx>
Syntax:	`void FrIf_MainFunction_<ClstIdx>( void )`
Service ID[hex]:	0x27
Timing:	VARIABLE_CYCLIC
Description:	This function will be called cyclically by a task body provided by the BSW Scheduler.

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_JobListExec_<ClstIdx>() if the CC does not support asynchronous buffer access.
- Monitoring the proper (in time) execution of the FrIf_JobListExec_<ClstIdx>() and resynchronize the Joblist if necessary.

Please refere to chapter 7.3 for a detailed description.

Pre condition: The function FrIf_MainFunction_<ClstIdx> 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 FlexRay Interface module the calling period, which is provided for the BSW scheduler module." ⌋ ()

[FrIf05278] ⌈The function FrIf_MainFunction_<ClstIdx> shall exist once per FlexRay Cluster of a FlexRay Interface module. ⌋ ()

[FrIf05279] ⌈The function name of each instance of FrIf_MainFunction_<ClstIdx> shall contain the index of the respective FlexRay Cluster (ClstIdx). ⌋ ()

[FrIf05280] ⌈Caveats of FrIf_MainFunction_<ClstIdx>: The FlexRay Interface has to be initialized with a call of FrIf_Init() before this API service may be called, see FrIf05003. ⌋ ()

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.

[FrIf05043] ⌈

API function	*Description*
FrTrcv_CheckWakeupByTransceiver	--
FrTrcv_ClearTransceiverWakeup	This function clears a pending wake up event.
FrTrcv_GetTransceiverMode	This function returns the actual state of the transceiver.
FrTrcv_GetTransceiverWUReason	This function returns the wakeup reason.
FrTrcv_SetTransceiverMode	This service sets the transceiver mode.
Fr_AbortCommunication	Invokes the CC CHI command 'FREEZE'.
Fr_AckAbsoluteTimerIRQ	Resets the interrupt condition of an absolute timer.
Fr_AllowColdstart	Invokes the CC CHI command 'ALLOW_COLDSTART'.
Fr_CancelAbsoluteTimer	Stops an absolute timer.
Fr_CheckTxLPduStatus	Checks the transmit status of the LSdu.
Fr_ControllerInit	Initialzes a FlexRay CC.
Fr_DisableAbsoluteTimerIRQ	Disables the interrupt line of an absolute timer.
Fr_EnableAbsoluteTimerIRQ	Enables the interrupt line of an absolute timer.
Fr_GetAbsoluteTimerIRQStatus	Gets IRQ status of an absolute timer.

Fr_GetGlobalTime	Gets the current global FlexRay time.
Fr_GetPOCStatus	Gets the POC status.
Fr_GetSyncState	Gets the sync state.
Fr_HaltCommunication	Invokes the CC CHI command 'DEFERRED_HALT'.
Fr_ReceiveRxLPdu	Receives data from the FlexRay network.
Fr_SendWUP	Invokes the CC CHI command 'WAKEUP'.
Fr_SetAbsoluteTimer	Sets the absolute FlexRay timer.
Fr_SetWakeupChannel	Sets a wakeup channel.
Fr_StartCommunication	Starts communication.
Fr_TransmitTxLPdu	Transmits data on the FlexRay network.

⌋ ()

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

[FrIf05044] ⌈

API function	*Description*
Dem_ReportErrorStatus	Queues the reported events from the BSW modules (API is only used by BSW modules). The interface has an asynchronous behavior, because the processing of the event is done within the Dem main function.
Det_ReportError	Service to report development errors.
FrTrcv_DisableTransceiverBranch	This function disables the specified branch on the addressed (active star) transceiver.
FrTrcv_EnableTransceiverBranch	This function enables the specified branch on the addressed (active star) transceiver.
FrTrcv_GetTransceiverError	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.
Fr_AllSlots	Invokes the CC CHI command 'ALL_SLOTS'.
Fr_CancelTxLPdu	Cancels the already pending transmission of a LPdu contained in a controllers physical transmit resource (e.g. message buffer).
Fr_DisableLPdu	Disables the hardware resource of a LPdu for transmission/reception.
Fr_GetChannelStatus	Gets the channel status information.
Fr_GetClockCorrection	Gets the current clock correction values. See variables vInterimRateCorrection and vInterimOffsetCorrection of [12] for details.
Fr_GetNmVector	Gets the network management vector of the last communication cycle.
Fr_GetNumOfStartupFrames	Gets the current number of startup frames seen on the cluster. See variable vStartupPairs of [12] for details.
Fr_GetSyncFrameList	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	Gets the wakeup received information from the FlexRay controller.
Fr_PrepareLPdu	Prepares a LPdu.
Fr_ReadCCConfig	Reads a FlexRay protocol configuration parameter for a particular FlexRay controller out of the module's configuration.
Fr_ReconfigLPdu	Reconfigures a given LPdu according to the parameters (FrameId, Channel, CycleRepetition, CycleOffset, PayloadLength, HeaderCRC) at runtime.

⌋ ()

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 [2]. 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 (CDDs), 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.

8.8.3.1 <UL_RxIndication>

[FrIf05045] ⌈

Service name:	<User_RxIndication>	

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

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

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 FrIf_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>

[FrIf05046] ⌈

Service name:	<User_TxConfirmation>	

Syntax:	`void <User_TxConfirmation>(`
	`  PduIdType TxPduId`
	`)`	

Sync/Async:	Synchronous	
Reentrancy:	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in):	TxPduId	ID of the I-PDU that has been transmitted.
Parameters (inout):	None	
Parameters (out):	None	
Return value:	None	
Description:	The lower layer communication module confirms the transmission of an I-PDU.	

⌋ ()

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>

[FrIf05047] ⌈

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.
	PduInfoPtr	Contains a pointer to a buffer (SduDataPtr) to where the SDU shall be copied to. On return, the service will indicate the length of the copied SDU data in SduLength.
Parameters (inout):	None	
Parameters (out):	None	
Return value:	Std_ReturnType	E_OK: SDU has been copied and SduLength indicates the number of copied bytes. E_NOT_OK: No SDU has been copied. PduInfoPtr must not be used since it may contain a NULL pointer or point to invalid data.
Description:	The lower layer communication module requests the buffer of the SDU for transmission from the upper layer module.	

⌋ ()

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

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

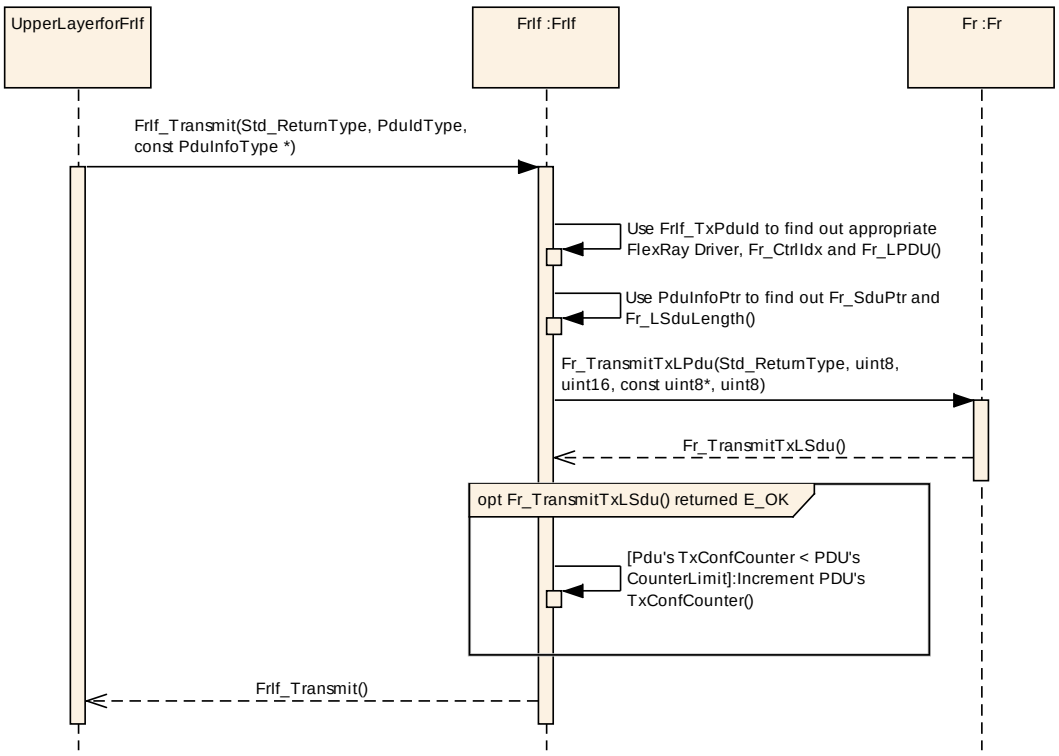


Figure 9-1: TransmitWithImmediateBufferAccess

9.1.2 TransmitWithDecoupledBufferAccess

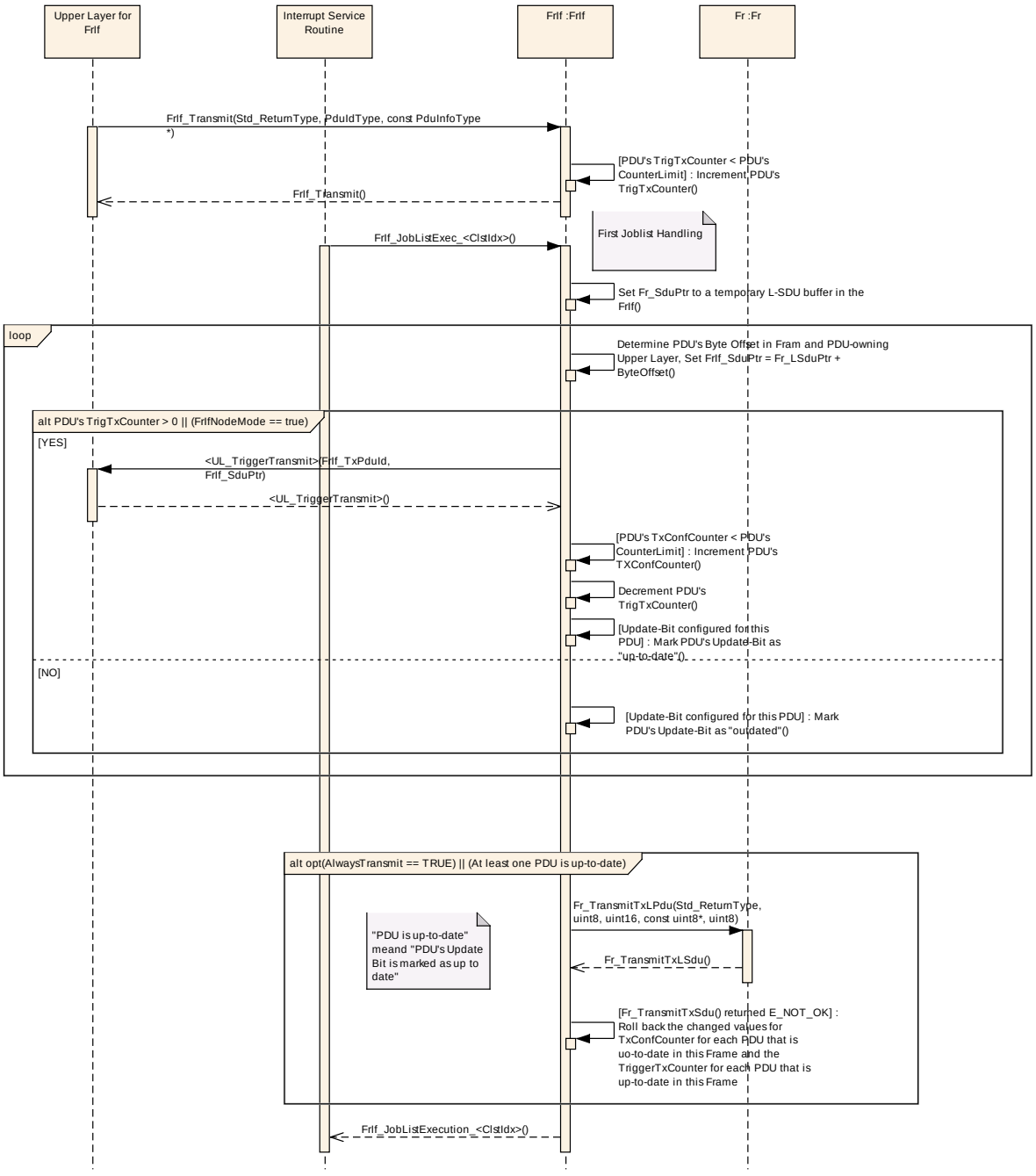
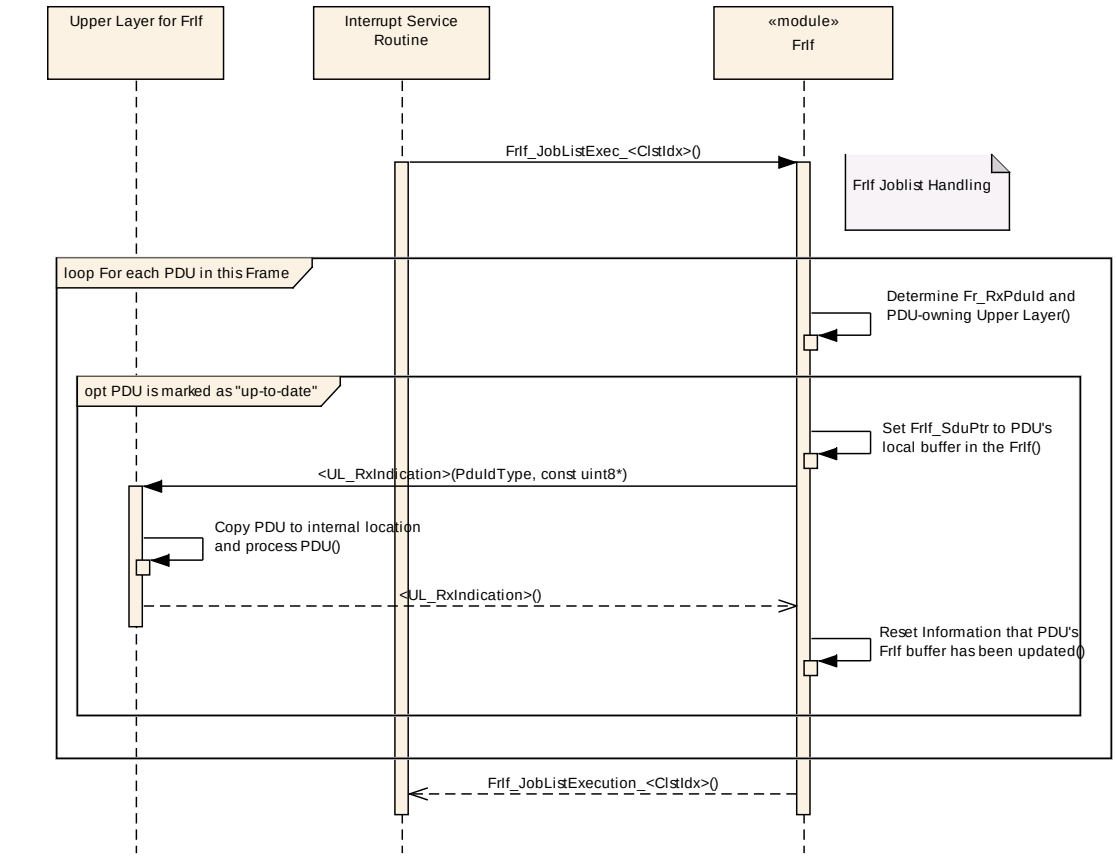


Figure 9-2: TransmitWithDecoupledBufferAccess

9.1.3 ProvideTxConfirmation



Status: Approved by WP4.2.2.1.5
Some finishing by TO for SWS 0.26
(see FlexRay UML Sequence Diagrams - Change History.doc)
2006-04-12: Update by BMW_TK to match Frlf SWS V1.2.5
2006-04-13: Update by DECOMSYS_TGAL to match Frlf SWS V1.2.5
2006-04-27: Minor changes and corrections by BMW_TK

Description:

Comments:

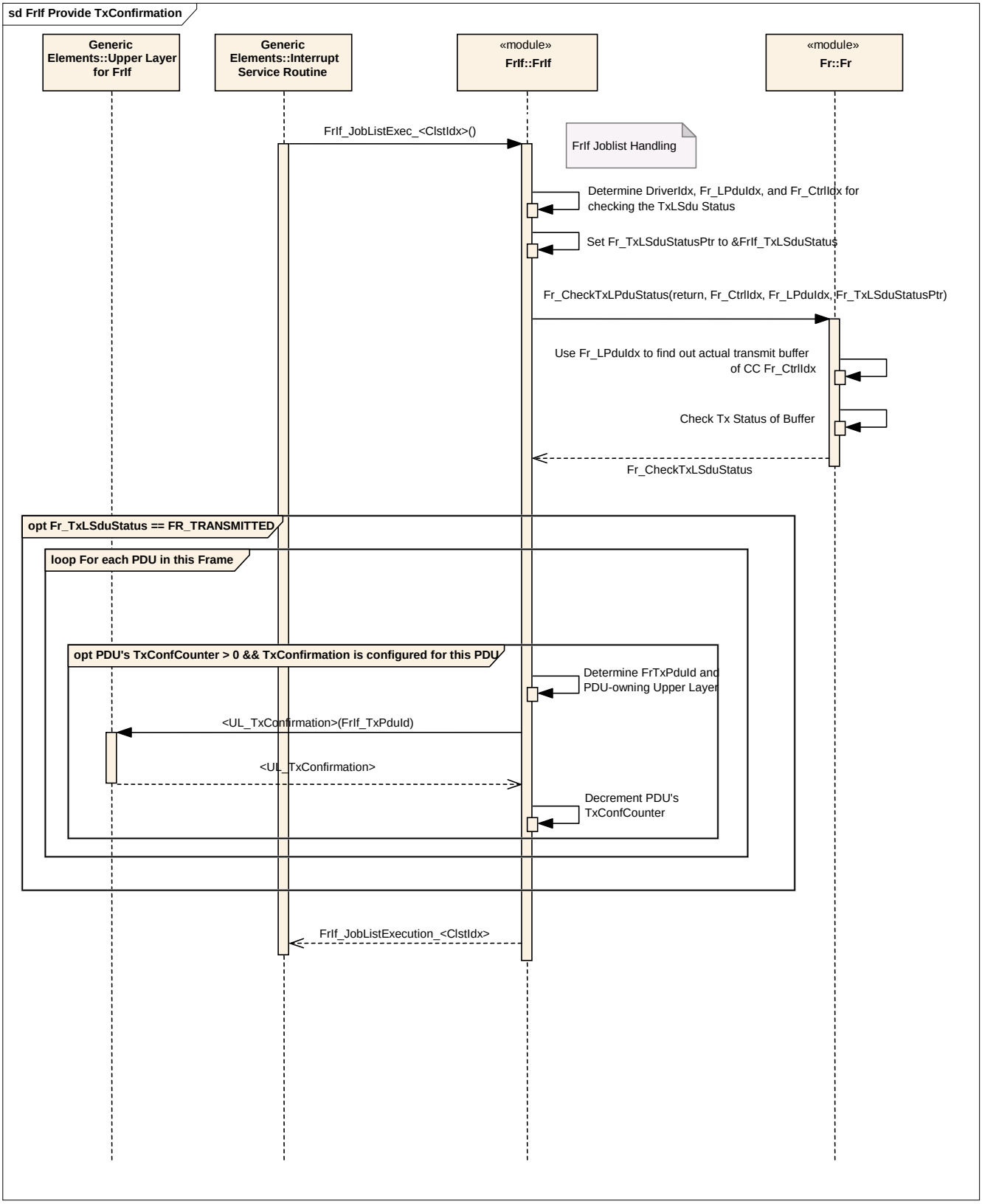


Figure 9-3: ProvideTxConfirmation

9.2 Data Reception

9.2.1 ReceiveAndIndicate

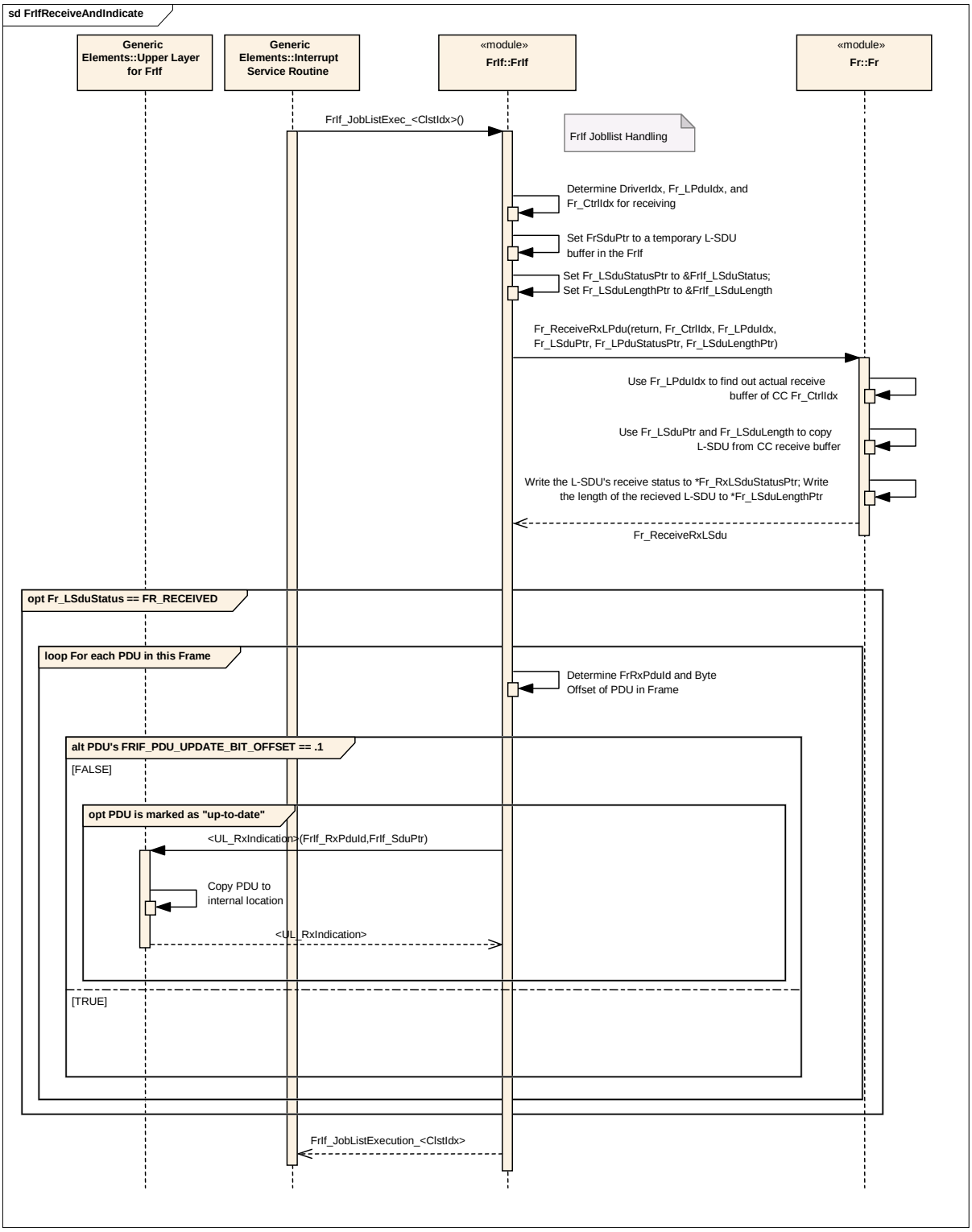


Figure 9-4: ReceiveAndIndicate

9.2.2 ReceiveAndStore

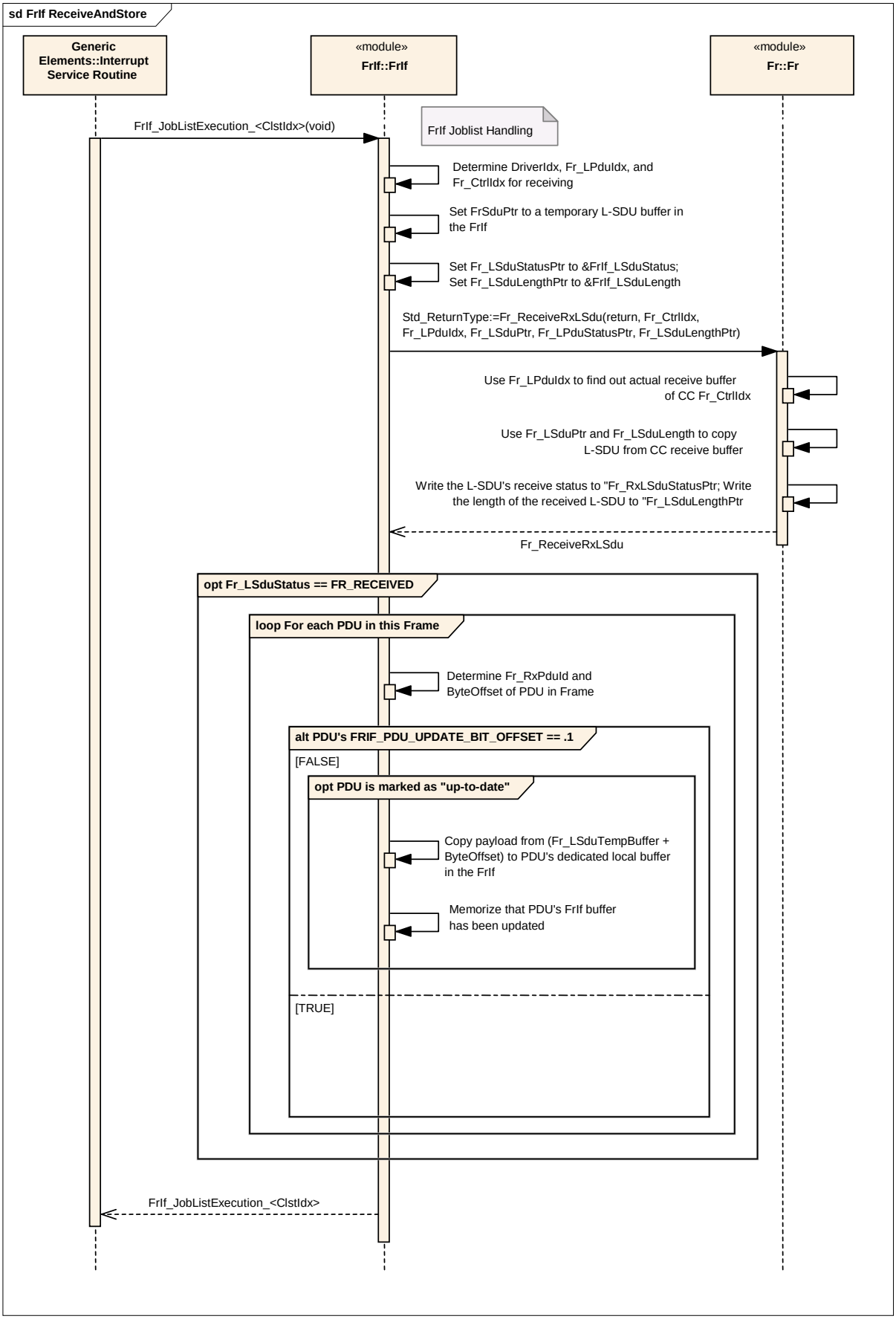


Figure 9-5: ReceiveAndStore

9.2.3 ProvideRxIndication

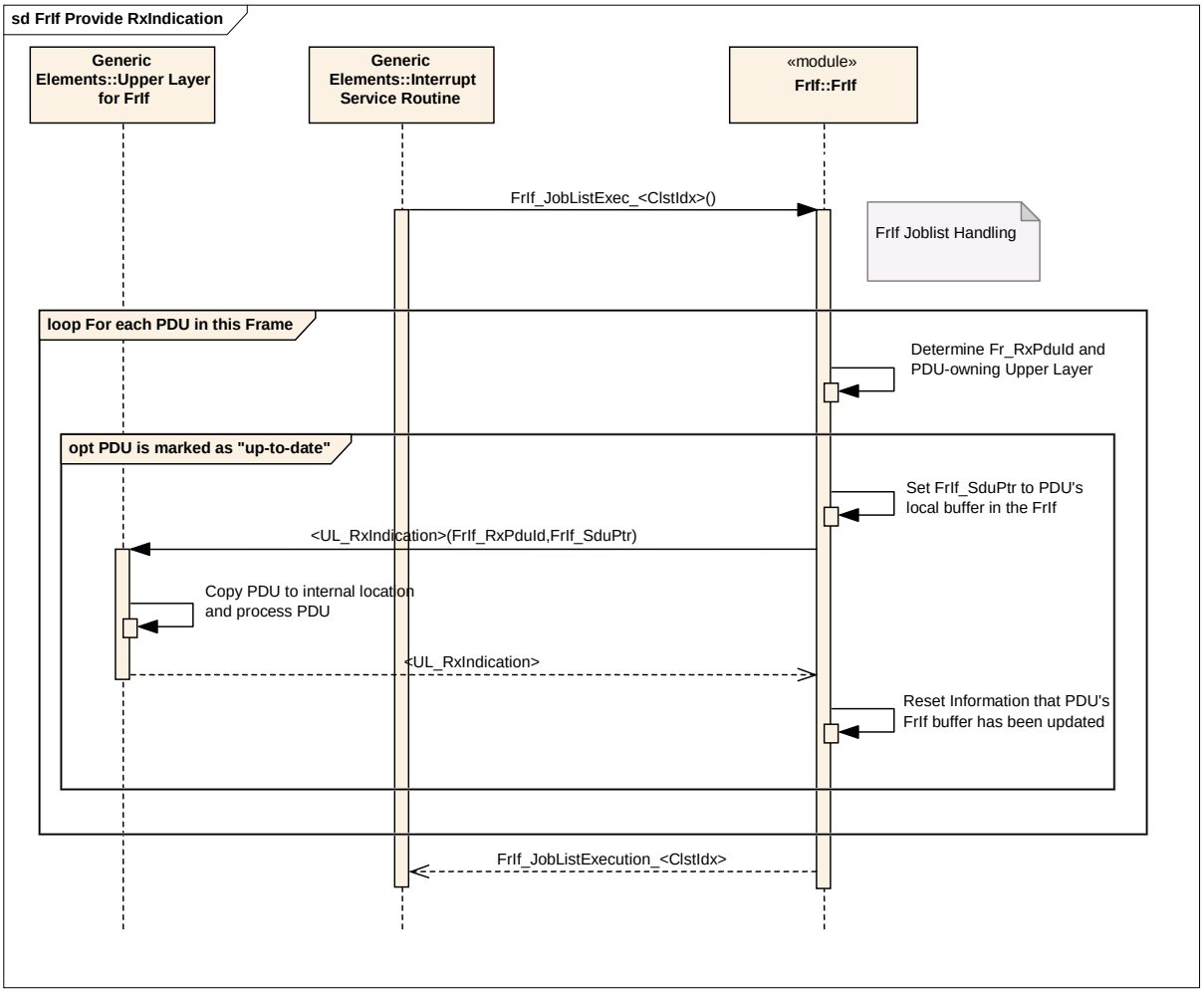


Figure 9-6: ProvideRxIndication

9.2.4 Cancel Transmission

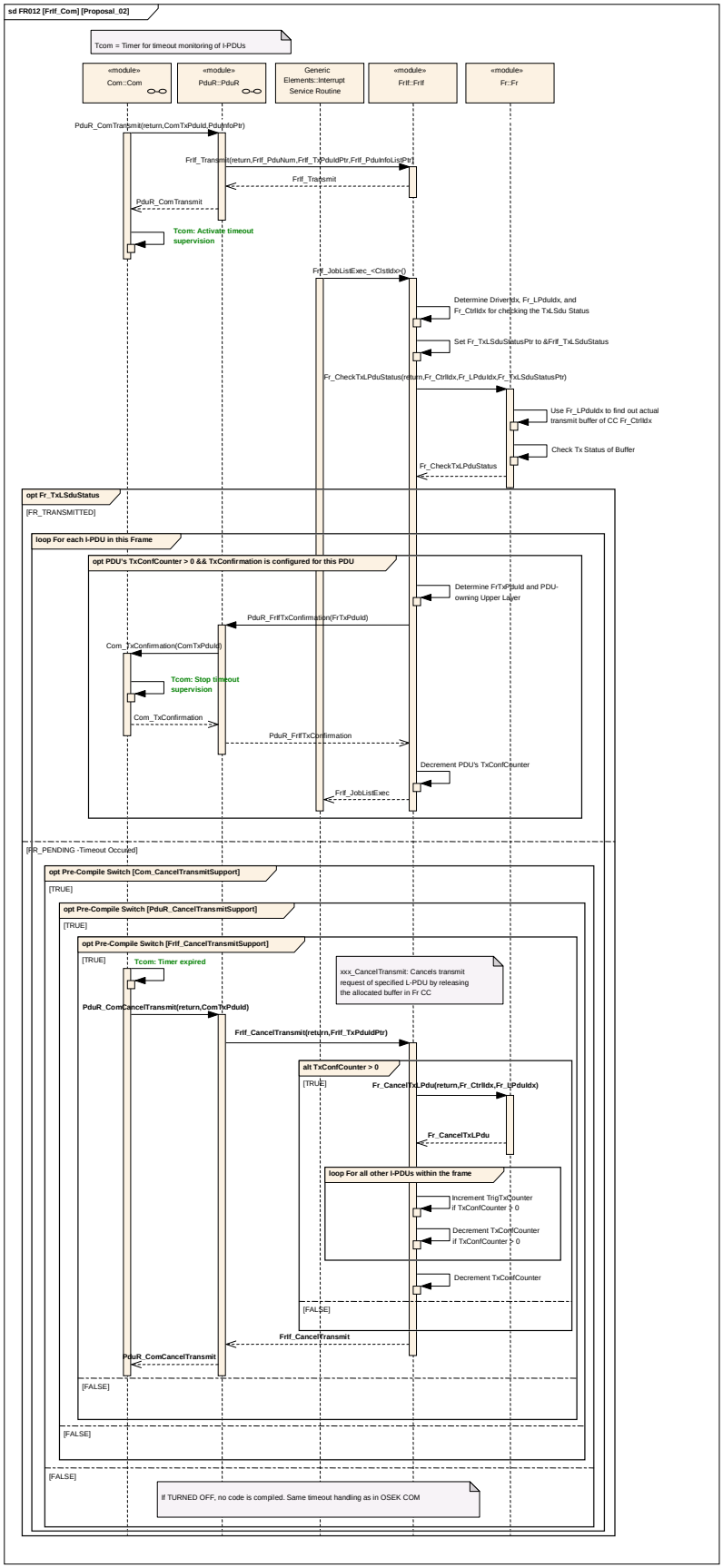


Figure 9-7: Cancel Transmission

9.3 Prepare LPDU

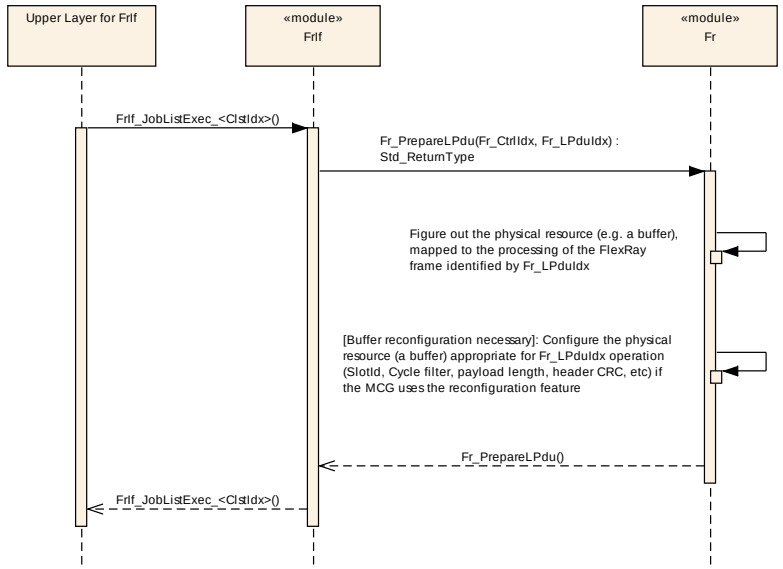


Figure 9-8: Prepare LPdu

10 Configuration Specification

This chapter defines configuration parameters and their clustering into containers.
Chapter 10.1 gives information to help understanding the subsequent chapters.
Chapter 10.2 specifies the structure (containers) and the parameters of the FlexRay Interface.
Chapter 9.3 specifies published information of the FlexRay Interface.

10.1 How to Read this Chapter

In addition to this section, it is highly recommended to read the documents:

- AUTOSAR Layered Software Architecture [2]
- AUTOSAR ECU Configuration Specification [14]
  This document describes the AUTOSAR configuration methodology and the AUTOSAR configuration metamodel in detail.

The following is only a short survey of the topic and it will not replace the ECU Configuration Specification document.

10.1.1 Configuration and Configuration Parameters

Configuration parameters define the variability of the generic part(s) of an implementation of a module. This means that only generic or configurable module implementation can be adapted to the environment (software/hardware) in use during system and/or ECU configuration.

The configuration of parameters can be achieved at different times during the software process: pre compile time, before link time or post build time. In the following, the term "configuration class" (of a parameter) shall be used in order to refer to a specific configuration point in time.

10.1.2 Variants

Variants describe sets of configuration parameters. E.g., variant 1: only pre-compile time configuration parameters; variant 2: mix of pre compile- and post build time-configuration parameters. In one variant, a parameter can only be of one configuration class.

10.1.3 Containers

[FrIf05077] ⌈

Containers structure the set of configuration parameters. This means:

- *all* configuration parameters are kept in containers.
- (sub-) containers can reference (sub-) containers. It is possible to assign a multiplicity to these references. The multiplicity then defines the possible number of instances of the contained parameters. ⌋ ()

10.1.4 Specification Template for Configuration Parameters

The following tables consist of three sections:

- the general section
- the configuration parameter section
- the section of included/referenced containers

Pre compile time - specifies whether the configuration parameter shall be of configuration class *Pre-compile time* or not

Label	*Description*
X	The configuration parameter shall be of configuration class *Pre-compile time*.
--	The configuration parameter shall never be of configuration class *Pre-compile time*.

Link time - specifies whether the configuration parameter shall be of configuration class *link time* or not

Label	*Description*
x	The configuration parameter shall be of configuration class *link time*.
--	The configuration parameter shall never be of configuration class *link time*.

Post build time - specifies whether the configuration parameter shall be of configuration class *post build time* or not

Label	*Description*
x	The configuration parameter shall be of configuration class *post build time* and no specific implementation is required.
L	*Loadable* - the configuration parameter shall be of configuration class *post build time* and only one configuration parameter set resides in the ECU.
M	*Multiple* - the configuration parameter shall be of configuration class *post build time* and is selected out of a set of multiple parameters by passing a dedicated pointer to the init function of the module.
--	The configuration parameter shall never be of configuration class *post build time*.

10.2 Containers and Configuration Parameters

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

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:
Configuration rules and constraints for plausibility checks shall be performed during configuration time, wherever possible.

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

10.2.1 Variants

[FrIf05281] ⌈VARIANT-POST-BUILD: All configuration parameters in container 'FrIfGeneral' shall be configurable at pre-compile time. All other configuration parameters shall be configurable at post-build-time. ⌋ ()

Use case: Object code delivery, selectable configuration

[FrIf05282] ⌈VARIANT-PRE-COMPILE: All configuration parameters shall be configurable at pre-compile time. ⌋ ()

Use case: Execution time optimizations

[FrIf05286] ⌈VARIANT-LINK-TIME: Includes all configuration options of the variant VARIANT-PRE-COMPILE. Additionally all parameters that are marked as link-time configurable with "VARIANT-LINK-TIME" shall be configurable at link time, for example by linking a special configured parameter object file. ⌋ ()

10.2.2 FrIf

SWS Item	**FrIf06087_Conf :**
Module Name	*FrIf*
Module Description	Configuration of the FrIf (FlexRay Interface) module.

Included Containers		
Container Name	***Multiplicity***	***Scope / Dependency***
FrIfConfig	1	Configuration of the FlexRay Interface. This container is a MultipleConfigurationContainer, i.e. this container and its sub-containers exist once per configuration set.
FrIfGeneral	1	This container contains the general configuration parameters of the FlexRay Interface.

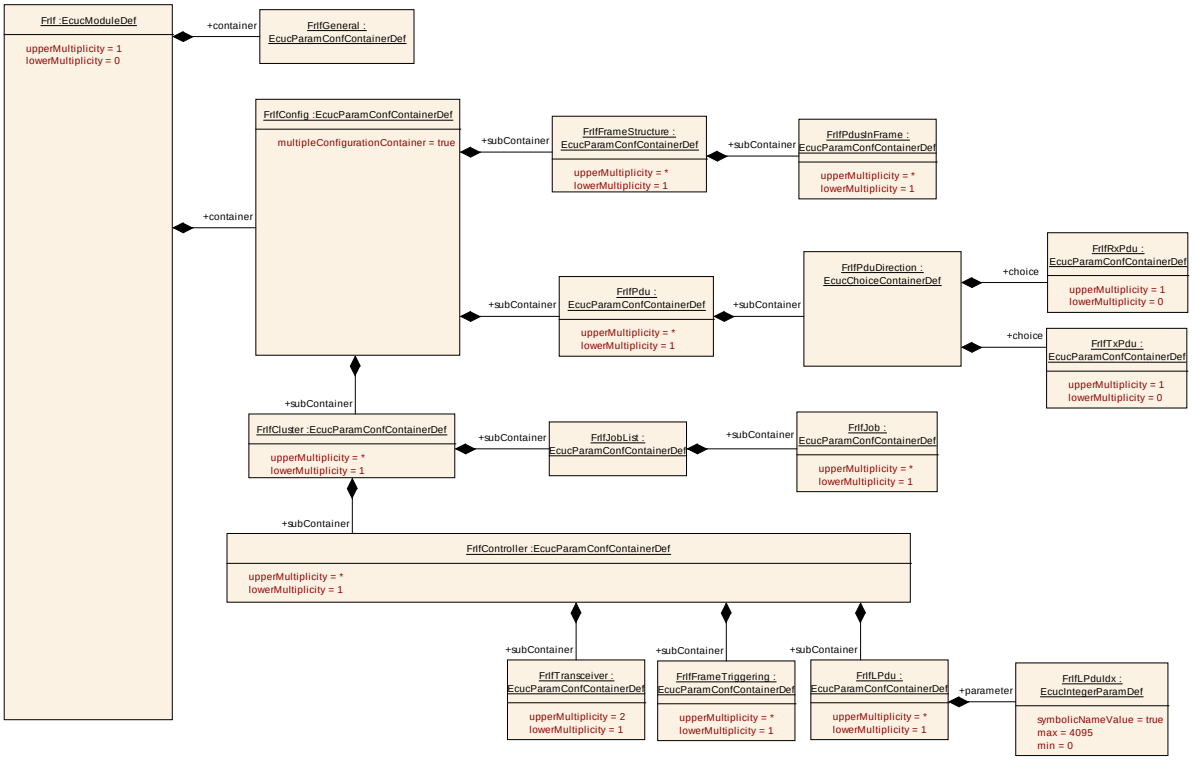


Figure 10-1: FlexRay Interface Module

10.2.3 FrIfGeneral

SWS Item	**FrIf05360_Conf :**
Container Name	FrIfGeneral
Description	This container contains the general configuration parameters of the FlexRay Interface.
Configuration Parameters	

SWS Item	**FrIf06112_Conf :**		
Name	FrIfAbsTimerIdx		
Description	Maximum number of supported absolut timers.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 15		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06108_Conf :**		
Name	FrIfAllSlotsSupport		
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf00002_Conf :**		
Name	FrIfCancelTransmitSupport		
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06080_Conf :**		
Name	FrIfDevErrorDetect		
Description	Switches the Development Error Detection and Notification on or off true: Development Error Detection and Notification on false: Development Error Detection and Notification off		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	

	Post-build time	--	
Scope / Dependency	scope: Module		

SWS Item	**FrIf06110_Conf :**		
Name	FrIfDisableLPduSupport		
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06102_Conf :**		
Name	FrIfDisableTransceiverBranchSupport		
Description	Configuration parameter to enable/disable FrIf support to disable branches of an active star.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06103_Conf :**		
Name	FrIfEnableTransceiverBranchSupport		
Description	Configuration parameter to enable/disable FrIf support to enable branches of an active star.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06106_Conf :**		
Name	FrIfGetClockCorrectionSupport		
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06105_Conf :**
Name	FrIfGetGetChannelStatusSupport
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06114_Conf :**		
Name	FrIfGetNmVectorSupport		
Description	Configuration parameter to enable/disable FrIf support to request the FlexRay hardware NMVector.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06104_Conf :**		
Name	FrIfGetNumOfStartupFramesSupport		
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06107_Conf :**		
Name	FrIfGetSyncFrameListSupport		
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06101_Conf :**		
Name	FrIfGetTransceiverErrorSupport		
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06111_Conf :**		
Name	FrIfGetWakeupRxStatusSupport		
Description	Configuration parameter to enable/disable FrIf support to get the wakeup received information from the FlexRay controller.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06081_Conf :**		
Name	FrIfNumClstSupported		
Description	Maximum number of FlexRay Clusters that the FlexRay Interface supports.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 15		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: Module		

SWS Item	**FrIf06082_Conf :**		
Name	FrIfNumCtrlSupported		
Description	Maximum number of FlexRay CCs that the FlexRay Interface supports		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 15		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: Module		

SWS Item	**FrIf06116_Conf :**		
Name	FrIfPublicCddHeaderFile		
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	--		
maxLength	--		
minLength	--		
regularExpression	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06117_Conf :**
Name	FrIfReadCCConfigApi
Description	Configuration parameter to enable/disable the optional FrIf_ReadCCConfig API.

Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf06109_Conf :**		
Name	FrIfReconfigLPduSupport		
Description	Configuration parameter to enable/disable FrIf support to enable/disable the reconfiguration of a given LPdu according to the parameters (FrameId, Channel, CycleRepetition, CycleOffset, PayloadLength, HeaderCRC) at runtime.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: local		

SWS Item	**FrIf00001_Conf :**		
Name	FrIfUnusedBitValue		
Description	Set unused bits to a defined value.		
Multiplicity	0..1		
Type	EcucIntegerParamDef		
Range	0 .. 1		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: Module		

SWS Item	**FrIf06083_Conf :**		
Name	FrIfVersionInfoApi		
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	--		
ConfigurationClass	***Pre-compile time***	X	All Variants
	Link time	--	
	Post-build time	--	
Scope / Dependency	scope: Module		

No Included Containers

10.2.4 FrIfCluster

SWS Item	**FrIf05366_Conf :**
Container Name	FrIfCluster
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.

Configuration Parameters

SWS Item	FrIf06002_Conf :		
Name	FrIfClstIdx		
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	--		
ConfigurationClass	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	FrIf00003_Conf :		
Name	FrIfDetectNITError		
Description	Indicates whether NIT error status of each cluster shall be detected or not.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	FrIf06006_Conf :		
Name	FrIfGChannels		
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	
ConfigurationClass	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	FrIf06008_Conf :		
Name	FrIfGColdStartAttempts		
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	--		
ConfigurationClass	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	FrIf06086_Conf :

Name	FrIfGCycleCountMax		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06009_Conf :**		
Name	FrIfGListenNoise		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06010_Conf :**		
Name	FrIfGMacroPerCycle		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module/Fr		

SWS Item	**FrIf06011_Conf :**		
Name	FrIfGMaxWithoutClockCorrectFatal		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06012_Conf :**

Name	FrIfGMaxWithoutClockCorrectPassive		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06013_Conf :**		
Name	FrIfGNetworkManagementVectorLength		
Description	Length of the Network Management vector in a cluster [bytes]		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 12		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06014_Conf :**		
Name	FrIfGNumberOfMinislots		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06015_Conf :**		
Name	FrIfGNumberOfStaticSlots		
Description	Number of static slots in the static segment		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 1023		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06018_Conf :**		
Name	FrIfGPayloadLengthStatic		
Description	Payload length of a static frame [16 bit words]		
Multiplicity	1		
Type	EcucIntegerParamDef		

Range	0 .. 127		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06019_Conf :**		
Name	FrIfGSyncFrameIDCountMax		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06020_Conf :**		
Name	FrIfGdActionPointOffset		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module/Fr		

SWS Item	**FrIf06021_Conf :**		
Name	FrIfGdBit		
Description	Nominal bit time in seconds		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	T100NS	--	
	T200NS	--	
	T400NS	--	
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06024_Conf :**		
Name	FrIfGdCasRxLowMax		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE

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

SWS Item	**FrIf06025_Conf :**		
Name	FrIfGdCycle		
Description	Length of the cycle, expressed in [s] Remark: Lower limit 0.000024 for FlexRay Protocol 3.0 compliance.		
Multiplicity	1		
Type	EcucFloatParamDef		
Range	`2.4E-5 .. 0.016`		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06026_Conf :**		
Name	FrIfGdDynamicSlotIdlePhase		
Description	Duration of the idle phase within a dynamic slot [Minislots].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf00012_Conf :**		
Name	FrIfGdIgnoreAfterTx		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06027_Conf :**		
Name	FrIfGdMacrotick		
Description	Duration of the cluster wide nominal macrotick, expressed in s		
Multiplicity	1		
Type	EcucFloatParamDef		
Range	`1E-6 .. 6E-6`		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06032_Conf :**
Name	FrIfGdMiniSlotActionPointOffset

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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06033_Conf :**		
Name	FrIfGdMinislot		
Description	Duration of a minislot [Macroticks]		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 63		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module/Fr		

SWS Item	**FrIf06034_Conf :**		
Name	FrIfGdNit		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06035_Conf :**		
Name	FrIfGdSampleClockPeriod		
Description	Sample clock period		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	T12_5NS	--	
	T25NS	--	
	T50NS	--	
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06036_Conf :**		
Name	FrIfGdStaticSlot		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06037_Conf :**		
Name	FrIfGdSymbolWindow		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf00011_Conf :**		
Name	FrIfGdSymbolWindowActionPointOffset		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06038_Conf :**		
Name	FrIfGdTSSTransmitter		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06039_Conf :**		
Name	FrIfGdWakeupRxIdle		
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	--		

ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06040_Conf :**		
Name	FrIfGdWakeupRxLow		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06041_Conf :**		
Name	FrIfGdWakeupRxWindow		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06043_Conf :**		
Name	FrIfGdWakeupTxActive		
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 gdWakeupSymbolTxLow.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	15 .. 60		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06042_Conf :**		
Name	FrIfGdWakeupTxIdle		
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 gdWakeupSymbolTxIdle.		
Multiplicity	1		

Type	EcucIntegerParamDef		
Range	45 .. 180		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06003_Conf :**		
Name	FrIfMainFunctionPeriod		
Description	The execution cycle of the FrIf_MainFunction_<cluster>() 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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06004_Conf :**		
Name	FrIfMaxIsrDelay		
Description	The maximum delay in macroticks the FrIf_JoblistExec_<cluster>() function is processed after the absolute timer interrupt was triggered.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 10240000		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf00004_Conf :**		
Name	FrIfSafetyMargin		
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 .. 10240000		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

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_ReportErrorStatus API in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId value. The

		standardized errors are provided in the 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_<ClstIdx>().

10.2.5 FrIfController

SWS Item	**FrIf05363_Conf :**
Container Name	FrIfController
Description	This container contains the configuration of FlexRay CC.
Configuration Parameters	

SWS Item	**FrIf06045_Conf :**		
Name	FrIfCtrlIdx		
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	--		
ConfigurationClass	***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	**FrIf06044_Conf :**		
Name	FrIfFrCtrlRef		
Description	Reference to a Controller, which is handled by a specific Driver. This reference is unique for the ECU.		
Multiplicity	1		
Type	Reference to [FrController]		
ConfigurationClass	***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.

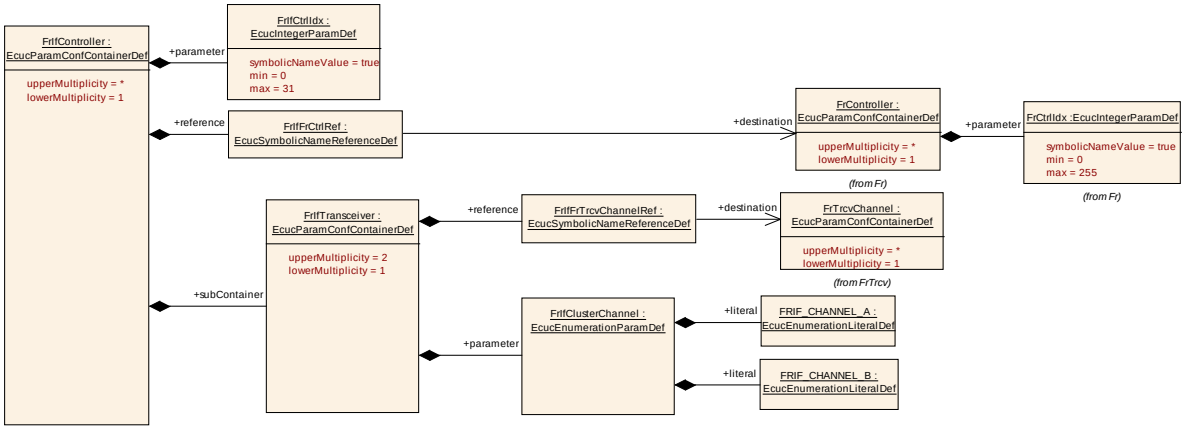


Figure 10-2: FlexRay Interface Controller (hardware reference)

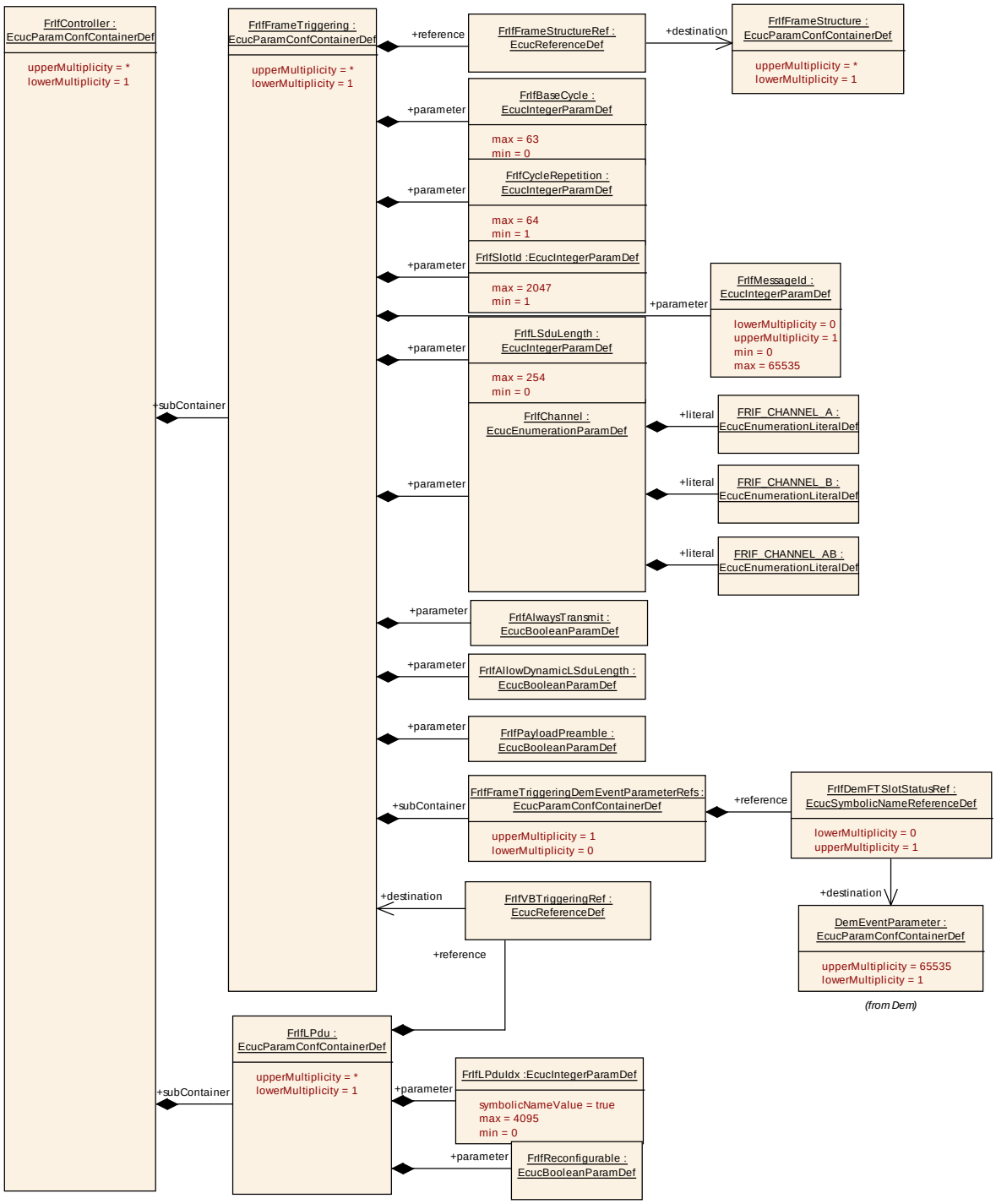


Figure 10-3: FlexRay Interface Controller (data reference)

10.2.6 FrIfTransceiver

SWS Item	**FrIf05391_Conf :**
Container Name	FrIfTransceiver
Description	Up to two FlexRay Transceivers may connect a Controller to a Cluster. This container realizes a Controller-Transceiver assignment.
Configuration Parameters	

SWS Item	**FrIf06062_Conf :**
Name	FrIfClusterChannel

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
ConfigurationClass	***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	**FrIf06061_Conf :**		
Name	FrIfFrTrcvChannelRef		
Description	Reference to a Transceiver Driver Channel. This reference is unique for the ECU.		
Multiplicity	1		
Type	Reference to [FrTrcvChannel]		
ConfigurationClass	***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

10.2.7 FrIfLPdu

SWS Item	**FrIf05364_Conf :**
Container Name	FrIfLPdu
Description	Reference to a L-PDU index
Configuration Parameters	

SWS Item	**FrIf06058_Conf :**		
Name	FrIfLPduIdx		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf00008_Conf :**
Name	FrIfReconfigurable
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06057_Conf :**		
Name	FrIfVBTriggeringRef		
Description	Reference to the assigned Frame triggering.		
Multiplicity	1		
Type	Reference to [FrIfFrameTriggering]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

No Included Containers

10.2.8 FrIfFrameTriggering

SWS Item	**FrIf06090_Conf :**
Container Name	FrIfFrameTriggering
Description	A Frame triggering contains the communication parameters of the FlexRay Frame as well as a reference to the Frame Construction Plan.
Configuration Parameters	

SWS Item	**FrIf06049_Conf :**		
Name	FrIfAllowDynamicLSduLength		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf00013_Conf :**		
Name	FrIfAlwaysTransmit		
Description	Defines wether the driver's API function Fr_TransmitTxLPdu() shall always be called for this L-PDU.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06051_Conf :**
Name	FrIfBaseCycle
Description	This parameter contains the FlexRay Base Cycle used to transmit this FlexRay Frame.
Multiplicity	1

Type	EcucIntegerParamDef		
Range	0 .. 63		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06052_Conf :**		
Name	FrIfChannel		
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
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06053_Conf :**		
Name	FrIfCycleRepetition		
Description	This parameter contains the FlexRay Cycle Repetition used to transmit this FlexRay Frame.. possible Values: 1,2,4,8,16,32,64		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 64		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06054_Conf :**		
Name	FrIfLSduLength		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module dependency: The parameter depends on the low level parameters of the FlexRay CC.		

SWS Item	**FrIf00010_Conf :**
Name	FrIfMessageId
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06055_Conf :**		
Name	FrIfPayloadPreamble		
Description	Switching the Payload Preamble bit.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06056_Conf :**		
Name	FrIfSlotId		
Description	This parameter contains the FlexRay Slot ID used to transmit this FlexRay Frame.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 2047		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06048_Conf :**		
Name	FrIfFrameStructureRef		
Description	Reference to the Construction Plan of the FlexRay Frame.		
Multiplicity	1		
Type	Reference to [FrIfFrameStructure]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

Included Containers		
Container Name	***Multiplicity***	***Scope / Dependency***
FrIfFrameTriggeringDemEventParameterRefs	0..1	Container for the references to DemEventParameter elements which shall be invoked using the API Dem_ReportErrorStatus API in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId value. The standardized errors are provided in the container and can be extended by vendor specific error references.

10.2.9 FrIfJobList

SWS Item	**FrIf05367_Conf :**
Container Name	FrIfJobList
Description	This container specifies a list of all FlexRay Jobs of the Cluster to be performed by FrIf_JobListExec_<ClstIdx>().
Configuration Parameters	

SWS Item	**FrIf06063_Conf :**		
Name	FrIfAbsTimerRef		
Description	Reference to the absolute timer to be used to trigger the interrupt whose ISR contains the FrIf_JobListExec_<ClstIdx>() function.		
Multiplicity	1		
Type	Reference to [FrAbsoluteTimer]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

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.

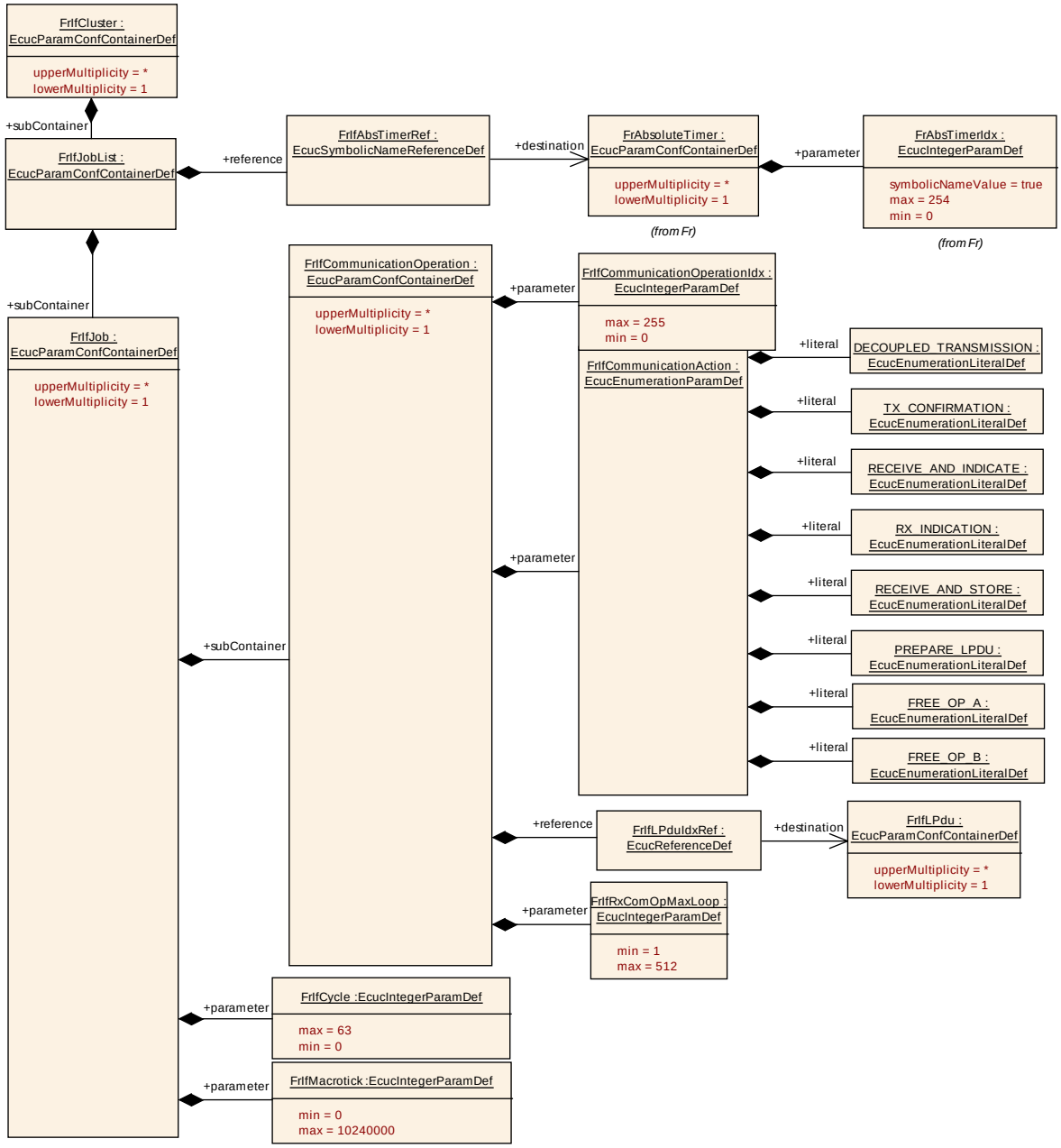


Figure 10-4: FlexRay Inferface JobList

10.2.10 FrIfJob

SWS Item	**FrIf05368_Conf :**
Container Name	FrIfJob
Description	A job may contain more than one operation that are executed at a specific point in time.
Configuration Parameters	

SWS Item	**FrIf06064_Conf :**	
Name	FrIfCycle	
Description	The FlexRay Cycle in which the communication operation will execute this job	
Multiplicity	1	
Type	EcucIntegerParamDef	
Range	0 .. 63	

Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06065_Conf :**		
Name	FrIfMacrotick		
Description	Macrotick offset in the Cycle [Macrotick]		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 10240000		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

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.

10.2.11 FrIfCommunicationOperation

SWS Item	**FrIf05369_Conf :**
Container Name	FrIfCommunicationOperation
Description	A separate operation which is part of a FlexRay Job and defines what type of action is executed.
Configuration Parameters	

SWS Item	**FrIf06067_Conf :**		
Name	FrIfCommunicationAction		
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	
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06068_Conf :**
Name	FrIfCommunicationOperationIdx
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf00007_Conf :**		
Name	FrIfRxComOpMaxLoop		
Description	Defines the maximum number of loops for the receive RECEIVE_AND_INDICATE (Use case: emptying a FIFO).		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 512		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06066_Conf :**		
Name	FrIfLPduIdxRef		
Description	Reference to a L-PDu index		
Multiplicity	1		
Type	Reference to [FrIfLPdu]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

No Included Containers

10.2.12 FrIfFrameStructure

SWS Item	**FrIf05370_Conf :**
Container Name	FrIfFrameStructure
Description	The Frame structure specifies a Construction Plan how a Frame is assembled with PDUs and their respective Update-Bits.
Configuration Parameters	

SWS Item	**FrIf06113_Conf :**		
Name	FrIfByteOrder		
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 ByteOrder 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 FrIfPduOffset indicates the position of the least significant bit in the Frame.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	BIG_ENDIAN	--	
	LITTLE_ENDIAN	--	
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE

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

Included Containers		
Container Name	***Multiplicity***	***Scope / Dependency***
FrIfPdusInFrame	1..*	This container holds all the information about a PDU in a FlexRay Frame.

10.2.13 FrIfPdusInFrame

SWS Item	**FrIf05371_Conf :**
Container Name	FrIfPdusInFrame
Description	This container holds all the information about a PDU in a FlexRay Frame.
Configuration Parameters	

SWS Item	**FrIf06070_Conf :**		
Name	FrIfPduOffset		
Description	The value specifies the offset of the PDU within the Frame [bytes].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 253		
Default value	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module 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	**FrIf06071_Conf :**		
Name	FrIfPduUpdateBitOffset		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module 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	**FrIf06069_Conf :**		
Name	FrIfPduRef		
Description	This is the reference to the local definition of a PDU.		
Multiplicity	1		
Type	Reference to [FrIfPdu]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME

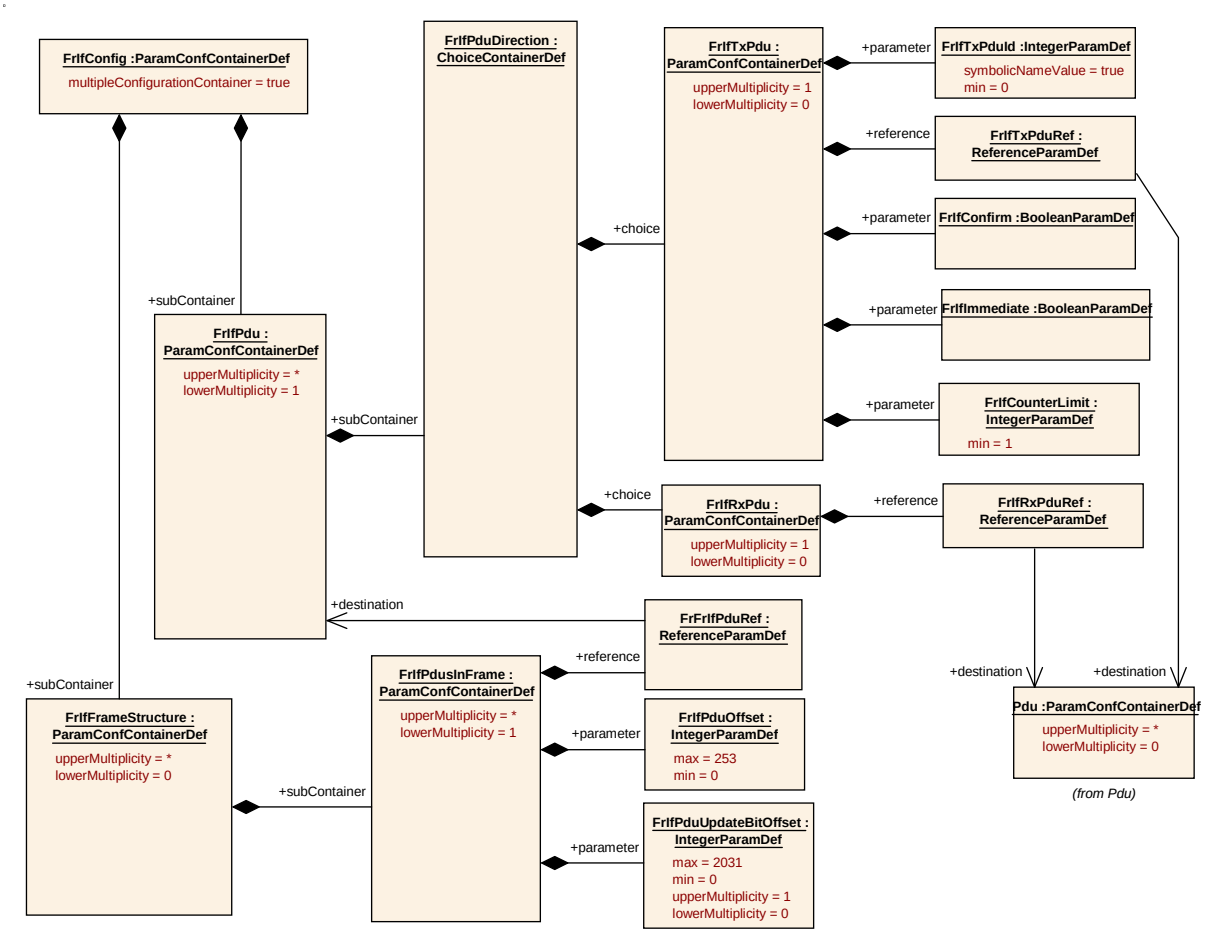
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

No Included Containers

10.2.14 FrIfPdu

SWS Item	**FrIf05372_Conf :**
Container Name	FrIfPdu{FRIF_PDU}
Description	Contains PDU information. A PDU may be either a transmission PDU or a reception PDU.
Configuration Parameters	

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



10.2.15 FrIfTxPdu

SWS Item	**FrIf05374_Conf :**
Container Name	FrIfTxPdu
Description	This container specifies transmission PDUs.

Configuration Parameters

SWS Item	FrIf06075_Conf :		
Name	FrIfConfirm		
Description	Defines whether the transmission of a PDU should be checked and confirmed to the PDU owning BSW module.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	FrIf06076_Conf :		
Name	FrIfCounterLimit		
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	1		
Type	EcucIntegerParamDef		
Range	1 .. 255		
Default value	--		
ConfigurationClass	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	FrIf06077_Conf :		
Name	FrIfImmediate		
Description	Defines whether the PDU is transmitted immediate or decoupled.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	--		
ConfigurationClass	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	FrIf06050_Conf :		
Name	FrIfNoneMode		
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		
ConfigurationClass	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module dependency: FrIfImmediate		

SWS Item	FrIf00014_Conf :
Name	FrIfTxConfirmationName
Description	This parameter defines the name of the <User_TxConfirmation>. This parameter depends on the parameter FrIfUserTxUL. If FrIfUserTxUL

	equals FR_TP, FR_NM, PDUR or XCP, the name of the <User_TxConfirmation> is fixed. If FrIfUserTxUL equals CDD, the name of the <User_TxConfirmation> is selectable.		
Multiplicity	0..1		
Type	EcucFunctionNameDef		
Default value	--		
maxLength	--		
minLength	--		
regularExpression	--		
ConfigurationClass	***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	**FrIf06078_Conf :**		
Name	FrIfTxPduId		
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	--		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: FrIf and PduR/FrNm/FrTp		

SWS Item	**FrIf06084_Conf :**		
Name	FrIfUserTriggerTransmitName		
Description	This parameter defines the name of the <User_TriggerTransmit>. This parameter depends on the parameter FrIfUserTxUL. If FrIfUserTxUL equals FR_TP, FR_NM, PDUR 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	--		
maxLength	--		
minLength	--		
regularExpression	--		
ConfigurationClass	***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	**FrIf00015_Conf :**	
Name	FrIfUserTxUL	
Description	This parameter defines the upper layer (UL) module to which the trigger of the to be transmitted FRIFTXPDUID (via the <User_TriggerTransmit>) or the confirmation of the successfully transmitted FRIFTXPDUID has to be routed (via the <User_TxConfirmation>).	
Multiplicity	1	
Type	EcucEnumerationParamDef	
Range	CDD	Complex Device Driver
	FR_NM	FR NM

	FR_TP	FR TP	
	PDUR	PDU Router	
	XCP	Extended Calibration Protocol	
ConfigurationClass	***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	**FrIf06074_Conf :**		
Name	FrIfTxPduRef		
Description	Reference to the external PDU definition.		
Multiplicity	1		
Type	Reference to [Pdu]		
ConfigurationClass	***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 FrIfRxPdu

SWS Item	**FrIf05373_Conf :**
Container Name	FrIfRxPdu
Description	Receive PDU
Configuration Parameters	

SWS Item	**FrIf00016_Conf :**		
Name	FrIfRxIndicationName		
Description	This parameter defines the name of the <User_RxIndication>. This parameter depends on the parameter FRIF_USERRXINDICATION_UL. If FRIF_USERRXINDICATION_UL equals FR_TP, FR_NM, PDUR or XCP, the name of the <User_RxIndication> is fixed. If FRIF_USERRXINDICATION_UL equals CDD, the name of the <User_RxIndication> is selectable.		
Multiplicity	0..1		
Type	EcucFunctionNameDef		
Default value	--		
maxLength	--		
minLength	--		
regularExpression	--		
ConfigurationClass	***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	**FrIf00017_Conf :**
Name	FrIfUserRxIndicationUL
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 FRIFRXPDU 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 Device Driver
	FR_NM		FR NM
	FR_TP		FR TP
	PDUR		PDU Router
	XCP		Extended Calibration Protocol
ConfigurationClass	***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	**FrIf06073_Conf :**		
Name	FrIfRxPduRef		
Description	Reference to the external PDU definition.		
Multiplicity	1		
Type	Reference to [Pdu]		
ConfigurationClass	***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

10.2.17 FrIfPduDirection

SWS Item	**FrIf06072_Conf :**
Choice container Name	FrIfPduDirection
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.

10.2.18 FrIfConfig

SWS Item	**FrIf06001_Conf :**
Container Name	FrIfConfig [Multi Config Container]
Description	Configuration of the FlexRay Interface. This container is a MultipleConfigurationContainer, i.e. this container and its sub-containers exist once per configuration set.
Configuration Parameters	

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.

10.2.19 FrIfClusterDemEventParameterRefs

SWS Item	**FrIf06091_Conf :**		
Container Name	FrIfClusterDemEventParameterRefs		
Description	Container for the references to DemEventParameter elements which shall be invoked using the API Dem_ReportErrorStatus API in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId value. The standardized errors are provided in the container and can be extended by vendor specific error references.		
Configuration Parameters			

SWS Item	**FrIf06097_Conf :**		
Name	FRIF_E_ACS_CH_A		
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 (neither to DET nor to DEM).		
Multiplicity	0..1		
Type	Reference to [DemEventParameter]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06098_Conf :**		
Name	FRIF_E_ACS_CH_B		
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 (neither to DET nor to DEM).		
Multiplicity	0..1		
Type	Reference to [DemEventParameter]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06093_Conf :**		
Name	FRIF_E_NIT_CH_A		
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 (neither to DET nor to DEM).		
Multiplicity	0..1		
Type	Reference to [DemEventParameter]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06094_Conf :**		
Name	FRIF_E_NIT_CH_B		
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 (neither to DET nor to DEM).		
Multiplicity	0..1		
Type	Reference to [DemEventParameter]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME

	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06095_Conf :**		
Name	FRIF_E_SW_CH_A		
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 (neither to DET nor to DEM).		
Multiplicity	0..1		
Type	Reference to [DemEventParameter]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

SWS Item	**FrIf06096_Conf :**		
Name	FRIF_E_SW_CH_B		
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 (neither to DET nor to DEM).		
Multiplicity	0..1		
Type	Reference to [DemEventParameter]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

No Included Containers

10.2.20 FrIfFrameTriggeringDemEventParameterRefs

SWS Item	**FrIf06099_Conf :**
Container Name	FrIfFrameTriggeringDemEventParameterRefs
Description	Container for the references to DemEventParameter elements which shall be invoked using the API Dem_ReportErrorStatus API in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId value. The standardized errors are provided in the container and can be extended by vendor specific error references.
Configuration Parameters	

SWS Item	**FrIf00009_Conf :**		
Name	FrIfDemFTSlotStatusRef		
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	Reference to [DemEventParameter]		
ConfigurationClass	***Pre-compile time***	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: Module		

No Included Containers

10.3 Published Information

[FrIf06117] ⌈The standardized common published parameters as required by BSW00402 in the General Requirements on Basic Software Modules [3] shall be published within the header file of this module and need to be provided in the BSW Module Description. The according module abbreviation can be found in the List of Basic Software Modules [1].⌋()

Additional module-specific published parameters are listed below if applicable.

11 Changes during SWS Improvements by Technical Office for set 2

11.1 Deleted SWS Items

SWS Item	*Rationale*
FrIf05051	Requirement ID removed from FlexRay driver requirement
FrIf05070	Requirement ID removed from configuration tool requirement
FrIf05071	Requirement ID removed from configuration tool requirement
FrIf05072	Requirement ID removed from configuration tool requirement
FrIf05073	Requirement ID removed from configuration tool requirement
FrIf05102	Requirement ID removed from BSW scheduler requirement
FrIf05118	Requirement ID removed from BSW scheduler requirement
FrIf05132	Explanation with requirement ID changed to text referencing authoritative requirements in chapter 10
FrIf05135	Explanation with requirement ID changed to text referencing authoritative requirements in chapter 10

11.2 Replaced SWS Items

SWS Item	*Replaced by SWS Item*	*Rationale*
FrIf05049	FrIf05147, FrIf05148	Requirements separated from rationale
FrIf05068	FrIf05284, FrIf05285, FrIf05284	Requirements separated
FrIf05075	FrIf05149, FrIf05150	Standard requirement separated from additional requirement

11.3 Changed SWS Items

SWS Item	*Rationale*
FrIf05052	Explanation in footnote separated from requirement
FrIf05067	Explanation separated from requirement
FrIf05076	Redundant rows containing FrIf.h, FrIf_Cfg.h and Dem.h removed
FrIf05079	Explanation separated from requirement
FrIf05130	Rationale separated from requirement

11.4 Added SWS Items

SWS Item	*Rationale*
FrIf05145	Requirement ID for standard requirement added
FrIf05151	Identified requirement
FrIf05152	Requirement ID for standard requirement added

FrIf05153	Requirement ID for standard requirement added
FrIf05154	Requirement ID for configuration
FrIf05155	Identified requirement
FrIf05156	Identified requirement
FrIf05157	Requirement ID for caveats
FrIf05158	Identified requirement
FrIf05159	Identified requirement
FrIf05160	Requirement ID for caveats
FrIf05161	Identified requirement
FrIf05162	Identified requirement
FrIf05163	Requirement ID for caveats
FrIf05164	Identified requirement
FrIf05165	Identified requirement
FrIf05166	Requirement ID for caveats
FrIf05167	Identified requirement
FrIf05168	Identified requirement
FrIf05169	Requirement ID for caveats
FrIf05170	Requirement ID for function FrIf_GetState
FrIf05171	Identified requirement
FrIf05172	Identified requirement
FrIf05173	Requirement ID for caveats
FrIf05174	Requirement ID for function FrIf_SetState
FrIf05175	Identified requirement
FrIf05176	Requirement ID for caveats
FrIf05177	Identified requirement
FrIf05178	Identified requirement
FrIf05179	Requirement ID for caveats
FrIf05180	Identified requirement
FrIf05181	Identified requirement
FrIf05182	Requirement ID for caveats
FrIf05183	Identified requirement
FrIf05184	Identified requirement
FrIf05185	Identified requirement
FrIf05186	Requirement ID for caveats
FrIf05187	Identified requirement
FrIf05188	Identified requirement
FrIf05189	Requirement ID for caveats
FrIf05190	Identified requirement
FrIf05191	Identified requirement
FrIf05192	Identified requirement
FrIf05193	Requirement ID for caveats
FrIf05194	Identified requirement
FrIf05195	Identified requirement
FrIf05196	Requirement ID for caveats
FrIf05197	Identified requirement
FrIf05198	Identified requirement
FrIf05199	Requirement ID for caveats
FrIf05200	Identified requirement
FrIf05201	Identified requirement
FrIf05202	Requirement ID for caveats
FrIf05203	Identified requirement
FrIf05204	Requirement ID for caveats
FrIf05205	Identified requirement
FrIf05206	Identified requirement
FrIf05207	Identified requirement
FrIf05208	Identified requirement
FrIf05209	Requirement ID for caveats
FrIf05210	Identified requirement

FrIf05211	Identified requirement
FrIf05212	Identified requirement
FrIf05213	Requirement ID for caveats
FrIf05214	Identified requirement
FrIf05215	Identified requirement
FrIf05216	Identified requirement
FrIf05217	Requirement ID for caveats
FrIf05218	Identified requirement
FrIf05219	Identified requirement
FrIf05220	Identified requirement
FrIf05221	Requirement ID for caveats
FrIf05222	Identified requirement
FrIf05223	Identified requirement
FrIf05224	Identified requirement
FrIf05225	Requirement ID for caveats
FrIf05226	Identified requirement
FrIf05227	Identified requirement
FrIf05228	Identified requirement
FrIf05229	Requirement ID for caveats
FrIf05230	Identified requirement
FrIf05231	Identified requirement
FrIf05232	Identified requirement
FrIf05233	Requirement ID for caveats
FrIf05234	Identified requirement
FrIf05235	Identified requirement
FrIf05236	Requirement ID for caveats
FrIf05237	Identified requirement
FrIf05238	Identified requirement
FrIf05239	Requirement ID for caveats
FrIf05240	Identified requirement
FrIf05241	Identified requirement
FrIf05242	Requirement ID for caveats
FrIf05243	Identified requirement
FrIf05244	Identified requirement
FrIf05245	Requirement ID for caveats
FrIf05246	Identified requirement
FrIf05247	Identified requirement
FrIf05248	Requirement ID for caveats
FrIf05249	Identified requirement
FrIf05250	Identified requirement
FrIf05251	Requirement ID for caveats
FrIf05252	Identified requirement
FrIf05253	Identified requirement
FrIf05254	Requirement ID for caveats
FrIf05255	Identified requirement
FrIf05256	Identified requirement
FrIf05257	Requirement ID for caveats
FrIf05258	Identified requirement
FrIf05259	Identified requirement
FrIf05260	Requirement ID for caveats
FrIf05261	Identified requirement
FrIf05262	Identified requirement
FrIf05263	Requirement ID for caveats
FrIf05264	Identified requirement
FrIf05265	Identified requirement
FrIf05266	Requirement ID for caveats
FrIf05267	Identified requirement
FrIf05268	Identified requirement

FrIf05269	Requirement ID for caveats
FrIf05270	Identified requirement
FrIf05271	Identified requirement
FrIf05272	Requirement ID for caveats
FrIf05273	Identified requirement
FrIf05274	Identified requirement
FrIf05275	Identified requirement
FrIf05276	Identified requirement
FrIf05277	Requirement ID for caveats
FrIf05278	Identified requirement
FrIf05279	Identified requirement
FrIf05280	Requirement ID for caveats
FrIf05281	Requirement ID for variant
FrIf05282	Requirement ID for variant
FrIf05283	Identified requirement
FrIf05287	Identified requirement
FrIf05288	Identified requirement
FrIf05289	Identified requirement
FrIf05290	Identified requirement
FrIf05291	Identified requirement
FrIf05292	Identified requirement
FrIf05293	Identified requirement
FrIf05294	Identified requirement
FrIf05295	Identified requirement
FrIf05296	Identified requirement
FrIf05297	Standard requirement
FrIf05298	Identified requirement
FrIf05299	Identified requirement changed to standard requirement
FrIf05300	Identified requirement changed to standard requirement

12 Changes on FlexRay Interface AUTOSAR R3.x

The module FlexRay Interface R4.0 supports new features like:

- FlexRay Protocol- and Physical Layer Specification 3.0
- Cancel Transmission functionality
- Additional APIs for Transceiver-, Bus- and Communication Controller monitoring
- Published Information reworked

13 Not applicable requirements

[FrIf06118]「 These requirements are not applicable to this specification.」 (BSW159, BSW167, BSW00387, BSW00416, BSW168, BSW00423, BSW00424, BSW00425, BSW00426, BSW00427, BSW00428, BSW00429, BSW00431, BSW00432, BSW00434, BSW00417, BSW00386, BSW161, BSW162, BSW005, BSW00415, BSW164, BSW00325, BSW00326, BSW00413, BSW00347, BSW00373, BSW00335, BSW00410, BSW00314, BSW00370, BSW00328, BSW00312, BSW006, BSW00377, BSW00306, BSW00371, BSW00376, BSW00329, BSW00330, , BSW00331, BSW009, BSW172, BSW010, BSW00333, BSW00341, BSW05078, BSW05101, BSW05163, BSW05164, BSW05165, BSW05067, BSW05068, BSW05069, BSW05153, BSW05035, BSW05038, BSW05162, BSW05113, BSW05102, BSW05009)