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△

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1 Introduction and functional overview

This specification describes the functionality, API and the configuration for the AUTOSAR Basic Software module FlexRay Driver (Fr).

The FlexRay Driver abstracts the hardware related implementation details of specific FlexRay Communication Controllers (CC). This specification basically relies on FlexRay CCs compliant to the FlexRay specification [1]. Additionally older FlexRay controllers compliant to FlexRay specification [2] are supported by this specification. Different behaviours in this SWS resulting from the different supported FlexRay specifications are pointed out as footnotes or remarks where applicable.

All supported features of a FlexRay controller are encapsulated within the Fr module and shall be accessed via this uniform interface only. The APIs provide abstract functional operations that are mapped to a sequence of hardware accesses depending on the actual implemented Fr module. Thus, the FlexRay Interface (Frlf), as the user of the Fr module, is independent of the underlying FlexRay CC hardware. The Fr module doesn't have a main-function or an ISR. All Fr module API functions are executed only in the context of the Frlf.

A single Fr module supports only a single type of FlexRay CC hardware implementation. The Fr supports multiple FlexRay CCs of this single hardware implementation. The FlexRay Driver's prefix is uniquely assigned per Fr module to allow usage of different FlexRay Drivers, the names of which are separated by namespace. The Frlf can access different FlexRay CC hardware implementations using different FlexRay Drivers. The Frlf configuration determines which driver from among different types is used to access a particular CC.

The configuration of the Fr module shall be done at system configuration time, with the Fr module's specific configuration being generated by a Module Configuration Generator (MCG), which translates the parameters out of the ECU configuration parameters to Fr module specific configuration data structures.

[Figure 1.1](#) depicts the basic structure of the FlexRay stack. One Frlf accesses several CCs using one or several FlexRay Drivers.

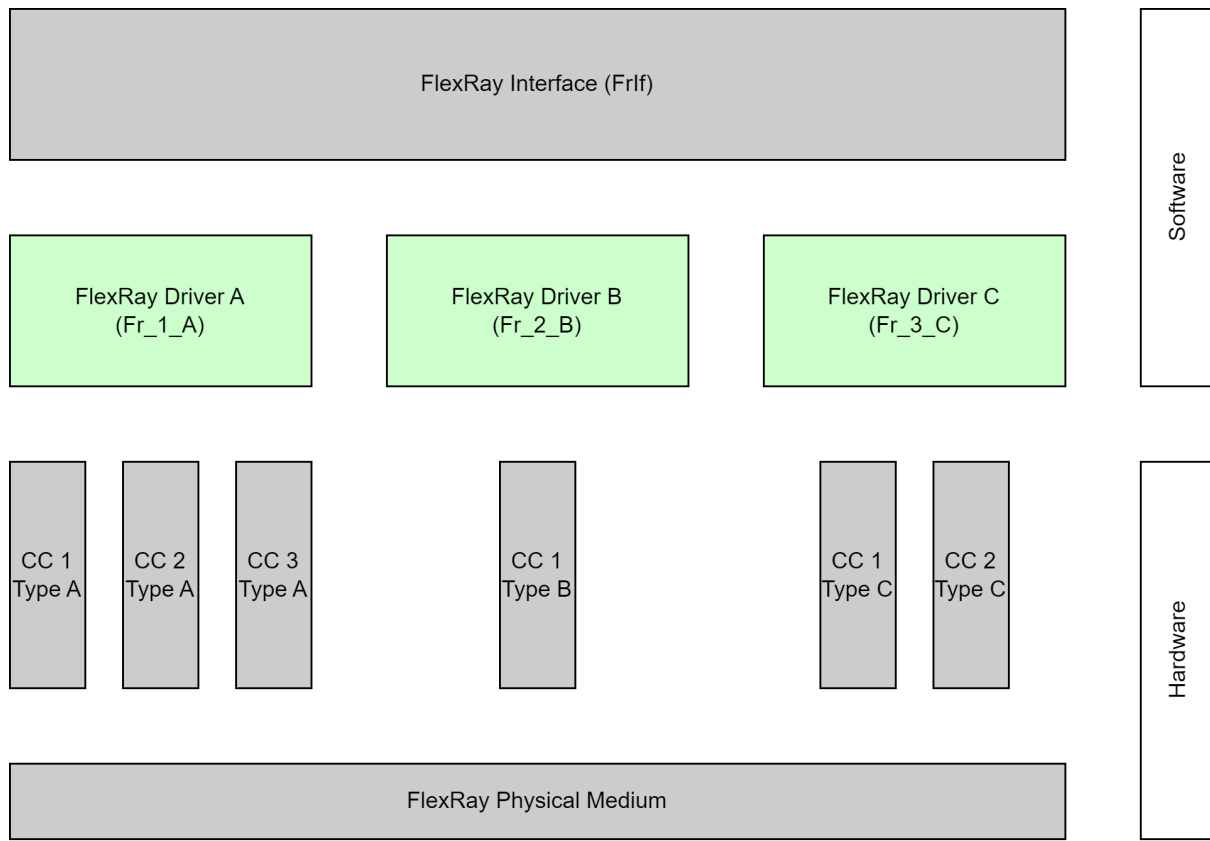


Figure 1.1: FlexRay stack module overview

2 Acronyms and Abbreviations

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

Abbreviation / Acronym:	Description:
API	Application Programming Interface
AUTOSAR	Automotive Open Systems Architecture
BSW	Basic Software
DEM/Dem	Autosar Module: Diagnostic Event Manager
DET/Det	Autosar Module: Default Error Tracer
ECU	Electronic Control Unit
MCG	Module Configuration Generator
CC	Communication Controller
CHI	Controller Host Interface
FIFO	First In First Out buffer
Fr	Autosar Module: FlexRay Driver
FrIf	Autosar Module: FlexRay Interface
FrTp	Autosar Module: FlexRay Transport Protocol
FrTrcv	Autosar Module: FlexRay Transceiver Driver
ID/Id	Identifier
ISR	Interrupt Service Routine
LPdu	Datalink layer Protocol Datagram Unit
MCAL	Microcontroller Abstraction Layer
MCU	Microcontroller Unit
MISRA	Motor Industry Software Reliability Association
NIT	FlexRay Network Idle Time
n/a	Not Applicable
OS	Operating System
PLL	Phase Locked Loop
POC	Protocol Operation Control (see [1] for details)
POCState	Actual CC internal state of the POC. This state might differ from vPOC!State in certain cases, e.g., after FREEZE command invocation (see [1] for details).
SchM	Autosar Module: Schedule Manager
SRS	System Requirements Specification
SW	SoftWare
SW-C	SoftWare Component
vPOC	Data structure provided from the CC to the host at the CHI, which contains the actual POC status of the CC (see [1] for details).
XML	Extensible Markup Language

Table 2.1: Acronyms and abbreviations used in the scope of this Document

Term:	Description:
absolute timer	An absolute timer is set to and triggered by an absolute global time of a FlexRay cluster. The FlexRay global time consists of a cycle and a macrotick offset
buffer	A buffer in the context of the Fr SWS describes a hardware transmit/receive resource, part of the FlexRay controller that is mapped to a FlexRay slot, channel, cycle for transmission or reception.
cluster	A communication system of multiple nodes connected to each other.
Macrotick	The macrotick represents the smallest unit of the global synchronized time of a FlexRay cluster.
Synchronized	<p>A FlexRay CC is considered synchronized, to the FlexRay cluster connected to, as long as the following condition holds true:</p> <pre data-bbox="624 712 1273 748"> (!vPOC!Freeze) && (vPOC!State == NORMAL_ACTIVE) (vPOC!State == NORMAL_PASSIVE) </pre>

Table 2.2: Terms used in the scope of this Document

3 Related documentation

3.1 Input documents & related standards and norms

- [1] ISO 17458-1:2013, Road vehicles - FlexRay communication system
<https://www.iso.org>
- [2] FlexRay Communications System Protocol Specification V2.1
<http://www.flexray.com/>
- [3] Glossary
AUTOSAR_FO_TR_Glossary
- [4] General Specification of Basic Software Modules
AUTOSAR_CP_SWS_BSWGeneral
- [5] Specification of Standard Types
AUTOSAR_CP_SWS_StandardTypes
- [6] Specification of FlexRay Interface
AUTOSAR_CP_SWS_FlexRayInterface

3.2 Related specification

AUTOSAR provides a General Specification on Basic Software modules [4], which is also valid for FlexRay Driver.

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

4 Constraints and assumptions

4.1 Limitations

[SWS_Fr_00449] [In the dynamic segment of each FlexRay Communication Cycle, a transmit/receive buffer of a FlexRay Communication Controller shall be used only one particular LPdu. This limits the reconfiguration possibilities and thus restricts the number of transmittable (sent and received) LPdus per dynamic segment to the accumulated number (over all CCs on one ECU) of transmit/receive buffers connected to one cluster. This limitation results from the unpredictability of the time of transmission of an LPdu within the dynamic segment. Because of that a point in time for the reconfiguration of a certain buffer for multiple usages within the dynamic segment cannot be predetermined.]

4.2 Applicability to car domains

The FlexRay Communication stack can be used wherever high data rates and fault tolerant communication (in conjunction with [1]) are required. Furthermore it enables the synchronized operation of several ECUs within a car.

5 Dependencies to other modules

This chapter lists the modules interacting with the Fr module.

Modules that use Fr module:

- The FrIf is the only user of the Fr module (except initialization by EcuM). It uses the Fr module(s) to access possibly different FlexRay Communication Controllers in a uniform and abstract way.
- The EcuM initializes the Fr module by calling Fr_Init.

Modules used by the Fr module:

- **[SWS_Fr_00453]** [The Fr module shall use the BSW Scheduler mechanisms for data consistency when required.]

Other Module dependencies:

- **[SWS_Fr_00454]** [On certain systems the CC might share resources with other components (e.g., the MCU), and might depend on their configurations. If those resources are within the scope of the other modules (e.g., PLL configuration, memory mapping), then the Fr module doesn't configure those components but requires that their initialization precede the Fr module's initialization.]

5.1 File structure

This section gives an overview about the files and their relations required for a proper implementation of the Fr module. Please note that the file structure is not completely specified but the implementation shall use at least the files and the file structure presented in this section.

5.1.1 Code file structure

[SWS_Fr_00116]

Upstream requirements: [SRS_BSW_00346](#), [SRS_BSW_00380](#)

[The code file structure shall not be completely defined within this specification.]

5.1.2 Header file structure

[SWS_Fr_00464] [The file `Fr.h` shall contain all types and function prototypes required by the Fr module's environment.]

[SWS_Fr_00117] [`Fr_GeneralTypes.h` shall contain all types and constants that are shared among the AUTOSAR FlexRay modules Fr, FrIf and FrTrcv.]

6 Requirements Tracing

Requirement	Description	Satisfied by
[SRS_BSW_00003]	All software modules shall provide version and identification information	[SWS_Fr_00080]
[SRS_BSW_00305]	Data types naming convention	[SWS_Fr_00077]
[SRS_BSW_00307]	Global variables naming convention	[SWS_Fr_00098]
[SRS_BSW_00308]	AUTOSAR Basic Software Modules shall not define global data in their header files, but in the C file	[SWS_Fr_00102]
[SRS_BSW_00334]	Machine readable module description	[SWS_Fr_00080]
[SRS_BSW_00336]	Basic SW module shall be able to shutdown	[SWS_Fr_00014]
[SRS_BSW_00342]	It shall be possible to create an AUTOSAR ECU out of modules provided as source code and modules provided as object code, even mixed	[SWS_Fr_00097]
[SRS_BSW_00345]	BSW Modules shall support pre-compile configuration	[SWS_Fr_00027]
[SRS_BSW_00346]	All AUTOSAR Basic Software Modules shall provide at least a basic set of module files	[SWS_Fr_00116]
[SRS_BSW_00347]	A Naming separation of different instances of BSW drivers shall be in place	[SWS_Fr_00076]
[SRS_BSW_00348]	All AUTOSAR standard types and constants shall be placed and organized in a standard type header file	[SWS_Fr_00099]
[SRS_BSW_00353]	All integer type definitions of target and compiler specific scope shall be placed and organized in a single type header	[SWS_Fr_00099]
[SRS_BSW_00358]	The return type of init() functions implemented by AUTOSAR Basic Software Modules shall be void	[SWS_Fr_00032]
[SRS_BSW_00374]	All Basic Software Modules shall provide a readable module vendor identification	[SWS_Fr_00080]
[SRS_BSW_00379]	All software modules shall provide a module identifier in the header file and in the module XML description file.	[SWS_Fr_00080]
[SRS_BSW_00380]	Configuration parameters being stored in memory shall be placed into separate c-files	[SWS_Fr_00116]
[SRS_BSW_00404]	BSW Modules shall support post-build configuration	[SWS_Fr_00027] [SWS_Fr_00032]
[SRS_BSW_00405]	BSW Modules shall support multiple configuration sets	[SWS_Fr_00032]
[SRS_BSW_00407]	Each BSW module shall provide a function to read out the version information of a dedicated module implementation	[SWS_Fr_00070]





Requirement	Description	Satisfied by
[SRS_BSW_00411]	All AUTOSAR Basic Software Modules shall apply a naming rule for enabling/disabling the existence of the API	[SWS_Fr_00070] [SWS_Fr_00340]
[SRS_BSW_00413]	An index-based accessing of the instances of BSW modules shall be done	[SWS_Fr_00075]
[SRS_BSW_00414]	Init functions shall have a pointer to a configuration structure as single parameter	[SWS_Fr_00032]
[SRS_BSW_00438]	Configuration data shall be defined in a structure	[SWS_Fr_00137]
[SRS_BSW_00441]	Naming convention for type, macro and function	[SWS_Fr_00505] [SWS_Fr_00506] [SWS_Fr_00507] [SWS_Fr_00508] [SWS_Fr_00509] [SWS_Fr_00511] [SWS_Fr_00512] [SWS_Fr_00514]
[SRS_Fr_05003]	Slot/Cycle Multiplexing shall be supported	[SWS_Fr_00005] [SWS_Fr_00092] [SWS_Fr_00093] [SWS_Fr_00094]
[SRS_Fr_05005]	The CC Hardware FIFO Mechanism shall be supported	[SWS_Fr_00593] [SWS_Fr_00594] [SWS_Fr_00595] [SWS_Fr_00596] [SWS_Fr_00597]
[SRS_Fr_05006]	Abstraction of FlexRay-Specific Features shall be provided	[SWS_Fr_00593]
[SRS_Fr_05011]	Initialization of the Low-Level Parameters shall be available	[SWS_Fr_00017]
[SRS_Fr_05012]	Initialization of the FlexRay CC Transmit/Receive Buffers shall be available	[SWS_Fr_00148]
[SRS_Fr_05019]	FlexRay Global Time shall be provided	[SWS_Fr_00042]
[SRS_Fr_05024]	The software interface of the Driver shall be independent of the CC buffers' configuration	[SWS_Fr_00005] [SWS_Fr_00092] [SWS_Fr_00093] [SWS_Fr_00094] [SWS_Fr_00440] [SWS_Fr_00441] [SWS_Fr_00610]
[SRS_Fr_05044]	CC's Absolute Timer shall be provided	[SWS_Fr_00033] [SWS_Fr_00095]
[SRS_Fr_05046]	Absolute Alarms of a CC shall be enabled	[SWS_Fr_00034]
[SRS_Fr_05047]	Absolute Alarms of a CC shall be disabled	[SWS_Fr_00035]
[SRS_Fr_05048]	Absolute Alarms of a CC shall be acknowledged	[SWS_Fr_00036]
[SRS_Fr_05055]	Timer Interrupts during Shutdown shall be avoided	[SWS_Fr_00106]
[SRS_Fr_05058]	The configuration of the FlexRay Driver shall be defined at system configuration time.	[SWS_Fr_00480]
[SRS_Fr_05059]	The Driver shall be configure the CC's transmit/receive buffers	[SWS_Fr_00148] [SWS_Fr_00524] [SWS_Fr_00539]
[SRS_Fr_05064]	Abstraction of FlexRay CC-specific Implementation shall be provided	[SWS_Fr_00465] [SWS_Fr_00466]
[SRS_Fr_05065]	The FlexRay Driver shall be able to communicate with at least four Flex Ray CCs of the same type	[SWS_Fr_00467]





Requirement	Description	Satisfied by
[SRS_Fr_05072]	The FlexRay Driver shall raise an error if the FlexRay Time Services function is called after the communication of the CC is Out of Sync	[SWS_Fr_00044]
[SRS_Fr_05106]	The Buffer of a specific CC in Normal Active Mode shall be reconfigurable	[SWS_Fr_00107]
[SRS_Fr_05109]	The FlexRay Driver shall provide a software interface to start-up a specific FlexRay CC	[SWS_Fr_00010]
[SRS_Fr_05114]	A FlexRay CC Communication shall be aborted when wanted	[SWS_Fr_00011]
[SRS_Fr_05115]	The FlexRay CC Communication shall be halted when wanted	[SWS_Fr_00014]
[SRS_Fr_05116]	Initialization of FlexRay CC shall be available	[SWS_Fr_00017]
[SRS_Fr_05117]	A Wake-Up Pattern shall be sent on a specific channel of a CC	[SWS_Fr_00009] [SWS_Fr_00091]
[SRS_Fr_05120]	FlexRay CC POC Status shall be provided	[SWS_Fr_00012]
[SRS_Fr_05125]	The FlexRay Driver shall provide services to handle interrupts of a Flex Ray Communication Controller.	[SWS_Fr_00034] [SWS_Fr_00035] [SWS_Fr_00036] [SWS_Fr_00108]
[SRS_Fr_05169]	Timer Interrupts during Start-up shall be avoided	[SWS_Fr_00152]

Table 6.1: Requirements Tracing

7 Functional specification

7.1 General description

[SWS_Fr_00465]

Upstream requirements: [SRS_Fr_05064](#)

[A single Fr module offers a uniform way to use features of FlexRay CCs independent of the CC implementation, thus hiding the actual hardware implementation (registers, buffers, etc.) from upper layers.]

[SWS_Fr_00466]

Upstream requirements: [SRS_Fr_05064](#)

[The Fr module maps abstract functional requests to sequences of CC specific hardware accesses.]

A detailed description for all API services can be found in [Chapter 8](#).

7.2 Implementation Requirements

This chapter lists requirements that shall be fulfilled by Fr module implementations.

[SWS_Fr_00076]

Upstream requirements: [SRS_BSW_00347](#)

[The Fr module's implementer shall replace all prefixes Fr within the Fr specification by a vendor specific prefix `Fr_<Vendor Id>_<Vendor specific name>` during implementation to allow the usage of different FlexRay Drivers within one build system. The Fr module's implementer shall apply this rule to all prefixes within filenames, Fr module specific datatypes, Fr module specific constants, Fr module specific global variables and API functions.]

[SWS_Fr_00097]

Upstream requirements: [SRS_BSW_00342](#)

[The Fr module shall implement the API functions specified by the Fr SWS as real C-code functions and shall not implement the API functions as macros.]

[SWS_Fr_00479] [The rationale of [\[SWS_Fr_00097\]](#) is to allow object code module integration.]

[SWS_Fr_00102]

Upstream requirements: [SRS_BSW_00308](#)

[None of the Fr module’s header files shall define global variables.]

[SWS_Fr_00106]

Upstream requirements: [SRS_Fr_05055](#)

[The Fr module or the underlying hardware or both shall stop FlexRay timers in case of loss of synchronization.]

The implementation may assume that

- The Fr module’s environment shall call all LPdu-based services ([Fr_TransmitTxLPdu\(\)](#), [Fr_ReceiveRxLPdu\(\)](#), [Fr_CheckTxLPduStatus\(\)](#), [Fr_PrepareLPdu\(\)](#)) synchronous to the FlexRay global time (at predefined determined points in time) in case of proper system operation.
- The Fr module’s environment may call all non LPdu-based services at any time independent from the FlexRay global time.

7.3 Indexing Scheme

Users of the Fr identify Fr resources by using an indexing scheme as depicted in [Figure 7.1](#).

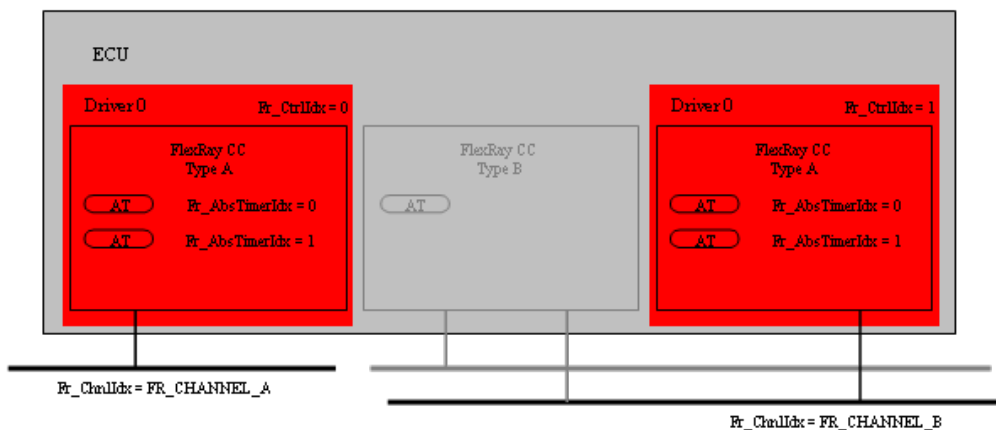


Figure 7.1: FlexRay Driver indexing scheme

The following Fr resources are available:

[SWS_Fr_00075]

Upstream requirements: [SRS_BSW_00413](#)

[CCs are identified via controller indices ([Fr_CtrlIdx](#)).]

[SWS_Fr_00467]

Upstream requirements: [SRS_Fr_05065](#)

[Each driver's CCs are identified by controller indices 0 to (n-1) where n is the number of CCs controlled by the particular Fr.]

[SWS_Fr_00344] [For each FlexRay CC the connected channels are identified by channel indices (Fr_ChnlIdx).]

[SWS_Fr_00468] [A dedicated type that holds the enumerations FR_CHANNEL_A, FR_CHANNEL_B or FR_CHANNEL_AB represents the channel index.]

[SWS_Fr_00469] [Channel indices are only valid within a tuple <Fr_CtrlIdx, Fr_ChnlIdx>.]

[SWS_Fr_00005]

Upstream requirements: [SRS_Fr_05003](#), [SRS_Fr_05024](#)

[Each FlexRay frame processed by Fr API functions is identified by an LPdu index (Fr_LPduIdx).]

[SWS_Fr_00470] [Each LPdu carries the LSdu. Each controller's LPdus are identified by LPdu indices from 0 to (n-1) where n is the number of LPdus processed by the corresponding CC.]

[SWS_Fr_00471] [LPdu indices are only valid within a tuple <Fr_CtrlIdx, Fr_LPduIdx>.]

[SWS_Fr_00472] [An Fr_LPduIdx uniquely identifies the following parameters of a FlexRay frame as a key: {Slot ID, Channel, cycle repetition, base cycle, transmit/receive}.]

[SWS_Fr_00345] [Each FlexRay CC contains absolute timers. Absolute FlexRay timers are identified via absolute timer indices (Fr_AbsTimerIdx).]

[SWS_Fr_00473] [Each CC's absolute timers are identified by absolute timer indices from 0 to (n-1), where n is the number of absolute timers controlled by the particular CC.]

[SWS_Fr_00474] [Absolute timer indices are only valid within a tuple <Fr_CtrlIdx, Fr_AbsTimerIdx>.]

The FlexRay Driver numbering scheme (Figure 7.1) assigns indices to these items on a per-driver basis. Note that only the FlexRay CCs handled by one specific Fr module (i.e., the FlexRay CCs of type A in the example given) are being assigned indices within the context of this Fr module. All other CCs (e.g., the FlexRay CC of type B) are not handled by this Fr module and thus no indices have been assigned to these FlexRay CCs within the context of this Fr module.

7.4 POC state machine control

[SWS_Fr_00477] [Since a FlexRay CC is condition-based, it internally maintains a state machine, the Protocol Operation Control (POC) state machine. The state transitions are driven both by hardware related events as well as by commands passed by the host at the CHI (see [1] for details).]

[SWS_Fr_00478] [The CHI commands driving the POC state machine are incorporated into several Fr module API functions. API functions affecting the POC state of a FlexRay CC are:

- `Fr_StartCommunication()`
- `Fr_HaltCommunication()`
- `Fr_AbortCommunication()`
- `Fr_SendWUP()`
- `Fr_ControllerInit()`

]

[SWS_Fr_00438] [All API functions other than those listed above shall not change the POC state of the FlexRay CC. Figure 3 shows the POC states of the FlexRay CC and the transitions applicable to the Fr module API functions. Note that

- certain transitions (marked with *) are performed by the invocation of a single API function call (`Fr_ControllerInit()`).
- certain transitions might be implicitly performed by the FlexRay CC without external command invocation (dotted arrow)
- certain transitions specified cannot be performed by the current Fr module API (not drawn in Figure 3 - compare to [5]).

]

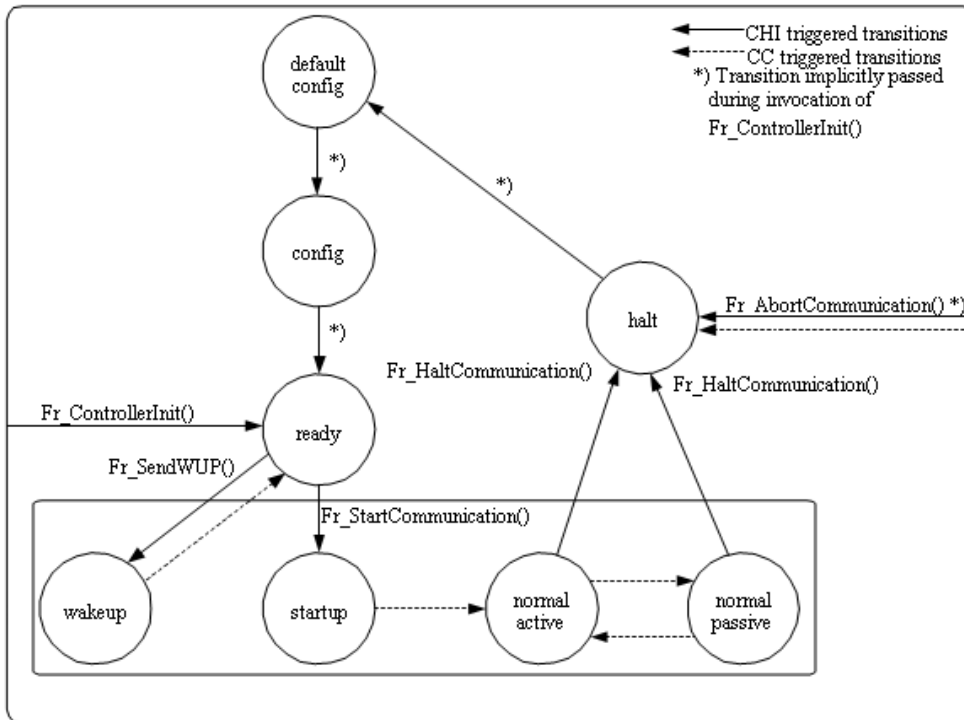


Figure 7.2: FlexRay Driver POC State Machine Control

7.5 FIFO support and message ID filtering

To efficiently support reception in certain use-cases, FlexRay controllers might support receive-FIFOs. The receive-FIFOs accept FlexRay frames based on a set of configured filter criterias which match FlexRay specific properties such as frameID, cycle, channel, as well as protocol add-ons like the message ID, in hardware.

[SWS_Fr_00593]

Upstream requirements: [SRS_Fr_05005](#), [SRS_Fr_05006](#)

[The hardware receive-FIFO shall be used if the FIFO filter-criterias as configured can be applied to the hardware FIFO.]

[SWS_Fr_00594]

Upstream requirements: [SRS_Fr_05005](#)

[All LPdus (as configured within `FrIf`) matching a receive-FIFO's filter-criteria shall be assigned to the respective receive-FIFO.]

[SWS_Fr_00595]

Upstream requirements: [SRS_Fr_05005](#)

[No specific buffers shall be assigned to LPdus that are assigned to a receive-FIFO.]

[SWS_Fr_00596]

Upstream requirements: [SRS_Fr_05005](#)

[If `Fr_ReceiveRxLPdu()` is called for an LPdu assigned to the receive FIFO, the service `Fr_ReceiveRxPdu()` consumes the first valid frame out of the respective FIFO and returns it as received frame. There is no receive-FIFO specific API, thus keeping the upper layers unaffected.]

Hint: This restricted implementation of the receive-FIFO covers a very typical use-case (FrTp):

- All received (L)Pdus assigned to the FIFO shall be processed by a single upper layer module.
- The upper layer does not care about the specific assignment of (L)Pdus to FlexRay FrameTriggerings.

[SWS_Fr_00597]

Upstream requirements: [SRS_Fr_05005](#)

[LPdus received via the FIFO shall be returned in the same order as they were received on the FlexRay network.]

7.6 Configuration description

[SWS_Fr_00080]

Upstream requirements: [SRS_BSW_00003](#), [SRS_BSW_00334](#), [SRS_BSW_00374](#), [SRS_BSW_00379](#)

[The Fr module shall provide an XML file that contains the data, which is required for the SW identification and configuration parameters. This file shall describe vendor specific configuration parameters if applicable.]

[SWS_Fr_00480]

Upstream requirements: [SRS_Fr_05058](#)

[A driver MCG reads the ECU configuration parameters of the Fr and the FrIf modules. While cluster related configuration parameters are contained in the FrIf module's configuration, CC related configuration parameters are contained in the Fr module's configuration. The Fr module's specific configuration tool shall read both ECU module

configurations to derive the configuration parameters for all FlexRay CCs mapped to the Fr module.]

[SWS_Fr_00481] [All frame transmission/reception related configuration parameters are located only in the Frlf module description (within configuration containers 'FrIfLPdu' and 'FrIfFrameTriggering'). The Fr must be able to handle all transmission/reception requests of all related LPdus. The LPdus within the Frlf configuration contain both an LPduldx which is passed to the Fr API as well as a link to a frame triggering that holds the link of the LPdu to the FlexRay network (assignment to Slot, channel, cycle).

The CC configuration parameters related to frame transmission and reception shall be derived from the communication matrix the CC is mapped to within the Frlf.]

[SWS_Fr_00482] [For optimization purposes the Fr MCG shall read the Frlf job list for detecting the points in time certain actions on the Fr will be synchronously invoked by the Frlf (see [6] for the Frlf configuration parameters).]

[SWS_Fr_00483] [Based on those invocation times the Fr MCG might decide certain resource alignment optimizations for transmission and reception (share buffers among different LPdus).]

[SWS_Fr_00003] [If the Frlf job list contains dedicated buffer reconfiguration entries that allow for optimization, then the Fr module's MCG may decide to share one buffer for several LPdus within the static segment.]

[SWS_Fr_00624] [If an LPdu is dynamically reconfigurable ('FrIfReconfigurable' set to true) the MCG shall decide to assign a single exclusive hardware message buffer to those LPdus.]

[SWS_Fr_00484] [The Fr MCG shall have knowledge about the capabilities of the CC and the corresponding driver, therefore this tool is called driver dependent.]

[SWS_Fr_00485] [If an Fr MCG is unable to map all required communication operations to the available resources, then it has to report that conflict¹.]

[SWS_Fr_00486] [The number of supported FlexRay CCs is defined at configuration time.]

¹This can result from either from running out of resources (e.g. buffers) or the mapping of the configuration to the particular device is not supported (e.g. configuration features supported in [1], but the device is compliant to [2]).

[SWS_Fr_00487] [The MCG shall ensure the consistency of the generated configuration.]

[SWS_Fr_00027]

Upstream requirements: [SRS_BSW_00345](#), [SRS_BSW_00404](#)

[The Fr module shall support the pre-compile-time and post-build-time configuration classes.]

An assignment of those configuration classes to configuration parameters can be found in [Chapter 10](#).

Hint: The description of the software configuration itself is not part of this specification but very implementation specific.

A detailed description of all Fr related configuration parameters is specified in [Chapter 10](#) of this document. Additionally the configuration parameters of the FrIc (see chapter 10 of [6]) shall be evaluated for Fr module configuration.

7.7 Error Classification

Section "Error Handling" of the document [4] "General Specification of Basic Software Modules" describes the error handling of the Basic Software in detail. Above all, it constitutes a classification scheme consisting of five error types which may occur in BSW modules.

Based on this foundation, the following section specifies particular errors arranged in the respective subsections below.

7.7.1 Development Errors

[SWS_Fr_91003] Definiton of development errors in module Fr [

<i>Type of error</i>	<i>Related error code</i>	<i>Error value</i>
parameter timer index exceeds number of available timers	FR_E_INV_TIMER_IDX	0x01
invalid pointer in parameter list	FR_E_PARAM_POINTER	0x02
parameter offset exceeds bounds	FR_E_INV_OFFSET	0x03
invalid controller index	FR_E_INV_CTRL_IDX	0x04
invalid channel index	FR_E_INV_CHNL_IDX	0x05
parameter cycle exceeds 63	FR_E_INV_CYCLE	0x06
Fr module was not initialized	FR_E_INIT_FAILED	0x08
Payload length parameter has an invalid value	FR_E_INV_LENGTH	0x0A





<i>Type of error</i>	<i>Related error code</i>	<i>Error value</i>
invalid LPdu index	FR_E_INV_LPDU_IDX	0x0B
invalid FlexRay header CRC	FR_E_INV_HEADERCRC	0x0C
invalid value passed as parameter Fr_Config ParamIdx	FR_E_INV_CONFIG_IDX	0x0D
invalid framelist size value	FR_E_INV_FRAMELIST_SIZE	0x0E

]

7.7.2 Runtime Errors

[SWS_Fr_91004] Definiton of runtime errors in module Fr [

<i>Type of error</i>	<i>Related error code</i>	<i>Error value</i>
Fr CC is not in the expected POC state	FR_E_INV_POCSSTATE	0x09

]

7.7.3 Production Errors

There are no production errors.

7.7.4 Extended Production Errors

[SWS_Fr_00498] [

Error Name:	FR_E_CTRL_TESTRESULT [_<Fr_CtrlIdx>]
Short Description:	FlexRay Controller hardware error
Long Description:	This extended production error indicates hardware errors of the FlexRay communication controller. Please note that this extended production error does not address Flexray protocol errors detected on the network.





Detection Criteria:	Fail	<p>Every API function accessing hardware registers of the FlexRay controller might detect a missbehavior of the device compared to the device specification.</p> <p>For details see requirements: [SWS_Fr_00147], [SWS_Fr_00176], [SWS_Fr_00181], [SWS_Fr_00520], [SWS_Fr_00186], [SWS_Fr_00190], [SWS_Fr_00195], [SWS_Fr_00201], [SWS_Fr_00216], [SWS_Fr_00223], [SWS_Fr_00613], [SWS_Fr_00232], [SWS_Fr_00243], [SWS_Fr_00248], [SWS_Fr_00529], [SWS_Fr_00543], [SWS_Fr_00255], [SWS_Fr_00261], [SWS_Fr_00552], [SWS_Fr_00560], [SWS_Fr_00568], [SWS_Fr_00580], [SWS_Fr_00589], [SWS_Fr_00272], [SWS_Fr_00286], [SWS_Fr_00297], [SWS_Fr_00308], [SWS_Fr_00319], [SWS_Fr_00331], [SWS_Fr_00652]</p>
	Pass	<p>During FlexRay communication controller initialization (function Fr_ControllerInit()) the proper operation of the hardware registers is successfully verified.</p> <p>For details see requirements: [SWS_Fr_00598]</p>
Secondary Parameters:	<p>In case of successful device operation verification (function Fr_ControllerInit()) report PASS.</p> <p>In case of an error always report FAIL.</p>	
Time Required:	<p>If a FlexRay Controller hardware error occurs it shall be immediately reported as error.</p>	
Monitor Frequency:	<p>continuous</p>	

]

[SWS_Fr_00600] [

Error Name:	FR_E_LPDU_SLOTSTATUS [_<LPduldx>]	
Short Description:	FlexRay Protocol communication error	
Long Description:	This production error indicates Flexray protocol communication errors on the network for a particular LPdu.	
Detection Criteria:	Fail	<p>Each time FlexRay slot status with at least one of the following FlexRay protocol errors active:</p> <ul style="list-style-type: none"> • vSS!SyntaxError • vSS!ContentError • vSS!Bviolation <p>For details see requirements: [SWS_Fr_00605], [SWS_Fr_00606]</p>



△

	Pass	<p>Each time FlexRay slot status with none one of the following FlexRay protocol errors active:</p> <ul style="list-style-type: none"> • vSS!SyntaxError • vSS!ContentError • vSS!Bviolation <p>For details see requirements: [SWS_Fr_00627], [SWS_Fr_00629]</p>
Secondary Parameters:	Detection of production error events is active only during ongoing FlexRay communication.	
Time Required:	The time for detecting an evident FlexRay protocol error in a particular slot strongly depends on the period of the actual FlexRay slot and thus on the FlexRay protocol configuration parameters.	
Monitor Frequency:	continuous	

└

7.8 Security Events

The module does not report security events.

8 API specification

[SWS_Fr_00098]

Upstream requirements: [SRS_BSW_00307](#)

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

8.1 Imported types

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

[SWS_Fr_00099] Definition of imported datatypes of module Fr

Upstream requirements: [SRS_BSW_00348](#), [SRS_BSW_00353](#)

[

<i>Module</i>	<i>Header File</i>	<i>Imported Type</i>
Dem	Rte_Dem_Type.h	Dem_EventIdType
	Rte_Dem_Type.h	Dem_EventStatusType
Std	Std_Types.h	Std_ReturnType
	Std_Types.h	Std_VersionInfoType

]

8.2 Macro definitions

8.2.1 Configuration parameter index macros

The following table lists macros which list symbolic names that can be passed into API function `Fr_ReadCCConfig()` as parameter `Fr_ConfigParamIdx` (see [Section 8.4.32](#)).

Each macro (index) uniquely identifies a configuration parameter which value can be read out of the controller's configuration using `Fr_ReadCCConfig()`.

Macro name:	Value:	Maps to configuration parameter:
FR_CIDX_GDCYCLE	0	FrIfGdCycle
FR_CIDX_PMICROPERCYCLE	1	FrPMicroPerCycle
FR_CIDX_PDLISTENTIMEOUT	2	FrPdListenTimeout
FR_CIDX_GMACROPERCYCLE	3	FrIfGMacroPerCycle
FR_CIDX_GDMACROTICK	4	FrIfGdMacrotick
FR_CIDX_GNUMBEROFMINISLOTS	5	FrIfGNumberOfMinislots
FR_CIDX_GNUMBEROFSTATICSLOTS	6	FrIfGNumberOfStaticSlots
FR_CIDX_GDNIT	7	FrIfGdNit
FR_CIDX_GDSTATICSLOT	8	FrIfGdStaticSlot
FR_CIDX_GWAKEUPRXWINDOW	9	FrIfGdWakeupRxWindow
FR_CIDX_PKEYSLOTID	10	FrPKeySlotId
FR_CIDX_PLATESTTX	11	FrPLatestTx
FR_CIDX_POFFSETCORRECTIONOUT	12	FrPOffsetCorrectionOut
FR_CIDX_POFFSETCORRECTIONSTART	13	FrPOffsetCorrectionStart
FR_CIDX_PRATECORRECTIONOUT	14	FrPRateCorrectionOut
FR_CIDX_PSECONDKEYSLOTID	15	FrPSecondKeySlotId
FR_CIDX_PDACCEPTEDSTARTUPRANGE	16	FrPdAcceptedStartupRange
FR_CIDX_GCOLDSTARTATTEMPTS	17	FrIfGColdStartAttempts
FR_CIDX_GCYCLECOUNTMAX	18	FrIfGCycleCountMax
FR_CIDX_GLISTENNOISE	19	FrIfGListenNoise
FR_CIDX_GMAXWITHOUTCLOCKCORRECTFATAL	20	FrIfGMaxWithoutClockCorrectFatal
FR_CIDX_GMAXWITHOUTCLOCKCORRECTPASSIVE	21	FrIfGMaxWithoutClockCorrectPassive
FR_CIDX_GNETWORKMANAGEMENTVECTORLENGTH	22	FrIfGNetworkManagementVectorLength
FR_CIDX_GPAYLOADLENGTHSTATIC	23	FrIfGPayloadLengthStatic
FR_CIDX_GSYNCFRAMEIDCOUNTMAX	24	FrIfGSyncFrameIDCountMax
FR_CIDX_GDACTIONPOINTOFFSET	25	FrIfGdActionPointOffset
FR_CIDX_GDBIT	26	FrIfGdBit
FR_CIDX_GDCASRXLOWMAX	27	FrIfGdCasRxLowMax
FR_CIDX_GDDYNAMICSLOTIDLEPHASE	28	FrIfGdDynamicSlotIdlePhase
FR_CIDX_GDMINISLOTACTIONPOINTOFFSET	29	FrIfGdMiniSlotActionPointOffset
FR_CIDX_GDMINISLOT	30	FrIfGdMinislot
FR_CIDX_GDSAMPLECLOCKPERIOD	31	FrIfGdSampleClockPeriod
FR_CIDX_GDSYMBOLWINDOW	32	FrIfGdSymbolWindow
FR_CIDX_GDSYMBOLWINDOWACTIONPOINTOFFSET	33	FrIfGdSymbolWindowActionPointOffset
FR_CIDX_GDTSSTRANSMITTER	34	FrIfGdTssTransmitter
FR_CIDX_GWAKEUPRXIDLE	35	FrIfGdWakeupRxIdle
FR_CIDX_GWAKEUPRXLOW	36	FrIfGdWakeupRxLow
FR_CIDX_GWAKEUPTXACTIVE	37	FrIfGdWakeupTxActive
FR_CIDX_GWAKEUPTXIDLE	38	FrIfGdWakeupTxIdle
FR_CIDX_PALLOWPASSIVETOACTIVE	39	FrPAllowPassiveToActive
FR_CIDX_PCHANNELS	40	FrPChannels
FR_CIDX_PCLUSTERDRIFTDAMPING	41	FrPClusterDriftDamping
FR_CIDX_PDECODINGCORRECTION	42	FrPDecodingCorrection
FR_CIDX_PDELAYCOMPENSATIONA	43	FrPDelayCompensationA
FR_CIDX_PDELAYCOMPENSATIONB	44	FrPDelayCompensationB
FR_CIDX_PMACROINITIALOFFSETA	45	FrPMacroInitialOffsetA





Macro name:	Value:	Maps to configuration parameter:
FR_CIDX_PMACROINITIALOFFSETB	46	FrPMacroInitialOffsetB
FR_CIDX_PMICROINITIALOFFSETA	47	FrPMicroInitialOffsetA
FR_CIDX_PMICROINITIALOFFSETB	48	FrPMicroInitialOffsetB
FR_CIDX_PPAYLOADLENGTHDYNMAX	49	FrPPayloadLengthDynMax
FR_CIDX_PSAMPLESPERMICROTICK	50	FrPSamplesPerMicrotick
FR_CIDX_PWAKEUPCHANNEL	51	FrPWakeupChannel
FR_CIDX_PWAKEUPPATTERN	52	FrPWakeupPattern
FR_CIDX_PDMICROTICK	53	FrPdMicrotick
FR_CIDX_GDIGNOREAFTERTX	54	FrIfGdIgnoreAfterTx
FR_CIDX_PALLOWHALTDUETOCLOCK	55	FrPAllowHaltDueToClock
FR_CIDX_PEXTERNALSYNC	56	FrPEexternalSync
FR_CIDX_PFALLBACKINTERNAL	57	FrPFallBackInternal
FR_CIDX_PKEYSLOTONLYENABLED	58	FrPKeySlotOnlyEnabled
FR_CIDX_PKEYSLOTUSEDFORSTARTUP	59	FrPKeySlotUsedForStartup
FR_CIDX_PKEYSLOTUSEDFORSYNC	60	FrPKeySlotUsedForSync
FR_CIDX_PNMVECTOREARLYUPDATE	61	FrPNmVectorEarlyUpdate
FR_CIDX_PTWOKEYSLOTMODE	62	FrPTwoKeySlotMode

8.3 Type definitions

[SWS_Fr_00499] [The content of `Fr_GeneralTypes.h` shall be protected by a `FR_GENERAL_TYPES` define.]

[SWS_Fr_00500] [If different FlexRay drivers are used, only one instance of this file has to be included in the source tree. For implementation all `Fr_GeneralTypes.h` related types in the documents mentioned before shall be considered.]

[SWS_Fr_00077]

Upstream requirements: [SRS_BSW_00305](#)

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

8.3.1 Fr_ConfigType

[SWS_Fr_91001] Definition of datatype Fr_ConfigType [

Name	Fr_ConfigType
Kind	Structure
Description	This type contains the implementation-specific post build configuration structure.
Available via	Fr.h

]

[SWS_Fr_00648] [Rules of [SWS_Fr_00076] shall be applied to Fr_ConfigType.]

8.3.2 Fr_POCStateType

[SWS_Fr_00505] Definition of datatype Fr_POCStateType

Upstream requirements: [SRS_BSW_00441](#)

[

Name	Fr_POCStateType		
Kind	Enumeration		
Range	FR_POCSTATE_CONFIG	0x00	Represents literal CONFIG of formal type definition T_POCState.
	FR_POCSTATE_DEFAULT_CONFIG	0x01	Represents literal DEFAULT_CONFIG of formal type definition T_POCState.
	FR_POCSTATE_HALT	0x02	Represents literal HALT of formal type definition T_POCState.
	FR_POCSTATE_NORMAL_ACTIVE	0x03	Represents literal NORMAL_ACTIVE of formal type definition T_POCState.
	FR_POCSTATE_NORMAL_PASSIVE	0x04	Represents literal NORMAL_PASSIVE of formal type definition T_POCState.
	FR_POCSTATE_READY	0x05	Represents literal READY of formal type definition T_POCState.
	FR_POCSTATE_STARTUP	0x06	Represents literal STARTUP of formal type definition T_POCState.
	FR_POCSTATE_WAKEUP	0x07	Represents literal WAKEUP of formal type definition T_POCState.
Description	This formal definition refers to the description of type T_POCState in chapter 2.2.1.3 POC status of [12].		
Available via	Fr_GeneralTypes.h		

]

8.3.3 Fr_SlotModeType

[SWS_Fr_00506] Definition of datatype Fr_SlotModeType

Upstream requirements: [SRS_BSW_00441](#)

[

Name	Fr_SlotModeType		
Kind	Enumeration		
Range	FR_SLOTMODE_KEYSLLOT	0x00	Represents literal KEYSLOT of formal type definition T_SlotMode.
	FR_SLOTMODE_ALL_PENDING	0x01	Represents literal ALL_PENDING of formal type definition T_SlotMode.
	FR_SLOTMODE_ALL	0x02	Represents literal ALL of formal type definition T_SlotMode.
Description	This formal definition refers to the description of type T_SlotMode in chapter 2.2.1.3 POC status of [12].		
Available via	Fr_GeneralTypes.h		

]

¹

8.3.4 Fr_ErrorModeType

[SWS_Fr_00507] Definition of datatype Fr_ErrorModeType

Upstream requirements: [SRS_BSW_00441](#)

[

Name	Fr_ErrorModeType		
Kind	Enumeration		
Range	FR_ERRORMODE_ACTIVE	0x00	Represents literal ACTIVE of formal type definition T_ErrorMode.
	FR_ERRORMODE_PASSIVE	0x01	Represents literal PASSIVE of formal type definition T_ErrorMode.
	FR_ERRORMODE_COMM_HALT	0x02	Represents literal COMM_HALT of formal type definition T_ErrorMode.
Description	This formal definition refers to the description of type T_ErrorMode in chapter 2.2.1.3 POC status of [12].		
Available via	Fr_GeneralTypes.h		

]

¹For FlexRay 2.1 Rev A compliant FlexRay controllers see literal SINGLESLOT instead of KEYSLOT in [2].

8.3.5 Fr_WakeupStatusType

[SWS_Fr_00508] Definition of datatype Fr_WakeupStatusType

Upstream requirements: [SRS_BSW_00441](#)

[

Name	Fr_WakeupStatusType		
Kind	Enumeration		
Range	FR_WAKEUP_UNDEFINED	0x00	Represents literal UNDEFINED of formal type definition T_WakeupStatus.
	FR_WAKEUP_RECEIVED_HEADER	0x01	Represents literal RECEIVED_HEADER of formal type definition T_WakeupStatus.
	FR_WAKEUP_RECEIVED_WUP	0x02	Represents literal RECEIVED_WUP of formal type definition T_WakeupStatus.
	FR_WAKEUP_COLLISION_HEADER	0x03	Represents literal COLLISION_HEADER of formal type definition T_WakeupStatus.
	FR_WAKEUP_COLLISION_WUP	0x04	Represents literal COLLISION_WUP of formal type definition T_WakeupStatus.
	FR_WAKEUP_COLLISION_UNKNOWN	0x05	Represents literal COLLISION_UNKNOWN of formal type definition T_WakeupStatus.
	FR_WAKEUP_TRANSMITTED	0x06	Represents literal TRANSMITTED of formal type definition T_WakeupStatus.
Description	This formal definition refers to the description of type T_WakeupStatus in chapter 2.2.1.3 POC status of [12].		
Available via	Fr_GeneralTypes.h		

]

8.3.6 Fr_StartupStateType

[SWS_Fr_00509] Definition of datatype Fr_StartupStateType

Upstream requirements: [SRS_BSW_00441](#)

[

Name	Fr_StartupStateType		
Kind	Enumeration		
Range	FR_STARTUP_UNDEFINED	0x00	Represents literal UNDEFINED of formal type definition T_StartupState.
	FR_STARTUP_COLDSTART_LISTEN	0x01	Represents literal COLDSTART_LISTEN of formal type definition T_StartupState.
	FR_STARTUP_INTEGRATION_COLDSTART_CHECK	0x02	Represents literal INTEGRATION_COLDSTART_CHECK of formal type definition T_StartupState.
	FR_STARTUP_COLDSTART_JOIN	0x03	Represents literal COLDSTART_JOIN of formal type definition T_StartupState.

▽



	FR_STARTUP_COLDSTART_COLLISION_RESOLUTION	0x04	Represents literal COLDSTART_COLLISION_RESOLUTION of formal type definition T_StartupState.
	FR_STARTUP_COLDSTART_CONSISTENCY_CHECK	0x05	Represents literal COLDSTART_CONSISTENCY_CHECK of formal type definition T_StartupState.
	FR_STARTUP_INTEGRATION_LISTEN	0x06	Represents literal INTEGRATION_LISTEN of formal type definition T_StartupState.
	FR_STARTUP_INITIALIZE_SCHEDULE	0x07	Represents literal INITIALIZE_SCHEDULE of formal type definition T_StartupState.
	FR_STARTUP_INTEGRATION_CONSISTENCY_CHECK	0x08	Represents literal INTEGRATION_CONSISTENCY_CHECK of formal type definition T_StartupState.
	FR_STARTUP_COLDSTART_GAP	0x09	Represents literal COLDSTART_GAP of formal type definition T_StartupState.
	FR_STARTUP_EXTERNAL_STARTUP	0x0a	Represents literal EXTERNAL_STARTUP of formal type definition T_StartupState.
Description	This formal definition refers to the description of type T_StartupState in chapter 2.2.1.3 POC status of [12].		
Available via	Fr_GeneralTypes.h		

]

Note: Fr_StartupStateType contains the superset of FlexRay 2.1 and FlexRay 3.0 specification. Thus state FR_STARTUP_EXTERNAL_STARTUP cannot be reached on FlexRay 2.1 compliant FlexRay controllers.

8.3.7 Fr_POCStatusType

[SWS_Fr_00510] Definition of datatype Fr_POCStatusType [

Name	Fr_POCStatusType	
Kind	Structure	
Elements	CHIHaltRequest	
	Type	boolean
	Comment	–
	ColdstartNoise	
	Type	boolean
	Comment	–
	ErrorMode	
	Type	Fr_ErrorModeType
	Comment	–
	Freeze	
	Type	boolean
	Comment	–
SlotMode		



△

	Type	Fr_SlotModeType
	Comment	–
	StartupState	
	Type	Fr_StartupStateType
	Comment	–
	State	
	Type	Fr_POCTestType
	Comment	–
	WakeupStatus	
	Type	Fr_WakeupStatusType
	Comment	–
	CHIReadyRequest	
	Type	boolean
	Comment	–
Description	This formal definition refers to the description of type T_POCTest in chapter 2.2.1.3 POC status of [12].	
Available via	Fr_GeneralTypes.h	

]

8.3.8 Fr_TxLPduStatusType

[SWS_Fr_00511] Definition of datatype Fr_TxLPduStatusType

 Upstream requirements: [SRS_BSW_00441](#)

[

Name	Fr_TxLPduStatusType		
Kind	Enumeration		
Range	FR_TRANSMITTED	0x00	LPdu has been transmitted
	FR_TRANSMITTED_CONFLICT	0x01	A transmission conflict has occurred.
	FR_NOT_TRANSMITTED	0x02	LPdu has not been transmitted
Description	These values are used to determine whether a LPdu has been transmitted or not.		
Available via	Fr_GeneralTypes.h		

]

8.3.9 Fr_RxLPduStatusType

[SWS_Fr_00512] Definition of datatype Fr_RxLPduStatusType

Upstream requirements: [SRS_BSW_00441](#)

[

Name	Fr_RxLPduStatusType		
Kind	Enumeration		
Range	FR_RECEIVED	0x00	LPdu has been received
	FR_NOT_RECEIVED	0x01	LPdu has not been received
	FR_RECEIVED_MORE_DATA_AVAILABLE	0x02	LPdu has been received. More instances of this LPdu are available (FIFO usage).
Description	These values are used to determine if a LPdu has been received or not.		
Available via	Fr_GeneralTypes.h		

]

8.3.10 Fr_ChannelType

[SWS_Fr_00514] Definition of ImplementationDataType Fr_ChannelType

Upstream requirements: [SRS_BSW_00441](#)

[

Name	Fr_ChannelType		
Kind	Enumeration		
Range	FR_CHANNEL_A	0x01	Refers to channel A of a CC.
	FR_CHANNEL_B	0x02	Refers to channel B of a CC.
	FR_CHANNEL_AB	0x03	Refers to both channels (A and B) of a CC.
Description	The values are used to reference channels on a CC.		
Variation	-		
Available via	Fr_GeneralTypes.h		

]

8.3.11 Fr_SlotAssignmentType

[SWS_Fr_91002] Definition of datatype Fr_SlotAssignmentType [

Name	Fr_SlotAssignmentType	
Kind	Structure	
Elements	Cycle	
	Type	uint8
	Comment	Cycle in which the frame is transmitted / received.
	SlotId	
	Type	uint16
	Comment	Slot ID of the frame.
	channelId	
	Type	Fr_ChannelType
Comment	Channel of the frame.	
Description	This structure contains information about the assignment of a FlexRay frame to a cycle and a slot ID.	
Available via	Fr_GeneralTypes.h	

]

8.4 Function definitions

During specification of the API functions the following guidelines were applied:

- The API functions of the Fr module shall have the return type `Std_ReturnType` or `void` (no return code).
- If an API function of the Fr module has the return type `Std_ReturnType`, and if the function performs its service successfully, then it shall return `E_OK` otherwise `E_NOT_OK`.
- If the Fr module's environment is passing input parameters by a reference, then the Fr SWS shall use the `const` qualifier (`const type *`) to guarantee that it doesn't change the input parameter.
- For output parameters, a memory address to store the parameter is passed as an argument.
- If API functions of the Fr module successfully finish (return `E_OK`), then all output parameters shall be written with with valid values.
- If API functions of the Fr module erroneously finish (return `E_NOT_OK`), then no output parameter shall be written. Output parameters shall keep their original values in this case.

8.4.1 Fr_Init

[SWS_Fr_00032] Definition of API function Fr_Init

Upstream requirements: [SRS_BSW_00358](#), [SRS_BSW_00404](#), [SRS_BSW_00405](#), [SRS_BSW_00414](#)

[

Service Name	Fr_Init	
Syntax	<pre>void Fr_Init (const Fr_ConfigType* Fr_ConfigPtr)</pre>	
Service ID [hex]	0x1c	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	Fr_ConfigPtr	Address to an Fr dependant configuration structure that contains all information for operating the Fr subsequently.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Initializes the Fr.	
Available via	Fr.h	

]

CC precondition for the function `Fr_Init()`: None.

[SWS_Fr_00137]

Upstream requirements: [SRS_BSW_00438](#)

[The function `Fr_Init()` shall internally store the configuration address to enable subsequent API calls to access the configuration.]

8.4.2 Fr_ControllerInit

[SWS_Fr_00017] Definition of API function Fr_ControllerInit

Upstream requirements: [SRS_Fr_05116](#), [SRS_Fr_05011](#)

[

Service Name	Fr_ControllerInit	
Syntax	<pre>Std_ReturnType Fr_ControllerInit (uint8 Fr_CtrlIdx)</pre>	
Service ID [hex]	0x00	

▽

△

Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
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	Initializes a FlexRay CC.	
Available via	Fr.h	

]

[SWS_Fr_00148]

Upstream requirements: [SRS_Fr_05059](#), [SRS_Fr_05012](#)

[The function `Fr_ControllerInit()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Switch CC into 'POC:config' (from any other POCState).
2. Configure all FlexRay cluster and node configuration parameters (e.g., cycle length, macrotick duration).
3. Configure all transmit/receive resources (e.g., buffer initialization) according to the frame triggering configuration parameters contained in the `FrIf`.
4. Switch CC into 'POC:ready'
5. Return `E_OK`.

]

CC post condition for the function `Fr_ControllerInit()`: CC `Fr_CtrlIdx` shall be left in POCState 'POC:ready'.

[SWS_Fr_00149] [The function `Fr_ControllerInit()` shall ensure that no transmission requests are pending.]

[SWS_Fr_00150] [The function `Fr_ControllerInit()` shall ensure that no reception indications are pending.]

[SWS_Fr_00151] [The function `Fr_ControllerInit()` shall ensure that no interrupts are pending.]

[SWS_Fr_00152]

Upstream requirements: [SRS_Fr_05169](#)

[The function `Fr_ControllerInit()` shall ensure that all timers are disabled.]

[SWS_Fr_00153] [The function `Fr_ControllerInit()` shall ensure that all interrupts are disabled.]

[SWS_Fr_00515] [The function `Fr_ControllerInit()` shall disable all LPdus which are dynamically reconfigurable (see `Fr_ReconfigLPdu()`, `Fr_DisableLPdu()`).]

[SWS_Fr_00147] [If the function `Fr_ControllerInit()` detects errors while testing the CC (CC test), then it shall repeat the test procedure a configurable number (`FrCtrlTestCount`) of times. If all tests fail, then it calls `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and returns `E_NOT_OK`.]

[SWS_Fr_00647] [The CC test as described in [\[SWS_Fr_00147\]](#) shall verify (read back and compare to reference values held in the configuration) that the node and cluster FlexRay parameters were written properly into the FlexRay CC.]

[SWS_Fr_00598] [If the function `Fr_ControllerInit()` passes the CC test within a number of configurable (`FrCtrlTestCount`) times, then it calls `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_PASSED`).]

[SWS_Fr_00143] [If development error detection for the Fr module is enabled, and if the function `Fr_ControllerInit()` is called before the successful initialization of Fr, then the function `Fr_ControllerInit()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00144] [If development error detection for the Fr module is enabled, then the function `Fr_ControllerInit()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_ControllerInit()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

8.4.3 Fr_StartCommunication

[SWS_Fr_00010] Definition of API function Fr_StartCommunication

Upstream requirements: [SRS_Fr_05109](#)

[

Service Name	Fr_StartCommunication	
Syntax	Std_ReturnType Fr_StartCommunication (uint8 Fr_CtrlIdx)	
Service ID [hex]	0x03	
Sync/Async	Asynchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
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	Starts communication.	
Available via	Fr.h	

]

Note: The Fr module's environment shall only call the function [Fr_StartCommunication\(\)](#) when CC `Fr_CtrlIdx` is in POCState 'POC:ready'.

[SWS_Fr_00177] [The function [Fr_StartCommunication\(\)](#) shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Invoke the CC CHI command 'RUN', which initiates the startup procedure within the FlexRay CC.
2. Return E_OK.

]

The function call of [Fr_StartCommunication\(\)](#) changes the CC POCState to POC:startup which is a transitional state. In the case when communication startup succeeds, the CC will change the POCState to 'POC:normal active' or 'POC:normal passive'. It is not guaranteed that the FlexRay CC will reside in the 'POC:normal active' or 'POC:normal passive' state after a call of the function [Fr_StartCommunication\(\)](#).

[SWS_Fr_00176] [If the function [Fr_StartCommunication\(\)](#) is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return E_NOT_OK.]

[SWS_Fr_00173] [If development error detection for the Fr module is enabled, and if the function `Fr_StartCommunication()` is called before successful initialization of the Fr, then the function `Fr_StartCommunication()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00174] [If development error detection for the Fr module is enabled, and the function `Fr_StartCommunication()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_StartCommunication()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00175] [The function `Fr_StartCommunication()` shall check whether the CC `Fr_CtrlIdx`'s `POCState` is in `POC:ready`. If the `POCState` is not `POC:ready`, then the function `Fr_StartCommunication()` shall raise the runtime error `FR_E_INV_POCSTATE`.]

8.4.4 Fr_AllowColdstart

[SWS_Fr_00114] Definition of API function `Fr_AllowColdstart` [

Service Name	Fr_AllowColdstart	
Syntax	Std_ReturnType Fr_AllowColdstart (uint8 Fr_CtrlIdx)	
Service ID [hex]	0x23	
Sync/Async	Asynchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
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	Invokes the CC CHI command 'ALLOW_COLDSTART'.	
Available via	Fr.h	

]

Note: The Fr Module's environment shall only call the function `Fr_AllowColdstart()` when the CC `Fr_CtrlIdx` is in `POCState` 'POC:ready' or 'POC:startup'.

[SWS_Fr_00182] [The function `Fr_AllowColdstart()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Invoke the CC CHI command 'ALLOW_COLDSTART'.
2. Return E_OK.

]

[SWS_Fr_00181] [If the function `Fr_AllowColdstart()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00178] [If development error detection for the Fr module is enabled, and if the function `Fr_AllowColdstart()` is called before the successful initialization of Fr, then the function `Fr_AllowColdstart()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00179] [If development error detection for the Fr module is enabled, then the function `Fr_AllowColdstart()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_AllowColdstart()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00180] [The function `Fr_AllowColdstart()` shall check the CC `Fr_CtrlIdx`'s `POCState`. If the `POCState` is `POC:default config`, `POC:config`, or `POC:halt`, then the function `Fr_AllowColdstart()` shall raise the runtime error `FR_E_INV_POCSTATE`.]

8.4.5 Fr_AllSlots

[SWS_Fr_00516] Definition of API function Fr_AllSlots [

Service Name	Fr_AllSlots	
Syntax	Std_ReturnType Fr_AllSlots (uint8 Fr_CtrlIdx)	
Service ID [hex]	0x24	
Sync/Async	Asynchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	<code>E_OK</code> : API call finished successfully. <code>E_NOT_OK</code> : API call aborted due to errors.
Description	Invokes the CC CHI command 'ALL_SLOTS'.	
Available via	Fr.h	

]

Note: The Fr module's environment shall only call the function `Fr_AllSlots()` when `CC Fr_CtrlIdx` is synchronous to the FlexRay global time.

[SWS_Fr_00518] [The function `Fr_AllSlots()` shall perform the following tasks on FlexRay `CC Fr_CtrlIdx`:

1. Invoke the CC CHI command 'ALL_SLOTS', which requests a switch from key slot only mode to all slots transmission mode at the beginning of the next communication cycle.
2. Return `E_OK`.

]

Note: The function `Fr_AllSlots()` requests to switch from key slot only mode to all slots transmission mode at the beginning of the next communication cycle.

[SWS_Fr_00520] [If the function `Fr_AllSlots()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00521] [If development error detection for the Fr module is enabled, and if the function `Fr_AllSlots()` is called before the successful initialization of Fr, then the function `Fr_AllSlots()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00522] [If development error detection for the Fr module is enabled, then the function `Fr_AllSlots()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_AllSlots()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00523] [The function `Fr_AllSlots()` shall check whether the `CC Fr_CtrlIdx` is synchronous to the FlexRay global time. If the `CC Fr_CtrlIdx` is not synchronous to the FlexRay global time, then the function `Fr_AllSlots()` shall raise the runtime error `FR_E_INV_POCSTATE`.]

8.4.6 Fr_HaltCommunication

[SWS_Fr_00014] Definition of API function Fr_HaltCommunication

Upstream requirements: [SRS_BSW_00336](#), [SRS_Fr_05115](#)

[

Service Name	Fr_HaltCommunication	
Syntax	Std_ReturnType Fr_HaltCommunication (uint8 Fr_CtrlIdx)	
Service ID [hex]	0x04	
Sync/Async	Asynchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
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	Invokes the CC CHI command 'DEFERRED_HALT'.	
Available via	Fr.h	

]

Note: The Fr module's environment shall only call the function [Fr_HaltCommunication\(\)](#) when CC `Fr_CtrlIdx` is synchronous to the FlexRay global time.

[SWS_Fr_00187] [The function [Fr_HaltCommunication\(\)](#) shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Invoke the CC CHI command 'DEFERRED_HALT'².
2. Return `E_OK`.

]

Note: The function [Fr_HaltCommunication\(\)](#) requests the halt state which shall be reached by the end of the current FlexRay communication cycle but might not be reached immediately.

[SWS_Fr_00186] [If the function [Fr_HaltCommunication\(\)](#) is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

²Invoke the command 'HALT' for FlexRay Controllers compliant to [2].

[SWS_Fr_00183] [If development error detection for the Fr module is enabled, and if the function `Fr_HaltCommunication()` is called before the successful initialization of Fr, then the function `Fr_HaltCommunication()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00184] [If development error detection for the Fr module is enabled, then the function `Fr_HaltCommunication()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_HaltCommunication()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00185] [The function `Fr_HaltCommunication()` shall check whether the CC `Fr_CtrlIdx` is synchronous to the FlexRay global time. If the CC `Fr_CtrlIdx` is not synchronous to the FlexRay global time, then the function `Fr_HaltCommunication()` shall raise the runtime error `FR_E_INV_POCSSTATE`.]

8.4.7 Fr_AbortCommunication

[SWS_Fr_00011] Definition of API function Fr_AbortCommunication

Upstream requirements: [SRS_Fr_05114](#)

[

Service Name	Fr_AbortCommunication	
Syntax	Std_ReturnType Fr_AbortCommunication (uint8 Fr_CtrlIdx)	
Service ID [hex]	0x05	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
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	Invokes the CC CHI command 'FREEZE'.	
Available via	Fr.h	

]

[SWS_Fr_00191] [The function `Fr_AbortCommunication()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

- Invoke the CC CHI command 'FREEZE', which immediately aborts communication (if active) and changes to the POC:halt state from any previous POCState.
- Return `E_OK`.

]

Note: The function `Fr_AbortCommunication()` leaves the CC `Fr_CtrlIdx` in POC-State POC:halt (vPOC!Freeze is set).

[SWS_Fr_00190] [If the function `Fr_AbortCommunication()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00188] [If development error detection for the Fr module is enabled, and if the function `Fr_AbortCommunication()` is called before the successful initialization of Fr, then the function `Fr_AbortCommunication()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00189] [If development error detection for the Fr module is enabled, then the function `Fr_AbortCommunication()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_AbortCommunication()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

8.4.8 Fr_SendWUP

[SWS_Fr_00009] Definition of API function Fr_SendWUP

Upstream requirements: [SRS_Fr_05117](#)

[

Service Name	Fr_SendWUP	
Syntax	Std_ReturnType Fr_SendWUP (uint8 Fr_CtrlIdx)	
Service ID [hex]	0x06	
Sync/Async	Asynchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	<code>E_OK</code> : API call finished successfully. <code>E_NOT_OK</code> : API call aborted due to errors.
Description	Invokes the CC CHI command 'WAKEUP'.	
Available via	Fr.h	

]

Note: The Fr module's environment shall only call `Fr_SendWUP()` when CC `Fr_CtrlIdx` is in POCState 'POC:ready'.

[SWS_Fr_00196] [The function `Fr_SendWUP()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Invoke the CC CHI command 'WAKEUP', which initiates the wakeup transmission procedure on the configured FlexRay channel.
2. Return `E_OK`.

]

Note: The function `Fr_SendWUP()` changes the CC `Fr_CtrlIdx` POCState to POC:wakeup, which is a transitional state. After wakeup procedure completion, the CC will reach POC:ready again.

Note: Sending a wakeup pattern does not necessarily cause all cluster nodes to be awoken afterwards. The function `Fr_SendWUP()` just invokes the wakeup symbol transmission procedure on a certain FlexRay CC.

[SWS_Fr_00195] [If the function `Fr_SendWUP()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00192] [If development error detection for the Fr module is enabled, and if the function `Fr_SendWUP()` is called before the successful initialization of Fr, then the function `Fr_SendWUP()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00193] [If development error detection for the Fr module is enabled, then the function `Fr_SendWUP()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_SendWUP()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00194] [The function `Fr_SendWUP()` shall check whether the CC `Fr_CtrlIdx`'s POCState is POC:ready. If the POCState is not POC:ready, then the function `Fr_SendWUP()` shall raise the runtime error `FR_E_INV_POCSTATE`.]

8.4.9 Fr_SetWakeupChannel

[SWS_Fr_00091] Definition of API function Fr_SetWakeupChannel

Upstream requirements: [SRS_Fr_05117](#)

[

Service Name	Fr_SetWakeupChannel	
Syntax	Std_ReturnType Fr_SetWakeupChannel (uint8 Fr_CtrlIdx, Fr_ChannelType Fr_ChnlIdx)	
Service ID [hex]	0x07	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_ChnlIdx	Index of FlexRay channel within the context of the FlexRay CC Fr_CtrlIdx. Valid values are FR_CHANNEL_A and FR_CHANNEL_B.
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	Sets a wakeup channel.	
Available via	Fr.h	

]

[SWS_Fr_00202] [The function [Fr_SetWakeupChannel\(\)](#) shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Change the CC's POCState to POC:config by invoking the CHI command 'CONFIG'.
2. Configure the wakeup channel according to parameter `Fr_ChnlIdx`.
3. Change the CC's POCState to POC:ready again by invoking the CHI command 'CONFIG_COMPLETE'.
4. Return `E_OK`.

]

[SWS_Fr_00201] [If the function [Fr_SetWakeupChannel\(\)](#) is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00197] [If development error detection for the Fr module is enabled, and if the function [Fr_SetWakeupChannel\(\)](#) is called before the successful initialization

of Fr, then the function `Fr_SetWakeupChannel()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00198] [If development error detection for the Fr module is enabled, then the function `Fr_SetWakeupChannel()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_SetWakeupChannel()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00199] [If development error detection for the Fr module is enabled, then the function `Fr_SetWakeupChannel()` shall check the validity of the parameter `Fr_ChnIdx`. If `Fr_ChnIdx` is invalid, then the function `Fr_SetWakeupChannel()` shall raise the development error `FR_E_INV_CHNL_IDX`.]

[SWS_Fr_00200] [The function `Fr_SetWakeupChannel()` shall check whether the CC `Fr_CtrlIdx`'s `POCState` is `POC:ready`. If the `POCState` is not 'POC:ready', then the function `Fr_SetWakeupChannel()` shall raise the runtime error `FR_E_INV_POCSTATE`.]

8.4.10 Fr_GetPOCStatus

[SWS_Fr_00012] Definition of API function Fr_GetPOCStatus

Upstream requirements: [SRS_Fr_05120](#)

[

Service Name	Fr_GetPOCStatus	
Syntax	<pre>Std_ReturnType Fr_GetPOCStatus (uint8 Fr_CtrlIdx, Fr_POCTestType* Fr_POCTestPtr)</pre>	
Service ID [hex]	0x0a	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	Fr_POCTestPtr	Address the output value is stored to.
Return value	Std_ReturnType	E_OK: API call finished successfully. E_NOT_OK: API call aborted due to errors.
Description	Gets the POC status.	
Available via	Fr.h	

]

CC precondition for the function `Fr_GetPOCStatus()`: None.

[SWS_Fr_00217] [The function `Fr_GetPOCStatus()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Query the CC's actual POC status by reading the CHI variable 'vPOC' and write the result to parameter `Fr_POCStatusPtr`.
2. Return `E_OK`.

]

[SWS_Fr_00216] [If the function `Fr_GetPOCStatus()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00213] [If development error detection for the Fr module is enabled, and if the function `Fr_GetPOCStatus()` is called before the successful initialization of Fr, then the function `Fr_GetPOCStatus()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00214] [If development error detection for the Fr module is enabled, then the function `Fr_GetPOCStatus()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_GetPOCStatus()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00215] [If development error detection for the Fr module is enabled, then the function `Fr_GetPOCStatus()` shall check whether the parameter `Fr_POCStatusPtr` is a NULL pointer (`NULL_PTR`). If `Fr_POCStatusPtr` is a NULL pointer, then the function `Fr_GetPOCStatus()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.11 Fr_TransmitTxLPdu

[SWS_Fr_00092] Definition of API function Fr_TransmitTxLPdu

Upstream requirements: [SRS_Fr_05003](#), [SRS_Fr_05024](#)

[

Service Name	Fr_TransmitTxLPdu	
Syntax	<pre>Std_ReturnType Fr_TransmitTxLPdu (uint8 Fr_CtrlIdx, uint16 Fr_LPduIdx, const uint8* Fr_LSduPtr, uint8 Fr_LSduLength, Fr_SlotAssignmentType* Fr_SlotAssignmentPtr)</pre>	
Service ID [hex]	0x0b	
Sync/Async	Asynchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_LPduIdx	This index is used to uniquely identify a FlexRay frame.
	Fr_LSduPtr	This reference points to a buffer where the assembled LSdu to be transmitted within this LPdu is stored at.
	Fr_LSduLength	Determines the length of the data (in Bytes) to be transmitted.
Parameters (inout)	None	
Parameters (out)	Fr_SlotAssignmentPtr	This reference points to the memory location where the actual cycle, slot ID, and channel of the frame identified by Fr_LPduIdx shall be stored. A NULL_PTR indicates that the information is not required by the caller.
Return value	Std_ReturnType	E_OK: API call finished successfully. E_NOT_OK: API call aborted due to errors.
Description	Transmits data on the FlexRay network.	
Available via	Fr.h	

]

CC precondition for the function `Fr_TransmitTxLPdu()`: None.

[SWS_Fr_00224] [The function `Fr_TransmitTxLPdu()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Figure out the physical resource (e.g., a buffer) mapped to the transmission of the FlexRay frame identified by `Fr_LPduIdx`.
2. If `FrExtendedLPduReporting` is enabled and `Fr_SlotAssignment` is not a NULL pointer, copy expected cycle and slot ID of the transmitted frame to `Fr_SlotAssignment`.
3. If the transmit Lpdu supports dynamic payload length (configuration parameter `FrIfAllowDynamicLSduLength` is set to `true`), then the transmission resource shall be reconfigured to match the payload length `Fr_LSduLength` passed to the API. Note that the dynamic payload length is only applicable to frames within the dynamic FlexRay segment.

4. Copy `Fr_LsduLength` bytes from address `Fr_LsduPtr` into the FlexRay CC's transmission resource and then activate it for transmission.

5. Return `E_OK`.

]

[SWS_Fr_00440]

Upstream requirements: [SRS_Fr_05024](#)

[If a transmit resource is shared between more than 1 Lpdu (using the reconfiguration mechanism of `Fr_PrepareLPdu`), then the function `Fr_TransmitTxLPdu()` must ensure that the transmit resource is correctly configured to match the properties of `Fr_LpduIdx`. This means that if a transmit operation (`Fr_TransmitTxLPdu()`) is called for a particular `Fr_LpduIdx` and the Lpdu shares a single buffer with another Lpdu, then it shall check at the time of service invocation whether the buffer is configured according to the Lpdu to be processed.

The function `Fr_TransmitTxLPdu()` shall return `E_NOT_OK` and abort the function execution if a wrong buffer configuration is detected.]

[SWS_Fr_00225] [The Fr module shall ensure that the payload data is transmitted on the FlexRay network in the same byte order as was passed by the parameter `Fr_LsduPtr` in the function `Fr_TransmitTxLPdu()`. (first byte = lowest address, last byte = highest address).]

[SWS_Fr_00223] [If the function `Fr_TransmitTxLPdu()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00218] [If development error detection for the Fr module is enabled, and if the function `Fr_TransmitTxLPdu()` is called before the successful initialization of Fr, then the function `Fr_TransmitTxLPdu()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00219] [If development error detection for the Fr module is enabled, then the function `Fr_TransmitTxLPdu()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_TransmitTxLPdu()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00220] [If development error detection for the Fr module is enabled, then the function `Fr_TransmitTxLPdu()` shall check the validity of the parameter `Fr_LpduIdx`. If `Fr_LpduIdx` is invalid, then the function `Fr_TransmitTxLPdu()` shall raise the development error `FR_E_INV_LPDU_IDX`.]

[SWS_Fr_00221] [If development error detection for the Fr module is enabled, then the function `Fr_TransmitTxLPdu()` shall check the validity of the parameter `Fr_LsduLength`. If `Fr_LsduLength` is invalid, then the function `Fr_TransmitTxLPdu()` shall raise the development error `FR_E_INV_LENGTH`.]

[SWS_Fr_00222] [If development error detection for the Fr module is enabled, then the function `Fr_TransmitTxLPdu()` shall check whether the parameter `Fr_LsduPtr` is a NULL pointer (`NULL_PTR`). If `Fr_LsduPtr` is a NULL pointer, then the function `Fr_TransmitTxLPdu()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.12 Fr_CancelTxLPdu

[SWS_Fr_00610] Definition of API function Fr_CancelTxLPdu

Upstream requirements: [SRS_Fr_05024](#)

[

Service Name	Fr_CancelTxLPdu	
Syntax	<pre>Std_ReturnType Fr_CancelTxLPdu (uint8 Fr_CtrlIdx, uint16 Fr_LPduIdx)</pre>	
Service ID [hex]	0x2d	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_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	
Description		Cancels the already pending transmission of a LPdu contained in a controllers physical transmit resource (e.g. message buffer).
Available via	Fr.h	

]

CC precondition for the function `Fr_CancelTxLPdu()`: None.

[SWS_Fr_00611] [The function `Fr_CancelTxLPdu()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

- Figure out the physical resource (e.g., a buffer) mapped to the transmission of the FlexRay frame identified by `Fr_LPduIdx`.

- If the physical resource figured out is actively pending for transmission, then the transmit request of this particular resource shall be terminated and `E_OK` returned. If no transmission is pending `E_NOT_OK` shall be returned, indicating that no such cancelation took place.

]

[SWS_Fr_00612] [If a transmit resource is shared between more than 1 Lpdu (using reconfiguration mechanism of `Fr_PrepareLPdu()`), then the function `Fr_CancelTxLPdu()` must ensure that the transmit resource is correctly configured to match the properties of `Fr_LpduIdx`. This means that if a cancel transmit operation (`Fr_CancelTxLPdu()`) is called for a particular `Fr_LpduIdx` and the Lpdu shares a single buffer with another Lpdu, then it shall check at the time of service invocation that the buffer is configured according to the Lpdu to be processed.

The function `Fr_CancelTxLPdu()` shall return `E_NOT_OK` and abort the function execution if a wrong configuration is detected.]

[SWS_Fr_00613] [If the function `Fr_CancelTxLPdu()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00614] [If development error detection for the Fr module is enabled, and if the function `Fr_CancelTxLPdu()` is called before the successful initialization of Fr, then the function `Fr_CancelTxLPdu()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00615] [If development error detection for the Fr module is enabled, then the function `Fr_CancelTxLPdu()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_CancelTxLPdu()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00616] [If development error detection for the Fr module is enabled, then the function `Fr_CancelTxLPdu()` shall check the validity of the parameter `Fr_LpduIdx`. If `Fr_LpduIdx` is invalid, then the function `Fr_CancelTxLPdu()` shall raise the development error `FR_E_INV_LPDU_IDX`.]

8.4.13 Fr_ReceiveRxLPdu

[SWS_Fr_00093] Definition of API function Fr_ReceiveRxLPdu

Upstream requirements: [SRS_Fr_05003](#), [SRS_Fr_05024](#)

[

Service Name	Fr_ReceiveRxLPdu	
Syntax	<pre>Std_ReturnType Fr_ReceiveRxLPdu (uint8 Fr_CtrlIdx, uint16 Fr_LPduIdx, uint8* Fr_LSduPtr, Fr_RxLPduStatusType* Fr_LPduStatusPtr, uint8* Fr_LSduLengthPtr, Fr_SlotAssignmentType* Fr_SlotAssignmentPtr)</pre>	
Service ID [hex]	0x0c	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_LPduldx	This index is used to uniquely identify a FlexRay frame.
Parameters (inout)	None	
Parameters (out)	Fr_LSduPtr	This reference points to the buffer where the LSdu to be received shall be stored.
	Fr_LPduStatusPtr	This reference points to the memory location where the status of the LPdu shall be stored
	Fr_LSduLengthPtr	This reference points to the memory location where the length of the LSdu (in bytes) shall be stored. This length represents the number of bytes copied to Fr_LSduPtr.
	Fr_SlotAssignmentPtr	This reference points to the memory location where the actual cycle, slot ID, and channel of the frame identified by Fr_LPduldx shall be stored. A NULL_PTR indicates that the information is not required by the caller.
Return value	Std_ReturnType	E_OK: API call finished successfully. E_NOT_OK: API call aborted due to errors.
Description	Receives data from the FlexRay network.	
Available via	Fr.h	

]

CC precondition for the function [Fr_ReceiveRxLPdu\(\)](#): None.

[SWS_Fr_00233] [The function [Fr_ReceiveRxLPdu\(\)](#) shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Figure out the physical resource (e.g., a buffer, a receive-FIFO) mapped to the reception of the FlexRay frame as identified by `Fr_LPduIdx`.
2. Figure out whether a new FlexRay frame instance has been received within the receive resource as figured in bullet 1. If the receive resource is a FIFO, then consume the first element out of the FIFO.

3. If `FrExtendedLPduReporting` is enabled and `Fr_SlotAssignment` is not a NULL pointer and a new FlexRay frame has been accepted, copy cycle and slot ID of the frame to `Fr_SlotAssignment`.
4. If a new FlexRay frame has been accepted, then copy the received payload data to address `Fr_LsduPtr`, store the number of bytes copied to `Fr_LsduLengthPtr` and store the status `FR_RECEIVED` to `Fr_RxLPduStatusPtr`. If a FIFO is used as received resource and the FIFO is not empty, then store the status `FR_RECEIVED_MORE_DATA_AVAILABLE` to `Fr_RxLPduStatusPtr`.
5. If no new frame has been accepted, then do not copy any payload data to `Fr_LsduPtr`, write 0 to the parameter `Fr_LsduLengthPtr` and store the status `FR_NOT_RECEIVED` to `Fr_RxLPduStatusPtr`.
6. Return `E_OK`.

]

[SWS_Fr_00441]*Upstream requirements:* [SRS_Fr_05024](#)

[If a receive resource is shared between more than 1 LPdus (using reconfiguration mechanism of `Fr_PrepareLPdu()`), then the function `Fr_ReceiveRxLPdu()` must ensure that the receive resource is correctly configured to match the properties of `Fr_LpduIdx`. This means that if a receive operation (`Fr_ReceiveRxLPdu()`) is called for a particular `Fr_LPduIdx` and the LPdu shares a single buffer with another LPdu, then it shall check that at the time of service invocation the buffer is configured according to the LPdu to be processed.]

The function `Fr_ReceiveRxLPdu()` shall return `E_NOT_OK` and abort the function execution if a wrong buffer configuration is detected.]

[SWS_Fr_00234] [The function `Fr_ReceiveRxLPdu()` shall ensure that the payload data is copied to `Fr_LsduPtr` in the same byte order as it was received on the FlexRay bus. (first byte = lowest address, last byte = highest address).]

[SWS_Fr_00604] [If stringent check is disabled by configuration parameter (`Fr-RxStringentCheck` is `false`), then received data is accepted if the `SlotStatus` shows a valid frame (`vSS!ValidFrame`). Otherwise `FR_NOT_RECEIVED` is written to `Fr_RxLPduStatusPtr` and 0 is written to `Fr_LsduLengthPtr`.]

[SWS_Fr_00603] [If stringent check is enabled by configuration parameter (`Fr-RxStringentCheck` is `true`), then received data is accepted only if the `SlotStatus` shows a valid frame (`vSS!ValidFrame`) and there was no single `SlotStatus` error bit set (`vSS!SyntaxError`, `vSS!ContentError`, `vSS!Bviolation`). Otherwise `FR_NOT_RECEIVED` is written to `Fr_RxLPduStatusPtr` and 0 is written to `Fr_LsduLengthPtr`.]

[SWS_Fr_00236] [The function `Fr_ReceiveRxLPdu()` shall ensure that `FR_RECEIVED` is returned only for non-Nullframes.]

[SWS_Fr_00237] [The function `Fr_ReceiveRxLPdu()` shall ensure that the function returns `FR_RECEIVED` only once per received frame.]

[SWS_Fr_00645] [If stringent length check is enabled by configuration parameter (`FrRxStringentLengthCheck` is `true`), then received data is accepted only if the received payload length exactly matches the expected payload length as provided by configuration parameter `FrIfLSduLength`. Otherwise `FR_NOT_RECEIVED` is written to `Fr_RxLPduStatusPtr` and 0 is written to `Fr_LSduLengthPtr` .]

[SWS_Fr_00239] [The function `Fr_ReceiveRxLPdu()` shall ensure that the number of payload bytes copied to `Fr_LsduPtr`, and therefore the payload length stored to `Fr_LSduLengthPtr` are limited both by the received payload length as well as by the configuration parameter `FrIfLSduLength` configured in the `FrIf`.

This enables

- the partly reception of large FlexRay frames (e.g., enables local resource optimizations, support for transparent frame extensions).
- the reception of short FlexRay frames. (e.g., frames with dynamic payload length).

]

[SWS_Fr_00232] [If the function `Fr_ReceiveRxLPdu()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00605] [If the optional configuration parameter `FrIfDemFTSlotStatusRef` exists and a single slot status error bit (`vSS!SyntaxError`, `vSS!ContentError`, `vSS!Bviolation`) is set, then the slot status information shall be reported to DEM as `Dem_SetEventStatus()` (`FR_E_LPDU_SLOTSTATUS`, `DEM_EVENT_STATUS_FAILED`).]

[SWS_Fr_00627] [If the optional configuration parameter `FrIfDemFTSlotStatusRef` exists and no single slot status error bit (`vSS!SyntaxError`, `vSS!ContentError`, `vSS!Bviolation`) is set, then the slot status information shall be reported to DEM as `Dem_SetEventStatus()` (`FR_E_LPDU_SLOTSTATUS`, `DEM_EVENT_STATUS_PASSED`).]

[SWS_Fr_00628] [Dem_SetEventStatus() shall only be called if the optional configuration parameter FrIfDemFTSlotStatusRef exists.]

[SWS_Fr_00226] [If development error detection for the Fr module is enabled, and if the function Fr_ReceiveRxLPdu() is called before the successful initialization of Fr, then the function Fr_ReceiveRxLPdu() shall raise the development error FR_E_INIT_FAILED.]

[SWS_Fr_00227] [If development error detection for the Fr module is enabled, then the function Fr_ReceiveRxLPdu() shall check the validity of the parameter Fr_CtrlIdx. If Fr_CtrlIdx is invalid, then the function Fr_ReceiveRxLPdu() shall raise the development error FR_E_INV_CTRL_IDX.]

[SWS_Fr_00228] [If development error detection for the Fr module is enabled, then the function Fr_ReceiveRxLPdu() shall check the validity of the parameter Fr_LpduIdx. If Fr_LpduIdx is invalid, then the function Fr_ReceiveRxLPdu() shall raise the development error FR_E_INV_LPDU_IDX.]

[SWS_Fr_00229] [If development error detection for the Fr module is enabled, then the function Fr_ReceiveRxLPdu() shall check whether the parameter Fr_LsduPtr is a NULL pointer (NULL_PTR). If Fr_LsduPtr is a NULL pointer, then the function Fr_ReceiveRxLPdu() shall raise the development error FR_E_PARAM_POINTER.]

[SWS_Fr_00230] [If development error detection for the Fr module is enabled, then the function Fr_ReceiveRxLPdu() shall check whether the parameter Fr_RxLPduStatusPtr is a NULL pointer (NULL_PTR). If Fr_RxLPduStatusPtr is a NULL pointer, then the function Fr_ReceiveRxLPdu() shall raise the development error FR_E_PARAM_POINTER.]

[SWS_Fr_00231] [If development error detection for the Fr module is enabled, then the function Fr_ReceiveRxLPdu() shall check whether the parameter Fr_LsduLengthPtr is a NULL pointer (NULL_PTR). If Fr_LsduLengthPtr is a NULL pointer, then the function Fr_ReceiveRxLPdu() shall raise the development error FR_E_PARAM_POINTER.]

8.4.14 Fr_CheckTxLPduStatus

[SWS_Fr_00094] Definition of API function Fr_CheckTxLPduStatus

Upstream requirements: [SRS_Fr_05003](#), [SRS_Fr_05024](#)

[

Service Name	Fr_CheckTxLPduStatus	
Syntax	<pre>Std_ReturnType* Fr_CheckTxLPduStatus (uint8 Fr_CtrlIdx, uint16 Fr_LPduIdx, Fr_TxLPduStatusType* Fr_TxLPduStatusPtr, Fr_SlotAssignmentType* Fr_SlotAssignmentPtr)</pre>	
Service ID [hex]	0x0d	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_LPduldx	This index is used to uniquely identify a FlexRay frame
Parameters (inout)	None	
Parameters (out)	Fr_TxLPduStatusPtr	This reference is used to store the transmit status of the LPdu
	Fr_SlotAssignmentPtr	This reference points to the memory location where the actual cycle, slot ID, and channel of the frame identified by Fr_LPduldx shall be stored. A NULL_PTR indicates that the information is not required by the caller.
Return value	Std_ReturnType*	E_OK: API call finished successfully. E_NOT_OK: API call aborted due to errors.
Description	Checks the transmit status of the LSdu.	
Available via	Fr.h	

]

CC precondition for the function [Fr_CheckTxLPduStatus\(\)](#): None.

[SWS_Fr_00244] [The function [Fr_CheckTxLPduStatus\(\)](#) shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Figure out the physical resource (e.g., a buffer) mapped to the transmission of the FlexRay frame identified by `Fr_LPduIdx`.
2. Check whether the transmission resource as figured in bullet 1 is pending for transmission³ and if a TX conflict (vss!TxConflict) occurred for this resource.
3. If `FrExtendedLPduReporting` is enabled and `Fr_SlotAssignment` is not a NULL pointer, copy cycle and slot ID of the checked frame to `Fr_SlotAssignment`.
4. If a transmission request is pending, then store the status `FR_NOT_TRANSMITTED` to `Fr_TxLPduStatusPtr`.

³The returned status does not check whether a transmission has been really performed, but returns whether a transmission resource is empty or not.

5. If no transmission request is pending and no TX conflict occurred, then store the status `FR_TRANSMITTED` to `Fr_TxLPduStatusPtr`.
6. If no transmission request is pending and a TX conflict occurred, then store the status `FR_TRANSMITTED_CONFLICT` to `Fr_TxLPduStatusPtr`.
7. Return `E_OK`.

]

[SWS_Fr_00243] [If the function `Fr_CheckTxLPduStatus()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00606] [If the optional configuration parameter `FrIfDemFTSlotStatusRef` exists and a single slot status error bit (`vSS!SyntaxError`, `vSS!ContentError`, `vSS!Bviolation`) is set, then the slot status information shall be reported to DEM as `Dem_SetEventStatus()` (`FR_E_LPDU_SLOTSTATUS`, `DEM_EVENT_STATUS_FAILED`).]

[SWS_Fr_00629] [If the optional configuration parameter `FrIfDemFTSlotStatusRef` exists and no single slot status error bit (`vSS!SyntaxError`, `vSS!ContentError`, `vSS!Bviolation`) is set, then the slot status information shall be reported to DEM as `Dem_SetEventStatus()` (`FR_E_LPDU_SLOTSTATUS`, `DEM_EVENT_STATUS_PASSED`).]

[SWS_Fr_00630] [`Dem_SetEventStatus()` shall be called only if the optional configuration parameter `FrIfDemFTSlotStatusRef` exists.]

[SWS_Fr_00240] [If development error detection for the Fr module is enabled, and if the function `Fr_CheckTxLPduStatus()` is called before the successful initialization of Fr, then the function `Fr_CheckTxLPduStatus()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00241] [If development error detection for the Fr module is enabled, then the function `Fr_CheckTxLPduStatus()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_CheckTxLPduStatus()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00242] [If development error detection for the Fr module is enabled, then the function `Fr_CheckTxLPduStatus()` shall check the validity of the parameter `Fr_LpduIdx`. If `Fr_LpduIdx` is invalid, then the function `Fr_CheckTxLPduStatus()` shall raise the development error `FR_E_INV_LPDU_IDX`.]

[SWS_Fr_00343] [If development error detection for the Fr module is enabled, then the function `Fr_CheckTxLPduStatus()` shall check whether the parameter `Fr_TxLPduStatusPtr` is a NULL pointer (NULL_PTR). If `Fr_TxLPduStatusPtr` is a NULL pointer, then the function `Fr_CheckTxLPduStatus()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.15 Fr_PrepareLPdu

[SWS_Fr_00107] Definition of API function Fr_PrepareLPdu

Upstream requirements: [SRS_Fr_05106](#)

[

Service Name	Fr_PrepareLPdu	
Syntax	<pre>Std_ReturnType Fr_PrepareLPdu (uint8 Fr_CtrlIdx, uint16 Fr_LPduIdx)</pre>	
Service ID [hex]	0x1f	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_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	Prepares a LPdu.	
Available via	Fr.h	

]

CC precondition for the function `Fr_PrepareLPdu()`: None.

[SWS_Fr_00249] [The function `Fr_PrepareLPdu()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Figure out the physical resource (e.g., a buffer) mapped to the processing of the FlexRay frame identified by `Fr_LpduIdx`.
2. Configure the physical resource (a buffer) appropriate for `Fr_LpduIdx` operation (SlotId, Cycle filter, payload length, header CRC, etc.) if the MCG uses the reconfiguration feature⁴.

⁴If the MCG decides to save message buffers using message buffer reconfiguration it assigns two different LPdus (A and B) a single message buffer X. Each LPdu is linked to a (different) FrameTriggering configuration which contains the slot/cycle/channel assignment. Depending whether LPdu A or B is

3. Return E_OK.

]

[SWS_Fr_00250] [The function `Fr_PrepareLPdu()` shall be pre compile time configurable On/Off by the configuration parameter: `FrPrepareLPduSupport`.]

[SWS_Fr_00248] [If the function `Fr_PrepareLPdu()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00245] [If development error detection for the Fr module is enabled, and if the function `Fr_PrepareLPdu()` is called before the successful initialization of Fr, then the function `Fr_PrepareLPdu()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00246] [If development error detection for the Fr module is enabled, then the function `Fr_PrepareLPdu()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_PrepareLPdu()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00247] [If development error detection for the Fr module is enabled, then the function `Fr_PrepareLPdu()` shall check the validity of the parameter `Fr_LpduIdx`. If `Fr_LpduIdx` is invalid, then the function `Fr_PrepareLPdu()` shall raise the development error `FR_E_INV_LPDU_IDX`.]

passed to `Fr_PrepareLPdu()`, the message buffer X is configured according to the slot/cycle/channel assignment of the related LPdu.

8.4.16 Fr_ReconfigLPdu

[SWS_Fr_00524] Definition of API function Fr_ReconfigLPdu

Upstream requirements: [SRS_Fr_05059](#)

Service Name	Fr_ReconfigLPdu	
Syntax	<pre>Std_ReturnType Fr_ReconfigLPdu (uint8 Fr_CtrlIdx, uint16 Fr_LPduIdx, uint16 Fr_FrameId, Fr_ChannelType Fr_ChnlIdx, uint8 Fr_CycleRepetition, uint8 Fr_CycleOffset, uint8 Fr_PayloadLength, uint16 Fr_HeaderCRC)</pre>	
Service ID [hex]	0x25	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_LPduldx	This index is used to uniquely identify a FlexRay frame
	Fr_FrameId	FlexRay Frame ID the FrLf_LPdu shall be configured to.
	Fr_ChnlIdx	FlexRay Channel the FrLf_LPdu shall be configured to.
	Fr_CycleRepetition	Cycle Repetition part of the cycle filter mechanism FrLf_LPdu shall be configured to.
	Fr_CycleOffset	Cycle Offset part of the cycle filter mechanism FrLf_LPdu shall be configured to.
	Fr_PayloadLength	Payloadlength in units of bytes the FrLf_LPduldx shall be configured to.
	Fr_HeaderCRC	Header CRC the FrLf_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	Reconfigures a given LPdu according to the parameters (FrameId, Channel, CycleRepetition, CycleOffset, PayloadLength, HeaderCRC) at runtime.	
Available via	Fr.h	

CC precondition for the function [Fr_ReconfigLPdu\(\)](#): None.

[SWS_Fr_00525] [The function [Fr_ReconfigLPdu\(\)](#) shall perform the following tasks on FlexRay CC [Fr_CtrlIdx](#):

- Figure out the physical resource (e.g., a buffer) mapped to the processing of the FlexRay frame as identified by [Fr_LPduIdx](#).

- Configure the physical resource (a buffer) according to the parameters given at the API. The Lpdu direction is statically associated with the Lpdu and cannot be changed by this service.
- Return E_OK.

]

[SWS_Fr_00526] [Whether an Lpdu is dynamically reconfigurable is determined via the configuration parameter `FrIfReconfigurable` which is a property of the `FrIfLPdu` configuration parameter container.]

[SWS_Fr_00527] [Since FlexRay supports only even number of bytes as payload length, the parameter `Fr_PayloadLength` must be internally rounded to the next higher even number if it is odd.]

[SWS_Fr_00528] [The function `Fr_ReconfigLPdu()` shall be pre compile time configurable On/Off by the configuration parameter: `FrReconfigLPduSupport`.]

[SWS_Fr_00529] [If the function `Fr_ReconfigLPdu()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00530] [If development error detection for the Fr module is enabled, and if the function `Fr_ReconfigLPdu()` is called before the successful initialization of Fr, then the function `Fr_ReconfigLPdu()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00531] [If development error detection for the Fr module is enabled, then the function `Fr_ReconfigLPdu()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_ReconfigLPdu()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00532] [If development error detection for the Fr module is enabled, then the function `Fr_ReconfigLPdu()` shall check the validity of the parameter `Fr_LpduIdx`. If `Fr_LpduIdx` is invalid, then the function `Fr_ReconfigLPdu()` shall raise the development error `FR_E_INV_LPDU_IDX`.]

[SWS_Fr_00533] [If development error detection for the Fr module is enabled, then the function `Fr_ReconfigLPdu()` shall check the validity of the parameter `Fr_ChnlIdx`. If `Fr_ChnlIdx` is invalid, then the function `Fr_ReconfigLPdu()` shall raise the development error `FR_E_INV_CHNL_IDX`.]

[SWS_Fr_00534] [If development error detection for the Fr module is enabled, then the function `Fr_ReconfigLPdu()` shall check the validity of the parameter `Fr_CycleRepetition`. If `Fr_CycleRepetition` is invalid, then the function `Fr_ReconfigLPdu()` shall raise the development error `FR_E_INV_CYCLE`.]

[SWS_Fr_00535] [Valid values⁵ for parameter `Fr_CycleRepetition` are 1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 50 and 64.]

[SWS_Fr_00536] [If development error detection for the Fr module is enabled, then the function `Fr_ReconfigLPdu()` shall check the parameter `Fr_CycleOffset` for being valid. If `Fr_CycleOffset` is invalid, then the function `Fr_ReconfigLPdu()` shall raise the development error `FR_E_INV_CYCLE`.]

[SWS_Fr_00537] [Valid values for parameter `Fr_CycleOffset` are 0 to (`Fr_CycleRepetition` - 1).]

[SWS_Fr_00538] [If development error detection for the Fr module is enabled, then the function `Fr_ReconfigLPdu()` shall check the validity of the parameter `Fr_PayloadLength`. If `Fr_PayloadLength` is invalid, then the function `Fr_ReconfigLPdu()` shall raise the development error `FR_E_INV_LENGTH`.]

[SWS_Fr_00634] [If development error detection for the Fr module is enabled, then the function `Fr_ReconfigLPdu()` shall check the parameter `Fr_HeaderCRC` for being valid⁶. If `Fr_HeaderCRC` is invalid, then the function `Fr_ReconfigLPdu()` shall raise the development error `FR_E_INV_HEADERCRC`.]

⁵For FlexRay Controllers compliant to [2] only cycle repetition values 1, 2, 4, 8, 16, 32 and 64 shall be supported.

⁶This does not mean that the CRC shall be recalculated. Instead the CRC shall be checked whether it fits in the allowed value range (0 - 2047) or not.

8.4.17 Fr_DisableLPdu

[SWS_Fr_00539] Definition of API function Fr_DisableLPdu

Upstream requirements: [SRS_Fr_05059](#)

[

Service Name	Fr_DisableLPdu	
Syntax	<pre>Std_ReturnType Fr_DisableLPdu (uint8 Fr_CtrlIdx, uint16 Fr_LPduIdx)</pre>	
Service ID [hex]	0x26	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_LPduldx	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	
Description	Disables the hardware resource of a LPdu for transmission/reception.	
Available via	Fr.h	

]

CC precondition for the function [Fr_DisableLPdu\(\)](#): None.

[SWS_Fr_00540] [The function [Fr_DisableLPdu\(\)](#) shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Figure out the physical resource (e.g., a buffer) mapped to the processing of the FlexRay frame identified by `Fr_LPduIdx`.
2. Configure the physical resource (a buffer) in a way that it doesn't take part in the transmission/reception process.
3. Return `E_OK`.

]

[SWS_Fr_00541] [Only Lpdus that can be dynamically reconfigured can be disabled by this service (see [Fr_ReconfigLPdu\(\)](#)).]

[SWS_Fr_00542] [The function [Fr_DisableLPdu\(\)](#) shall be pre compile time configurable On/Off by the configuration parameter: [FrDisableLPduSupport](#).]

[SWS_Fr_00543] [If the function `Fr_DisableLPdu()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00544] [If development error detection for the Fr module is enabled, and if the function `Fr_DisableLPdu()` is called before the successful initialization of Fr, then the function `Fr_DisableLPdu()` shall raise the development error `FR_E_INIT_FAILED` and return `E_NOT_OK`.]

[SWS_Fr_00545] [If development error detection for the Fr module is enabled, then the function `Fr_DisableLPdu()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_DisableLPdu()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00546] [If development error detection for the Fr module is enabled, then the function `Fr_DisableLPdu()` shall check the validity of the parameter `Fr_LpduIdx`. If `Fr_LpduIdx` is invalid, then the function `Fr_DisableLPdu()` shall raise the development error `FR_E_INV_LPDU_IDX`.]

8.4.18 Fr_GetGlobalTime

[SWS_Fr_00042] Definition of API function Fr_GetGlobalTime

Upstream requirements: [SRS_Fr_05019](#)

[

Service Name	Fr_GetGlobalTime	
Syntax	<pre>Std_ReturnType Fr_GetGlobalTime (uint8 Fr_CtrlIdx, uint8* Fr_CyclePtr, uint16* Fr_MacroTickPtr)</pre>	
Service ID [hex]	0x10	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	Fr_CyclePtr	Address where the current FlexRay communication cycle value shall be stored.
	Fr_MacroTickPtr	Address where the current macrotick value shall be stored.
Return value	Std_ReturnType	<code>E_OK</code> : API call finished successfully. <code>E_NOT_OK</code> : API call aborted due to errors.



△

Description	Gets the current global FlexRay time. Important Note: Fr_GetGlobalTime may be called within an exclusive area.
Available via	Fr.h

]

Note: The Fr module's environment shall only call `Fr_GetGlobalTime()` if the CC `Fr_CtrlIdx` is synchronous to FlexRay global time.

[SWS_Fr_00256] [The function `Fr_GetGlobalTime()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Read the current global FlexRay time and write it to the output parameters `Fr_CyclePtr` and `Fr_MacrotickPtr`.
2. Return `E_OK`.

]

[SWS_Fr_00257] [The function `Fr_GetGlobalTime()` shall ensure that the time information is consistent and valid. This means that the values returned of both parameters (`Fr_CyclePtr` and `Fr_MacrotickPtr`) must be taken from a single point in time. The resulting global time shall always strictly increase over time (until it wraps around at the time-boundary).]

[SWS_Fr_00044]

Upstream requirements: [SRS_Fr_05072](#)

[The function `Fr_GetGlobalTime()` shall ensure that the time information is valid and up to date (synchronized CC), - otherwise the output parameters shall not be written and `E_NOT_OK` returned.]

[SWS_Fr_00255] [If the function `Fr_GetGlobalTime()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00251] [If development error detection for the Fr module is enabled, and if the function `Fr_GetGlobalTime()` is called before the successful initialization of Fr, then the function `Fr_GetGlobalTime()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00252] [If development error detection for the Fr module is enabled, then the function `Fr_GetGlobalTime()` shall check the validity of the parameter `Fr_CtrlIdx`.

If `Fr_CtrlIdx` is invalid, then the function `Fr_GetGlobalTime()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00253] [If development error detection for the Fr module is enabled, then the function `Fr_GetGlobalTime()` shall check whether the parameter `Fr_CyclePtr` is a NULL pointer (`NULL_PTR`). If `Fr_CyclePtr` is a NULL pointer, the function `Fr_GetGlobalTime()` shall raise the development error `FR_E_PARAM_POINTER`.]

[SWS_Fr_00254] [If development error detection for the Fr module is enabled, then the function `Fr_GetGlobalTime()` shall check whether the parameter `Fr_MacroTickPtr` is a NULL pointer (`NULL_PTR`). If `Fr_MacroTickPtr` is a NULL pointer, the function `Fr_GetGlobalTime()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.19 Fr_GetNmVector

[SWS_Fr_00113] Definition of API function Fr_GetNmVector [

Service Name	Fr_GetNmVector	
Syntax	<pre>Std_ReturnType Fr_GetNmVector (uint8 Fr_CtrlIdx, uint8* Fr_NmVectorPtr)</pre>	
Service ID [hex]	0x22	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	Fr_NmVectorPtr	Address where the NmVector of the last communication cycle shall be stored.
Return value	Std_ReturnType	E_OK: API call finished successfully. E_NOT_OK: API call aborted due to errors.
Description	Gets the network management vector of the last communication cycle.	
Available via	Fr.h	

]

Note: The Fr module's environment shall only call the function `Fr_GetNmVector()` when the CC `Fr_CtrlIdx` is synchronous to FlexRay global time.

Note: The NM-Vector will be updated at a defined point in time (see [1]). At this point of time the service `Fr_GetNmVector()` shall not be called, in order to ensure a consistent NM-Vector value.

[SWS_Fr_00262] [The function `Fr_GetNmVector()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Read the current accrued network management vector out of the FlexRay CC and then write it to the output parameter `Fr_NmVectorPtr`. The number of bytes written to the output parameter is constant and is known at configuration time (`FrIfGNetworkManagementVectorLength`).
2. Return `E_OK`.

]

[SWS_Fr_00263] [The function `Fr_GetNmVector()` shall ensure that the FlexRay CC is synchronous to global time when the data is read - otherwise the output parameters shall not be written and `E_NOT_OK` returned.]

[SWS_Fr_00264] [The function `Fr_GetNmVector()` shall ensure that the payload data is copied to `Fr_NmVectorPtr` in the same byte order as they were received on the FlexRay bus. (first byte = lowest address, last byte = highest address).]

[SWS_Fr_00261] [If the function `Fr_GetNmVector()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00258] [If development error detection for the Fr module is enabled, and if the function `Fr_GetNmVector()` is called before the successful initialization of Fr, then the function `Fr_GetNmVector()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00259] [If development error detection for the Fr module is enabled, then the function `Fr_GetNmVector()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_GetNmVector()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00260] [If development error detection for the Fr module is enabled, then the function `Fr_GetNmVector()` shall check whether the parameter `Fr_NmVectorPtr` is a NULL pointer (`NULL_PTR`). If `Fr_NmVectorPtr` is a NULL pointer, then the function `Fr_GetNmVector()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.20 Fr_GetNumOfStartupFrames

[SWS_Fr_00547] Definition of API function Fr_GetNumOfStartupFrames [

Service Name	Fr_GetNumOfStartupFrames	
Syntax	<pre>Std_ReturnType Fr_GetNumOfStartupFrames (uint8 Fr_CtrlIdx, uint8* Fr_NumOfStartupFramesPtr)</pre>	
Service ID [hex]	0x27	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	Fr_NumOfStartupFramesPtr	Address where the number of startup frames seen within the last even/odd cycle pair shall be stored.
Return value	Std_ReturnType	E_OK: API call finished successfully. E_NOT_OK: API call aborted due to errors.
Description	Gets the current number of startup frames seen on the cluster. See variable vStartupPairs of [12] for details.	
Available via	Fr.h	

]

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Note: The Fr module's environment shall only call `Fr_GetNumOfStartupFrames()` if the CC `Fr_CtrlIdx` is synchronous to FlexRay global time.

[SWS_Fr_00549] [The function `Fr_GetNumOfStartupFrames()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Read the number of aligned startup frame pairs received or transmitted during the previous double cycle, aggregated across both channels and write it to the output parameter `Fr_NumOfStartupFramesPtr`.
2. Return `E_OK`.

]

[SWS_Fr_00550] [If the hardware doesn't support accumulating the number of startupframes, (FlexRay 2.1 Rev A compliant hardware), then the driver shall always assume 2 startup frames available.]

[SWS_Fr_00551] [The function `Fr_GetNumOfStartupFrames()` shall ensure that the information is valid and up to date (synchronized CC) - otherwise the output parameters shall not be written and `E_NOT_OK` returned.]

⁷FlexRay 2.1 Rev A compliant controllers do not support `vStartupPairs`. See [SWS_Fr_00550] for FlexRay 2.1 Rev A controllers implementation constraints.

[SWS_Fr_00552] [If the function `Fr_GetNumOfStartupFrames()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00553] [If development error detection for the Fr module is enabled, and if the function `Fr_GetNumOfStartupFrames()` is called before the successful initialization of Fr, then the function `Fr_GetNumOfStartupFrames()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00554] [If development error detection for the Fr module is enabled, then the function `Fr_GetNumOfStartupFrames()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_GetNumOfStartupFrames()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00555] [If development error detection for the Fr module is enabled, then the function `Fr_GetNumOfStartupFrames()` shall check whether the parameter `Fr_NumOfStartupFramesPtr` is a NULL pointer (`NULL_PTR`). If `Fr_NumOfStartupFramesPtr` is a NULL pointer, then the function `Fr_GetNumOfStartupFrames()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.21 Fr_GetChannelStatus

[SWS_Fr_00556] Definition of API function Fr_GetChannelStatus [

Service Name	Fr_GetChannelStatus	
Syntax	<pre>Std_ReturnType Fr_GetChannelStatus (uint8 Fr_CtrlIdx, uint16* Fr_ChannelAStatusPtr, uint16* Fr_ChannelBStatusPtr)</pre>	
Service ID [hex]	0x28	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	Fr_ChannelAStatusPtr	Address where the bitcoded channel A status information shall be stored.
	Fr_ChannelBStatusPtr	Address where the bitcoded channel B status information shall be stored.
Return value	Std_ReturnType	<code>E_OK</code> : API call finished successfully. <code>E_NOT_OK</code> : API call aborted due to errors.
Description	Gets the channel status information.	
Available via	Fr.h	

]

Note: The Fr module's environment shall only call `Fr_GetChannelStatus()` if the CC `Fr_CtrlIdx` is synchronous to FlexRay global time.

[SWS_Fr_00558] [The function `Fr_GetChannelStatus()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Read the aggregated channel status, NIT status, symbol window status and write it to the output parameter `Fr_ChannelAStatusPtr/ Fr_ChannelBStatusPtr`. The value of `*Fr_ChannelAStatusPtr/ *Fr_ChannelBStatusPtr` is bitcoded with the following meaning (Bit 0 = LSB, Bit 15 = MSB)⁸:
 - Bit 0** Channel A/B aggregated channel status vSS!ValidFrame
 - Bit 1** Channel A/B aggregated channel status vSS!SyntaxError
 - Bit 2** Channel A/B aggregated channel status vSS!ContentError
 - Bit 3** Channel A/B aggregated channel status additional communication
 - Bit 4** Channel A/B aggregated channel status vSS!Bviolation
 - Bit 5** Channel A/B aggregated channel status vSS!TxConflict
 - Bit 6** Not used (0)
 - Bit 7** Not used (0)
 - Bit 8** Channel A/B symbol window status data vSS!ValidMTS
 - Bit 9** Channel A/B symbol window status data vSS!SyntaxError
 - Bit 10** Channel A/B symbol window status data vSS!Bviolation
 - Bit 11** Channel A/B symbol window status data vSS!TxConflict
 - Bit 12** Channel A/B NIT status data vSS!SyntaxError
 - Bit 13** Channel A/B NIT status data vSS!Bviolation
 - Bit 14** Not used (0)
 - Bit 15** Not used (0)
2. Reset the aggregated channel status information within the FlexRay controller.
3. Return `E_OK`.

]

⁸Bit 5 and Bit 11 shall be set to 0 for FlexRay 2.1 compliant controllers, since vSS!TxConflict is not supported on this hardware.

[SWS_Fr_00559] [The function `Fr_GetChannelStatus()` shall ensure that the information is valid and up to date (synchronized CC) - otherwise the output parameters shall not be written and `E_NOT_OK` returned.]

[SWS_Fr_00560] [If the function `Fr_GetChannelStatus()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00561] [If development error detection for the Fr module is enabled, and if the function `Fr_GetChannelStatus()` is called before the successful initialization of Fr, then the function `Fr_GetChannelStatus()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00562] [If development error detection for the Fr module is enabled, then the function `Fr_GetChannelStatus()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_GetChannelStatus()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00563] [If development error detection for the Fr module is enabled, then the function `Fr_GetChannelStatus()` shall check whether the parameter `Fr_ChannelAStatusPtr` is a NULL pointer (`NULL_PTR`). If `Fr_ChannelAStatusPtr` is a NULL pointer, then the function `Fr_GetChannelStatus()` shall raise the development error `FR_E_PARAM_POINTER`.]

[SWS_Fr_00607] [If development error detection for the Fr module is enabled, then the function `Fr_GetChannelStatus()` shall check whether the parameter `Fr_ChannelBStatusPtr` is a NULL pointer (`NULL_PTR`). If `Fr_ChannelBStatusPtr` is a NULL pointer, then the function `Fr_GetChannelStatus()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.22 Fr_GetClockCorrection

[SWS_Fr_00564] Definition of API function `Fr_GetClockCorrection` [

Service Name	<code>Fr_GetClockCorrection</code>
Syntax	<pre>Std_ReturnType Fr_GetClockCorrection (uint8 Fr_CtrlIdx, sint16* Fr_RateCorrectionPtr, sint32* Fr_OffsetCorrectionPtr)</pre>



△

Service ID [hex]	0x29	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	Fr_RateCorrectionPtr	Address where the current rate correction value shall be stored.
	Fr_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	Gets the current clock correction values. See variables vInterimRateCorrection and vInterimOffsetCorrection of [12] for details.	
Available via	Fr.h	

]

9,10

[SWS_Fr_00566] [The function `Fr_GetClockCorrection()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Read the rate correction value (`vInterimRateCorrection`¹¹) and write it as signed integer to the output parameter `Fr_RateCorrectionPtr`. Read the offset correction value (`vInterimOffsetCorrection`¹²) and write it as signed integer to the output parameter `Fr_OffsetCorrectionPtr`
2. Return `E_OK`.

]

[SWS_Fr_00568] [If the function `Fr_GetClockCorrection()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00569] [If development error detection for the Fr module is enabled, and if the function `Fr_GetClockCorrection()` is called before the successful initialization of Fr, then the function `Fr_GetClockCorrection()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00570] [If development error detection for the Fr module is enabled, then the function `Fr_GetClockCorrection()` shall check the validity of the parameter

⁹vInterimRate Correction maps to vRateCorrection for FlexRay 2.1 compliant controllers, see [2]

¹⁰vInterimOffsetCorrection maps to vOffsetCorrection for FlexRay 2.1 compliant controllers, see [2]

¹¹vInterimRate Correction maps to vRateCorrection for FlexRay 2.1 compliant controllers, see [2]

¹²vInterimOffsetCorrection maps to vOffsetCorrection for FlexRay 2.1 compliant controllers, see [2]

Fr_CtrlIdx. If Fr_CtrlIdx is invalid, then the function `Fr_GetClockCorrection()` shall raise the development error FR_E_INV_CTRL_IDX.]

[SWS_Fr_00571] [If development error detection for the Fr module is enabled, then the function `Fr_GetClockCorrection()` shall check whether the parameter Fr_RateCorrectionPtr is a NULL pointer (NULL_PTR). If Fr_RateCorrectionPtr is a NULL pointer, then the function `Fr_GetClockCorrection()` shall raise the development error FR_E_PARAM_POINTER.]

[SWS_Fr_00572] [If development error detection for the Fr module is enabled, then the function `Fr_GetClockCorrection()` shall check whether the parameter Fr_OffsetCorrectionPtr is a NULL pointer (NULL_PTR). If Fr_OffsetCorrectionPtr is a NULL pointer, then the function `Fr_GetClockCorrection()` shall raise the development error FR_E_PARAM_POINTER.]

8.4.23 Fr_GetSyncFrameList

[SWS_Fr_00573] Definition of API function Fr_GetSyncFrameList [

Service Name	Fr_GetSyncFrameList	
Syntax	<pre>Std_ReturnType Fr_GetSyncFrameList (uint8 Fr_CtrlIdx, uint8 Fr_ListSize, uint16* Fr_ChannelAEvenListPtr, uint16* Fr_ChannelBEvenListPtr, uint16* Fr_ChannelAOddListPtr, uint16* Fr_ChannelBOddListPtr)</pre>	
Service ID [hex]	0x2a	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_ListSize	Size of the arrays passed via parameters: Fr_ChannelAEvenListPtr Fr_ChannelBEvenListPtr Fr_ChannelAOddListPtr Fr_ChannelBOddListPtr. The service must ensure to not write more entries into those arrays than granted by this parameter.
Parameters (inout)	None	
Parameters (out)	Fr_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 Fr_ListSize. Unused list elements are filled with the value '0' to indicate that no more syncframe has been seen.
	Fr_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 Fr_ListSize. Unused list elements are filled with the value '0' to indicate that no more syncframe has been seen.



△

	Fr_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 Fr_ListSize. Unused list elements are filled with the value '0' to indicate that no more syncframe has been seen.
	Fr_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 Fr_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	Gets a list of syncframes received or transmitted on channel A and channel B via the even and odd communication cycle. See variables vsSynclListA and vsSynclListB of [12] for details.	
Available via	Fr.h	

]

[SWS_Fr_00575] [The function `Fr_GetSyncFrameList()` shall perform the following tasks on FlexRay CC `Fr_CtrIdx`:

1. Read the list of syncframes received in the last even communication cycle on channel A and write it as array to the memory location `Fr_ChannelAEvenListPtr`.
2. Read the list of syncframes received in the last even communication cycle on channel B and write it as array to the memory location `Fr_ChannelBEvenListPtr`.
3. Read the list of syncframes received in the last odd communication cycle on channel A and write it as array to the memory location `Fr_ChannelAOddListPtr`.
4. Read the list of syncframes received in the last odd communication cycle on channel B and write it as array to the memory location `Fr_ChannelBOddListPtr`.
5. Return `E_OK`.

]

[SWS_Fr_00576] [The size of the array written to `Fr_ChannelAEvenListPtr`, `Fr_ChannelBEvenListPtr`, `Fr_ChannelAOddListPtr` and `Fr_ChannelBOddListPtr` shall be limited to `Fr_ListSize` (array elements 0 to $(Fr_ListSize - 1)$).]

[SWS_Fr_00577] [Unused array elements shall be set to 0, indicating no valid sync frame.]

[SWS_Fr_00578] [A maximum number of 15 syncframes shall be supported.]

[SWS_Fr_00580] [If the function `Fr_GetSyncFrameList()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00581] [If development error detection for the Fr module is enabled, and if the function `Fr_GetSyncFrameList()` is called before the successful initialization of Fr, then the function `Fr_GetSyncFrameList()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00582] [If development error detection for the Fr module is enabled, then the function `Fr_GetSyncFrameList()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_GetSyncFrameList()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00667] [If development error detection for the Fr module is enabled, then the function `Fr_GetSyncFrameList()` shall check the validity of the parameter `Fr_ListSize`. If `Fr_ListSize` is larger than 15, then the function `Fr_GetSyncFrameList()` shall raise the development error `FR_E_INV_FRAMELIST_SIZE`.]

[SWS_Fr_00583] [If development error detection for the Fr module is enabled, then the function `Fr_GetSyncFrameList()` shall check whether the parameter `Fr_ChannelAEvenListPtr` is a NULL pointer (`NULL_PTR`). If `Fr_ChannelAEvenListPtr` is a NULL pointer, then the function `Fr_GetSyncFrameList()` shall raise the development error `FR_E_PARAM_POINTER`.]

[SWS_Fr_00584] [If development error detection for the Fr module is enabled, then the function `Fr_GetSyncFrameList()` shall check whether the parameter `Fr_ChannelBEvenListPtr` is a NULL pointer (`NULL_PTR`). If `Fr_ChannelBEvenListPtr` is a NULL pointer, then the function `Fr_GetSyncFrameList()` shall raise the development error `FR_E_PARAM_POINTER`.]

[SWS_Fr_00585] [If development error detection for the Fr module is enabled, then the function `Fr_GetSyncFrameList()` shall check whether the parameter `Fr_ChannelAOddListPtr` is a NULL pointer (`NULL_PTR`). If `Fr_ChannelAOddListPtr` is a NULL pointer, then the function `Fr_GetSyncFrameList()` shall raise the development error `FR_E_PARAM_POINTER`.]

[SWS_Fr_00586] [If development error detection for the Fr module is enabled, then the function `Fr_GetSyncFrameList()` shall check whether the parameter `Fr_ChannelBOddListPtr` is a NULL pointer (`NULL_PTR`). If `Fr_ChannelBOddListPtr` is a NULL pointer, then the function `Fr_GetSyncFrameList()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.24 Fr_GetWakeupRxStatus

[SWS_Fr_00587] Definition of API function Fr_GetWakeupRxStatus [

Service Name	Fr_GetWakeupRxStatus	
Syntax	<pre>Std_ReturnType Fr_GetWakeupRxStatus (uint8 Fr_CtrlIdx, uint8* Fr_WakeupRxStatusPtr)</pre>	
Service ID [hex]	0x2b	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
Parameters (inout)	None	
Parameters (out)	Fr_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	Gets the wakeup received information from the FlexRay controller.	
Available via	Fr.h	

]

[SWS_Fr_00588] [The function `Fr_GetWakeupRxStatus()` shall perform the following tasks on FlexRay CC `Fr_CtrlIdx`:

1. Read the wakeup pattern received indicators for channel A and channel B and write it to the output parameter `Fr_WakeupRxStatusPtr`. The value of `*Fr_WakeupRxStatusPtr` is bitcoded with the following meaning (Bit 0 = LSB, Bit 7 = MSB):
 - Bit 0** Wakeup pattern received on channel A (1), otherwise (0)
 - Bit 1** Wakeup pattern received on channel B (1), otherwise (0)
 - Bit 2** Not used (always 0)
 - Bit 3** Not used (always 0)
 - Bit 4** Not used (always 0)
 - Bit 5** Not used (always 0)
 - Bit 6** Not used (always 0)
 - Bit 7** Not used (always 0)
2. Reset the wakeup received indication status information within the FlexRay controller.
3. Return `E_OK`.

]

[SWS_Fr_00589] [If the function `Fr_GetWakeupRxStatus()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00590] [If development error detection for the Fr module is enabled, and if the function `Fr_GetWakeupRxStatus()` is called before the successful initialization of Fr, then the function `Fr_GetWakeupRxStatus()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00591] [If development error detection for the Fr module is enabled, then the function `Fr_GetWakeupRxStatus()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_GetWakeupRxStatus()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00592] [If development error detection for the Fr module is enabled, then the function `Fr_GetWakeupRxStatus()` shall check whether the parameter `Fr_WakeupRxStatusPtr` is a NULL pointer (`NULL_PTR`). If `Fr_WakeupRxStatusPtr` is a NULL pointer, then the function `Fr_GetWakeupRxStatus()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.25 Fr_SetAbsoluteTimer

[SWS_Fr_00033] Definition of API function `Fr_SetAbsoluteTimer`

Upstream requirements: [SRS_Fr_05044](#)

[

Service Name	Fr_SetAbsoluteTimer	
Syntax	<pre>Std_ReturnType Fr_SetAbsoluteTimer (uint8 Fr_CtrlIdx, uint8 Fr_AbsTimerIdx, uint8 Fr_Cycle, uint16 Fr_Offset)</pre>	
Service ID [hex]	0x11	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_AbsTimerIdx	Index of absolute timer within the context of the FlexRay CC.
	Fr_Cycle	Absolute cycle the timer shall elapse in.
	Fr_Offset	Offset within cycle Fr_Cycle in units of macrotick the timer shall elapse at.



△

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	Sets the absolute FlexRay timer.	
Available via	Fr.h	

]

Note: The Fr module's environment shall only call `Fr_SetAbsoluteTimer()` when the CC `Fr_CtrlIdx` is synchronous to FlexRay global time (at the moment of timer activation).

[SWS_Fr_00273] [The function `Fr_SetAbsoluteTimer()` shall perform the following tasks:

1. Program the absolute FlexRay timer `Fr_AbsTimerIdx` according to the parameters `Fr_Cycle` and `Fr_Offset`.
2. Return `E_OK`.

]

[SWS_Fr_00272] [If the function `Fr_SetAbsoluteTimer()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00267] [If development error detection for the Fr module is enabled, and if the function `Fr_SetAbsoluteTimer()` is called before the successful initialization of Fr, then the function `Fr_SetAbsoluteTimer()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00268] [If development error detection for the Fr module is enabled, then the function `Fr_SetAbsoluteTimer()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_SetAbsoluteTimer()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00269] [If development error detection for the Fr module is enabled, then the function `Fr_SetAbsoluteTimer()` shall check the validity of the parameter `Fr_AbsTimerIdx`. If `Fr_AbsTimerIdx` is invalid, then the function `Fr_SetAbsoluteTimer()` shall raise the development error `FR_E_INV_TIMER_IDX`.]

[SWS_Fr_00270] [If development error detection for the Fr module is enabled, then the function `Fr_SetAbsoluteTimer()` shall check the validity of the parameter

Fr_Cycle. If Fr_Cycle is invalid, then the function `Fr_SetAbsoluteTimer()` shall raise the development error `FR_E_INV_CYCLE`.]

[SWS_Fr_00271] [If development error detection for the Fr module is enabled, then the function `Fr_SetAbsoluteTimer()` shall check the validity of the parameter `Fr_Offset`. If `Fr_Offset` is invalid, then the function `Fr_SetAbsoluteTimer()` shall raise the development error `FR_E_INV_OFFSET`.]

[SWS_Fr_00436] [The function `Fr_SetAbsoluteTimer()` shall check whether the CC `Fr_CtrlIdx` is synchronous to the FlexRay global time. If the CC `Fr_CtrlIdx` is not synchronous to the FlexRay global time, then the function `Fr_SetAbsoluteTimer()` shall raise the runtime error `FR_E_INV_POCSSTATE`.]

8.4.26 Fr_CancelAbsoluteTimer

[SWS_Fr_00095] Definition of API function Fr_CancelAbsoluteTimer

Upstream requirements: [SRS_Fr_05044](#)

[

Service Name	Fr_CancelAbsoluteTimer	
Syntax	<pre>Std_ReturnType Fr_CancelAbsoluteTimer (uint8 Fr_CtrlIdx, uint8 Fr_AbsTimerIdx)</pre>	
Service ID [hex]	0x13	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_AbsTimerIdx	Index of absolute timer within the context of the FlexRay CC.
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	Stops an absolute timer.	
Available via	Fr.h	

]

CC precondition for the function `Fr_CancelAbsoluteTimer()`: None.

[SWS_Fr_00287] [The function `Fr_CancelAbsoluteTimer()` shall perform the following tasks:

1. Stop the absolute timer `Fr_AbsTimerIdx`.

2. Return E_OK.

]

[SWS_Fr_00286] [If the function `Fr_CancelAbsoluteTimer()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00283] [If development error detection for the Fr module is enabled, and if the function `Fr_CancelAbsoluteTimer()` is called before the successful initialization of Fr, then the function `Fr_CancelAbsoluteTimer()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00284] [If development error detection for the Fr module is enabled, then the function `Fr_CancelAbsoluteTimer()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_CancelAbsoluteTimer()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00285] [If development error detection for the Fr module is enabled, then the function `Fr_CancelAbsoluteTimer()` shall check the validity of the parameter `Fr_AbsTimerIdx`. If `Fr_AbsTimerIdx` is invalid, then the function `Fr_CancelAbsoluteTimer()` shall raise the development error `FR_E_INV_TIMER_IDX`.]

8.4.27 Fr_EnableAbsoluteTimerIRQ

[SWS_Fr_00034] Definition of API function Fr_EnableAbsoluteTimerIRQ

Upstream requirements: [SRS_Fr_05125](#), [SRS_Fr_05046](#)

[

Service Name	Fr_EnableAbsoluteTimerIRQ	
Syntax	<pre>Std_ReturnType Fr_EnableAbsoluteTimerIRQ (uint8 Fr_CtrlIdx, uint8 Fr_AbsTimerIdx)</pre>	
Service ID [hex]	0x15	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_AbsTimerIdx	Index of absolute timer within the context of the FlexRay CC.
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	Enables the interrupt line of an absolute timer.	
Available via	Fr.h	

]

CC precondition for the function `Fr_EnableAbsoluteTimerIRQ()`: None.

[SWS_Fr_00298] [The function `Fr_EnableAbsoluteTimerIRQ()` shall perform the following tasks:

1. Enable the interrupt line related to timer `Fr_AbsTimerIdx`.
2. Return `E_OK`.

]

[SWS_Fr_00297] [If the function `Fr_EnableAbsoluteTimerIRQ()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00294] [If development error detection for the Fr module is enabled, and if the function `Fr_EnableAbsoluteTimerIRQ()` is called before the successful initialization of Fr, then the function `Fr_EnableAbsoluteTimerIRQ()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00295] [If development error detection for the Fr module is enabled, then the function `Fr_EnableAbsoluteTimerIRQ()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_EnableAbsoluteTimerIRQ()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00296] [If development error detection for the Fr module is enabled, then the function `Fr_EnableAbsoluteTimerIRQ()` shall check the validity of the parameter `Fr_AbsTimerIdx`. If `Fr_AbsTimerIdx` is invalid, then the function `Fr_EnableAbsoluteTimerIRQ()` shall raise the development error `FR_E_INV_TIMER_IDX`.]

8.4.28 Fr_AckAbsoluteTimerIRQ

[SWS_Fr_00036] Definition of API function Fr_AckAbsoluteTimerIRQ

Upstream requirements: [SRS_Fr_05125](#), [SRS_Fr_05048](#)

[

Service Name	Fr_AckAbsoluteTimerIRQ	
Syntax	Std_ReturnType Fr_AckAbsoluteTimerIRQ (uint8 Fr_CtrlIdx, uint8 Fr_AbsTimerIdx)	
Service ID [hex]	0x17	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_AbsTimerIdx	Index of absolute timer within the context of the FlexRay CC.
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	
Available via		Fr.h

]

CC precondition for the function [Fr_AckAbsoluteTimerIRQ\(\)](#): None.

[SWS_Fr_00309] [The function [Fr_AckAbsoluteTimerIRQ\(\)](#) shall perform the following tasks:

1. Reset the interrupt condition of absolute timer `Fr_AbsTimerIdx`.
2. Return `E_OK`.

]

[SWS_Fr_00308] [If the function [Fr_AckAbsoluteTimerIRQ\(\)](#) is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00305] [If development error detection for the Fr module is enabled, and if the function [Fr_AckAbsoluteTimerIRQ\(\)](#) is called before the successful initialization of Fr, then the function [Fr_AckAbsoluteTimerIRQ\(\)](#) shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00306] [If development error detection for the Fr module is enabled, then the function `Fr_AckAbsoluteTimerIRQ()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_AckAbsoluteTimerIRQ()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00307] [If development error detection for the Fr module is enabled, then the function `Fr_AckAbsoluteTimerIRQ()` shall check the validity of the parameter `Fr_AbsTimerIdx`. If `Fr_AbsTimerIdx` is invalid, then the function `Fr_AckAbsoluteTimerIRQ()` shall raise the development error `FR_E_INV_TIMER_IDX`.]

8.4.29 Fr_DisableAbsoluteTimerIRQ

[SWS_Fr_00035] Definition of API function Fr_DisableAbsoluteTimerIRQ

Upstream requirements: [SRS_Fr_05125](#), [SRS_Fr_05047](#)

[

Service Name	Fr_DisableAbsoluteTimerIRQ	
Syntax	<pre>Std_ReturnType Fr_DisableAbsoluteTimerIRQ (uint8 Fr_CtrlIdx, uint8 Fr_AbsTimerIdx)</pre>	
Service ID [hex]	0x19	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_AbsTimerIdx	Index of absolute timer within the context of the FlexRay CC.
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	Disables the interrupt line of an absolute timer.	
Available via	Fr.h	

]

CC precondition for the function `Fr_DisableAbsoluteTimerIRQ()`: None.

[SWS_Fr_00320] [The function `Fr_DisableAbsoluteTimerIRQ()` shall perform the following tasks:

1. Disable the interrupt line related to absolute timer `Fr_AbsTimerIdx`.
2. Return `E_OK`.

]

[SWS_Fr_00319] [If the function `Fr_DisableAbsoluteTimerIRQ()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00316] [If development error detection for the Fr module is enabled, and if the function `Fr_DisableAbsoluteTimerIRQ()` is called before the successful initialization of Fr, then the function `Fr_DisableAbsoluteTimerIRQ()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00317] [If development error detection for the Fr module is enabled, then the function `Fr_DisableAbsoluteTimerIRQ()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_DisableAbsoluteTimerIRQ()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00318] [If development error detection for the Fr module is enabled, then the function `Fr_DisableAbsoluteTimerIRQ()` shall check the validity of the parameter `Fr_AbsTimerIdx`. If `Fr_AbsTimerIdx` is invalid, then the function `Fr_DisableAbsoluteTimerIRQ()` shall raise the development error `FR_E_INV_TIMER_IDX`.]

8.4.30 Fr_GetAbsoluteTimerIRQStatus

[SWS_Fr_00108] Definition of API function Fr_GetAbsoluteTimerIRQStatus

Upstream requirements: [SRS_Fr_05125](#)

[

Service Name	Fr_GetAbsoluteTimerIRQStatus	
Syntax	<pre>Std_ReturnType Fr_GetAbsoluteTimerIRQStatus (uint8 Fr_CtrlIdx, uint8 Fr_AbsTimerIdx, boolean* Fr_IRQStatusPtr)</pre>	
Service ID [hex]	0x20	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	
Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_AbsTimerIdx	Index of absolute timer within the context of the FlexRay CC.
Parameters (inout)	None	
Parameters (out)	Fr_IRQStatusPtr	Address the output value is stored to.
Return value	Std_ReturnType	<code>E_OK</code> : API call finished successfully. <code>E_NOT_OK</code> : API call aborted due to errors.
Description	Gets IRQ status of an absolute timer.	

▽



Available via

Fr.h

]

CC precondition for the function `Fr_GetAbsoluteTimerIRQStatus()`: None.

[SWS_Fr_00332] [The function `Fr_GetAbsoluteTimerIRQStatus()` shall perform the following tasks:

1. Check whether the interrupt of absolute timer `Fr_AbsTimerIdx` is pending. Write `TRUE` to output parameter `Fr_IRQStatusPtr` in case the interrupt is pending, `FALSE` otherwise.
2. Return `E_OK`.

]

[SWS_Fr_00331] [If the function `Fr_GetAbsoluteTimerIRQStatus()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00327] [If development error detection for the Fr module is enabled, and if the function `Fr_GetAbsoluteTimerIRQStatus()` is called before the successful initialization of Fr, then the function `Fr_GetAbsoluteTimerIRQStatus()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00328] [If development error detection for the Fr module is enabled, then the function `Fr_GetAbsoluteTimerIRQStatus()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_GetAbsoluteTimerIRQStatus()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00329] [If development error detection for the Fr module is enabled, then the function `Fr_GetAbsoluteTimerIRQStatus()` shall check the validity of the parameter `Fr_AbsTimerIdx`. If `Fr_AbsTimerIdx` is invalid, then the function `Fr_GetAbsoluteTimerIRQStatus()` shall raise the development error `FR_E_INV_TIMER_IDX`.]

[SWS_Fr_00330] [If development error detection for the Fr module is enabled, then the function `Fr_GetAbsoluteTimerIRQStatus()` shall check whether the parameter `Fr_IRQStatusPtr` is a `NULL` pointer (`NULL_PTR`). If `Fr_IRQStatusPtr` is a `NULL` pointer, then the function `Fr_GetAbsoluteTimerIRQStatus()` shall raise the development error `FR_E_PARAM_POINTER`.]

8.4.31 Fr_GetVersionInfo

[SWS_Fr_00070] Definition of API function Fr_GetVersionInfo

Upstream requirements: [SRS_BSW_00407](#), [SRS_BSW_00411](#)

[

Service Name	Fr_GetVersionInfo	
Syntax	<pre>void Fr_GetVersionInfo (Std_VersionInfoType* VersionInfoPtr)</pre>	
Service ID [hex]	0x1b	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	None	
Parameters (inout)	None	
Parameters (out)	VersionInfoPtr	Pointer to where to store the version information of this module.
Return value	None	
Description	Returns the version information of this module.	
Available via	Fr.h	

]

[SWS_Fr_00340]

Upstream requirements: [SRS_BSW_00411](#)

[If development error detection for the Fr module is enabled, then the function `Fr_GetVersionInfo()` shall check whether the parameter `VersionInfoPtr` is a NULL pointer (`NULL_PTR`). If `VersionInfoPtr` is a NULL pointer, then the function `Fr_GetVersionInfo()` shall raise the development error `FR_E_PARAM_POINTER` and return.]

8.4.32 Fr_ReadCCConfig

[SWS_Fr_00651] Definition of API function Fr_ReadCCConfig [

Service Name	Fr_ReadCCConfig	
Syntax	<pre>Std_ReturnType Fr_ReadCCConfig (uint8 Fr_CtrlIdx, uint8 Fr_ConfigParamIdx, uint32* Fr_ConfigParamValuePtr)</pre>	
Service ID [hex]	0x2e	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant for the same device	



△

Parameters (in)	Fr_CtrlIdx	Index of FlexRay CC within the context of the FlexRay Driver.
	Fr_ConfigParamIdx	Index that identifies the configuration parameter to read. See macros FR_CIDX_<config_parameter_name>.
Parameters (inout)	None	
Parameters (out)	Fr_ConfigParamValuePtr	Address the output value is stored to.
Return value	Std_ReturnType	E_OK: API call finished successfully. E_NOT_OK: API call aborted due to errors.
Description	Reads a FlexRay protocol configuration parameter for a particular FlexRay controller out of the module's configuration.	
Available via	Fr.h	

]

The function `Fr_ReadCCConfig()` shall perform the following tasks:

1. Read the value of the configuration parameter requested by `Fr_ConfigParamIdx` from the configuration and write it to output parameter `*Fr_ConfigParamValuePtr`.
2. Return `E_OK`.

[SWS_Fr_00652] [If the function `Fr_ReadCCConfig()` is able to and detects a hardware error while performing the requested functionality, then it shall call `Dem_SetEventStatus()` (`FR_E_CTRL_TESTRESULT`, `DEM_EVENT_STATUS_FAILED`) and return `E_NOT_OK`.]

[SWS_Fr_00653] [If development error detection for the Fr module is enabled, and if the function `Fr_ReadCCConfig()` is called before the successful initialization of Fr, then the function `Fr_ReadCCConfig()` shall raise the development error `FR_E_INIT_FAILED`.]

[SWS_Fr_00654] [If development error detection for the Fr module is enabled, then the function `Fr_ReadCCConfig()` shall check the validity of the parameter `Fr_CtrlIdx`. If `Fr_CtrlIdx` is invalid, then the function `Fr_ReadCCConfig()` shall raise the development error `FR_E_INV_CTRL_IDX`.]

[SWS_Fr_00655] [If development error detection for the Fr module is enabled, then the function `Fr_ReadCCConfig()` shall check the validity of the parameter `Fr_ConfigParamIdx`. If `Fr_ConfigParamIdx` is invalid, then the function `Fr_ReadCCConfig()` shall raise the development error `FR_E_INV_CONFIG_IDX`.]

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¹³Valid values are listed in [Section 8.2.1 “Configuration parameter index macros”](#) and in requirements [\[SWS_Fr_00662\]](#), [\[SWS_Fr_00663\]](#), [\[SWS_Fr_00664\]](#), [\[SWS_Fr_00665\]](#), [\[SWS_Fr_00666\]](#).

[SWS_Fr_00656] [If development error detection for the Fr module is enabled, then the function `Fr_ReadCCConfig()` shall check whether the parameter `Fr_ConfigParamValuePtr` is a NULL pointer (`NULL_PTR`). If `Fr_ConfigParamValuePtr` is a NULL pointer, then the function `Fr_ReadCCConfig()` shall raise the development error `FR_E_PARAM_POINTER`.]

Configuration parameters values are specified as integer, float, enumeration or boolean. In order to map those values to the output parameter of type `uint32`, the following generic rules for conversion shall be applied for integer and float:

- **[SWS_Fr_00658]** [integers are mapped 1 to 1.]
- **[SWS_Fr_00659]** [floats (units of seconds) are converted to units of nanoseconds (with nanosecond granularity) and converted to `uint32`.]
- **[SWS_Fr_00661]** [booleans shall output 1 for true and 0 for false.]

For configuration parameters specified as enumeration type, the following mappings shall be applied:

[SWS_Fr_00662] [If parameter `Fr_ConfigParamIdx` is set to `FR_CIDX_PCHANNELS` (`FrPChannels`) then the value stored at `Fr_ConfigParamValuePtr` shall be interpreted as the following literals

- 0 `FR_CHANNEL_A`
 - 1 `FR_CHANNEL_B`
 - 2 `FR_CHANNEL_AB`
-]

[SWS_Fr_00663] [If parameter `Fr_ConfigParamIdx` is set to `FR_CIDX_PSAMPLESPERMICROTICK` (`FrPSamplesPerMicrotick`) then the value stored at `Fr_ConfigParamValuePtr` shall be interpreted as the following literals

- 0 `N1SAMPLES`
 - 1 `N2SAMPLES`
 - 2 `N4SAMPLES`
-]

[SWS_Fr_00664] If parameter `Fr_ConfigParamIdx` is set to `FR_CIDX_PWAKEUPCHANNEL` (`FrPWakeUpChannel`) then the value stored at `Fr_ConfigParamValuePtr` shall be interpreted as the following literals

- 0 `FR_CHANNEL_A`
- 1 `FR_CHANNEL_B`
-]

[SWS_Fr_00665] If parameter `Fr_ConfigParamIdx` is set to `FR_CIDX_PDMICROTICK` (`FrPdMicrotick`) then the value stored at `Fr_ConfigParamValuePtr` shall be interpreted as the following literals

- 0 `T12_5NS`
- 1 `T25NS`
- 2 `T50NS`
- 3 `T100NS`
- 4 `T200NS`
-]

[SWS_Fr_00666] If parameter `Fr_ConfigParamIdx` is set to `FR_CIDX_GDSAMPLECLOCKPERIOD` (`FrIfGdSampleClockPeriod`) then the value stored at `Fr_ConfigParamValuePtr` shall be interpreted as the following literals

- 0 `T12_5NS`
- 1 `T25NS`
- 2 `T50NS`
-]

8.5 Callback notifications

The FlexRay Driver does not call any callbacks.

8.6 Scheduled functions

The FlexRay driver, which is executed in the context of the FlexRay Interface has no function to be scheduled.

8.7 Expected interfaces

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

8.7.1 Mandatory interfaces

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

[SWS_Fr_00390] Definition of mandatory interfaces required by module Fr [

<i>API Function</i>	<i>Header File</i>	<i>Description</i>
Dem_SetEventStatus	Dem.h	Called by SW-Cs or BSW modules to report monitor status information to the Dem. BSW modules calling Dem_SetEventStatus can safely ignore the return value. This API will be available only if ((Dem/Dem ConfigSet/DemEventParameter/DemEvent ReportingType) == STANDARD_REPORTING)
Det_ReportRuntimeError	Det.h	Service to report runtime errors. If a callout has been configured then this callout shall be called.

]

8.7.2 Optional interfaces

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

[SWS_Fr_00391] Definition of optional interfaces requested by module Fr [

<i>API Function</i>	<i>Header File</i>	<i>Description</i>
Det_ReportError	Det.h	Service to report development errors.
SchM_Enter_Fr	<none>	Invokes the SchM_Enter function to enter a module local exclusive area.
SchM_Exit_Fr	<none>	Invokes the SchM_Exit function to exit an exclusive area.

]

Further optional interfaces might be accessed in case the Fr uses other modules for accessing the CC hardware.

8.7.3 Configurable interfaces

There are no configurable interfaces related to the FlexRay Driver.

8.8 Service Interfaces

No service interfaces provided.

9 Sequence diagrams

The usage of the driver is depicted in the Sequence diagrams of the FlexRay Interface.

10 Configuration specification

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

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

Chapter 10.3 specifies published information of the module FlexRay Driver.

10.1 How to read this chapter

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

[SWS_Fr_00670] [The Flexray Driver module shall reject configurations with partition mappings which are not supported by the implementation.]

10.2 Containers and configuration parameters

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

10.2.1 Fr

[ECUC_Fr_00456] Definition of EcucModuleDef Fr [

Module Name	Fr
Description	Configuration of the Fr (FlexRay driver) module.
Post-Build Variant Support	true
Supported Config Variants	VARIANT-POST-BUILD, VARIANT-PRE-COMPILE

Included Containers		
Container Name	Multiplicity	Scope / Dependency
FrGeneral	1	General configuration (parameters) of the FlexRay Driver module.
FrMultipleConfiguration	1	This container contains the configuration parameters and sub containers of the AUTOSAR Fr module.

]

10.2.2 FrGeneral

[ECUC_Fr_00392] Definition of EcucParamConfContainerDef FrGeneral [

Container Name	FrGeneral
Parent Container	Fr
Description	General configuration (parameters) of the FlexRay Driver module.
Configuration Parameters	

Included Parameters		
Parameter Name	Multiplicity	ECUC ID
FrCtrlTestCount	1	[ECUC_Fr_00001]
FrDevErrorDetect	1	[ECUC_Fr_00393]
FrDisableLPduSupport	1	[ECUC_Fr_00455]
FrExtendedLPduReporting	1	[ECUC_Fr_00459]
FrIndex	1	[ECUC_Fr_00439]
FrNumCtrlSupported	1	[ECUC_Fr_00394]
FrPrepareLPduSupport	1	[ECUC_Fr_00453]
FrReconfigLPduSupport	1	[ECUC_Fr_00454]
FrRxStringentCheck	1	[ECUC_Fr_00002]
FrRxStringentLengthCheck	1	[ECUC_Fr_00016]
FrVersionInfoApi	1	[ECUC_Fr_00396]
FrEcucPartitionRef	0..*	[ECUC_Fr_00457]

No Included Containers

]

[ECUC_Fr_00001] Definition of EcucIntegerParamDef FrCtrlTestCount [

Parameter Name	FrCtrlTestCount		
Parent Container	FrGeneral		
Description	Maximum number of iterations the FlexRay controller hardware test is performed during controller initialization.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	1		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00393] Definition of EcucBooleanParamDef FrDevErrorDetect [

Parameter Name	FrDevErrorDetect		
Parent Container	FrGeneral		
Description	Switches the development error detection and notification on or off. <ul style="list-style-type: none"> • true: detection and notification is enabled. • false: detection and notification is disabled. 		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00455] Definition of EcucBooleanParamDef FrDisableLPduSupport [

Parameter Name	FrDisableLPduSupport		
Parent Container	FrGeneral		
Description	Enables or disabled API function Fr_DisableLPdu.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00459] Definition of EcucBooleanParamDef FrExtendedLPduReporting [

Parameter Name	FrExtendedLPduReporting		
Parent Container	FrGeneral		
Description	Enables or disables reporting of actual cycle and slot ID by Fr_TransmitTxLPdu, Fr_ReceiveRxLPdu, and Fr_CheckTxLPduStatus.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	





Scope / Dependency	scope: local
---------------------------	--------------

]

[ECUC_Fr_00439] Definition of EcucIntegerParamDef FrIndex [

Parameter Name	FrIndex		
Parent Container	FrGeneral		
Description	Specifies the InstanceId of this module instance. If only one instance is present it shall have the Id 0.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	-		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	-	
	Post-build time	-	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00394] Definition of EcucIntegerParamDef FrNumCtrlSupported [

Parameter Name	FrNumCtrlSupported		
Parent Container	FrGeneral		
Description	Determines the maximum number of communication controllers that the driver supports.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 256		
Default value	-		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	-	
	Post-build time	-	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00453] Definition of EcucBooleanParamDef FrPrepareLPduSupport [

Parameter Name	FrPrepareLPduSupport		
Parent Container	FrGeneral		
Description	Enables or disables API function Fr_PrepareLPdu.		
Multiplicity	1		



△

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

]

[ECUC_Fr_00454] Definition of EcucBooleanParamDef FrReconfigLPduSupport

[

Parameter Name	FrReconfigLPduSupport		
Parent Container	FrGeneral		
Description	Enables or disabled API function Fr_ReconfigLPdu.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00002] Definition of EcucBooleanParamDef FrRxStringentCheck

[

Parameter Name	FrRxStringentCheck		
Parent Container	FrGeneral		
Description	If stringent check is enabled (true), received frames are accepted only if no slot status error occurred.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00016] Definition of EcucBooleanParamDef FrRxStringentLengthCheck

Parameter Name	FrRxStringentLengthCheck		
Parent Container	FrGeneral		
Description	If stringent check is enabled (true), received frames are accepted only if the received payload length matches the configured payload length.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00396] Definition of EcucBooleanParamDef FrVersionInfoApi

Parameter Name	FrVersionInfoApi		
Parent Container	FrGeneral		
Description	Enables/disables the existence of the Fr_GetVersionInfo API.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

]

[ECUC_Fr_00457] Definition of EcucReferenceDef FrEcucPartitionRef

Parameter Name	FrEcucPartitionRef		
Parent Container	FrGeneral		
Description	Maps the Flexray driver to zero or multiple ECUC partitions to make the modules API available in this partition.		
Multiplicity	0..*		
Type	Reference to EcucPartition		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Value Configuration Class	Pre-compile time	X	All Variants





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

]

10.2.3 FrController

[ECUC_Fr_00083] Definition of EcucParamConfContainerDef FrController [

Container Name	FrController
Parent Container	FrMultipleConfiguration
Description	Configuration of the individual controller.
Configuration Parameters	

Included Parameters		
Parameter Name	Multiplicity	ECUC ID
FrCtrlIdx	1	[ECUC_Fr_00400]
FrPAllowHaltDueToClock	1	[ECUC_Fr_00402]
FrPAllowPassiveToActive	1	[ECUC_Fr_00403]
FrPChannels	1	[ECUC_Fr_00404]
FrPClusterDriftDamping	1	[ECUC_Fr_00405]
FrPdAcceptedStartupRange	1	[ECUC_Fr_00428]
FrPDecodingCorrection	1	[ECUC_Fr_00406]
FrPDelayCompensationA	1	[ECUC_Fr_00407]
FrPDelayCompensationB	1	[ECUC_Fr_00408]
FrPdListenTimeout	1	[ECUC_Fr_00429]
FrPdMicrotick	1	[ECUC_Fr_00431]
FrPExternalSync	1	[ECUC_Fr_00448]
FrPFallBackInternal	1	[ECUC_Fr_00447]
FrPKeySlotId	1	[ECUC_Fr_00411]
FrPKeySlotOnlyEnabled	1	[ECUC_Fr_00425]
FrPKeySlotUsedForStartup	1	[ECUC_Fr_00412]
FrPKeySlotUsedForSync	1	[ECUC_Fr_00413]
FrPLatestTx	1	[ECUC_Fr_00414]
FrPMacroInitialOffsetA	1	[ECUC_Fr_00415]
FrPMacroInitialOffsetB	1	[ECUC_Fr_00416]
FrPMicroInitialOffsetA	1	[ECUC_Fr_00417]
FrPMicroInitialOffsetB	1	[ECUC_Fr_00418]
FrPMicroPerCycle	1	[ECUC_Fr_00419]
FrPNmVectorEarlyUpdate	1	[ECUC_Fr_00444]
FrPOffsetCorrectionOut	1	[ECUC_Fr_00421]
FrPOffsetCorrectionStart	1	[ECUC_Fr_00450]





Included Parameters		
Parameter Name	Multiplicity	ECUC ID
FrPPayloadLengthDynMax	1	[ECUC_Fr_00422]
FrPRateCorrectionOut	1	[ECUC_Fr_00423]
FrPSamplesPerMicrotick	1	[ECUC_Fr_00424]
FrPSecondKeySlotId	1	[ECUC_Fr_00445]
FrPTwoKeySlotMode	1	[ECUC_Fr_00446]
FrPWakeupChannel	1	[ECUC_Fr_00426]
FrPWakeupPattern	1	[ECUC_Fr_00427]
FrCtrlEcucPartitionRef	0..1	[ECUC_Fr_00458]

Included Containers		
Container Name	Multiplicity	Scope / Dependency
FrAbsoluteTimer	1..*	Specifies the absolute timer configuration parameters of the Fr.
FrControllerDemEventParameter Refs	0..1	Container for the references to DemEventParameter elements which shall be invoked using the API Dem_SetEventStatus in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId symbolic value. The standardized errors are provided in this container and can be extended by vendor-specific error references.
FrFifo	0..*	One First In First Out (FIFO) queued receive structure, defining the admittance criteria to the FIFO, and mandating the ability to admit messages into the FIFO based on Message Id filtering criteria.

]

[ECUC_Fr_00400] Definition of EcucIntegerParamDef FrCtrlIdx [

Parameter Name	FrCtrlIdx		
Parent Container	FrController		
Description	Determines index of CC within Fr.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 255		
Default value	-		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	-	
	Post-build time	-	
Scope / Dependency	scope: local withAuto = true		

]

[ECUC_Fr_00402] Definition of EcucBooleanParamDef FrPAllowHaltDueToClock

[

Parameter Name	FrPAllowHaltDueToClock		
Parent Container	FrController		
Description	Boolean flag that controls the transition to the POC:halt state due to a clock synchronization errors. If set to true, the CC is allowed to transition to POC:halt. If set to false, the CC will not transition to the POC:halt state but will enter or remain in the POC:normal passive state (self healing would still be possible)		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00403] Definition of EcucIntegerParamDef FrPAllowPassiveToActive

[

Parameter Name	FrPAllowPassiveToActive		
Parent Container	FrController		
Description	Number of consecutive even/odd cycle pairs that must have valid clock correction terms before the CC will be allowed to transition from the POC:normal passive state to POC:normal active state. If set to zero, the CC is not allowed to transition from POC:normal passive to POC:normal active		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 31		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00404] Definition of EcucEnumerationParamDef FrPChannels [

Parameter Name	FrPChannels		
Parent Container	FrController		
Description	Channels to which the node is connected. 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	
	FR_CHANNEL_B	Cluster uses channel B	
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00405] Definition of EcucIntegerParamDef FrPClusterDriftDamping [

Parameter Name	FrPClusterDriftDamping		
Parent Container	FrController		
Description	Local cluster drift damping factor used for rate correction [Microticks]. Remark: Upper limit 10 for FlexRay Protocol 3.0 compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 20		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00428] Definition of EcucIntegerParamDef FrPdAcceptedStartup Range [

Parameter Name	FrPdAcceptedStartupRange		
Parent Container	FrController		
Description	Expanded range of measured clock deviation allowed for startup frames during integration [Microticks]. Remark: Upper limit 1875 for FlexRay Protocol 2.1 Rev A compliance. Remark: Lower limit 29 for FlexRay Protocol 3.0 compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2743		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00406] Definition of EcucIntegerParamDef FrPDecodingCorrection [

Parameter Name	FrPDecodingCorrection		
Parent Container	FrController		
Description	Value used by the receiver to calculate the difference between primary time reference point and secondary time reference point [Microticks]. Remark: Lower limit 14 for FlexRay Protocol 2.1 Rev. A compliance. Upper limit 136 for FlexRay Protocol 3.0 compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	12 .. 143		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00407] Definition of EcucIntegerParamDef FrPDelayCompensationA [

[

Parameter Name	FrPDelayCompensationA		
Parent Container	FrController		
Description	Value used to compensate for reception delays on the indicated channel. This covers assumed propagation delay up to cPropagationDelayMax for microticks in the range of 0.0125us to 0.05us [Microticks]. Remark: Lower limit 4 for FlexRay Protocol 3.0 compliance. Remark: Upper limit 200 for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 211		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00408] Definition of EcucIntegerParamDef FrPDelayCompensationB

[

Parameter Name	FrPDelayCompensationB		
Parent Container	FrController		
Description	Value used to compensate for reception delays on the indicated channel. This covers assumed propagation delay up to cPropagationDelayMax for microticks in the range of 0.0125us to 0.05us [Microticks]. Remark: Lower limit 4 for FlexRay Protocol 3.0 compliance. Remark: Upper limit 200 for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 211		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00429] Definition of EcucIntegerParamDef FrPdListenTimeout [

Parameter Name	FrPdListenTimeout		
Parent Container	FrController		
Description	Value for the startup listen timeout and wakeup listen timeout. Although this is a node local parameter, the real time equivalent of this value should be the same for all nodes in the cluster [Microticks]. Remark: Lower limit 1926 for FlexRay Protocol 3.0 compliance. Upper limit 1283846 for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1284 .. 2567692		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00431] Definition of EcucEnumerationParamDef FrPdMicrotick [

Parameter Name	FrPdMicrotick		
Parent Container	FrController		
Description	Duration of a microtick. Remark: Allowed range T12_5NS, T25NS, T50NS for FlexRay Protocol 3.0 compliance.		
Multiplicity	1		
Type	EcucEnumerationParamDef		





Range	T100NS	100 ns	
	T12_5NS	12.5 ns	
	T200NS	200 ns	
	T25NS	25 ns	
	T50NS	50 ns	
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00448] Definition of EcucBooleanParamDef FrPExternalSync [

Parameter Name	FrPExternalSync		
Parent Container	FrController		
Description	Flag indicating whether the node is externally synchronized (operating as time gateway sink in an TT-E cluster) or locally synchronized. If FrPExternalSync is set to 'true' then FrPTwoKeySlotMode must also be set to 'true'. Remarks: Set to 'false' for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00447] Definition of EcucBooleanParamDef FrPFallBackInternal [

Parameter Name	FrPFallBackInternal		
Parent Container	FrController		
Description	Flag indicating whether a time gateway sink node will switch to local clock operation when synchronization with the time gateway source node is lost (FrPFallBackInternal = true) or will instead go to POC:ready (FrPFallBackInternal =false). Remarks: Set to 'false' for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD





Scope / Dependency	scope: local
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]

[ECUC_Fr_00411] Definition of EcucIntegerParamDef FrPKeySlotId [

Parameter Name	FrPKeySlotId		
Parent Container	FrController		
Description	ID of the key slot, i.e., the slot used to transmit the startup frame, sync frame, or designated key slot frame. If this parameter is set to zero the node does not have a key slot. For Fr3.0: if the value is not provided in System Description it shall be configured to 0. For Fr2.1: if the value is not provided in System Description it is driver implementation specific which value to configure.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 1023		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00425] Definition of EcucBooleanParamDef FrPKeySlotOnlyEnabled [

Parameter Name	FrPKeySlotOnlyEnabled		
Parent Container	FrController		
Description	Flag indicating whether or not the node shall enter key slot only mode following startup. Remarks: This parameter maps to FlexRay Protocol 2.1 Rev. A parameter pSingleSlot Enabled.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00412] Definition of EcucBooleanParamDef FrPKeySlotUsedForStartup [

Parameter Name	FrPKeySlotUsedForStartup		
Parent Container	FrController		
Description	Flag indicating whether the key slot is used to transmit a startup frame. If FrPKeySlotUsedForStartup is set to true then FrPKeySlotUsedForSync must also be set to true. If FrPTwoKeySlotMode is set to true then both FrPKeySlotUsedForSync and FrPKeySlotUsedForStartup must also be set to true.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00413] Definition of EcucBooleanParamDef FrPKeySlotUsedForSync [

Parameter Name	FrPKeySlotUsedForSync		
Parent Container	FrController		
Description	Flag indicating whether the key slot is used to transmit a sync frame. If FrPKeySlotUsedForStartup is set to true then FrPKeySlotUsedForSync must also be set to true. If FrPTwoKeySlotMode is set to true then both FrPKeySlotUsedForSync and FrPKeySlotUsedForStartup must also be set to true.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00414] Definition of EcucIntegerParamDef FrPLatestTx [

Parameter Name	FrPLatestTx		
Parent Container	FrController		
Description	Number of the last minislot in which a frame transmission can start in the dynamic segment. Remark: Upper limit 7980 for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 7988		

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Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00415] Definition of EcucIntegerParamDef FrPMacroInitialOffsetA [

Parameter Name	FrPMacroInitialOffsetA		
Parent Container	FrController		
Description	Integer number of macroticks between the static slot boundary and the following macrotick boundary of the secondary time reference point based on the nominal macrotick duration [Macroticks].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 68		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00416] Definition of EcucIntegerParamDef FrPMacroInitialOffsetB [

Parameter Name	FrPMacroInitialOffsetB		
Parent Container	FrController		
Description	Integer number of macroticks between the static slot boundary and the following macrotick boundary of the secondary time reference point based on the nominal macrotick duration [Macroticks].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	2 .. 68		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00417] Definition of EcucIntegerParamDef FrPMicroInitialOffsetA [

Parameter Name	FrPMicroInitialOffsetA		
Parent Container	FrController		
Description	Number of microticks between the secondary time reference point and the macrotick boundary immediately following the secondary time reference point. The parameter depends on FrPDelayCompensationA and therefore it has to be set independently for each channel [Microticks].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 239		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00418] Definition of EcucIntegerParamDef FrPMicroInitialOffsetB [

Parameter Name	FrPMicroInitialOffsetB		
Parent Container	FrController		
Description	Number of microticks between the secondary time reference point and the macrotick boundary immediately following the secondary time reference point. The parameter depends on FrPDelayCompensationB and therefore it has to be set independently for each channel [Microticks].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 239		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00419] Definition of EcucIntegerParamDef FrPMicroPerCycle [

Parameter Name	FrPMicroPerCycle		
Parent Container	FrController		
Description	Nominal number of microticks in the communication cycle of the local node. If nodes have different microtick durations this number will differ from node to node [Microticks]. Remark: Lower limit 960 for FlexRay Protocol 3.0 compliance. Upper limit 640000 for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		



△

Range	640 .. 1280000		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00444] Definition of EcucBooleanParamDef FrPNmVectorEarlyUpdate

[

Parameter Name	FrPNmVectorEarlyUpdate		
Parent Container	FrController		
Description	Flag indicating when the update of the Network Management Vector in the CHI shall take place. If FrPNmVectorEarlyUpdate is set to false, the update shall take place after the NIT. If FrPNmVectorEarlyUpdate is set to true, the update shall take place after the end of the static segment. Remarks: Set to 'false' for FlexRay Protocol 2.1 Rev. A compliance.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00421] Definition of EcucIntegerParamDef FrPOffsetCorrectionOut

[

Parameter Name	FrPOffsetCorrectionOut		
Parent Container	FrController		
Description	Magnitude of the maximum permissible offset correction value [Microticks]. Remark: Upper limit 15567 for FlexRay Protocol 2.1 Rev A compliance. Remark: Lower limit 15 for FlexRay Protocol 3.0 compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	13 .. 16082		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00450] Definition of EcucIntegerParamDef FrPOffsetCorrectionStart [

Parameter Name	FrPOffsetCorrectionStart		
Parent Container	FrController		
Description	Start of the offset correction phase within the NIT, expressed as the number of macroticks from the start of cycle [Macroticks]. Remark: This parameter maps to FlexRay Protocol 2.1 Rev. A parameter gOffsetCorrectionStart. Remark: Lower limit 9 for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	7 .. 15999		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00422] Definition of EcucIntegerParamDef FrPPayloadLengthDynMax [

[

Parameter Name	FrPPayloadLengthDynMax		
Parent Container	FrController		
Description	Maximum payload length for dynamic frames [16 bit words].		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 127		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00423] Definition of EcucIntegerParamDef FrPRateCorrectionOut [

Parameter Name	FrPRateCorrectionOut		
Parent Container	FrController		
Description	Magnitude of the maximum permissible rate correction value and the maximum drift offset between two nodes operating with unsynchronized clocks for one communication cycle [Microticks]. Remarks: This parameter maps to FlexRay Protocol 2.1 Rev. A parameter pdMaxDrift. Lower limit 3 for FlexRay Protocol 3.0 compliance. Upper limit 1923 for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		





Range	2 .. 3846		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00424] Definition of EcucEnumerationParamDef FrPSamplesPerMicrotick [

Parameter Name	FrPSamplesPerMicrotick		
Parent Container	FrController		
Description	Number of samples per microtick. Remark: Allowed range N1SAMPLES, N2SAMPLES for FlexRay Protocol 3.0 compliance.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	N1SAMPLES	1 sample	
	N2SAMPLES	2 samples	
	N4SAMPLES	4 samples	
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00445] Definition of EcucIntegerParamDef FrPSecondKeySlotId [

Parameter Name	FrPSecondKeySlotId		
Parent Container	FrController		
Description	ID of the second key slot, in which a second startup frame shall be sent when operating as a coldstart node in a TT-L or TT-D cluster. If this parameter is set to zero the node does not have a second key slot. Remark: Set to 0 for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 1023		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD





Scope / Dependency	scope: local
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]

[ECUC_Fr_00446] Definition of EcucBooleanParamDef FrPTwoKeySlotMode [

Parameter Name	FrPTwoKeySlotMode		
Parent Container	FrController		
Description	Flag indicating whether node operates as a coldstart node in a TT-E or TT-L cluster. If pTwoKeySlotMode is set to true then both pKeySlotUsedForSync and pKeySlotUsedForStartup must also be set to true. If pExternalSync is set to true then pTwoKeySlotMode must also be set to true. Remark: Set to false for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00426] Definition of EcucEnumerationParamDef FrPWakeupChannel [

[

Parameter Name	FrPWakeupChannel		
Parent Container	FrController		
Description	Channel used by the node to send a wakeup pattern. FrPWakeupChannel must be selected from among the channels configured by FrPChannels.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	FR_CHANNEL_A	-	
	FR_CHANNEL_B	-	
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00427] Definition of EcucIntegerParamDef FrPWakeupPattern [

Parameter Name	FrPWakeupPattern		
Parent Container	FrController		
Description	Number of repetitions of the wakeup symbol that are combined to form a wakeup pattern when the node enters the POC:wakeup send state. Remark: Lower limit 2 for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 63		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00458] Definition of EcucReferenceDef FrCtrlEcucPartitionRef [

Parameter Name	FrCtrlEcucPartitionRef		
Parent Container	FrController		
Description	Maps one single Flexray controller to zero or one ECUC partitions. The ECUC partition referenced is a subset of the ECUC partitions where the Flexray driver is mapped to.		
Multiplicity	0..1		
Type	Reference to EcucPartition		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	Pre-compile time	X	All Variants
	Link time	-	
	Post-build time	-	
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	-	
	Post-build time	-	
Scope / Dependency	scope: ECU		

]

[SWS_Fr_CONSTR_00002] [The ECUC partitions referenced by FrCtrlEcucPartitionRef shall be a subset of the ECUC partitions referenced by FrEcucPartitionRef.]

[SWS_Fr_CONSTR_00003] [FrController and FrTrcvChannel of one communication channel shall all reference the same ECUC partition.]

[SWS_Fr_CONSTR_00004] [If FrEcucPartitionRef references one or more ECUC partitions, FrCtrlEcucPartitionRef shall have a multiplicity of one and reference one of these ECUC partitions as well.]

10.2.4 FrAbsoluteTimer

[ECUC_Fr_00432] Definition of EcucParamConfContainerDef FrAbsoluteTimer [

Container Name	FrAbsoluteTimer
Parent Container	FrController
Description	Specifies the absolute timer configuration parameters of the Fr.
Configuration Parameters	

Included Parameters		
Parameter Name	Multiplicity	ECUC ID
FrAbsTimerIdx	1	[ECUC_Fr_00433]

No Included Containers

]

[ECUC_Fr_00433] Definition of EcucIntegerParamDef FrAbsTimerIdx [

Parameter Name	FrAbsTimerIdx		
Parent Container	FrAbsoluteTimer		
Description	Contains the index of an absolute timer contained in Fr on a certain FlexRay CC.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 254		
Default value	-		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	-	
	Post-build time	-	
Scope / Dependency	scope: local withAuto = true		

]

10.2.5 FrControllerDemEventParameterRefs

[ECUC_Fr_00452] Definition of EcucParamConfContainerDef FrControllerDemEventParameterRefs [

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

Included Parameters		
Parameter Name	Multiplicity	ECUC ID
FR_E_CTRL_TESTRESULT	0..1	[ECUC_Fr_00005]

No Included Containers

]

[[ECUC_Fr_00005](#)] Definition of EcucReferenceDef [FR_E_CTRL_TESTRESULT](#) [

Parameter Name	FR_E_CTRL_TESTRESULT		
Parent Container	FrControllerDemEventParameterRefs		
Description	Reference to DEM event Id that is reported for FlexRay controller hardware test failure. If this parameter is not configured, no event reporting happens.		
Multiplicity	0..1		
Type	Symbolic name reference to DemEventParameter		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

10.2.6 FrFifo

[[ECUC_Fr_00009](#)] Definition of EcucParamConfContainerDef [FrFifo](#) [

Container Name	FrFifo
Parent Container	FrController
Description	One First In First Out (FIFO) queued receive structure, defining the admittance criteria to the FIFO, and mandating the ability to admit messages into the FIFO based on Message Id filtering criteria.
Configuration Parameters	

Included Parameters		
Parameter Name	Multiplicity	ECUC ID
FrAdmitWithoutMessageld	1	[ECUC_Fr_00006]
FrBaseCycle	1	[ECUC_Fr_00007]
FrChannels	1	[ECUC_Fr_00449]
FrCycleRepetition	1	[ECUC_Fr_00008]
FrFifoDepth	1	[ECUC_Fr_00010]
FrMsgIdMask	1	[ECUC_Fr_00011]
FrMsgIdMatch	1	[ECUC_Fr_00012]

Included Containers		
Container Name	Multiplicity	Scope / Dependency
FrRange	1..*	FIFO Frame Id range acceptance criteria.

]

[[ECUC_Fr_00006](#)] Definition of EcucBooleanParamDef [FrAdmitWithoutMessageId](#) [

Parameter Name	FrAdmitWithoutMessageld		
Parent Container	FrFifo		
Description	Determines whether or not frames received in the dynamic segment that don't contain a message ID will be admitted into the FIFO.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[[ECUC_Fr_00007](#)] Definition of EcucIntegerParamDef [FrBaseCycle](#) [

Parameter Name	FrBaseCycle		
Parent Container	FrFifo		
Description	FIFO cycle counter acceptance criteria.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 63		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD





Scope / Dependency	scope: local
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]

[ECUC_Fr_00449] Definition of EcucEnumerationParamDef FrChannels [

Parameter Name	FrChannels		
Parent Container	FrFifo		
Description	FIFO channel admittance criteria.		
Multiplicity	1		
Type	EcucEnumerationParamDef		
Range	FR_CHANNEL_A	Frames received on channel A	
	FR_CHANNEL_AB	Frames received on channel A and B	
	FR_CHANNEL_B	Frames received on channel B	
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00008] Definition of EcucIntegerParamDef FrCycleRepetition [

Parameter Name	FrCycleRepetition		
Parent Container	FrFifo		
Description	FIFO cycle counter acceptance criteria. Valid values are 1,2,4,5,8,10,16,20,32,40,50,64. Remark: Values 1,2,4,8,16,32,64 are valid only for FlexRay Protocol 2.1 Rev A compliance.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 64		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00010] Definition of EcucIntegerParamDef FrFifoDepth [

Parameter Name	FrFifoDepth		
Parent Container	FrFifo		
Description	FrFifoDepth configures the maximum number of rx-frames which can be contained in the FIFO.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	1 .. 2048		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00011] Definition of EcucIntegerParamDef FrMsgIdMask [

Parameter Name	FrMsgIdMask		
Parent Container	FrFifo		
Description	FIFO message identifier acceptance criteria (Mask filter).		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00012] Definition of EcucIntegerParamDef FrMsgIdMatch [

Parameter Name	FrMsgIdMatch		
Parent Container	FrFifo		
Description	FIFO message identifier acceptance criteria (Match filter).		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	



△

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

]

10.2.7 FrRange

[ECUC_Fr_00013] Definition of EcucParamConfContainerDef FrRange [

Container Name	FrRange
Parent Container	FrFifo
Description	FIFO Frame Id range acceptance criteria.
Configuration Parameters	

Included Parameters		
Parameter Name	Multiplicity	ECUC ID
FrRangeMax	1	[ECUC_Fr_00014]
FrRangeMin	1	[ECUC_Fr_00015]

No Included Containers

]

[ECUC_Fr_00014] Definition of EcucIntegerParamDef FrRangeMax [

Parameter Name	FrRangeMax		
Parent Container	FrRange		
Description	Last Frameld of this range that will be accepted by the FIFO.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2047		
Default value	-		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	-	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

[ECUC_Fr_00015] Definition of EcucIntegerParamDef FrRangeMin [

Parameter Name	FrRangeMin		
Parent Container	FrRange		
Description	First Frameld of this range that will be accepted by the FIFO.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2047		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	–	
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

]

10.2.8 FrMultipleConfiguration

[ECUC_Fr_00397] Definition of EcucParamConfContainerDef FrMultipleConfiguration [

Container Name	FrMultipleConfiguration		
Parent Container	Fr		
Description	This container contains the configuration parameters and sub containers of the AUTOSAR Fr module.		
Configuration Parameters			
No Included Parameters			
Included Containers			
Container Name	Multiplicity	Scope / Dependency	
FrController	1..*	Container to hold multiple configuration sets.	

]

10.3 Published Information

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

A Not applicable requirements

[SWS_Fr_NA_00602]

Upstream requirements: SRS_BSW_00344, SRS_BSW_00375, SRS_BSW_00386, SRS_BSW_00416, SRS_BSW_00417, SRS_BSW_00422, SRS_BSW_00423, SRS_BSW_00424, SRS_BSW_00425, SRS_BSW_00426, SRS_BSW_00427, SRS_BSW_00428, SRS_BSW_00429, SRS_BSW_00432, SRS_BSW_00433, SRS_BSW_00437, SRS_BSW_00450, SRS_BSW_00168, SRS_BSW_00170, SRS_Fr_05000, SRS_Fr_05001, SRS_Fr_05002, SRS_Fr_05033, SRS_Fr_05053, SRS_Fr_05052

[These requirements are not applicable to this specification.]

B Change history of AUTOSAR traceable items

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

B.1 Traceable item history of this document according to AUTOSAR Release R24-11

B.1.1 Added Specification Items in R24-11

none

B.1.2 Changed Specification Items in R24-11

Number	Heading
[ECUC_Fr_00457]	Definition of EcucReferenceDef FrEcucPartitionRef

Table B.1: Changed Specification Items in R24-11

B.1.3 Deleted Specification Items in R24-11

none

B.1.4 Added Constraints in R24-11

none

B.1.5 Changed Constraints in R24-11

none

B.1.6 Deleted Constraints in R24-11

Number	Heading
[SWS_Fr_- CONSTR_- 00001]	

Table B.2: Deleted Constraints in R24-11