

|                                   |                                        |
|-----------------------------------|----------------------------------------|
| <b>Document Title</b>             | Specification of FlexRay State Manager |
| <b>Document Owner</b>             | AUTOSAR                                |
| <b>Document Responsibility</b>    | AUTOSAR                                |
| <b>Document Identification No</b> | 254                                    |
| <b>Document Classification</b>    | Standard                               |

|                         |       |
|-------------------------|-------|
| <b>Document Version</b> | 1.1.0 |
| <b>Document Status</b>  | Final |
| <b>Part of Release</b>  | 3.0   |
| <b>Revision</b>         | 7     |

| Document Change History |         |                        |                                                                                                                                                                                                                                                                                                                                              |
|-------------------------|---------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date                    | Version | Changed by             | Change Description                                                                                                                                                                                                                                                                                                                           |
| 15.09.2010              | 1.1.0   | AUTOSAR Administration | <ul style="list-style-type: none"><li>Added notification for FrNm in case of a long term synchronization loss</li><li>StartupRepetitions made optional to allow for unlimited repetition of startup</li><li>Introduction of CANSM_RX_PDU_INIT and CANSM_TX_PDU_INIT, update of Com_IpduGroupStart</li><li>Legal disclaimer revised</li></ul> |
| 01.02.2008              | 1.0.1   | AUTOSAR Administration | Chapter 8 API Spelling harmonized                                                                                                                                                                                                                                                                                                            |
| 20.11.2007              | 1.0.0   | AUTOSAR Administration | Initial Release                                                                                                                                                                                                                                                                                                                              |

## Disclaimer

This specification and the material contained in it, as released by AUTOSAR is for the purpose of information only. AUTOSAR and the companies that have contributed to it shall not be liable for any use of the specification.

The material contained in this specification is protected by copyright and other types of Intellectual Property Rights. The commercial exploitation of the material contained in this specification requires a license to such Intellectual Property Rights.

This specification may be utilized or reproduced without any modification, in any form or by any means, for informational purposes only.

For any other purpose, no part of the specification may be utilized or reproduced, in any form or by any means, without permission in writing from the publisher.

The AUTOSAR specifications have been developed for automotive applications only. They have neither been developed, nor tested for non-automotive applications.

The word AUTOSAR and the AUTOSAR logo are registered trademarks.

## Advice for users

AUTOSAR Specification Documents may contain exemplary items (exemplary reference models, "use cases", and/or references to exemplary technical solutions, devices, processes or software).

Any such exemplary items are contained in the Specification Documents for illustration purposes only, and they themselves are not part of the AUTOSAR Standard. Neither their presence in such Specification Documents, nor any later documentation of AUTOSAR conformance of products actually implementing such exemplary items, imply that intellectual property rights covering such exemplary items are licensed under the same rules as applicable to the AUTOSAR Standard.

## Table of Contents

|       |                                                  |    |
|-------|--------------------------------------------------|----|
| 1     | Introduction and functional overview .....       | 5  |
| 2     | Acronyms and abbreviations .....                 | 6  |
| 3     | Related documentation.....                       | 7  |
| 3.1   | Input documents.....                             | 7  |
| 3.2   | Related standards and norms .....                | 7  |
| 4     | Constraints and assumptions .....                | 8  |
| 4.1   | Limitations .....                                | 8  |
| 4.2   | Applicability to car domains.....                | 8  |
| 5     | Dependencies to other modules.....               | 9  |
| 5.1   | AUTOSAR BSW Scheduler.....                       | 9  |
| 5.2   | Communication Manager .....                      | 9  |
| 5.3   | AUTOSAR FlexRay Interface .....                  | 9  |
| 5.4   | AUTOSAR Com .....                                | 9  |
| 5.5   | AUTOSAR Development Error Tracer.....            | 9  |
| 5.6   | AUTOSAR Diagnostic Event Manager .....           | 9  |
| 5.7   | File structure .....                             | 9  |
| 5.7.1 | Code file structure .....                        | 9  |
| 5.7.2 | Header file structure.....                       | 10 |
| 6     | Requirements traceability .....                  | 12 |
| 7     | Functional specification .....                   | 14 |
| 7.1   | Background & Rationale.....                      | 14 |
| 7.2   | State Machine of the FlexRay State Manager ..... | 14 |
| 7.2.1 | General .....                                    | 14 |
| 7.2.2 | States .....                                     | 14 |
| 7.2.3 | Variables .....                                  | 15 |
| 7.2.4 | State Machine Configuration .....                | 15 |
| 7.2.5 | Conditions .....                                 | 16 |
| 7.2.6 | Timers .....                                     | 16 |
| 7.2.7 | Functional Elements.....                         | 16 |
| 7.2.8 | Transitions.....                                 | 18 |
| 7.3   | Configuration description.....                   | 21 |
| 7.4   | Error classification .....                       | 21 |
| 7.5   | Error detection.....                             | 22 |
| 7.6   | Error notification .....                         | 22 |
| 8     | API specification .....                          | 23 |
| 8.1   | Imported types.....                              | 23 |
| 8.2   | Type definitions .....                           | 23 |
| 8.2.1 | FrSm_ConfigType .....                            | 23 |
| 8.3   | Function definitions .....                       | 23 |
| 8.3.1 | FrSm_Init .....                                  | 23 |
| 8.3.2 | FrSm_RequestComMode .....                        | 24 |
| 8.3.3 | FrSm_GetCurrentComMode .....                     | 25 |

|          |                                                             |    |
|----------|-------------------------------------------------------------|----|
| 8.3.4    | FrSm_GetVersionInfo .....                                   | 26 |
| 8.4      | Call-back notifications .....                               | 27 |
| 8.5      | Scheduled functions .....                                   | 27 |
| 8.5.1    | FrSm_MainFunction_<Cluster Id> .....                        | 27 |
| 8.6      | Expected Interfaces.....                                    | 28 |
| 8.6.1    | Mandatory Interfaces .....                                  | 28 |
| 8.6.2    | Optional Interfaces .....                                   | 29 |
| 8.6.3    | Configurable interfaces .....                               | 29 |
| 9        | Sequence diagrams .....                                     | 30 |
| 9.1      | Initialization .....                                        | 30 |
| 9.2      | Transition from no communication to full communication..... | 31 |
| 9.3      | Transition from full communication to no communication..... | 32 |
| 10       | Configuration specification.....                            | 33 |
| 10.1     | How to read this chapter .....                              | 33 |
| 10.1.1   | Configuration and configuration parameters .....            | 33 |
| 10.1.2   | Variants.....                                               | 33 |
| 10.1.3   | Containers.....                                             | 33 |
| 10.1.4   | Specification template for configuration parameters .....   | 34 |
| 10.2     | Containers and configuration parameters .....               | 35 |
| 10.2.1   | Variants.....                                               | 35 |
| 10.2.1.1 | Variant1 (Pre-compile Configuration) .....                  | 35 |
| 10.2.1.2 | Variant2 (Link-time Configuration) .....                    | 35 |
| 10.2.1.3 | Variant3 (Post-build Configuration) .....                   | 35 |
| 10.2.2   | FrSm .....                                                  | 35 |
| 10.2.3   | FrSmGeneral.....                                            | 36 |
| 10.2.4   | FrSmCluster .....                                           | 36 |
| 10.3     | Published Information.....                                  | 40 |
| 11       | Changes during SWS Improvements by Technical Office .....   | 41 |
| 11.1     | Deleted SWS Items .....                                     | 41 |
| 11.2     | Replaced SWS Items .....                                    | 41 |
| 11.3     | Changed SWS Items.....                                      | 41 |
| 11.4     | Added SWS Items.....                                        | 41 |
| 12       | Changes for Revision 3.0.7.....                             | 42 |
| 12.1     | Deleted SWS Items .....                                     | 42 |
| 12.2     | Replaced SWS Items .....                                    | 42 |
| 12.3     | Changed SWS Items.....                                      | 42 |
| 12.4     | Added SWS Items.....                                        | 42 |

# 1 Introduction and functional overview

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

In the AUTOSAR Layered Software Architecture, the FlexRay State Manager belongs to the ECU Abstraction Layer, or more precisely, to the Communication Hardware Abstraction.

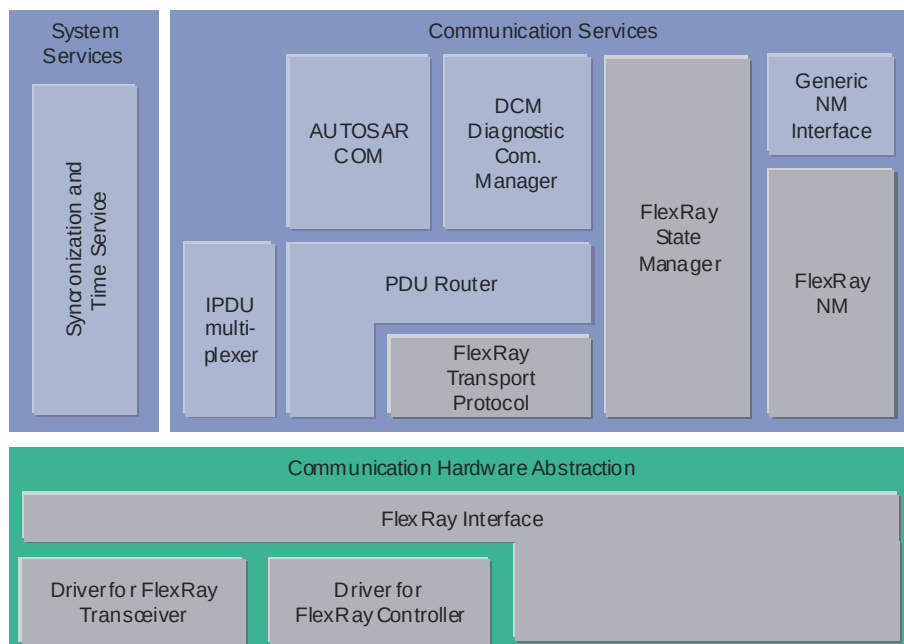
The main task of the FlexRay State Manager can be summarized as follows:

FrSm010:

The FlexRay State Manager shall provide an abstract interface to the AUTOSAR Communication Manager to startup or shutdown the communication on a FlexRay cluster.

FrSm012:

The FlexRay State Manager does not directly access the FlexRay hardware (FlexRay Communication Controller and FlexRay Transceiver), but by means of the FlexRay Interface. The FlexRay Interface redirects the request to the appropriate driver module.



**Figure 1 Software Architecture Overview**

## 2 Acronyms and abbreviations

| <b>Acronym:</b>    | <b>Description:</b>                                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>API</b>         | Application Program Interface                                                                                                                                                            |
| <b>CC</b>          | Communication Controller                                                                                                                                                                 |
| <b>CHI</b>         | Controller Host Interface                                                                                                                                                                |
| <b>FrIf</b>        | FlexRay Interface (AUTOSAR BSW module)                                                                                                                                                   |
| <b>POC</b>         | Protocol Operation Control                                                                                                                                                               |
| <b>POCState</b>    | Actual CC internal state of the POC. This state might differ from vPOC!State in certain cases, e.g. after FREEZE command invocation (see [11] for details).                              |
| <b>WUP</b>         | Wake-Up Pattern                                                                                                                                                                          |
| <b>ComM</b>        | AUTOSAR Communication Manager                                                                                                                                                            |
| <b>vPOC</b>        | Data structure provided from the <a href="#">CC</a> to the host at the <a href="#">CHI</a> , which contains the actual <a href="#">POC</a> status of the <a href="#">CC</a> .            |
| <b>vPOC!Freeze</b> | vPOC!Freeze denotes the Freeze bit that is part of the vPOC data structure. The Freeze bit is used by the CC to indicate that the HALT state has been entered due to an error condition. |
| <b>FrSm</b>        | FlexRay State Manager                                                                                                                                                                    |

| <b>Abbreviation:</b> | <b>Description:</b>                        |
|----------------------|--------------------------------------------|
| <b>i.e.</b>          | [lat.] id est = [eng.] that is             |
| <b>e.g.</b>          | [lat.] exempli gratia = [eng.] for example |
| <b>N/A</b>           | Not applicable                             |
|                      |                                            |

| <b>Term:</b>           | <b>Description:</b>                                                                                     |
|------------------------|---------------------------------------------------------------------------------------------------------|
| <b>Active wake-up</b>  | Wake-up caused by the ECU e.g. by a sensor.                                                             |
| <b>Passive wake-up</b> | Wakeup caused by another ECU and propagated (e.g. by bus or wakeup-line) to the ECU currently in focus. |
| <b>Remote wake-up</b>  | A <a href="#">passive wake-up</a> received by the FlexRay bus.                                          |
|                        |                                                                                                         |

## 3 Related documentation

### 3.1 Input documents

- [1] List of Basic Software Modules  
AUTOSAR\_BasicSoftwareModules
- [2] Layered Software Architecture  
AUTOSAR\_LayeredSoftwareArchitecture
- [3] General Requirements on Basic Software Modules  
AUTOSAR\_SRS\_General
- [4] Specification of ECU Configuration  
AUTOSAR\_ECU\_Configuration
- [5] Specification of Communication Stack Types  
AUTOSAR\_SWS\_ComStackTypes
- [6] Requirements on FlexRay  
AUTOSAR\_SRS\_FlexRay
- [7] Specification of FlexRay Interface  
AUTOSAR\_SWS\_FlexRay\_Interface
- [8] Specification of FlexRay Driver  
AUTOSAR\_SWS\_FlexRay\_Driver
- [9] Specification of Communication Manager  
AUTOSAR\_SWS\_ComManager
- [10] AUTOSAR\_SRS\_ModeManagement.doc  
AUTOSAR\_SRS\_ModeManagement
- [11] AUTOSAR Basic Software Module Description Template,  
AUTOSAR\_BSW\_Module\_Description.pdf

### 3.2 Related standards and norms

- [12] FlexRay Communications System Protocol Specification Version 2.1 Rev A

## 4 Constraints and assumptions

### 4.1 Limitations

This specification only defines the straightforward case for starting and stopping the communication on a FlexRay cluster.

The following items are not supported by the current version of this specification.

- Wake-up forwarding on a dual-channel FlexRay cluster is left open.
- The handling of single-slot mode is left open.
- The case of multiple [CC](#) of one ECU assigned to one FlexRay cluster is not fully defined as the error handling is missing. Thus, the current version can only be used for the case of one [CC](#) per cluster.

### 4.2 Applicability to car domains

The FlexRay Communication stack can be used wherever high data rates and fault tolerant communication (in conjunction with [11]) is required. Furthermore, it enables the synchronized operation of several ECUs within a car.

The FlexRay State Manager can be used for all domain applications which use the FlexRay Protocol.



## 5 Dependencies to other modules

### 5.1 AUTOSAR BSW Scheduler

The BSW Scheduler calls the main functions of the FrSm, which are necessary for the cyclic processes of the FrSm.

### 5.2 Communication Manager

The [ComM](#) requests network communication modes and is notified by the FrSm when a communication mode is reached.

### 5.3 AUTOSAR FlexRay Interface

The FrSm uses the API of the [Frlf](#) to initialize the FlexRay Communication Hardware and to control the operating modes of the FlexRay Controllers and FlexRay Transceivers assigned to the FlexRay Networks.

### 5.4 AUTOSAR Com

The FrSm uses the API of COM to control FlexRay related I-PDU groups.

### 5.5 AUTOSAR Development Error Tracer

In order to be able to report development errors, the FlexRay State Manager has to have access to the error hook of the Development Error Tracer.

### 5.6 AUTOSAR Diagnostic Event Manager

In order to be able to report production errors the FlexRay State Manager has to have access to the Diagnostic Event Manager.

### 5.7 File structure

#### 5.7.1 Code file structure

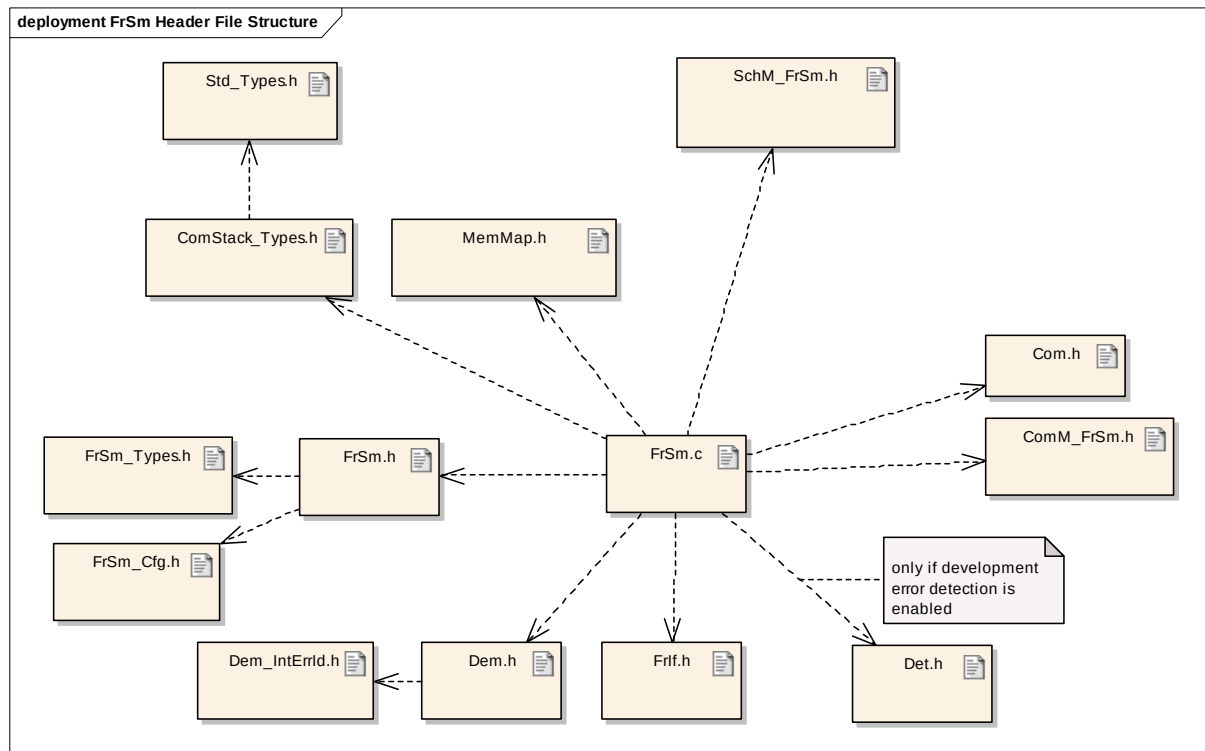
FrSm051:

The code file structure shall not be defined within this specification completely. At this point it shall be pointed out that the code-file structure shall include the following files named:

- FrSm\_Lcfg.c – for link time configurable parameters and
- FrSm\_PBCfg.c – for post build time configurable parameters.

These files shall contain all link time and post-build time configurable parameters.

## 5.7.2 Header file structure



FrSm052:

The header file FrSm.h exports the API of the FrSm. This file includes further header files and declares the function prototypes, which are supposed to be referenced by user modules.

FrSm053:

The header file FrSm\_Cfg.h shall contain the pre-compile parameters of the module and the declarations of FrSm\_Lcfg.c and FrSm\_Pbcfg.c

FrSm054:

The header file FrSm\_Types.h exports the FrSm specific types.

FrSm055:

The FrSm implementation (FrSm.c) references its header file FrSm.h to get access to its own API declaration and to its configuration parameters.

FrSm056:

The FrSm needs to report development errors if development errors are enabled by configuration. Therefore, it includes the header file Det.h.

FrSm057:

The FrSm includes the header file MemMap.h in order to map its code and data into specific memory sections.

FrSm058:

The FrSm implementation (FrSm.c) references the API of the FrIf. Therefore, it includes the header file FrIf.h.

FrSm059:

The module shall include the Dem.h file. By this inclusion the APIs to report errors as well as the required Event Id symbols are included. This specification defines the name of the Event Id symbols which are provided by XML to the DEM configuration

tool. The DEM configuration tool assigns ECU dependent values to the Event Id symbols and publishes the symbols in Dem\_IntErrId.h.

FrSm106:

The FrSm implementation (FrSm.c) references the API of COM. Therefore, it includes the header file Com.h.

## 6 Requirements traceability

Document: AUTOSAR requirements on Basic Software, general

| <b>Requirement</b>                                                            | <b>Satisfied by</b>                               |
|-------------------------------------------------------------------------------|---------------------------------------------------|
| [BSW00344] Reference to link-time configuration                               | <a href="#">FrSm051</a>                           |
| [BSW00404] Reference to post build time configuration                         | <a href="#">FrSm051</a>                           |
| [BSW00405] Reference to multiple configuration sets                           | <a href="#">FrSm013</a>                           |
| [BSW00345] Pre-compile-time configuration                                     | <a href="#">FrSm053</a>                           |
| [BSW159] Tool-based configuration                                             | <a href="#">FrSm064</a>                           |
| [BSW167] Static configuration checking                                        | <a href="#">FrSm065</a>                           |
| [BSW171] Configurability of optional functionality                            | <a href="#">FrSm066</a>                           |
| [BSW170] Data for reconfiguration of AUTOSAR SW-Components                    | Not applicable                                    |
| [BSW00380] Separate C-Files for configuration parameters                      | <a href="#">FrSm051</a>                           |
| [BSW00419] Separate C-Files for pre-compile time configuration parameters     | Not applicable                                    |
| [BSW00381] Separate configuration header file for pre-compile time parameters | <a href="#">FrSm013</a>                           |
| [BSW00412] Separate H-File for configuration parameters                       | <a href="#">FrSm053</a>                           |
| [BSW00383] List dependencies of configuration files                           | <a href="#">FrSm070</a> <a href="#">FrSm071</a>   |
| [BSW00384] List dependencies to other modules                                 | See chapter 5                                     |
| [BSW00387] Specify the configuration class of callback function               | Not applicable                                    |
| [BSW00388] Introduce containers                                               | See chapter 10.2                                  |
| [BSW00389] Containers shall have names                                        | See chapter 10.2                                  |
| [BSW00390] Parameter content shall be unique within the module                | See chapter 10.2                                  |
| [BSW00391] Parameter shall have unique names                                  | See chapter 10.2                                  |
| [BSW00392] Parameters shall have a type                                       | See chapter 10.2                                  |
| [BSW00394] Specify the scope of the parameters                                | See chapter 10.2                                  |
| [BSW00395] List the required parameters (per parameter)                       | See chapter 10.2                                  |
| [BSW00396] Configuration classes                                              | See chapter 10.2                                  |
| [BSW00397] Pre-compile-time parameters                                        | See chapter 10.2                                  |
| [BSW00398] Link-time parameters                                               | See chapter 10.2                                  |
| [BSW00399] Loadable Post-build time parameters                                | See chapter 10.2                                  |
| [BSW00400] Selectable Post-build time parameters                              | See chapter 10.2                                  |
| [BSW00438] Post Build Configuration Data Structure                            | <a href="#">FrSm013</a> , <a href="#">FrSm014</a> |
| [BSW00402] Published information                                              | See 10.3                                          |
|                                                                               |                                                   |
|                                                                               |                                                   |
|                                                                               |                                                   |

Document: AUTOSAR\_SRS\_ModeManagement

| <b>Requirement</b>                                                                    | <b>Satisfied by</b>     |
|---------------------------------------------------------------------------------------|-------------------------|
| [BSW09090] User-to-channel relationship                                               | Not applicable          |
| [BSW09133] Assigning physical channels to the Communication Manager                   | Not applicable          |
| [BSW09132] Assigning Network Management to physical channels                          | Not applicable          |
| [BSW09141] Configuration of physical channel wake-up                                  | Not applicable          |
| [BSW09078] Coordinating communication requests                                        | Not applicable          |
| [BSW049] Initiating wake-up and keeping awake physical channels                       | Not applicable          |
| [BSW09080] Physical channel independency                                              | Not applicable          |
| [BSW09081] API for requesting communication                                           | <a href="#">FrSm020</a> |
| [BSW09083] Support of different communication modes                                   | See chapter 7.2         |
| [BSW09084] API for querying the current communication                                 | <a href="#">FrSm024</a> |
| [BSW09085] Indication of communication mode changes                                   | See chapter 7.2         |
| [BSW09168] Pseudo-channel for local                                                   | Not applicable          |
| [BSW09071] Limit Communication Manager modes                                          | Not applicable          |
| [BSW09157] Revoke Communication Manager mode limitation                               | Not applicable          |
| [BSW09087] Proxy communication request after wake-up                                  | Not applicable          |
| [BSW09088] Handling of different physical channel types                               | Not applicable          |
| [BSW09089] Preventing waking up physical channels                                     | Not applicable          |
| [BSW09155] Counting of inhibited communication requests                               | Not applicable          |
| [BSW09156] API to retrieve the number of inhibited "Full Communication" mode requests | Not applicable          |
| [BSW09079] Transparent relationship between software components and physical channels | Not applicable          |

Document: AUTOSAR\_SRS\_FlexRay

Not applicable

## 7 Functional specification

### 7.1 Background & Rationale

FlexRay start-up is a complex process that is completely different from CAN. E.g. on CAN every message can wakeup the bus, on FlexRay a special wakeup pattern is needed. In order to make the FlexRay start-up process as reliable as possible, it has to be controlled by a BSW module with in-depth FlexRay knowledge. As the AUTOSAR Communication Manager has a completely abstracted bus view, it is the task of the FlexRay State Manager to map this abstracted view to the states of the FlexRay [POC](#) and to the [CHI](#) commands to change these states.

### 7.2 State Machine of the FlexRay State Manager

#### 7.2.1 General

FrSm030:

The FlexRay State Manager shall have one state machine for each FlexRay cluster.

The states of this state machine are to some extent derived from the [POC](#) states of the FlexRay [CC](#). This document is based on the assumption that there is always a unique [POC](#) state for every FlexRay cluster (see Limitations in section 4.1).

FrSm031:

The state machine of each cluster shall be processed in the main function `FrSm_MainFunction_<Cluster Id>` assigned to that cluster (see section 8.5.1). However, as defined in section 8.3.2, some transitions of the state machine shall also be processed in the context of the [FrSm\\_RequestComMode](#) function in order to achieve a deterministic behaviour for shutdown.

#### 7.2.2 States

FrSm032:

The state machine shall comprise the following states:

| <i>FrSm Cluster State</i> | <i>Mapped FlexRay <a href="#">CC</a> state</i>                                                                                                                             |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FRSM_READY                | <a href="#">POC</a> :ready or (transitional) <a href="#">POC</a> :default config or (transitional) <a href="#">POC</a> :config or (transitional) <a href="#">POC</a> :halt |
| FRSM_WAKEUP               | <a href="#">POC</a> :wake-up                                                                                                                                               |
| FRSM_STARTUP              | <a href="#">POC</a> :start-up                                                                                                                                              |
| FRSM_HALT_REQ             | <a href="#">POC</a> :normal active or <a href="#">POC</a> :normal passive                                                                                                  |
| FRSM_ONLINE               | <a href="#">POC</a> :normal active                                                                                                                                         |
| FRSM_ONLINE_PASSIVE       | <a href="#">POC</a> :normal passive                                                                                                                                        |

### 7.2.3 Variables

FrSm033:

In addition to its state, the state machine shall comprise the following variables.

| FrSm Variable  | Type                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| reqComMode     | <a href="#">ComM_ModeType</a> | The communication mode that has been requested by the <a href="#">ComM</a> .<br>The communication modes are abbreviated in this document as follows:<br>NoCom: COMM_NO_COMMUNICATION<br>SilentCom: COMM_SILENT_COMMUNICATION<br>FullCom: COMM_FULL_COMMUNICATION<br>According to the definition of <a href="#">ComM_ModeType</a> these modes are ordered as follows:<br><a href="#">NoCom</a> < <a href="#">SilentCom</a> < <a href="#">FullCom</a> |
| startupCounter | uint8                         | The number of startup attempts that have been performed                                                                                                                                                                                                                                                                                                                                                                                             |

### 7.2.4 State Machine Configuration

FrSm034:

The state machine uses the following configuration parameters that are defined in chapter 10.2.

| FrSm Configuration Parameter | Type    | Description                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IsWakeupECU                  | Boolean | See chapter 10.2                                                                                                                                                                                                                                                                                                                                                                           |
| IsColdstartECU               | Boolean | See chapter 10.2                                                                                                                                                                                                                                                                                                                                                                           |
| StartupRepetitionsWithWakeup | uint8   | The number of times an ECU may repeat the startup procedure including a wakeup for a FlexRay cluster.<br>If this optional configuration parameter is missing, there shall be no limitation, i.e. the configuration parameter shall be treated as having the value $\infty$                                                                                                                 |
| StartupRepetitions           | uint8   | Determines how often the ECU can repeat the startup procedure by reinitializing the FlexRay <a href="#">CC</a> , see chapter 10.2. This value must not be smaller than <a href="#">StartupRepetitionsWithWakeup</a> .<br>If this optional configuration parameter is missing, there shall be no limitation, i.e. the configuration parameter shall be treated as having the value $\infty$ |

## 7.2.5 Conditions

The state machine description uses the following conditions that are evaluated during runtime for each FlexRay cluster:

| FrSm Condition | Type    | Description                                                                          |
|----------------|---------|--------------------------------------------------------------------------------------|
| t3_IsActive    | Boolean | Evaluates to true if t3 has been started and has not expired yet, otherwise to false |

## 7.2.6 Timers

| Timer | Description                                                                                                                                                                                                                                                               |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| t1    | The timer <a href="#">t1</a> models the duration of time between finishing wakeup and calling FrIf_AllowColdstart in the FlexRay State Manager state machine.<br>The duration of this timer can be statically configured with the configuration parameter FrSmDurationT1. |
| t2    | The timer <a href="#">t2</a> models the time difference after which the FlexRay State Manager will repeat the startup of the FlexRay cluster.<br>The duration of this timer can be statically configured with the configuration parameter FrSmDurationT2.                 |
| t3    | The timer t3 supervises the transition to <a href="#">FullCom</a> . The duration of this timer can be statically configured with the configuration parameter FrSmDurationT3.                                                                                              |

FrSm103: If the configuration parameter FrSmDurationT1 is set to 0, timer [t1](#) shall not be started. Instead, the call of FrIf\_AllowColdstart shall immediately follow the call of FrIf\_StartCommunication.

FrSm037: If the duration FrSmDurationT2 of timer [t2](#) is set to 0, the startup of the FlexRay cluster shall not be supervised.

FrSm125: If the duration FrSmDurationT3 of timer [t3](#) is set to 0, the transition to [FullCom](#) shall not be supervised.

FrSm038: The duration of timer [t1](#), [t2](#) and [t3](#) shall always be multiples of the cycle time of the main function.

Note, that no assumption is made whether timer [t1](#), [t2](#) or [t3](#) are implemented in software or hardware.

## 7.2.7 Functional Elements

FrSm039:

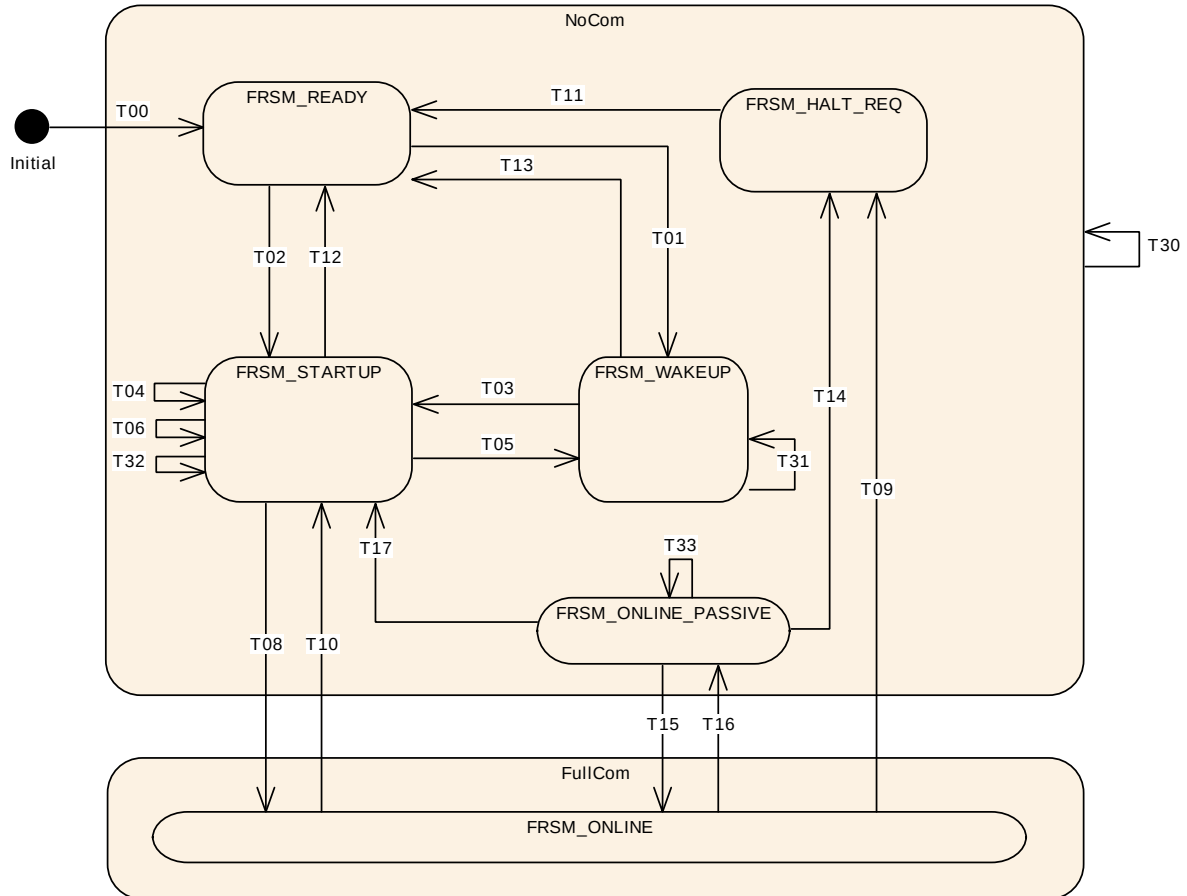


The functionality being performed in the transitions of the state machine is partitioned into the following functional elements.

| Functional Element   | Description                                                                                                                                                                                                     |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FE_WAKEUP            | Call <code>FrIf_SendWUP</code> for one controller of the FlexRay cluster. Because of the limitations defined in chapter 4.1, the case of multiple controllers per cluster is not in the scope of this document. |
| FE_CONFIG            | Call <code>FrIf_ControllerInit</code> for each controller of the FlexRay cluster.                                                                                                                               |
| FE_START             | Call <code>FrIf_StartCommunication</code> for each controller of the FlexRay cluster.                                                                                                                           |
| FE_ALLOW_COLDSTART   | Call <code>FrIf_AllowColdstart</code> for each controller of the FlexRay cluster if the configuration parameter <a href="#">IsColdstartECU</a> is true.                                                         |
| FE_HALT              | Call <code>FrIf_HaltCommunication</code> for each controller of the FlexRay cluster.                                                                                                                            |
| FE_TRCV_STANDBY      | Call <code>FrIf_SetTransceiverMode( FRTRCV_TRCV-MODE_STANDBY)</code> and <code>FrIf_EnableTransceiver-Wakeup</code> for each transceiver of the FlexRay cluster.                                                |
| FE_TRCV_NORMAL       | Call <code>FrIf_SetTransceiverMode( FRTRCV_TRCV-MODE_NORMAL)</code> , <code>FrIf_DisableTransceiverWakeup</code> and <code>FrIf_ClearTransceiverWakeup</code> for each transceiver of the FlexRay cluster.      |
| FE_START_FRIF        | Set the <a href="#">FrIf</a> state to ONLINE by calling <code>FrIf_SetState(FRIF_GOTO_ONLINE)</code> for the cluster.                                                                                           |
| FE_STOP_FRIF         | Set the <a href="#">FrIf</a> state to OFFLINE by calling <code>FrIf_SetState(FRIF_GOTO_OFFLINE)</code> for the cluster.                                                                                         |
| FE_DEM_STATUS_FAILED | Report status of production error <a href="#">FRSM_E_CLUSTER_STARTUP</a> as failed                                                                                                                              |
| FE_DEM_STATUS_PASSED | Report status of production error <a href="#">FRSM_E_CLUSTER_STARTUP</a> as passed                                                                                                                              |
| FE_FULL_COM_IND      | Indicate to the <a href="#">ComM</a> that <a href="#">FullCom</a> has been reached by calling <a href="#">ComM_FrSm_ModelIndication(FullCom)</a>                                                                |
| FE_NO_COM_IND        | Indicate to the <a href="#">ComM</a> that <a href="#">FullCom</a> has been left by calling <a href="#">ComM_FrSm_ModelIndication(NoCom)</a> .                                                                   |
| FE_START_COM_RX      | Start the I-PDU-group for reception that is referenced by <code>FrSmRxIPduGroupRef</code> by calling <code>Com_IPduGroupStart</code> with the parameter Initialize set to <code>FrSmRxPduInit</code> .          |
| FE_STOP_COM_RX       | Stop the I-PDU-group for reception that is referenced by <code>FrSmRxIPduGroupRef</code> by calling <code>Com_IPduGroupStop</code> .                                                                            |
| FE_START_COM_TX      | Start the I-PDU-group for transmission that is referenced by <code>FrSmTxIPduGroupRef</code> by calling <code>Com_IPduGroupStart</code> with the parameter Initialize set to <code>FrSmTxPduInit</code> .       |
| FE_STOP_COM_TX       | Stop the I-PDU-group for transmission that is referenced by <code>FrSmTxIPduGroupRef</code> by calling <code>Com_IPduGroupStop</code> .                                                                         |
| FE_STARTUP_ERROR_IND | Call <code>FrNm_StartupError</code> .                                                                                                                                                                           |

## 7.2.8 Transitions

FrSm093: The following diagram defines the transitions of the FrSm state machine.



**Figure 2 State machine of the FlexRay State Manager**

FrSm104:

The following table defines the events and conditions that trigger the transitions of FrSm state machine and the actions that are executed within the transitions.

FrSm105:

The FrSm shall execute the actions of the transition in the order that is defined in the table.

| ID       | Transition | Event [Condition]                                                                                                                                                                                                                                    | Actions                                                                                                                                                                                                                                                       |
|----------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FrSm119: | T00        |                                                                                                                                                                                                                                                      | <a href="#">FE_CONFIG</a>                                                                                                                                                                                                                                     |
| FrSm072: | T01        | [<br><a href="#">reqComMode</a> = <a href="#">FullCom</a><br>^ <a href="#">IsWakeupECU</a> ]                                                                                                                                                         | <a href="#">FE_TRCV_NORMAL</a><br><a href="#">startupCounter</a> := 1<br><a href="#">FE_WAKEUP</a>                                                                                                                                                            |
| FrSm073: | T02        | [<br><a href="#">reqComMode</a> = <a href="#">FullCom</a><br>^ ¬ <a href="#">IsWakeupECU</a> ]                                                                                                                                                       | <a href="#">FE_TRCV_NORMAL</a><br><a href="#">startupCounter</a> := 1<br><a href="#">FE_START</a><br><a href="#">FE_ALLOW_COLDSTART</a><br>start <a href="#">t2</a>                                                                                           |
| FrSm074: | T03        | [<br><a href="#">vPOC!State</a> = Ready<br>^ ¬ <a href="#">vPOC!Freeze</a><br>^ <a href="#">reqComMode</a> = <a href="#">FullCom</a> ]                                                                                                               | <a href="#">FE_START</a><br>start <a href="#">t1</a>                                                                                                                                                                                                          |
| FrSm075: | T04        | <a href="#">t1</a> [ <a href="#">reqComMode</a> = <a href="#">FullCom</a> ]                                                                                                                                                                          | <a href="#">FE_ALLOW_COLDSTART</a><br>start <a href="#">t2</a>                                                                                                                                                                                                |
| FrSm076: | T05        | <a href="#">t2</a> [<br><a href="#">startupCounter</a><br><= <a href="#">StartupRepetitions-</a><br><a href="#">WithWakeup</a><br>^ <a href="#">reqComMode</a> = <a href="#">FullCom</a> ]                                                           | <a href="#">FE_CONFIG</a><br><a href="#">FE_WAKEUP</a><br><a href="#">startupCounter</a> :=<br><a href="#">startupCounter</a> + 1                                                                                                                             |
| FrSm077: | T06        | <a href="#">t2</a> [<br><a href="#">StartupRepetitionsWithWakeup</a><br><<br><a href="#">startupCounter</a><br>^ <a href="#">startupCounter</a> <=<br><a href="#">StartupRepetitions</a><br>^ <a href="#">reqComMode</a> = <a href="#">FullCom</a> ] | <a href="#">FE_CONFIG</a><br><a href="#">FE_START</a><br><a href="#">FE_ALLOW_COLDSTART</a><br><a href="#">startupCounter</a> :=<br><a href="#">startupCounter</a> + 1<br>start <a href="#">t2</a>                                                            |
| FrSm079: | T08        | [<br><a href="#">vPOC!State</a> = Normal Active<br>^ ¬ <a href="#">vPOC!Freeze</a> ]                                                                                                                                                                 | cancel <a href="#">t1</a><br>cancel <a href="#">t2</a><br><a href="#">FE_START_COM_RX</a><br><a href="#">FE_START_FRIF</a><br><a href="#">FE_START_COM_TX</a><br><a href="#">FE_DEM_STATUS_PASSED</a><br><a href="#">FE_FULL_COM_IND</a>                      |
| FrSm080: | T09        | [<br><a href="#">reqComMode</a> = <a href="#">NoCom</a> ]                                                                                                                                                                                            | <a href="#">FE_STOP_COM_TX</a><br><a href="#">FE_STOP_FRIF</a><br><a href="#">FE_STOP_COM_RX</a><br><a href="#">FE_HALT</a><br><a href="#">FE_NO_COM_IND</a>                                                                                                  |
| FrSm081: | T10        | [<br><a href="#">vPOC!State</a> = Halt<br>∨ <a href="#">vPOC!Freeze</a> ]                                                                                                                                                                            | <a href="#">FE_STOP_COM_TX</a><br><a href="#">FE_STOP_FRIF</a><br><a href="#">FE_STOP_COM_RX</a><br><a href="#">FE_NO_COM_IND</a><br><a href="#">FE_CONFIG</a><br><a href="#">FE_START</a><br><a href="#">startupCounter</a> := 1<br>start <a href="#">t2</a> |
| FrSm083: | T11        | [<br><a href="#">vPOC!State</a> = Halt<br>∨ <a href="#">vPOC!Freeze</a> ]                                                                                                                                                                            | <a href="#">FE_TRCV_STANDBY</a><br><a href="#">FE_CONFIG</a>                                                                                                                                                                                                  |
| FrSm084: | T12        | [<br><a href="#">reqComMode</a> = <a href="#">NoCom</a> ]                                                                                                                                                                                            | cancel <a href="#">t1</a><br>cancel <a href="#">t2</a><br><a href="#">FE_TRCV_STANDBY</a><br><a href="#">FE_CONFIG</a>                                                                                                                                        |

| ID       | Transition | Event [Condition]                                                                            | Actions                                                                                                                                                  |
|----------|------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| FrSm085: | T13        | [ <a href="#">reqComMode</a> = <a href="#">NoCom</a> ]                                       | <a href="#">FE TRCV STANDBY</a><br><a href="#">FE CONFIG</a>                                                                                             |
|          | T14        | [ <a href="#">reqComMode</a> = <a href="#">NoCom</a> ]                                       | <a href="#">FE STOP FRIF</a><br><a href="#">FE HALT</a>                                                                                                  |
| FrSm086: | T15        | [ <a href="#">vPOC!State</a> = Normal Active<br>$\wedge \neg$ <a href="#">vPOC!Freeze</a> ]  | <a href="#">FE START COM RX</a><br><a href="#">FE START COM TX</a><br><a href="#">FE FULL COM IND</a>                                                    |
| FrSm087: | T16        | [ <a href="#">vPOC!State</a> = Normal Passive<br>$\wedge \neg$ <a href="#">vPOC!Freeze</a> ] | <a href="#">FE STOP COM TX</a><br><a href="#">FE STOP COM RX</a><br><a href="#">FE NO COM IND</a>                                                        |
| FrSm117: | T17        | [ <a href="#">vPOC!State</a> = Halt<br>$\vee$ <a href="#">vPOC!Freeze</a> ]                  | <a href="#">FE STOP FRIF</a><br><a href="#">FE CONFIG</a><br><a href="#">FE START</a><br><a href="#">startupCounter</a> := 1<br>start <a href="#">t2</a> |
| FrSm121: | T30        | <a href="#">t3</a>                                                                           | <a href="#">FE DEM STATUS FAILED</a><br><a href="#">FE STARTUP ERROR IND</a>                                                                             |
| FrSm122: | T31        | [ $\neg$ <a href="#">t3_IsActive</a> ]                                                       | <a href="#">FE STARTUP ERROR IND</a>                                                                                                                     |
| FrSm123: | T32        | [ $\neg$ <a href="#">t3_IsActive</a> ]                                                       | <a href="#">FE STARTUP ERROR IND</a>                                                                                                                     |
| FrSm124: | T33        | [ $\neg$ <a href="#">t3_IsActive</a> ]                                                       | <a href="#">FE STARTUP ERROR IND</a>                                                                                                                     |
|          |            |                                                                                              |                                                                                                                                                          |

Legend:  $\wedge$  AND

$\vee$  OR

$\neg$  NOT

:= assignment

start t: start timer t

cancel t: stop timer t

[...] guard condition for transition

t1 [...] t1 has expired

FrSm092: The transitions T09 and T14 (see [FrSm080](#)) shall be executed in the context of the [FrSm\\_RequestComMode](#) function, see section 8.3.2.

FrSm040: If synchronization is lost after FullCom has been reached, the FrSm shall first try to bring the FlexRay CC to the startup state without allowing cold start.

Rationale: The loss of synchronization may be a local problem of the ECU. Thus the ECU should first try to re-integrate without disturbing the cluster.

FrSm062: If resynchronization cannot be achieved before [t2](#) expires (see [FrSm076](#) and [FrSm077](#)), the same wakeup and startup procedure as for the initial synchronization shall be used.

Note: If the startup of a FlexRay cluster is not successful (i.e. timer [t2](#) expires), the FrSm module will repeat the startup procedure depending on the value of the counter [startupCounter](#):

- If [startupCounter](#) does not exceed the threshold [StartupRepetitionsWithWakeup](#), the startup procedure will be repeated including the wakeup.
- If [startupCounter](#) exceeds the threshold [StartupRepetitionsWithWakeup](#) but does not exceed the threshold [StartupRepetitions](#), the startup procedure will be repeated without wakeup.

Note: If the counter [startupCounter](#) exceeds the threshold [StartupRepetitions](#) the FrSm will report the production error [FRSM\\_E\\_CLUSTER\\_STARTUP](#) and remain in state [FRSM\\_STARTUP](#). Thus, if an ECU has been configured as a coldstart node, it will then stop performing coldstart attempts. However, if another ECU performs a coldstart, the ECU will join the coldstart.

Note: If no threshold [StartupRepetitions](#) has been configured, an ECU that has been configured as a coldstart node will not stop performing coldstart attempts until either synchronization has been achieved or [NoCom](#) is requested.

Rationale: If the RX path of a FlexRay CC is faulty, an ECU performing a wakeup or coldstart could disturb the FlexRay communication as it will not be able to detect any collision. Thus, an unlimited number of coldstart attempts could lead to a continuous disturbance of the FlexRay communication.

Note: An ECU which has been woken up by a [passive wake-up](#) does not need to perform a wake-up. However, this version of the FrSm will always try to perform a wake-up, if the ECU has been configured as a wake-up node.

## 7.3 Configuration description

The FlexRay State Manager configuration tool reads the ECU configuration description of the FlexRay Interface as the mapping of controllers to clusters is contained in the FlexRay Interface configuration description.

## 7.4 Error classification

FrSm041:

Values for production code Event Ids are assigned externally by the configuration of the Dem. They are published in the file Dem\_IntErrId.h and included via Dem.h.

FrSm042::

Development error values are of type uint8.

| Type or error                        | Relevance   | Related error code     | Value [hex] |
|--------------------------------------|-------------|------------------------|-------------|
| Invalid pointer in parameter list    | Development | FRSM_E_INV_POINTER     | 0x01        |
| Invalid network handle parameter     | Development | FRSM_E_INV_HANDLE      | 0x02        |
| FrSm module was not initialized      | Development | FRSM_E_NOT_INITIALIZED | 0x03        |
| Invalid communication mode requested | Development | FRSM_E_INV_MODE        | 0x04        |

|                                                                                            |            |                        |                 |
|--------------------------------------------------------------------------------------------|------------|------------------------|-----------------|
|                                                                                            |            |                        |                 |
| FlexRay startup could not reach the state <i>normal active</i> within the configured time. | Production | FRSM_E_CLUSTER_STARTUP | Assigned by DEM |

## 7.5 Error detection

FrSm043:

The detection of development errors shall be configurable (*ON / OFF*) at pre-compile time.

The switch *FrSmDevErrorDetect* (see chapter 10) shall activate or deactivate the detection of all development errors.

FrSm044:

If the *FrSmDevErrorDetect* switch is enabled API parameter checking is enabled. The detailed description of the detected errors can be found in chapter 7.4 and chapter 8.

[FrSm01202]:

The detection of production code errors cannot be switched off.

## 7.6 Error notification

FrSm045:

Detected development errors shall be reported to the *Det\_ReportError* service of the Development Error Tracer (DET) if the pre-processor switch *FrSmDevErrorDetect* is set (see chapter 10).

FrSm046:

Production errors shall be reported to Diagnostic Event Manager.

## 8 API specification

### 8.1 Imported types

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

**FrSm095:**

| Header file      | Imported Type            |
|------------------|--------------------------|
| FrTrcv_Types.h   | FrTrcv_TrvcModeType      |
| FrNm_Types.h     | NetworkHandleType        |
| FrIf_Types.h     | FrIf_StateTransitionType |
| ComStack_Types.h | NetworkHandleType        |
| Fr_Types.h       | Fr_ChannelType           |
|                  | Fr_POCTestStatusType     |
| Dem_Types.h      | Dem_EventIdType          |
| Com_Types.h      | Com_PduGroupIdType       |
| Std_Types.h      | Std_ReturnType           |
|                  | Std_VersionInfoType      |
| ComM_Types.h     | ComM_ModeType            |

### 8.2 Type definitions

#### 8.2.1 FrSm\_ConfigType

|                     |                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Name:</b>        | FrSm_ConfigType                                                                                               |
| <b>Type:</b>        | Structure                                                                                                     |
| <b>Range:</b>       | Implementation specific.                                                                                      |
| <b>Description:</b> | This type contains the implementation-specific post build time configuration structure that is for FrSm_Init. |

### 8.3 Function definitions

This is a list of functions provided for upper layer modules.

#### 8.3.1 FrSm\_Init

**FrSm013:**

|                         |                                                               |
|-------------------------|---------------------------------------------------------------|
| <b>Service name:</b>    | FrSm_Init                                                     |
| <b>Syntax:</b>          | void FrSm_Init(<br>const FrSm_ConfigType* FrSm_ConfigPtr<br>) |
| <b>Service ID[hex]:</b> | 0x01                                                          |
| <b>Sync/Async:</b>      | Synchronous                                                   |

|                            |                                        |                                               |
|----------------------------|----------------------------------------|-----------------------------------------------|
| <b>Reentrancy:</b>         | Non Reentrant                          |                                               |
| <b>Parameters (in):</b>    | FrSm_ConfigPtr                         | Pointer to a selected configuration structure |
| <b>Parameters (inout):</b> | None                                   |                                               |
| <b>Parameters (out):</b>   | None                                   |                                               |
| <b>Return value:</b>       | None                                   |                                               |
| <b>Description:</b>        | Initializes the FlexRay State Manager. |                                               |

FrSm014: The [FrSm\\_Init](#) function shall

- initialize the state machines for all FlexRay clusters and set them into the state [FRSM\\_READY](#);
- internally store the configuration data address to enable subsequent API calls to access the configuration data;
- if development error detection is enabled (FrSmDevErrorDetect is ON) the successful initialization shall be remembered internally for other API functions to check for proper module initialization.

FrSm015: If development error detection is enabled (FrSmDevErrorDetect is ON) and FrSm\_ConfigPtr equals NULL\_PTR, the FrSm shall report the error [FRSM\\_E\\_INV\\_POINTER](#) to the DET and shall not perform the initialization. However, a value of NULL\_PTR for FrSm\_ConfigPtr shall not be treated as an error, if a configuration variant (see section 10.1.2) without post-build data is used.

### 8.3.2 FrSm\_RequestComMode

FrSm020:

|                            |                                                                                                         |                                                                                            |
|----------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>Service name:</b>       | FrSm_RequestComMode                                                                                     |                                                                                            |
| <b>Syntax:</b>             | Std_ReturnType FrSm_RequestComMode(<br>NetworkHandleType NetworkHandle,<br>ComM_ModeType ComM_Mode<br>) |                                                                                            |
| <b>Service ID[hex]:</b>    | 0x02                                                                                                    |                                                                                            |
| <b>Sync/Async:</b>         | Asynchronous                                                                                            |                                                                                            |
| <b>Reentrancy:</b>         | Reentrant for different FlexRay clusters                                                                |                                                                                            |
| <b>Parameters (in):</b>    | NetworkHandle                                                                                           | This parameter identifies the FlexRay cluster for which a communication mode is requested. |
|                            | ComM_Mode                                                                                               | This parameter holds the requested communication mode.                                     |
| <b>Parameters (inout):</b> | None                                                                                                    |                                                                                            |
| <b>Parameters (out):</b>   | None                                                                                                    |                                                                                            |
| <b>Return value:</b>       | Std_ReturnType                                                                                          | E_OK: Request accepted                                                                     |
|                            |                                                                                                         | E_NOT_OK: Request not accepted                                                             |
| <b>Description:</b>        | This API function is used by the ComM to startup or shutdown the communication on a FlexRay cluster.    |                                                                                            |

FrSm021: The [FrSm\\_RequestComMode](#) function shall store the requested communication mode. The next activation of the [FrSm\\_MainFunction](#) will then process this request when processing the state machine of the corresponding cluster.



Note, that the state machine definition in section 7.2 refers to this stored request as [comReq](#).

FrSm022: If [NoCom](#) is requested after [FullCom](#) has been reached (i.e. when the FrSm state machine of the corresponding cluster is in state [FRSM\\_ONLINE](#)), the [FrSm\\_RequestComMode](#) function shall immediately process the corresponding transition of the state machine (see section 7.2).

Rationale: This shall ensure that the [NoCom](#) request will stop the participation of the ECU in the FlexRay communication at the end of the current FlexRay cycle.

FrSm023: The silent communication mode is not supported on FlexRay; it may not be requested by the [ComM](#).

FrSm018:

If development error detection is enabled and the parameter NetworkHandle has an invalid value the development error code [FRSM\\_E\\_INV\\_HANDLE](#) shall be raised and the function shall return E\_NOT\_OK.

FrSm019:

If development error detection is enabled and the parameter ComM\_Mode has an invalid value the development error code [FRSM\\_E\\_INV\\_MODE](#) shall be raised and the function shall return E\_NOT\_OK.

FrSm061:

If development error detection is enabled and the FrSm has not been initialized using [FrSm\\_Init](#), the development error code [FRSM\\_E\\_NOT\\_INITIALIZED](#) shall be raised and the function shall return E\_NOT\_OK.

### 8.3.3 FrSm\_GetCurrentComMode

FrSm024:

|                            |                                                                                                                |                                                                                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Service name:</b>       | FrSm_GetCurrentComMode                                                                                         |                                                                                                                    |
| <b>Syntax:</b>             | Std_ReturnType FrSm_GetCurrentComMode(<br>NetworkHandleType NetworkHandle,<br>ComM_ModeType* ComM_ModePtr<br>) |                                                                                                                    |
| <b>Service ID[hex]:</b>    | 0x03                                                                                                           |                                                                                                                    |
| <b>Sync/Async:</b>         | Synchronous                                                                                                    |                                                                                                                    |
| <b>Reentrancy:</b>         | Reentrant for different FlexRay clusters                                                                       |                                                                                                                    |
| <b>Parameters (in):</b>    | NetworkHandle                                                                                                  | Handle of communication network                                                                                    |
| <b>Parameters (inout):</b> | None                                                                                                           |                                                                                                                    |
| <b>Parameters (out):</b>   | ComM_ModePtr                                                                                                   | Pointer to the memory location where the current communication mode shall be stored                                |
| <b>Return value:</b>       | Std_ReturnType                                                                                                 | E_OK: Request accepted<br>E_NOT_OK: Request was not accepted as the FrSm has not been initialized using FrSm_Init. |
| <b>Description:</b>        | This API function can be used to determine the current communication mode of a FlexRay cluster.                |                                                                                                                    |

FrSm025: The [FrSm\\_GetCurrentComMode](#) function shall write the current communication mode of the corresponding FlexRay cluster into the given memory location.

FrSm026:

The communication mode shall be determined as follows:

- If the cluster state machine is in state [FRSM ONLINE](#) and the [FrIf](#) is in state FRIF\_ONLINE, the communication mode is COMM\_FULL\_COMMUNICATION.
- In any other case, the communication mode is COMM\_NO\_COMMUNICATION.

FrSm027:

If development error detection is enabled and the parameter NetworkHandle has an invalid value the development error code [FRSM E INV HANDLE](#) shall be raised and the function shall return E\_NOT\_OK.

FrSm028:

If development error detection is enabled and the parameter ComM\_ModePtr equals NULL\_PTR the development error code [FRSM E INV POINTER](#) shall be raised and the function shall return E\_NOT\_OK.

FrSm060:

If development error detection is enabled and the FrSm has not been initialized using [FrSm\\_Init](#), the development error code [FRSM E NOT INITIALIZED](#) shall be raised and the function shall return E\_NOT\_OK.

### 8.3.4 FrSm\_GetVersionInfo

FrSm029:

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                   |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| <b>Service name:</b>       | FrSm_GetVersionInfo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                   |
| <b>Syntax:</b>             | void FrSm_GetVersionInfo(<br>Std_VersionInfoType* versioninfo<br>)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                   |
| <b>Service ID[hex]:</b>    | 0x04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                   |
| <b>Sync/Async:</b>         | Synchronous                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                   |
| <b>Reentrancy:</b>         | Reentrant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                   |
| <b>Parameters (in):</b>    | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                   |
| <b>Parameters (inout):</b> | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                   |
| <b>Parameters (out):</b>   | versioninfo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Pointer to where to store the version information of this module. |
| <b>Return value:</b>       | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                   |
| <b>Description:</b>        | <p>This service returns the version information of this module. The version information includes:</p> <ul style="list-style-type: none"> <li>- Module Id</li> <li>- Vendor Id</li> <li>- Vendor specific version numbers (BSW00407).</li> </ul> <p>This function shall be pre compile time configurable On/Off by the configuration parameter: FRSM_VERSION_INFO_API</p> <p>Hint:<br/>If source code for caller and callee of this function is available this function should be realized as a macro. The macro should be defined in the modules header file.</p> |                                                                   |

Configuration of FrSm\_GetVersionInfo: This function shall be pre compile time configurable On/Off by the configuration parameter: FrSmVersionInfoApi

## 8.4 Call-back notifications

The FlexRay State Manager does not provide any call-back API services to other BSW modules. Therefore, the header file FrSm\_Cbk.h is not needed.

## 8.5 Scheduled functions

These functions are directly called by Basic Software Scheduler. The following functions shall have no return value and no parameter. All functions shall be non reentrant.

### 8.5.1 FrSm\_MainFunction\_<Cluster Id>

FrSm118:

|                         |                                           |
|-------------------------|-------------------------------------------|
| <b>Service name:</b>    | FrSm_MainFunction_<Cluster Id>            |
| <b>Syntax:</b>          | void FrSm_MainFunction_<Cluster Id>(<br>) |
| <b>Service ID[hex]:</b> | 0x80                                      |
| <b>Timing:</b>          | FIXED_CYCLIC                              |
| <b>Description:</b>     | --                                        |

FrSm114:

The Service ID of FrSm\_MainFunction\_<Cluster Id> shall be 0x80 + Cluster\_Id.

FrSm047:

The [FrSm\\_MainFunction](#) shall determine the [POC](#) status of all FlexRay [CC](#) that are connected to the corresponding FlexRay cluster. This document is based on the assumption that there is always a unique [POC](#) state for every FlexRay cluster (see Limitations in section 4.1).

FrSm048:

After determining the [POC](#) status, the [FrSm\\_MainFunction](#) shall process the state machine of the corresponding cluster.

FrSm049:

The [FrSm\\_MainFunction](#) shall be called cyclically with a cycle time that is shorter than or equal to the FlexRay cycle duration.

Rationale: The [FrSm\\_MainFunction](#) should be called at least once per FlexRay cycle. As the [POC](#) status only changes once per cycle, multiple invocations per FlexRay cycle have no benefit.

Note: After [FullCom](#) has been reached, the invocation of the [FrSm\\_MainFunction](#) can optionally be synchronized to the FlexRay global time to ensure that the [FrSm\\_MainFunction](#) is activated once per FlexRay cycle. However, this is outside of the scope of this specification.

Note: In case of very short FlexRay cycle times the [FrSm\\_MainFunction](#) can optionally be called with a cycle time that is larger than the FlexRay cycle time. However, this is outside of the scope of this specification as it can lead to increased startup time and to undetected [POC](#) status changes.

## 8.6 Expected Interfaces

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

### 8.6.1 Mandatory Interfaces

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

#### FrSm096:

| API function                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FrIf_SendWUP                  | Wraps the FlexRay Driver API function Fr_SendWUP().                                                                                                                                                                                                                                                                                                                                                                                                                |
| FrIf_ClearTransceiverWakeup   | Wraps the FlexRay Transceiver Driver API function FrTrcv_EnableTransceiverWakeup().                                                                                                                                                                                                                                                                                                                                                                                |
| Com_IpduGroupStart            | Starts a preconfigured I-PDU group. For example, cyclic I-PDUs will be sent out cyclically after the call of Com_IpduGroupStart(). See Chapter 7.4.5 for details.<br><br>If Initialize is true all I-PDUs of the I-PDU group shall be (re-)initialized before the I-PDU group is started. That is they shall behave like after a start-up of COM, for example the old_value of the filter objects and shadow buffers of signal groups have to be (re-)initialized. |
| FrIf_SetState                 | Requests FrIf state machine transition.                                                                                                                                                                                                                                                                                                                                                                                                                            |
| FrIf_DisableTransceiverWakeup | Wraps the FlexRay Transceiver Driver API function FrTrcv_DisableTransceiverWakeup().                                                                                                                                                                                                                                                                                                                                                                               |
| FrIf_AllowColdstart           | Wraps the FlexRay Driver API function Fr_AllowColdstart().                                                                                                                                                                                                                                                                                                                                                                                                         |
| FrIf_StartCommunication       | Wraps the FlexRay Driver API function Fr_StartCommunication().                                                                                                                                                                                                                                                                                                                                                                                                     |
| ComM_BusSM_ModelIndication    | Indication of the actual bus mode by the corresponding Bus State Manager. ComM shall propagate the indicated state to the users with means of the RTE (see ComM661).                                                                                                                                                                                                                                                                                               |
| FrIf_EnableTransceiverWakeup  | Wraps the FlexRay Transceiver Driver API function FrTrcv_EnableTransceiverWakeup().                                                                                                                                                                                                                                                                                                                                                                                |
| FrIf_HaltCommunication        | Wraps the FlexRay Driver API function Fr_HaltCommunication().                                                                                                                                                                                                                                                                                                                                                                                                      |
| Com_IpduGroupStop             | Stops a preconfigured I-PDU group. For example, cyclic I-PDUs will be stopped after the call of Com_IpduGroupStop(). See Chapter 7.4.5 for details.                                                                                                                                                                                                                                                                                                                |
| FrNm_StartupError             | This function is called by the FrSM when synchronization of the FlexRay cluster could not be achieved.                                                                                                                                                                                                                                                                                                                                                             |
| FrIf_ControllerInit           | Initialized a FlexRay CC.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| FrIf_GetPOCStatus             | Wraps the FlexRay Driver API function Fr_GetPOCStatus().                                                                                                                                                                                                                                                                                                                                                                                                           |
| Dem_ReportErrorStatus         | Reports errors to the DEM.                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| FrIf_SetTransceiverMode       | Wraps the FlexRay Transceiver Driver API function FrTrcv_SetTransceiverMode() .                                                                                                                                                                                                                                                                                                                                                                                    |

### 8.6.2 Optional Interfaces

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

#### FrSm097:

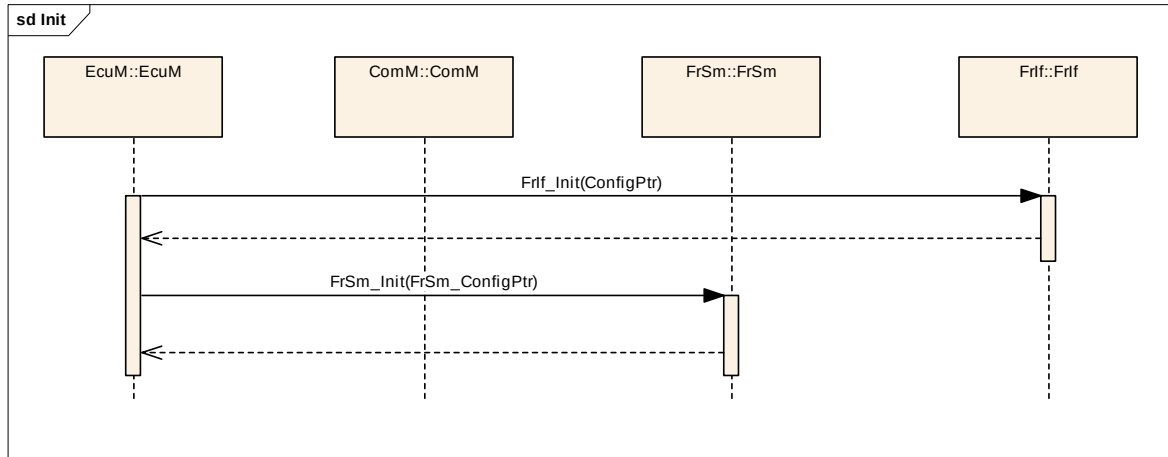
| <i>API function</i> | <i>Description</i>                    |
|---------------------|---------------------------------------|
| Det_ReportError     | Service to report development errors. |

### 8.6.3 Configurable interfaces

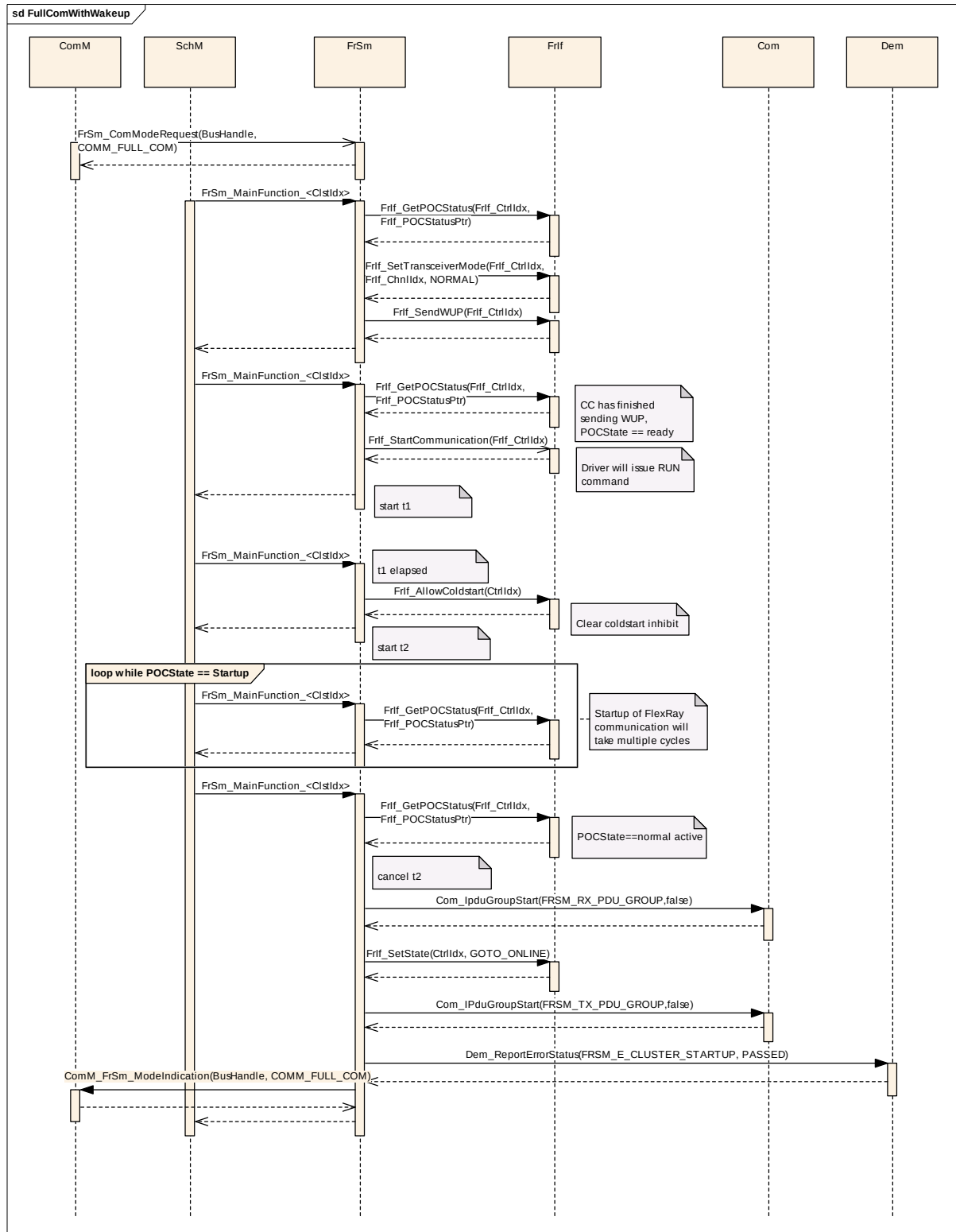
The [FrSm](#) has no configurable interface.

## 9 Sequence diagrams

### 9.1 Initialization

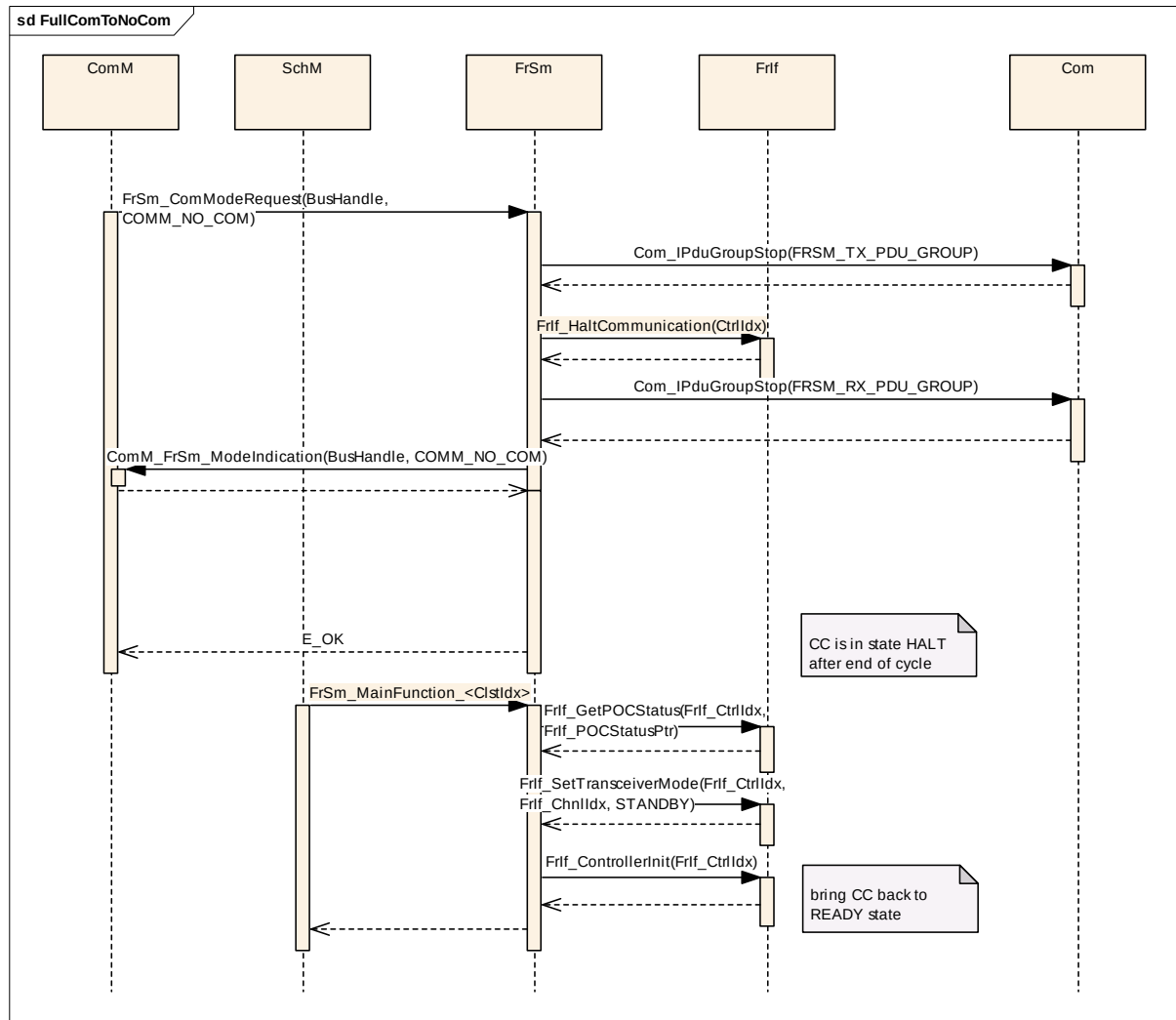


## 9.2 Transition from no communication to full communication



**Figure 3 Transition from no communication to full communication for the case of an ECU that is configured as wake-up and coldstart node.**

### 9.3 Transition from full communication to no communication





## 10 Configuration specification

In general, this chapter defines configuration parameters and their clustering into containers. In order to support the specification Chapter 10.1 describes fundamentals.

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

Chapter 10.3 specifies published information of the module FlexRay State Manager.

### 10.1 How to read this chapter

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

- AUTOSAR Layered Software Architecture [2]
- AUTOSAR ECU Configuration Specification [4]  
This document describes the AUTOSAR configuration methodology and the AUTOSAR configuration metamodel in detail.

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

#### 10.1.1 Configuration and configuration parameters

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

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

#### 10.1.2 Variants

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

#### 10.1.3 Containers

Containers structure the set of configuration parameters. This means:

- *all* configuration parameters are kept in containers.

- (sub-) containers can reference (sub-) containers. It is possible to assign a multiplicity to these references. The multiplicity then defines the possible number of instances of the contained parameters.

#### 10.1.4 Specification template for configuration parameters

The following tables consist of three sections:

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

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

| Label | Description                                                                                 |
|-------|---------------------------------------------------------------------------------------------|
| X     | The configuration parameter shall be of configuration class <i>Pre-compile time</i> .       |
| --    | The configuration parameter shall never be of configuration class <i>Pre-compile time</i> . |

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

| Label | Description                                                                          |
|-------|--------------------------------------------------------------------------------------|
| X     | The configuration parameter shall be of configuration class <i>Link time</i> .       |
| --    | The configuration parameter shall never be of configuration class <i>Link time</i> . |

Post Build - specifies whether the configuration parameter shall be of configuration class *Post Build* or not

| Label | Description                                                                                                                                                                                                            |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| X     | The configuration parameter shall be of configuration class <i>Post Build</i> and no specific implementation is required.                                                                                              |
| L     | <i>Loadable</i> - the configuration parameter shall be of configuration class <i>Post Build</i> and only one configuration parameter set resides in the ECU.                                                           |
| M     | <i>Multiple</i> - the configuration parameter shall be of configuration class <i>Post Build</i> and is selected out of a set of multiple parameters by passing a dedicated pointer to the init function of the module. |
| --    | The configuration parameter shall never be of configuration class <i>Post Build</i> .                                                                                                                                  |

>

## 10.2 Containers and configuration parameters

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

FrSm064: The [FrSm](#) shall support tool based configuration.

FrSm065: The configuration tool shall check the consistency of the configuration parameters at system configuration time.

### 10.2.1 Variants

#### 10.2.1.1 Variant1 (Pre-compile Configuration)

**FrSm098:** In the pre-compile configuration all parameters below that are marked as Pre-compile configurable shall be configurable in a pre-compile manner, for example as #defines.

The module is most likely delivered as source code.

#### 10.2.1.2 Variant2 (Link-time Configuration)

**FrSm099:** This configuration includes all configuration options of the “Pre-compile Configuration”. Additionally all parameters defined below, as link-time configurable shall be configurable at link time for example by linking a special configured parameter object file.

The module is most likely delivered as object code.

#### 10.2.1.3 Variant3 (Post-build Configuration)

**FrSm100:**

This configuration includes all configuration options of the “Link-time configuration”. Additionally all parameters defined below, as post build configurable shall be configurable post build for example by flashing configuration data.

The module is most likely delivered as object code.

### 10.2.2 FrSm

|                           |      |
|---------------------------|------|
| <b>Module Name</b>        | FrSm |
| <b>Module Description</b> |      |

| Included Containers |              |                    |
|---------------------|--------------|--------------------|
| Container Name      | Multiplicity | Scope / Dependency |
| FrSmCluster         | 1..*         |                    |
| FrSmGeneral         | 1            |                    |

### 10.2.3 FrSmGeneral

|                                 |                  |
|---------------------------------|------------------|
| <b>SWS Item</b>                 | <b>FrSm107 :</b> |
| <b>Container Name</b>           | FrSmGeneral      |
| <b>Description</b>              |                  |
| <b>Configuration Parameters</b> |                  |

|                           |                                                                                  |    |              |
|---------------------------|----------------------------------------------------------------------------------|----|--------------|
| <b>SWS Item</b>           | <b>FrSm066 :</b>                                                                 |    |              |
| <b>Name</b>               | FrSmDevErrorDetect {FRSM_DEV_ERROR_DETECT}                                       |    |              |
| <b>Description</b>        | Enables and disables the development error detection and notification mechanism. |    |              |
| <b>Multiplicity</b>       | 1                                                                                |    |              |
| <b>Type</b>               | BooleanParamDef                                                                  |    |              |
| <b>Default value</b>      | false                                                                            |    |              |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                          | X  | All Variants |
|                           | <b>Link time</b>                                                                 | -- |              |
|                           | <b>Post-build time</b>                                                           | -- |              |
| <b>Scope / Dependency</b> | scope: Module                                                                    |    |              |

|                           |                                            |    |              |
|---------------------------|--------------------------------------------|----|--------------|
| <b>SWS Item</b>           | <b>FrSm108 :</b>                           |    |              |
| <b>Name</b>               | FrSmVersionInfoApi {FRSM_VERSION_INFO_API} |    |              |
| <b>Description</b>        | Enables and disables the version info API  |    |              |
| <b>Multiplicity</b>       | 1                                          |    |              |
| <b>Type</b>               | BooleanParamDef                            |    |              |
| <b>Default value</b>      | false                                      |    |              |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                    | X  | All Variants |
|                           | <b>Link time</b>                           | -- |              |
|                           | <b>Post-build time</b>                     | -- |              |
| <b>Scope / Dependency</b> | scope: Module                              |    |              |

|                               |
|-------------------------------|
| <b>No Included Containers</b> |
|-------------------------------|

### 10.2.4 FrSmCluster

|                                 |                                                                |
|---------------------------------|----------------------------------------------------------------|
| <b>SWS Item</b>                 | <b>FrSm067 :</b>                                               |
| <b>Container Name</b>           | FrSmCluster{FrSmClusterConfiguration} [Multi Config Container] |
| <b>Description</b>              |                                                                |
| <b>Configuration Parameters</b> |                                                                |

|                           |                                                                                                                                         |   |                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---------------------|
| <b>SWS Item</b>           | <b>FrSm102 :</b>                                                                                                                        |   |                     |
| <b>Name</b>               | FrSmDurationT1 {FrSmDurationT1}                                                                                                         |   |                     |
| <b>Description</b>        | The duration of timer t1 as multiples of the cycle time of the FrSm main function. A value of 0 shall imply that the timer is not used. |   |                     |
| <b>Multiplicity</b>       | 1                                                                                                                                       |   |                     |
| <b>Type</b>               | IntegerParamDef                                                                                                                         |   |                     |
| <b>Default value</b>      | --                                                                                                                                      |   |                     |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                                                                 | X | VARIANT-PRE-COMPILE |
|                           | <b>Link time</b>                                                                                                                        | X | VARIANT-LINK-TIME   |

|                           |                                                             |   |                    |
|---------------------------|-------------------------------------------------------------|---|--------------------|
|                           | <b>Post-build time</b>                                      | X | VARIANT-POST-BUILD |
| <b>Scope / Dependency</b> | scope: Module<br>dependency: Fr/FrController/PMicroPerCycle |   |                    |

|                           |                                                                                                                                         |   |                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---------------------|
| <b>SWS Item</b>           | <b>FrSm89 :</b>                                                                                                                         |   |                     |
| <b>Name</b>               | FrSmDurationT2 {FrSmDurationT2}                                                                                                         |   |                     |
| <b>Description</b>        | The duration of timer t2 as multiples of the cycle time of the FrSm main function. A value of 0 shall imply that the timer is not used. |   |                     |
| <b>Multiplicity</b>       | 1                                                                                                                                       |   |                     |
| <b>Type</b>               | IntegerParamDef                                                                                                                         |   |                     |
| <b>Default value</b>      | --                                                                                                                                      |   |                     |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                                                                 | X | VARIANT-PRE-COMPILE |
|                           | <b>Link time</b>                                                                                                                        | X | VARIANT-LINK-TIME   |
|                           | <b>Post-build time</b>                                                                                                                  | X | VARIANT-POST-BUILD  |
| <b>Scope / Dependency</b> | scope: Module<br>dependency: Fr/FrController/PMicroPerCycle                                                                             |   |                     |

|                           |                                                                                                                                         |   |                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---|---------------------|
| <b>SWS Item</b>           | <b>FrSm120 :</b>                                                                                                                        |   |                     |
| <b>Name</b>               | FrSmDurationT3 {FrSmDurationT3}                                                                                                         |   |                     |
| <b>Description</b>        | The duration of timer t3 as multiples of the cycle time of the FrSm main function. A value of 0 shall imply that the timer is not used. |   |                     |
| <b>Multiplicity</b>       | 1                                                                                                                                       |   |                     |
| <b>Type</b>               | IntegerParamDef                                                                                                                         |   |                     |
| <b>Default value</b>      | --                                                                                                                                      |   |                     |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                                                                 | X | VARIANT-PRE-COMPILE |
|                           | <b>Link time</b>                                                                                                                        | X | VARIANT-LINK-TIME   |
|                           | <b>Post-build time</b>                                                                                                                  | X | VARIANT-POST-BUILD  |
| <b>Scope / Dependency</b> | scope: Module<br>dependency: Fr/FrController/PMicroPerCycle                                                                             |   |                     |

|                           |                                                                                                                           |   |                     |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------|---|---------------------|
| <b>SWS Item</b>           | <b>FrSm068 :</b>                                                                                                          |   |                     |
| <b>Name</b>               | FrSmIsColdstartEcu {FrSmIsColdstartECU}                                                                                   |   |                     |
| <b>Description</b>        | True: The ECU is a coldstart node for this FlexRay cluster. False: The ECU is no coldstart node for this FlexRay cluster. |   |                     |
| <b>Multiplicity</b>       | 1                                                                                                                         |   |                     |
| <b>Type</b>               | BooleanParamDef                                                                                                           |   |                     |
| <b>Default value</b>      | --                                                                                                                        |   |                     |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                                                   | X | VARIANT-PRE-COMPILE |
|                           | <b>Link time</b>                                                                                                          | X | VARIANT-LINK-TIME   |
|                           | <b>Post-build time</b>                                                                                                    | X | VARIANT-POST-BUILD  |
| <b>Scope / Dependency</b> | scope: Module                                                                                                             |   |                     |

|                           |                                                                                                                        |   |                     |
|---------------------------|------------------------------------------------------------------------------------------------------------------------|---|---------------------|
| <b>SWS Item</b>           | <b>FrSm109 :</b>                                                                                                       |   |                     |
| <b>Name</b>               | FrSmIsWakeupEcu {FrSmIsWakeupECU}                                                                                      |   |                     |
| <b>Description</b>        | True: FrSm shall perform a wakeup for this cluster. False: FrSm shall never perform a wakeup for this FlexRay cluster. |   |                     |
| <b>Multiplicity</b>       | 1                                                                                                                      |   |                     |
| <b>Type</b>               | BooleanParamDef                                                                                                        |   |                     |
| <b>Default value</b>      | --                                                                                                                     |   |                     |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                                                | X | VARIANT-PRE-COMPILE |
|                           | <b>Link time</b>                                                                                                       | X | VARIANT-LINK-TIME   |
|                           | <b>Post-build time</b>                                                                                                 | X | VARIANT-POST-BUILD  |
| <b>Scope / Dependency</b> | scope: Module                                                                                                          |   |                     |

|                 |                                                           |  |  |
|-----------------|-----------------------------------------------------------|--|--|
| <b>SWS Item</b> | <b>FrSm115 :</b>                                          |  |  |
| <b>Name</b>     | FrSmMainFunctionCycleTime {FRSM_MAIN_FUNCTION_CYCLE_TIME} |  |  |

|                           |                                                                                      |    |                                       |
|---------------------------|--------------------------------------------------------------------------------------|----|---------------------------------------|
| <b>Description</b>        | This parameter defines the cycle time of the periodic calling of FrSm main function. |    |                                       |
| <b>Multiplicity</b>       | 1                                                                                    |    |                                       |
| <b>Type</b>               | FloatParamDef                                                                        |    |                                       |
| <b>Default value</b>      | --                                                                                   |    |                                       |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                              | X  | VARIANT-PRE-COMPILE                   |
|                           | <b>Link time</b>                                                                     | X  | VARIANT-LINK-TIME, VARIANT-POST-BUILD |
|                           | <b>Post-build time</b>                                                               | -- |                                       |
| <b>Scope / Dependency</b> | scope: Module                                                                        |    |                                       |

|                           |                                                                                                                                                                                                                    |    |              |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------------|
| <b>SWS Item</b>           | <b>FrSm242 :</b>                                                                                                                                                                                                   |    |              |
| <b>Name</b>               | FrSmRxPduInit                                                                                                                                                                                                      |    |              |
| <b>Description</b>        | This parameter shall configure the initialize parameter for the configured RX PDU group, when the FrSM module references the API Com_IpduGroupStart in the transition from no communication to full communication. |    |              |
| <b>Multiplicity</b>       | 1                                                                                                                                                                                                                  |    |              |
| <b>Type</b>               | BooleanParamDef                                                                                                                                                                                                    |    |              |
| <b>Default value</b>      | --                                                                                                                                                                                                                 |    |              |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                                                                                                                                            | X  | All Variants |
|                           | <b>Link time</b>                                                                                                                                                                                                   | -- |              |
|                           | <b>Post-build time</b>                                                                                                                                                                                             | -- |              |
| <b>Scope / Dependency</b> | scope: Module                                                                                                                                                                                                      |    |              |

|                           |                                                                                                      |   |                     |
|---------------------------|------------------------------------------------------------------------------------------------------|---|---------------------|
| <b>SWS Item</b>           | <b>FrSm069 :</b>                                                                                     |   |                     |
| <b>Name</b>               | FrSmStartupRepetitions {FrSmStartupRepetitions}                                                      |   |                     |
| <b>Description</b>        | The number of times an ECU may repeat the startup procedure for a FlexRay cluster.                   |   |                     |
| <b>Multiplicity</b>       | 0..1                                                                                                 |   |                     |
| <b>Type</b>               | IntegerParamDef                                                                                      |   |                     |
| <b>Default value</b>      | --                                                                                                   |   |                     |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                              | X | VARIANT-PRE-COMPILE |
|                           | <b>Link time</b>                                                                                     | X | VARIANT-LINK-TIME   |
|                           | <b>Post-build time</b>                                                                               | X | VARIANT-POST-BUILD  |
| <b>Scope / Dependency</b> | scope: Module<br>dependency: This value must be greater or equal to FrSmStartupRepetitionsWithWakeup |   |                     |

|                           |                                                                                                       |   |                     |
|---------------------------|-------------------------------------------------------------------------------------------------------|---|---------------------|
| <b>SWS Item</b>           | <b>FrSm094 :</b>                                                                                      |   |                     |
| <b>Name</b>               | FrSmStartupRepetitionsWithWakeup {FrSmStartupRepetitionsWithWakeup}                                   |   |                     |
| <b>Description</b>        | The number of times an ECU may repeat the startup procedure including a wakeup for a FlexRay cluster. |   |                     |
| <b>Multiplicity</b>       | 0..1                                                                                                  |   |                     |
| <b>Type</b>               | IntegerParamDef                                                                                       |   |                     |
| <b>Default value</b>      | --                                                                                                    |   |                     |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                               | X | VARIANT-PRE-COMPILE |
|                           | <b>Link time</b>                                                                                      | X | VARIANT-LINK-TIME   |
|                           | <b>Post-build time</b>                                                                                | X | VARIANT-POST-BUILD  |
| <b>Scope / Dependency</b> | scope: Module                                                                                         |   |                     |

|                    |                                                                                                                                  |  |  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------|--|--|
| <b>SWS Item</b>    | <b>FrSm243 :</b>                                                                                                                 |  |  |
| <b>Name</b>        | FrSmTxPduInit                                                                                                                    |  |  |
| <b>Description</b> | This parameter shall configure the initialize parameter for the configured TX PDU group, when the FrSM module references the API |  |  |

|                           |                                                                                   |    |              |
|---------------------------|-----------------------------------------------------------------------------------|----|--------------|
|                           | Com_IpduGroupStart in the transition from no communication to full communication. |    |              |
| <b>Multiplicity</b>       | 1                                                                                 |    |              |
| <b>Type</b>               | BooleanParamDef                                                                   |    |              |
| <b>Default value</b>      | --                                                                                |    |              |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                           | X  | All Variants |
|                           | <b>Link time</b>                                                                  | -- |              |
|                           | <b>Post-build time</b>                                                            | -- |              |
| <b>Scope / Dependency</b> | scope: Module                                                                     |    |              |

|                           |                                                                                                                                                                                                                |    |                                       |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---------------------------------------|
| <b>SWS Item</b>           | <b>FrSm116 :</b>                                                                                                                                                                                               |    |                                       |
| <b>Name</b>               | FrSmFrIfClusterRef {FrIfClusterRef}                                                                                                                                                                            |    |                                       |
| <b>Description</b>        | References the cluster configuration in the FlexRay Interface configuration. Note that the assigned controllers and transceivers are defined in the FrIf configuration and can be accessed via this reference. |    |                                       |
| <b>Multiplicity</b>       | 1                                                                                                                                                                                                              |    |                                       |
| <b>Type</b>               | Reference to FrIfCluster                                                                                                                                                                                       |    |                                       |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                                                                                                                                        | X  | VARIANT-PRE-COMPILE                   |
|                           | <b>Link time</b>                                                                                                                                                                                               | X  | VARIANT-LINK-TIME, VARIANT-POST-BUILD |
|                           | <b>Post-build time</b>                                                                                                                                                                                         | -- |                                       |
| <b>Scope / Dependency</b> | scope: module                                                                                                                                                                                                  |    |                                       |

|                           |                                                                                                                                            |   |                     |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------|
| <b>SWS Item</b>           | <b>FrSm070 :</b>                                                                                                                           |   |                     |
| <b>Name</b>               | FrSmNetworkHandleRef {FrSmNetworkHandle}                                                                                                   |   |                     |
| <b>Description</b>        | Reference to the unique handle to identify one certain FlexRay network correspond to one of the network handles of the ComM configuration. |   |                     |
| <b>Multiplicity</b>       | 1                                                                                                                                          |   |                     |
| <b>Type</b>               | Reference to ComMChannel                                                                                                                   |   |                     |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                                                                                    | X | VARIANT-PRE-COMPILE |
|                           | <b>Link time</b>                                                                                                                           | X | VARIANT-LINK-TIME   |
|                           | <b>Post-build time</b>                                                                                                                     | X | VARIANT-POST-BUILD  |
| <b>Scope / Dependency</b> | scope: Module                                                                                                                              |   |                     |

|                           |                                                                        |    |                                       |
|---------------------------|------------------------------------------------------------------------|----|---------------------------------------|
| <b>SWS Item</b>           | <b>FrSm088 :</b>                                                       |    |                                       |
| <b>Name</b>               | FrSmRxIPduGroupRef {RxIpduGroupId}                                     |    |                                       |
| <b>Description</b>        | ID of the RX-IPDU group that shall be started and stopped by the FrSm. |    |                                       |
| <b>Multiplicity</b>       | 1                                                                      |    |                                       |
| <b>Type</b>               | Reference to ComIPduGroup                                              |    |                                       |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                | X  | VARIANT-PRE-COMPILE                   |
|                           | <b>Link time</b>                                                       | X  | VARIANT-LINK-TIME, VARIANT-POST-BUILD |
|                           | <b>Post-build time</b>                                                 | -- |                                       |
| <b>Scope / Dependency</b> | scope: Module                                                          |    |                                       |

|                           |                                                                        |    |                                       |
|---------------------------|------------------------------------------------------------------------|----|---------------------------------------|
| <b>SWS Item</b>           | <b>FrSm101 :</b>                                                       |    |                                       |
| <b>Name</b>               | FrSmTxIPduGroupRef {TxIpduGroupId}                                     |    |                                       |
| <b>Description</b>        | ID of the TX-IPDU group that shall be started and stopped by the FrSm. |    |                                       |
| <b>Multiplicity</b>       | 1                                                                      |    |                                       |
| <b>Type</b>               | Reference to ComIPduGroup                                              |    |                                       |
| <b>ConfigurationClass</b> | <b>Pre-compile time</b>                                                | X  | VARIANT-PRE-COMPILE                   |
|                           | <b>Link time</b>                                                       | X  | VARIANT-LINK-TIME, VARIANT-POST-BUILD |
|                           | <b>Post-build time</b>                                                 | -- |                                       |
| <b>Scope / Dependency</b> | scope: Module                                                          |    |                                       |

|                               |
|-------------------------------|
| <i>No Included Containers</i> |
|-------------------------------|

## 10.3 Published Information

Published information contains data defined by the implementer of the SW module that does not change when the module is adapted (i.e. configured) to the actual HW/SW environment. It thus contains version and manufacturer information.

The standard common published information like

```
vendorId (<Module>_VENDOR_ID),  
moduleId (<Module>_MODULE_ID),  
arMajorVersion (<Module>_AR_MAJOR_VERSION),  
arMinorVersion (<Module>_AR_MINOR_VERSION),  
arPatchVersion (<Module>_AR_PATCH_VERSION),  
swMajorVersion (<Module>_SW_MAJOR_VERSION),  
swMinorVersion (<Module>_SW_MINOR_VERSION),  
swPatchVersion (<Module>_SW_PATCH_VERSION),  
vendorApiInfix (<Module>_VENDOR_API_INFIX)
```

is provided in the BSW Module Description Template (see [11] Figure 4.1 and Figure 7.1).

Additional published parameters are listed below if applicable for this module.



## 11 Changes during SWS Improvements by Technical Office

### 11.1 Deleted SWS Items

None

### 11.2 Replaced SWS Items

None

### 11.3 Changed SWS Items

None

### 11.4 Added SWS Items

| <b>SWS Item</b>         | <b>Rationale</b>                                |
|-------------------------|-------------------------------------------------|
| <a href="#">FrSM095</a> | UML model linking of imported types             |
| <a href="#">FrSM096</a> | UML model linking of mandatory interfaces       |
| <a href="#">FrSM097</a> | UML model linking of optional interfaces        |
| <a href="#">FrSM098</a> | Definition of configuration variant needs an ID |
| <a href="#">FrSM099</a> | Definition of configuration variant needs an ID |
| <a href="#">FrSM100</a> | Definition of configuration variant needs an ID |

## 12 Changes for Revision 3.0.7

### 12.1 Deleted SWS Items

| <i>SWS Item</i> | <i>Rationale</i>                 |
|-----------------|----------------------------------|
| FrSm078         | Supervision is now done using t3 |

### 12.2 Replaced SWS Items

None

### 12.3 Changed SWS Items

| <i>SWS Item</i>         | <i>Rationale</i>                                             |
|-------------------------|--------------------------------------------------------------|
| <a href="#">FrSm037</a> | Removed part of requirement that was redundant to chapter 10 |
| <a href="#">FrSm103</a> | Removed part of requirement that was redundant to chapter 10 |

### 12.4 Added SWS Items

| <i>SWS Item</i>         | <i>Rationale</i>          |
|-------------------------|---------------------------|
| <a href="#">FrSm120</a> | supervision with timer T3 |
| <a href="#">FrSm121</a> | supervision with timer T3 |
| <a href="#">FrSm122</a> | supervision with timer T3 |
| <a href="#">FrSm123</a> | supervision with timer T3 |
| <a href="#">FrSm124</a> | supervision with timer T3 |
| <a href="#">FrSm125</a> | supervision with timer T3 |