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Table of Contents

1 Introduction and Functional Overview 6
1.1 Functional Safety Communication Protocol . . . 6
1.1.1 Functional Safety for Non-Segmented SAE J1939 Messages . . . 6
1.1.1.1 Example 1 . . . 8
1.1.2 SAE J1939 Functional Safety Protocol BSW Module . . . 8
1.2 SAE J1939 Terminology . . . 8
2 Acronyms and Abbreviations 10
3 Related Documentation 12
3.1 Input Documents & Related Standards and Norms . . . 12
3.2 Related Specification . . . 13
4 Constraints and Assumptions 14
4.1 Limitations . . . 14
4.2 Applicability to Car Domains . . . 14
5 Dependencies to Other Modules 15
5.1 File Structure . . . 15
5.1.1 Code File Structure . . . 15
5.1.2 Header File Structure . . . 15
6 Requirements Tracing 16
7 Functional Specification 17
7.1 Overview . . . 17
7.2 Module Handling . . . 19
7.2.1 Initialization . . . 19
7.2.2 Timing Related Functionality . . . 19
7.3 Message Handling . . . 20
7.3.1 Message Transmission . . . 20
7.3.2 Message Reception . . . 21
7.3.3 Timing Supervision . . . 23
7.4 Error Classification . . . 23
7.4.1 Development Errors . . . 24
7.4.2 Runtime Errors . . . 24
7.4.3 Production Errors . . . 24
7.5 Security Events . . . 25
8 API Specification 26
8.1 API Parameter Checking . . . 26
8.2 Imported Types . . . 26
8.3 Type Definitions . . . 27
8.3.1 J1939Fscp_ConfigType . . . 27
8.4 Function Definitions . . . 27

8.4.1 J1939Fscp_Init . . . 27
8.4.2 J1939Fscp_DeInit . . . 28
8.4.3 J1939Fscp_Transmit . . . 29
8.4.4 J1939Fscp_RxIndication . . . 30
8.4.5 J1939Fscp_TxConfirmation . . . 30
8.4.6 J1939Fscp_SetTxSafetyHandling . . . 31
8.4.7 J1939Fscp_SetRxSafetyHandling . . . 32
8.5 Scheduled Functions . . . 32
8.5.1 J1939Fscp_MainFunction . . . 32
8.6 Expected Interfaces . . . 33
8.6.1 Mandatory Interfaces . . . 33
8.6.2 Optional Interfaces . . . 33
9 Sequence Diagrams 35
9.1 Message Transmission . . . 35
9.2 Message Reception . . . 36
9.3 Signal Group Transformation . . . 36
10 Configuration Specification 37
10.1 Containers and configuration parameters . . . 37
10.1.1 J1939Fscp . . . 40
10.1.2 J1939FscpGeneral . . . 40
10.1.3 J1939FscpConfigSet . . . 42
10.1.4 J1939FscpRxChannel . . . 42
10.1.5 J1939FscpRxPg . . . 43
10.1.6 J1939FscpSdgRxPdu . . . 45
10.1.7 J1939FscpSdmRxPdu . . . 46
10.1.8 J1939FscpShmRxPdu . . . 48
10.1.9 J1939FscpTxChannel . . . 49
10.1.10 J1939FscpTxPg . . . 50
10.1.11 J1939FscpSdgTxPdu . . . 52
10.1.12 J1939FscpSdmTxPdu . . . 53
10.1.13 J1939FscpShmTxPdu . . . 55
10.2 Configuration Constraints . . . 56
A Not applicable requirements 58
B Change History of AUTOSAR Traceable Items 59
B.1 Traceable Item History of this Document According to AUTOSAR Release R26-11 . . . 59
B.1.1 Added Specification Items in R26-11 . . . 59
B.1.2 Changed Specification Items in R26-11 . . . 59
B.1.3 Deleted Specification Items in R26-11 . . . 59
B.1.4 Added Constraints in R26-11 . . . 59
B.1.5 Changed Constraints in R26-11 . . . 59
B.1.6 Deleted Constraints in R26-11 . . . 59

B.2 Traceable Item History of this Document According to AUTOSAR Release R25-11 60
B.2.1 Added Specification Items in R25-11 60
B.2.2 Changed Specification Items in R25-11 60
B.2.3 Deleted Specification Items in R25-11 60
B.2.4 Added Constraints in R25-11 60
B.2.5 Changed Constraints in R25-11 60
B.2.6 Deleted Constraints in R25-11 60
B.3 Traceable Item History of this Document According to AUTOSAR Release R24-11 60
B.3.1 Added Specification Items in R24-11 60
B.3.2 Changed Specification Items in R24-11 61
B.3.3 Deleted Specification Items in R24-11 61
B.3.4 Added Constraints in R24-11 61
B.3.5 Changed Constraints in R24-11 61
B.3.6 Deleted Constraints in R24-11 62

1 Introduction and Functional Overview

This specification describes the functionality, API, and the configuration of the AUTOSAR Basic Software Module SAE J1939 Functional Safety Communication Protocol.

This module provides services for initialization, Safety Data Group (SDG) operations, Safety Header Message/Safety Data Message processing, time supervision between producer and consumer application SWCs, and error management per SAE J1939-76 specification.

Please note: Throughout this specification, the abbreviation SDG refers to an SAE J1939-76 Safety Data Group in the remainder of this document, please don't confuse this abbreviation with the special data group described in the [1, CP TPS System Template].

The SAE J1939 Functional Safety Communication Protocol belongs to the service layer and its location is shown in Figure 1.1.

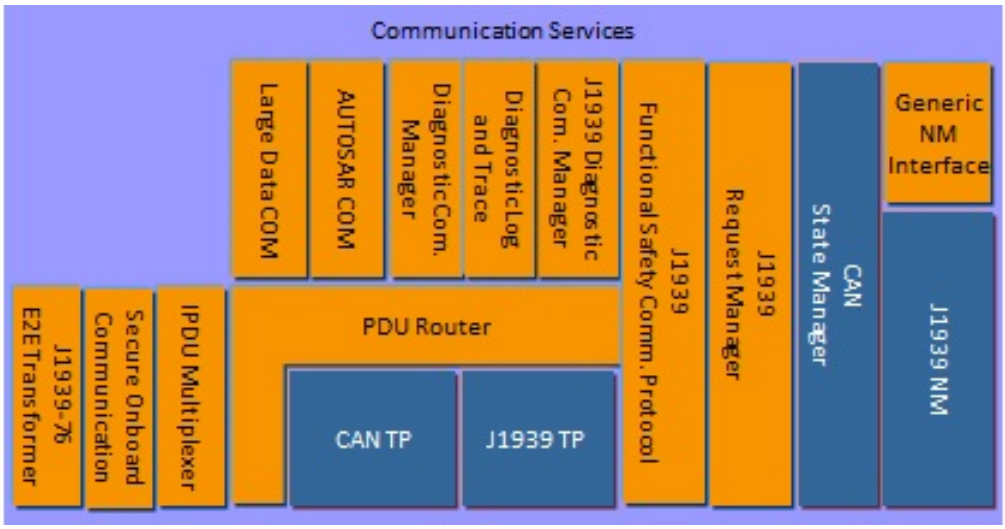


Figure 1.1: J1939 Functional Safety Communication Protocol

The E2E PROFILE_76 has been introduced for E2E protection of J1939 messages. A description of this new profile is provided in the E2E Protocol.

1.1 Functional Safety Communication Protocol

1.1.1 Functional Safety for Non-Segmented SAE J1939 Messages

SAE J1939-76 defines a message that allows applications to satisfy functional safety requirements depending on the level of functional safety needed. This message is the Safety Header Message (SHM, PGN = 0x0E00), and it is paired with an ordinary SAE J1939 message that requires functional safety coverage, referred to as the Safety Data Message (SDM). The SDM can have at maximum 8 bytes of data. The

SHM includes the sequence number, CRC, and enough information from the CAN ID to associate it with the SDM. Together, the SHM and SDM are referred to as the Safety Data Group (SDG).

The transmission of the SHM precedes the transmission of the associated SDM. The SDM must be transmitted within a specified duration (SRVT) of the transmission of the associated SHM. Network nodes that receive the SDG will validate the data in the SHM before using the data in the SDM. Network nodes that are not interested in checking the functional safety for the SDM can ignore the SHM and still process the SDM.

The SDM message corresponds to the J1939ProtectedIPdu in the [1, CP TPS System Template], which contains the payload of the specific PGN that requires protection. The ISignalIPdu linked to a J1939ProtectedIPdu in the [1, CP TPS System Template] corresponds to the J1939-76 SDG, and contains both, the parts of the SHM provided by the upper layer of SAE J1939 Functional Safety Communication Protocol (more specifically: the E2E protection layers) and the payload of the SDM provided by the application. After derivation, the SDG is represented by a ComIPdu that is referenced by J1939FscpSdgRxPdu.J1939FscpSdgRxPduRef or J1939FscpSdgTxPdu.J1939FscpSdgTxPduRef via a global Pdu.

Figure 1.2 shows the layout of the ISignalIPdu or ComIPdu, and how it maps to the SDG.

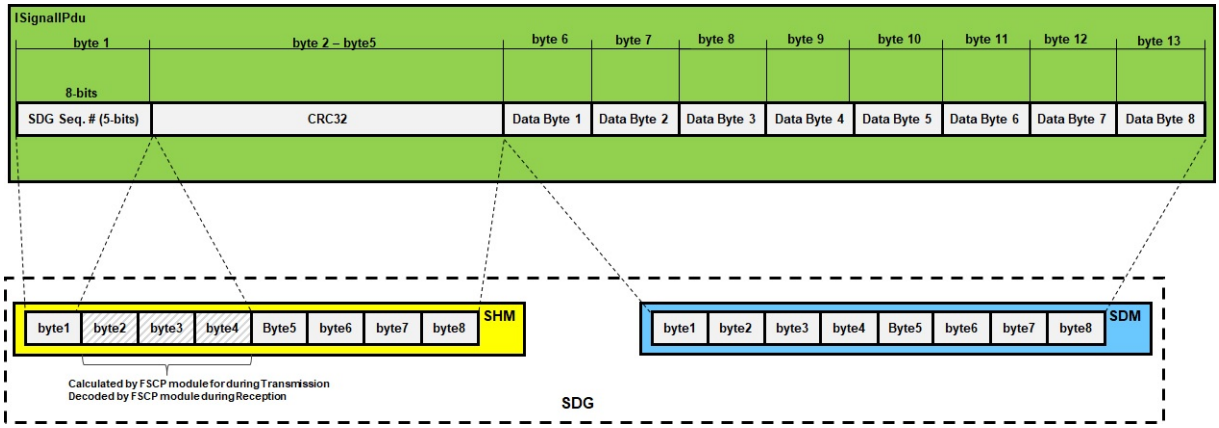


Figure 1.2: ComIPdu Layout

PGN protection is performed by using the E2E Transformer, which in the case of CAN signals requires the introduction of ISignalGroups to represent SAE J1939 messages. Additionally, the COM Based Transformer is required for serialization which is the first in the transformation chain. The following is an example of how the I-PDU layout of J1939 PG EEC1 must be modeled for E2E protection to meet the SAE J1939-76 specification.

See Chapter 1.1.1.1 for an example.

The PGN must be modeled as an ISignalGroup which is mapped to a data element of a Sender-Receiver interface of data type implementation record. In this case, the transformer chain must follow this order:

1. COM Based Transformer
2. E2E Transformer

Please note that CRC calculation is performed by the CRC Library, which is called by the E2E Library, which in turn is used by the E2E Transformer. For SAE J1939-76, CRC calculation uses the whole message (8 bytes or less).

1.1.1.1 Example 1

The PGN F004 (EEC1) defines the following signals:

Byte #	SP Label	SP Length (bits)
1	Engine Torque Mode	4
	Actual Engine - Percent Torque (Fractional)	4
2	Driver's Demand Engine - Percent Torque	8
3	Actual Engine - Percent Torque	8
4-5	Engine Speed	16
6	Source Address of Controlling Device for Engine Control	8
7	Engine Starter Mode	4
	reserved	4
8	Engine Demand - Percent Torque	8

Table 1.1: EEC1 IPdu Signal Layout

1.1.2 SAE J1939 Functional Safety Protocol BSW Module

The SAE J1939 Functional Safety Communication Protocol handles transmitting and receiving SDGs (both SHMs and SDMs). For transmitted messages that require functional safety protection, the SAE J1939 Functional Safety Communication Protocol determines the values of the data fields in the SHM for the associated SDM. For received SDGs, the SAE J1939 Functional Safety Communication Protocol validates the data fields in the SHM of a received SDG and reports the status to the data fields in the SDM. In other words, the module splits the SDG during transmission and combines the SHM and SDM during reception.

1.2 SAE J1939 Terminology

The terminology of J1939 differs noticeably from the usual AUTOSAR terminology. For consistency reasons, this introduction used the terms of the J1939 specification, while the remainder of this specification will use terms that are more common within AUTOSAR:

- 'I-PDU' replaces 'parameter group'

- ‘ISignalIPdu’ describes the data of the SDG (SHM + SDM)
- ‘J1939ProtectedIPdu’ describes the data of the SDM
- ‘ISignalGroup’ describes the set of parameters that need to be protected
- ‘ISignal’ describes a single parameter

2 Acronyms and Abbreviations

The glossary below includes terms and acronyms and abbreviations relevant to the SAE J1939 Functional Safety Communication Protocol module that are not included in the [2, AUTOSAR Glossary].

Acronym / Abbreviation	Description
BSW	Basic Software (module)
CAN ID	CAN identifier according to [3, ISO 11898] with 11 or 29 bits, the latter being defined by [4, SAE J1939-21] to consist of Priority, EDP, DP, PDUF, PDUS/DA, and SA.
CanIf	CAN Interface, see [5, CP SWS CAN Interface]
COM	Communication module, see [6, CP SWS COM]
ComXf	COM Based Transformer, see [7, CP SWS COM Based Transformer]
CRC	Cyclic Redundancy Check, a very common check sum
CrcLib	CRC Library, see [8, CP SWS CRC Library]
DA	Destination Address, part of the 29 bit CAN identifier of SAE J1939 messages
DEM	Diagnostic Event Manager, stores DTCs containing diagnostic events and test results, and associated information, see [9, CP SWS Diagnostic Event Manager]
DET	Default Error Tracer, supports development and runtime error reporting, see [10, CP SWS Default Error Tracer]
DP	Data Page, the most significant bit (MSB) of the 18 bit PGN
E2E	End-to-End protection, a safety concept which can be used to achieve higher (A)SIL levels
E2ELib	E2E Library, see [11, CP SWS E2E Library]
E2EProtocol	E2E Protocol, see [12, FO PRS E2E Protocol]
E2EXf	E2E Transformer, see [13, CP SWS E2E Transformer]
EcuM	ECU State Manager, see [14, CP SWS ECU State Manager]
EDP	Extended Data Page, the second bit (after MSB) of the 18 bit PGN
J1939Fscp	SAE J1939 Functional Safety Communication Protocol (this module)
MetaData	Meta data transferred alongside a PDU, consisting of a set of meta data items
MetaDataItem	A single item of meta data of defined type and size
Parameter	Parameter, SAE J1939 term for a signal, including defined scale, limits, offset, and physical unit
Parameter Group	A Parameter Group is a message of the SAE J1939 application layer. Each Parameter Group contains several Parameters (signals), and is uniquely identified by the PGN.
PDU	Protocol Data Unit, a message transferred between the layers of the AUTOSAR stack, also known as I-PDU
PDU1	J1939 PDU Type 1, this kind of PG can be sent to a specific destination address
PDU2	J1939 PDU Type 2, this kind of PG can only be sent as broadcast
PDUF	PDU Format, the middle byte of the 18 bit PGN which identifies the PG and determines the layout (PDU1/PDU2) of the PGN
PduR	PDU Router, see [15, CP SWS PDU Router]
PDUS	PDU Specific, the lower byte of the 18 bit PGN which further identifies PDU2 PG which cannot have a destination address
PG	Parameter Group, SAE J1939 term for a specific message layout
PGN	Parameter Group Number, unique identifier (18 bits: EDP, DP, PDUF, PDUS) of an SAE J1939 Parameter Group that is contained in the payload of many J1939 protocol messages and in the 29bit CAN identifier of SAE J1939 messages.
PRI	Priority, part of the 29 bit identifier of SAE J1939 messages

▽

△

Acronym / Abbreviation	Description
RTE	AUTOSAR Runtime Environment, handles application SW-Cs and interfaces between basic software and the application, see [16, SWS RTE]
SA	Source Address, part of the 29 bit identifier of SAE J1939 messages
SAE	Society of Automotive Engineers (in charge of J1939 specification)
SAE J1939	Serial control and communications standard for heavy duty vehicle networks created by the SAE, see [17, SAE J1939]
SAE J1939-21	Data link layer for CAN 2.0 created by the SAE, see [4, SAE J1939-21]
SAE J1939-76	Functional safety communications protocol layer created by the SAE, see [18, SAE J1939-76]
SchM	Basic Software Schedule Manager, part of the RTE
SCT	Safety Cycle Time, which passes between two instances of the same SDG according to SAE J1939-76
SDG	SAE J1939-76 Safety Data Group, consisting of an SHM followed by an SDM
SDM	SAE J1939-76 Safety Data Message, part of an SDG
SHM	SAE J1939-76 Safety Header Message, part of an SDG
SNA	Signal Not Available, all bits set to 1 in SAE J1939 PGs/Parameters
SPN	Suspect Parameter Number, unique identifier of an SAE J1939 Parameter
SRVT	Safety-Relevant Validation Time, which passes between the SHM and the SDM of an SDG according to SAE J1939-76
SW-C	AUTOSAR Software Component (of the Application)

Table 2.1: Acronyms and Abbreviations

3 Related Documentation

3.1 Input Documents & Related Standards and Norms

[1] System Template
AUTOSAR_CP_TPS_SystemTemplate

[2] Glossary
AUTOSAR_FO_TR_Glossary

[3] ISO 11898-1:2015 – Road vehicles – Controller area network (CAN)

[4] SAE J1939-21 Data Link Layer

[5] Specification of CAN Interface
AUTOSAR_CP_SWS_CANInterface

[6] Specification of Communication
AUTOSAR_CP_SWS_COM

[7] Specification of COM Based Transformer
AUTOSAR_CP_SWS_COMBasedTransformer

[8] Specification of CRC Library
AUTOSAR_CP_SWS_CRCLibrary

[9] Specification of Diagnostic Event Manager
AUTOSAR_CP_SWS_DiagnosticEventManager

[10] Specification of Default Error Tracer
AUTOSAR_CP_SWS_DefaultErrorTracer

[11] Specification of SW-C End-to-End Communication Protection Library
AUTOSAR_CP_SWS_E2ELibrary

[12] E2E Protocol Specification
AUTOSAR_FO_PRS_E2EProtocol

[13] Specification of Module E2E Transformer
AUTOSAR_CP_SWS_E2ETransformer

[14] Specification of ECU State Manager
AUTOSAR_CP_SWS_ECUStateManager

[15] Specification of PDU Router
AUTOSAR_CP_SWS_PDURouter

[16] Specification of RTE Software
AUTOSAR_CP_SWS_RTE

[17] SAE J1939 – Serial Control and Communications Heavy Duty Vehicle Network

[18] SAE J1939-76 Functional Safety Communications Protocol

[19] General Specification of Basic Software Modules
AUTOSAR_CP_SWS_BSWGeneral

[20] Layered Software Architecture
AUTOSAR_CP_EXP_LayeredSoftwareArchitecture

[21] General Requirements on Basic Software Modules
AUTOSAR_CP_RS_BSWGeneral

[22] Specification of Communication Stack Types
AUTOSAR_CP_SWS_CommunicationStackTypes

[23] Specification of Standard Types
AUTOSAR_CP_SWS_StandardTypes

3.2 Related Specification

AUTOSAR provides a General Specification on Basic Software modules [19, CP SWS BSW General], which is also valid for SAE J1939 Functional Safety Communication Protocol.

Thus, the specification [19, CP SWS BSW General] shall be considered as additional and required specification for SAE J1939 Functional Safety Communication Protocol.

4 Constraints and Assumptions

4.1 Limitations

The SAE J1939 Functional Safety Communication Protocol is specified in accordance with SAE J1939-76, which is able to satisfy the functional safety standards IEC 61508-2:2010 (up to SIL 3) and the industrial safety communication standard IEC 61784-3:2016. It is up to the system designer to perform the analysis and determine if the SAE J1939 Functional Safety Communication Protocol, the E2E protection layers and their integration into the AUTOSAR architecture satisfy the functional safety goals. Some limitations are described in sections 4.3 “Limitations” and 4.4 “SAE J1939 PG Constraints” of SAE J1939-76.

Please note that due to the architecture of AUTOSAR, the SAE J1939 Functional Safety Communication Protocol can only detect a subset of the IEC 61784-3 Communication Errors listed in table A1 in appendix A.1 “Qualitative Analysis” of SAE J1939-76. The majority of the communication errors are detected by the E2E protection layers, and only these can be reported directly to the application alongside the data as overlayed errors.

The following communication errors are detected directly by the SAE J1939 Functional Safety Communication Protocol:

Unacceptable Delay is detected only for the SRVT, and is reported via runtime error J1939FSCP_E_TIMEOUT_RX_SRVT. The SCT has to be measured and supervised directly by the application.

Addressing may be reported via runtime errors J1939FSCP_E_UNKNOWN_PGN, J1939FSCP_E_NO_SDM_RECEIVED, or J1939FSCP_E_NO_SHM_RECEIVED, or may result in silently dropping a message, depending on the actually observed problem.

An AUTOSAR ECU may also entirely ignore the SHM by configuring the SDM as ordinary communication message.

4.2 Applicability to Car Domains

J1939 is developed by the SAE as a standard for heavy-duty on-highway, farming, and construction vehicles. It is not used in passenger cars.

5 Dependencies to Other Modules

The [20, EXP Layered Software Architecture] shows an overview of the neighboring modules of the SAE J1939 Functional Safety Communication Protocol.

The SAE J1939 Functional Safety Communication Protocol module (J1939Fscp) has direct interfaces and/or configuration dependencies towards the PDU Router (PduR) and the Default Error Tracer (DET). Besides these, there are also indirect dependencies towards the Communication (COM) and the CAN Interface (CanIf).

The SAE J1939 Functional Safety Communication Protocol module includes header files of the PDU Router and the Default Error Tracer.

5.1 File Structure

5.1.1 Code File Structure

For details, refer to [19, SWS BSW General] 5.1.6 *"Code file structure"*.

5.1.2 Header File Structure

For details, refer to [19, SWS BSW General] 5.1.7 *"Header file structure"*.

6 Requirements Tracing

The following tables reference the requirements specified in [21, RS BSW General] and links to the fulfillment of these.

Requirement	Description	Satisfied by
[SRS_BSW_00101]	The Basic Software Module shall be able to initialize variables and hardware in a separate initialization function	[CP_SWS_J1939Fscp_00006] [CP_SWS_J1939Fscp_00008]
[SRS_BSW_00327]	Error values naming convention	[CP_SWS_J1939Fscp_90012] [CP_SWS_J1939Fscp_90013]
[SRS_BSW_00336]	Basic SW module shall be able to shutdown	[CP_SWS_J1939Fscp_00007]
[SRS_BSW_00337]	Classification of development errors	[CP_SWS_J1939Fscp_90012]
[SRS_BSW_00385]	List possible error notifications	[CP_SWS_J1939Fscp_90012] [CP_SWS_J1939Fscp_90013]
[SRS_BSW_00386]	The BSW shall specify the configuration and conditions for detecting an error	[CP_SWS_J1939Fscp_00002] [CP_SWS_J1939Fscp_00027]
[SRS_BSW_00441]	Naming convention for type, macro and function	[CP_SWS_J1939Fscp_90012] [CP_SWS_J1939Fscp_90013]
[SRS_BSW_00452]	Classification of runtime errors	[CP_SWS_J1939Fscp_90013]
[SRS_BSW_00478]	Timing limits of main functions	[CP_SWS_J1939Fscp_00001] [CP_SWS_J1939Fscp_00013]

Table 6.1: Requirements Tracing

7 Functional Specification

This chapter defines the behavior of the J1939 Functional Safety Communication Protocol module (J1939Fscp). The API of the module is defined in Chapter 8, while the configuration is defined in Chapter 10.

7.1 Overview

The J1939Fscp is responsible for processing the transmission request from the application (through COM and PduR) of the SDG (derived from an ISignalIPdu), extract the SHM (automatically derived) and SDM (derived from the J1939ProtectedIPdu), and ensure these PDUs are transmitted within the correct time separation (SRVT) between SHM and SDM, per SAE J1939-76. The transmission path is shown in Figure 7.1.

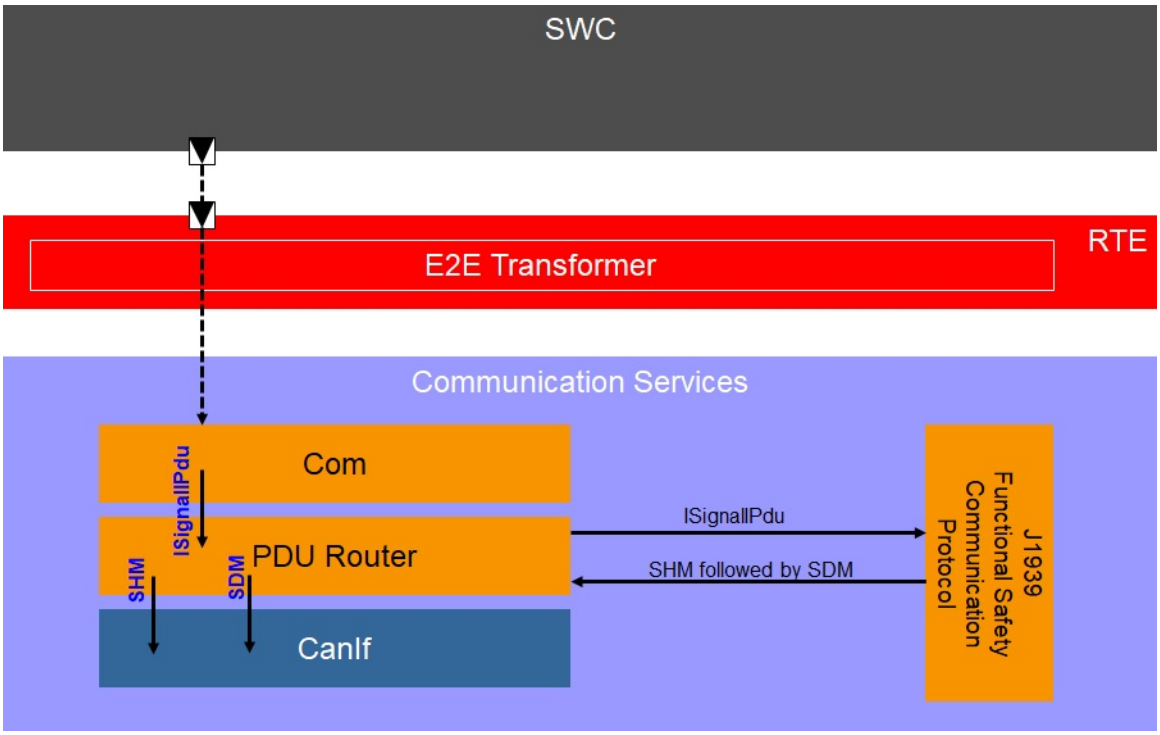


Figure 7.1: Transmission Path for SDG Processing

Prior the transmission of the SHM and SDM messages, E2E protection calculations are performed by the E2E Library. The J1939Fscp uses the result from the E2E Library and makes sure the SHM is properly formatted and passed to the lower layers.

Similarly, on the reception side, the J1939Fscp receives the SHM and SDM, assembles the SDG, and passes it to the upper layers for further processing. The reception path is shown in Figure 7.2.

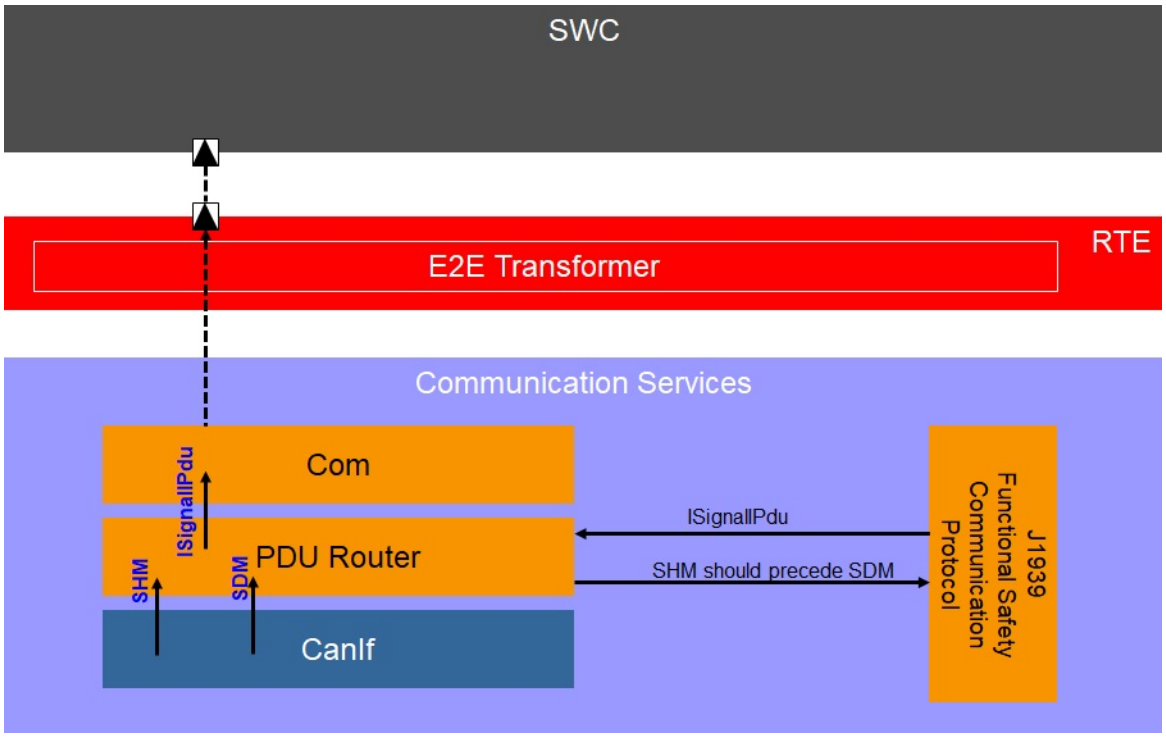


Figure 7.2: Reception Path for SDG Processing

The SDG exchanged with the upper layers contains the protection data for the SHM followed by the PGN data for the the SDM (see Figure 1.2). The protection data contains exactly 5 bytes, consisting of 1 byte for the sequence number followed by 4 bytes of the CRC in little endian byte order. The PGN data contains the data provided by the application, and may consist of 1 to 8 bytes.

[CP_SWS_J1939Fscp_00003] SRVT Transmission Monitoring

Status: DRAFT

⌈During message transmission, the J1939Fscp shall ensure that the time separation (SRVT) between SHM and SDM meets the timing requirements per SAE J1939-76.⌋

[CP_SWS_J1939Fscp_00004] SRVT Reception Monitoring

Status: DRAFT

⌈During message reception, the J1939Fscp shall ensure that the time separation (SRVT) between SHM and SDM meets the timing requirements per SAE J1939-76.⌋

[CP_SWS_J1939Fscp_00005] Reception of the Same PGN from Multiple Sources

Status: DRAFT

⌈The J1939Fscp shall be capable to handle receiving SDMs from multiple source addresses (same PGN, e.g., TSC1), and shall ensure that SRVT requirements are met for all of the received SDMs.⌋

7.2 Module Handling

This section contains description of auxiliary functionality of the J1939Fscp.

7.2.1 Initialization

The J1939Fscp is initialized via J1939Fscp_Init, and de-initialized via J1939Fscp_DeInit. Except for J1939Fscp_Init, the API functions of the J1939Fscp may only be called after the module has been properly initialized.

[CP_SWS_J1939Fscp_00006] Module Initialization

Status: DRAFT
Upstream requirements: SRS_BSW_00101

⌈A call to J1939Fscp_Init initializes all internal variables and sets the J1939Fscp to the initialized state.⌋

[CP_SWS_J1939Fscp_00007] Module Shutdown

Status: DRAFT
Upstream requirements: SRS_BSW_00336

⌈A call to J1939Fscp_DeInit sets the J1939Fscp back to the uninitialized state.⌋

[CP_SWS_J1939Fscp_00008] Re-initialization

Status: DRAFT
Upstream requirements: SRS_BSW_00101

⌈When J1939Fscp_Init is called in initialized state, the J1939Fscp shall not re-initialize its internal variables. It shall instead call Det_ReportError with the error code J1939FSCP_E_REINIT if DET reporting is enabled (see J1939FscpDevErrorDetect).⌋

7.2.2 Timing Related Functionality

To be able to measure times, the J1939Fscp is triggered cyclically via the J1939Fscp_MainFunction.

[CP_SWS_J1939Fscp_00009] Main Function Usage

Status: DRAFT

⌈The J1939Fscp shall use the J1939Fscp_MainFunction for timing related purposes.⌋

7.3 Message Handling

7.3.1 Message Transmission

The PduR calls J1939Fscp_Transmit to initiate the transmission of each SDG. After transmission of the corresponding SHM and SDM, the J1939Fscp reports the failure or success back to PduR with PduR_J1939FscpTxConfirmation. See also Figure 7.1 and Figure 9.1.

[CP_SWS_J1939Fscp_00010] SDG Decomposition and SHM Transmission

Status: DRAFT

⌈When J1939Fscp_Transmit is called, the J1939Fscp shall split the provided SDG data into the SHM parts and the SDM. If safety processing has not been disabled by J1939Fscp_SetTxSafetyHandling, the SDM data shall be stored, while the SHM shall be constructed as described in [CP_SWS_J1939Fscp_00014]. Finally, the J1939Fscp shall call PduR_J1939FscpTransmit to transmit the SHM unless safety processing has been disabled by J1939Fscp_SetTxSafetyHandling.⌋

Note: The assurance data prepared by the E2E transformer is ignored if safety processing has been disabled.

[CP_SWS_J1939Fscp_00014] SHM Composition: CAN ID

Status: DRAFT

⌈The J1939Fscp shall construct the SHM from the SDG data provided via J1939Fscp_Transmit and the CAN ID parts that are reflected in the SHM layout. The CAN ID parts shall be taken from the CanIfTxPduCfg.CanIfTxPduCanId that is referenced indirectly via the global PDU by J1939FscpSdmTxPduRef, and from the MetaDataItem of type CAN_ID_32, if parts of the CanIfTxPduCanId are declared as variable by a CanIfTxPduCfg.CanIfTxPduCanIdMask.⌋

[CP_SWS_J1939Fscp_00028] SHM Composition: Priority

Status: DRAFT

⌈For the transmission of the SHM, the J1939Fscp shall determine the Priority in the following way:

1. The value of J1939FscpShmTxPriority, if this is configured.
2. A value lower or equal to the Priority provided via a MetaDataItem of type CAN_ID_32 of the global PDU referenced via J1939FscpSdgTxPduRef if that is available.
3. A value lower or equal to the Priority configured for the CAN ID of the SDM otherwise.

⌋

Please refer to [18, SAE J1939-76] section 6.1 “Safety Header Message Definition” for the layout of the SHM.

[CP_SWS_J1939Fscp_00011] SDM Transmission

Status: DRAFT

⌈When J1939Fscp_TxConfirmation is called for the successful transmission of the SHM, or safety processing has not been disabled by J1939Fscp_SetTxSafetyHandling, the J1939Fscp shall start the SRVT timer with J1939FscpTxSrvt and call PduR_J1939FscpTransmit to transmit the stored SDM.⌋

[CP_SWS_J1939Fscp_00015] SDM Retry

Status: DRAFT

⌈When PduR_J1939FscpTransmit returns an error for the SDM transmission, and the SRVT timer is not yet expired, the J1939Fscp shall retry the transmission of the SDM.⌋

[CP_SWS_J1939Fscp_00016] Successful SDG Confirmation

Status: DRAFT

⌈When J1939Fscp_TxConfirmation is called for the successful transmission of the SDM, the J1939Fscp shall stop the SRVT timer and call PduR_J1939FscpTxConfirmation to notify the PduR of the successful transmission of the SDG.⌋

[CP_SWS_J1939Fscp_00017] Failed SDG Confirmation

Status: DRAFT

⌈When PduR_J1939FscpTransmit returns an error for the SHM transmission or receives a negative transmission confirmation for either SHM or SDM, or when the SRVT timer expires, the J1939Fscp shall call PduR_J1939FscpTxConfirmation with E_NOT_OK to notify the PduR of the failed transmission of the SDG.⌋

[CP_SWS_J1939Fscp_00018] SRVT Timeout During Transmission

Status: DRAFT

⌈When the SRVT timer expires, the J1939Fscp shall additionally report the runtime error J1939FSCP_E_TIMEOUT_TX_SRVT to the DET.⌋

7.3.2 Message Reception

The PduR calls J1939Fscp_RxIndication to notify J1939Fscp of the reception of SHM and SDM PDUs. See also Figure 7.2 and Figure 9.2.

[CP_SWS_J1939Fscp_00012] SHM Reception

Status: DRAFT

⌈When J1939Fscp_RxIndication is called for an SHM, the J1939Fscp shall compare the received SDG PGN against the configured SDMs. If a suitable SDM is found, the

J1939Fscp shall store the SA and DA (the latter only if the PGN is of type PDU1), the CRC and the sequence number, and start the SRVT timer with J1939FscpRxSrvt.⌋

Please refer to [18, SAE J1939-76] section 6.1 “Safety Header Message Definition” for the layout of the SHM.

[CP_SWS_J1939Fscp_00021] SDM Reception

Status: DRAFT

⌈When J1939Fscp_RxIndication is called for an SDM that matches the data stored from a previous SHM reception, the J1939Fscp shall stop the SRVT timer, assemble the SDG data as described in [CP_SWS_J1939Fscp_00026], and call PduR_J1939FscpRxIndication to forward the SDG to the PduR.⌋

[CP_SWS_J1939Fscp_00029] Safety Processing Disabled for Received Message

Status: DRAFT

⌈When SDM is received, but safety processing has been disabled by J1939Fscp_SetRxSafetyHandling, the assurance data shall be set to all zeros and PduR_J1939FscpRxIndication shall be called.⌋

Note: This will lead to a safety error in the received data in the application.

[CP_SWS_J1939Fscp_00026] SDG Composition

Status: DRAFT

⌈The J1939Fscp shall construct the SDG data from the received SHM and SDM by placing the sequence number in the first byte, the CRC in the following five bytes, and the SDM data in the remaining bytes of the PDU referenced via J1939FscpSdgRxPduRef.⌋

[CP_SWS_J1939Fscp_00022] SRVT Timeout During Reception

Status: DRAFT

⌈When the SRVT timer expires, the J1939Fscp shall stop the SDGs reception and report the runtime error J1939FSCP_E_TIMEOUT_RX_SRVT to the DET.⌋

[CP_SWS_J1939Fscp_00025] Unknown PGN

Status: DRAFT

⌈When J1939Fscp_RxIndication is called for an SHM where the received SDG PGN does not match any configured SDMs, the J1939Fscp shall report the runtime error J1939FSCP_E_UNKNOWN_PGN to the DET and drop the received SHM.⌋

[CP_SWS_J1939Fscp_00023] Missing SDM

Status: DRAFT

⌈When J1939Fscp_RxIndication is called for an SHM which matches the data stored from a previous SHM reception, the J1939Fscp shall stop the SDGs reception,

report the runtime error J1939FSCP_E_NO_SDM_RECEIVED to the DET, and start a new SDGs reception as described in [CP_SWS_J1939Fscp_00012].⌋

[CP_SWS_J1939Fscp_00024] Missing SHM

Status: DRAFT

⌈When J1939Fscp_RxIndication is called for an SDM which does not match the data stored from a previous SHM reception, the J1939Fscp shall report the runtime error J1939FSCP_E_NO_SHM_RECEIVED to the DET and drop the received SDM.⌋

[CP_SWS_J1939Fscp_00020] Receiving Parallel SDGs with Same PGN

Status: DRAFT

⌈The number of SDGs bound to the same J1939FscpRxPg that can be handled in parallel by the J1939Fscp shall be limitied by J1939FscpRxInstances.⌋

7.3.3 Timing Supervision

J1939Fscp monitors the SRVT on transmission and reception side, the effects are described in the corresponding sections above.

[CP_SWS_J1939Fscp_00013] SRVT Timeout Monitoring

Status: DRAFT
Upstream requirements: SRS_BSW_00478

⌈The J1939Fscp shall use J1939Fscp_MainFunction that is triggered with the configured J1939FscpMainFunctionPeriod to monitor the maximum time separation (SRVT) between the SHM and SDM messages in accordance with the SAE J1939-76 specification.⌋

7.4 Error Classification

Chapter [19, SWS BSW General] 7.2 *"Error Handling"* describes the error handling of the Basic Software in detail. Above all, it constitutes a classification scheme consisting of five error types which may occur in BSW modules.

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

7.4.1 Development Errors

[CP_SWS_J1939Fscp_90012] Definition of development errors in module J1939 Fscp

Status: DRAFT
Upstream requirements: SRS_BSW_00327, SRS_BSW_00337, SRS_BSW_00385, SRS_BSW_00441

⌈

Type of error	*Related error code*	*Error value*
An API was called while the module was uninitialized	J1939FSCP_E_UNINIT	0x01
J1939Fscp_Init was called twice	J1939FSCP_E_REINIT	0x02
J1939Fscp_Init was called with an invalid configuration pointer	J1939FSCP_E_INIT_FAILED	0x03
An API service was called with a NULL pointer	J1939FSCP_E_PARAM_POINTER	0x04
An API service was called with a wrong PDU ID	J1939FSCP_E_INVALID_PDU_SDU_ID	0x05
An API service was called with a wrong PDU length	J1939FSCP_E_INVALID_SIZE	0x06

⌋

7.4.2 Runtime Errors

[CP_SWS_J1939Fscp_90013] Definition of runtime errors in module J1939Fscp

Status: DRAFT
Upstream requirements: SRS_BSW_00327, SRS_BSW_00452, SRS_BSW_00385, SRS_BSW_00441

⌈

Type of error	*Related error code*	*Error value*
An SHM message was received with an unknown PGN	J1939FSCP_E_UNKNOWN_PGN	0x01
Two consecutive SDM PDUs were received with no SHM PDU in between	J1939FSCP_E_NO_SHM_RECEIVED	0x02
Two consecutive SHM PDUs were received with no SDM PDU in between	J1939FSCP_E_NO_SDM_RECEIVED	0x03
SRVT of SDG reception has timed out	J1939FSCP_E_TIMEOUT_RX_SRVT	0x04
SRVT of SDG transmission has timed out	J1939FSCP_E_TIMEOUT_TX_SRVT	0x05

⌋

7.4.3 Production Errors

The `J1939Fscp` module does not define production errors.

7.5 Security Events

The J1939Fscp module does not report security events.

8 API Specification

8.1 API Parameter Checking

The J1939Fscp performs parameter checks for all called APIs. It reports the development error J1939FSCP_E_INVALID_PDU_SDU_ID when a check of a PDU/SDU ID fails and J1939FSCP_E_PARAM_POINTER when a call provides a NULL pointer.

[CP_SWS_J1939Fscp_00002] Invalid PDU IDs

Status: DRAFT
Upstream requirements: SRS_BSW_00386

⌈If development error detection is enabled via J1939FscpDevErrorDetect, the J1939Fscp shall check PduIdType parameters of its API functions against the configured IDs, and shall report the development error J1939FSCP_E_INVALID_PDU_SDU_ID when an unknown ID is provided by the call.⌋

J1939FSCP_E_PARAM_POINTER shall be reported as specified in [19, SWS BSW General] by [SWS_BSW_00212].

J1939FSCP_E_UNINIT shall be reported as specified in [19, SWS BSW General] by [SWS_BSW_00243].

8.2 Imported Types

In this section, all types used by the J1939Fscp are listed together with the defining module:

[CP_SWS_J1939Fscp_90001] Definition of imported datatypes of module J1939 Fscp

Status: DRAFT

⌈

Module	*Header File*	*Imported Type*
Comtype	ComStack_Types.h	PduIdType
	ComStack_Types.h	PduInfoType
	ComStack_Types.h	PduLengthType
Std	Std_Types.h	Std_ReturnType

⌋

The types that are declared in ComStack_Types.h are defined in [22, SWS Communication Stack Types], while the types declared in Std_Types.h are defined in [23, SWS Standard Types].

8.3 Type Definitions

8.3.1 J1939Fscp_ConfigType

[CP_SWS_J1939Fscp_90004] Definition of datatype J1939Fscp_ConfigType

Status: DRAFT

⌈

Name	J1939Fscp_ConfigType (draft)	
Kind	Structure	
Elements	implementation specific	
	Type	–
	Comment	–
Description	This is the base type for the configuration of the J1939 Functional Safety Communication Protocol. A pointer to an instance of this structure will be used in the initialization of the J1939 Functional Safety Communication Protocol. The content of this structure is not standardized and depends on the configuration of the module. See chapter 10 Configuration. **Tags:** atp.Status=draft	
Available via	J1939Fscp.h	

⌋

8.4 Function Definitions

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

8.4.1 J1939Fscp_Init

[CP_SWS_J1939Fscp_90005] Definition of API function J1939Fscp_Init

Status: DRAFT

⌈

Service Name	J1939Fscp_Init (draft)	

Syntax	`void J1939Fscp_Init (`
	`  const J1939Fscp_ConfigType* configPtr`
	`)`	

Service ID [hex]	0x01	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	configPtr	Pointer to selected configuration structure
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	

▽

△

Description	This function initializes the J1939 Functional Safety Communication Protocol. **Tags:** atp.Status=draft
Available via	J1939Fscp.h

⌋

See Chapter 7.2.1 for details.

See Chapter 8.1 for parameter checks.

J1939FSCP_E_INIT_FAILED shall be reported as specified in [19, SWS BSW General] by [SWS_BSW_00050].

8.4.2 J1939Fscp_DeInit

[CP_SWS_J1939Fscp_90006] Definition of API function J1939Fscp_DeInit

Status: DRAFT

⌈

Service Name	J1939Fscp_DeInit (draft)

Syntax	`void J1939Fscp_DeInit (`
	`  void`
	`)`

Service ID [hex]	0x02
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in)	None
Parameters (inout)	None
Parameters (out)	None
Return value	None
Description	This function resets the J1939 Functional Safety Communication Protocol to the uninitialized state. **Tags:** atp.Status=draft
Available via	J1939Fscp.h

⌋

See Chapter 7.2.1 for details.

8.4.3 J1939Fscp_Transmit

[CP_SWS_J1939Fscp_90010] Definition of API function J1939Fscp_Transmit

Status: DRAFT

⌈

Service Name	J1939Fscp_Transmit (draft)	
Syntax	`Std_ReturnType J1939Fscp_Transmit ( PduIdType TxPduId, const PduInfoType* PduInfoPtr )`	
Service ID [hex]	0x49	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	TxPduId	Identifier of the PDU to be transmitted
	PduInfoPtr	Length of and pointer to the PDU data and pointer to MetaData.
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	`E_OK`: Transmit request has been accepted. `E_NOT_OK`: Transmit request has not been accepted.
Description	Requests transmission of a PDU. **Tags:** atp.Status=draft	
Available via	J1939Fscp.h	

⌋

See Chapter 7.3.1 for details.

See Chapter 8.1 for parameter checks.

[CP_SWS_J1939Fscp_00027] Invalid PDU length

Status: DRAFT
Upstream requirements: SRS_BSW_00386

⌈If development error detection is enabled via `J1939FscpDevErrorDetect`, the `J1939Fscp` shall check that `PduInfoPtr->SduLength` does not exceed 13 and matches the configured length of the `SDM`, and otherwise report the development error `J1939FSCP_E_INVALID_SIZE`.⌋

8.4.4 J1939Fscp_RxIndication

[CP_SWS_J1939Fscp_90009] Definition of callback function J1939Fscp_RxIndication

Status: DRAFT

⌈

Service Name	J1939Fscp_RxIndication (draft)	

Syntax	`void J1939Fscp_RxIndication (`
	`  PduIdType RxPduId,`
	`  const PduInfoType* PduInfoPtr`
	`)`	

Service ID [hex]	0x42	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	RxPduId	ID of the received PDU.
	PduInfoPtr	Contains the length (SduLength) of the received PDU, a pointer to a buffer (SduDataPtr) containing the PDU, and the MetaData related to this PDU.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Indication of a received PDU from a lower layer communication interface module. **Tags:** atp.Status=draft	
Available via	J1939Fscp.h	

⌋

See Chapter 7.3.2 for details.

See Chapter 7.2.1 for error handling and Chapter 8.1 for parameter checks.

8.4.5 J1939Fscp_TxConfirmation

[CP_SWS_J1939Fscp_90011] Definition of callback function J1939Fscp_TxConfirmation

Status: DRAFT

⌈

Service Name	J1939Fscp_TxConfirmation (draft)	

Syntax	`void J1939Fscp_TxConfirmation (`
	`  PduIdType TxPduId,`
	`  Std_ReturnType result`
	`)`	

Service ID [hex]	0x40	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	TxPduId	ID of the PDU that has been transmitted.

▽

△

	result	E_OK: The PDU was transmitted successfully. E_NOT_OK: Transmission of the PDU failed.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU. **Tags:** atp.Status=draft	
Available via	J1939Fscp.h	

⌋

See Chapter 7.3.1 for details.

See Chapter 7.2.1 for error handling and Chapter 8.1 for parameter checks.

8.4.6 J1939Fscp_SetTxSafetyHandling

[SWS_J1939Fscp_90014] Definition of API function J1939Fscp_SetTxSafetyHandling ⌈

Service Name	J1939Fscp_SetTxSafetyHandling	

Syntax	`void J1939Fscp_SetTxSafetyHandling (`
	`  PduIdType TxPduid,`
	`  boolean TxShmState`
	`)`	

Service ID [hex]	0x05	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	TxPduid	Identifier of the transmitted PDU for which the Fscp state shall be configured.
	TxShmState	FALSE - The SHM associated with TxPduId will not be passed to the PDU Router for transmit. TRUE - The SHM associated with TxPduId will be passed to the PDU Router for transmit.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Disables or enables safety handling of transmitted PDUs. If disabled, the SHM is omitted and only the SDM is transmitted.	
Available via	J1939Fscp.h	

⌋

See Chapter 7.3.1 for details.

See Chapter 7.2.1 for error handling and Chapter 8.1 for parameter checks.

8.4.7 J1939Fscp_SetRxSafetyHandling

[SWS_J1939Fscp_90015] Definition of API function J1939Fscp_SetRxSafetyHandling ⌈

Service Name	J1939Fscp_SetRxSafetyHandling	

Syntax	`void J1939Fscp_SetRxSafetyHandling (`
	`  PduIdType RxPduid,`
	`  boolean RxShmState`
	`)`	

Service ID [hex]	0x06	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	RxPduid	Identifier of the received PDU for which the Fscp state shall be configured.
	RxShmState	FALSE - The SHM associated with RxPduId will not be required to be received to pass the SDM to the PDU Router. TRUE - The SHM associated with RxPduId will be required to be received (and with the expected CRC and counter) to pass the SDM to the PDU Router
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Disables or enables safety handling of received PDUs. If disabled, the SDM is accepted without preceding SHM, and the SHM is ignored if received. The application will see a protection error.	
Available via	J1939Fscp.h	

⌋

See Chapter 7.3.2 for details.

See Chapter 7.2.1 for error handling and Chapter 8.1 for parameter checks.

8.5 Scheduled Functions

This function is directly called by the Basic Software Scheduler (SchM).

8.5.1 J1939Fscp_MainFunction

[CP_SWS_J1939Fscp_90008] Definition of scheduled function J1939Fscp_MainFunction

Status: DRAFT

⌈

Service Name	J1939Fscp_MainFunction (draft)

Syntax	`void J1939Fscp_MainFunction (`
	`  void`
	`)`

▽

△

Service ID [hex]	0x04
Description	Main function of the J1939 Functional Safety Communication Protocol. Used for scheduling purposes and timeout supervision. **Tags:** atp.Status=draft
Available via	SchM_J1939Fscp.h

⌋

[CP_SWS_J1939Fscp_00001] Main Function Period

Status: DRAFT
Upstream requirements: SRS_BSW_00478

⌈The frequency of invocations of `J1939Fscp_MainFunction` is determined by the configuration parameter `J1939FscpMainFunctionPeriod`.⌋

See Chapter 7.3.3 for details.

8.6 Expected Interfaces

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

8.6.1 Mandatory Interfaces

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

[CP_SWS_J1939Fscp_90002] Definition of mandatory interfaces required by module J1939Fscp

Status: DRAFT

⌈

API Function	***Header File***	***Description***
Det_ReportRuntimeError	Det.h	Service to report runtime errors. If a callout has been configured then this callout shall be called.

⌋

8.6.2 Optional Interfaces

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

[CP_SWS_J1939Fscp_90003] Definition of optional interfaces requested by module J1939Fscp

Status: DRAFT

⌈

API Function	*Header File*	*Description*
Det_ReportError	Det.h	Service to report development errors.
PduR_J1939FscpRxIndication	PduR_J1939Fscp.h	Indication of a received PDU from a lower layer communication interface module.
PduR_J1939FscpTransmit	PduR_J1939Fscp.h	Requests transmission of a PDU.
PduR_J1939FscpTxConfirmation	PduR_J1939Fscp.h	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU.

⌋

9 Sequence Diagrams

9.1 Message Transmission

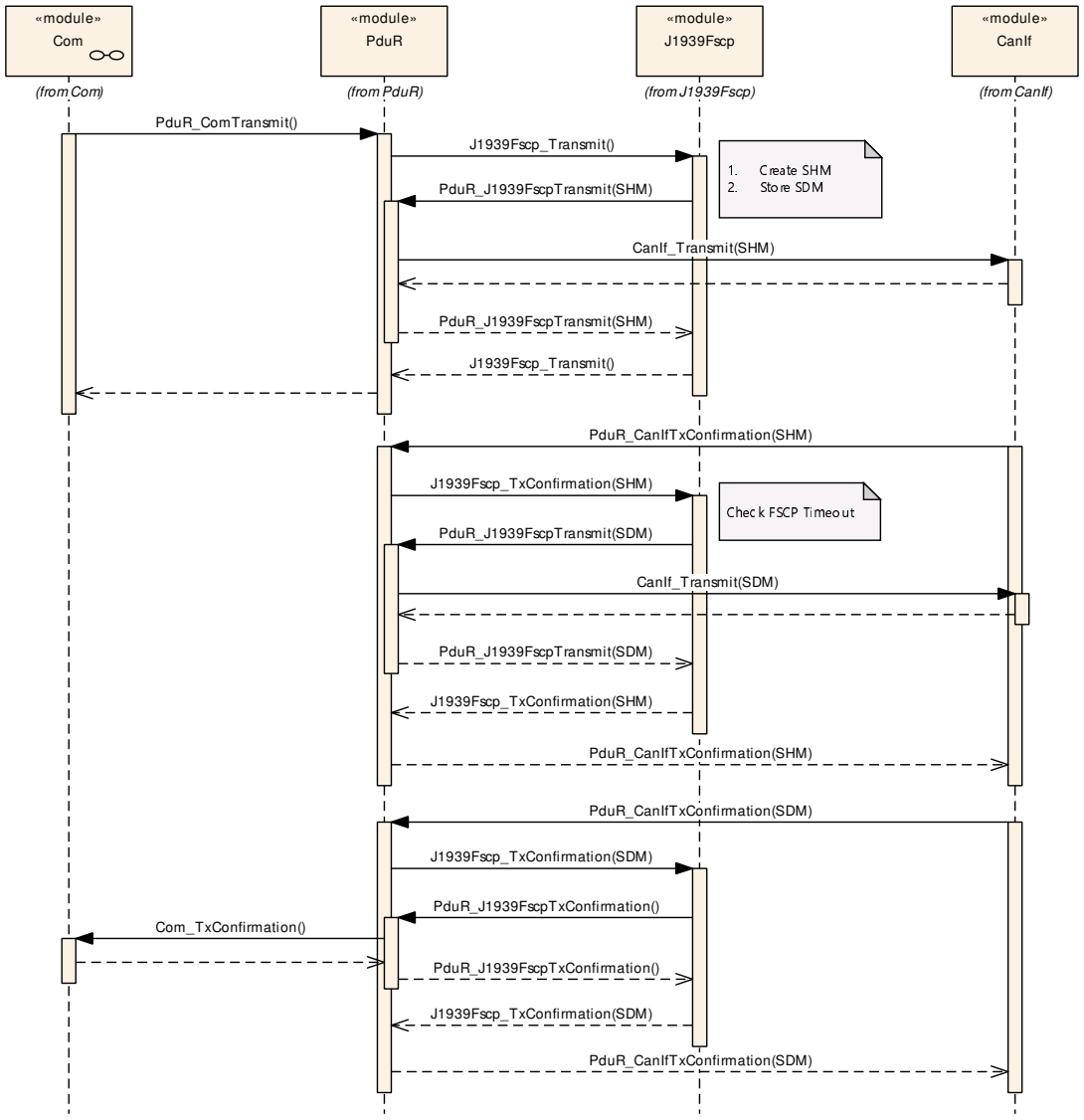


Figure 9.1: Transmission of J1939Fscp Messages

9.2 Message Reception

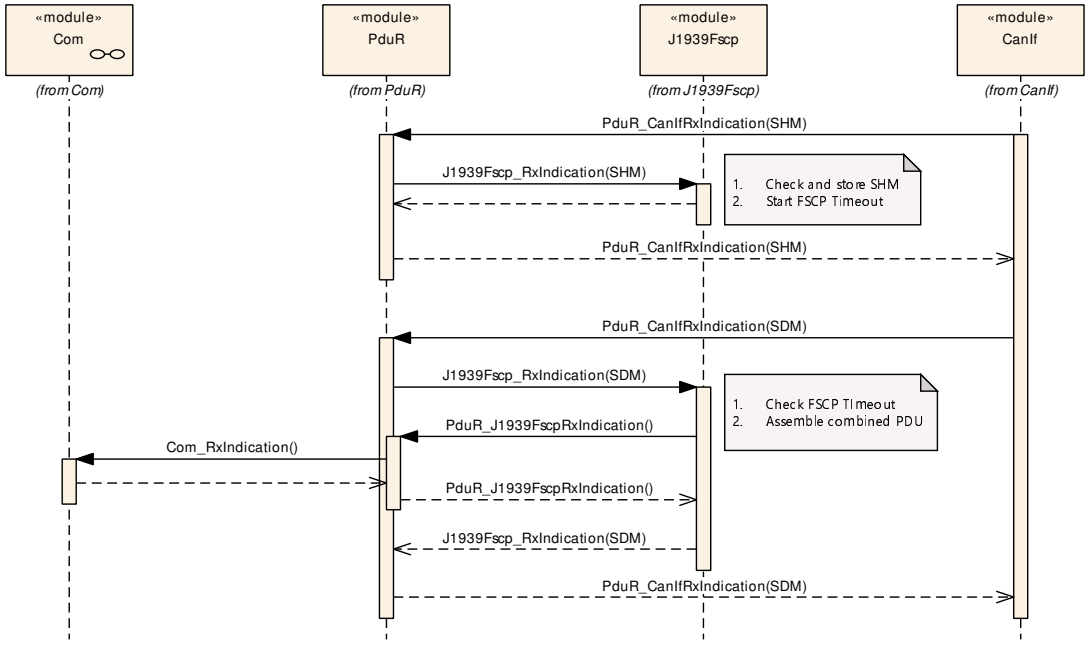


Figure 9.2: Reception of J1939Fscp Messages

9.3 Signal Group Transformation

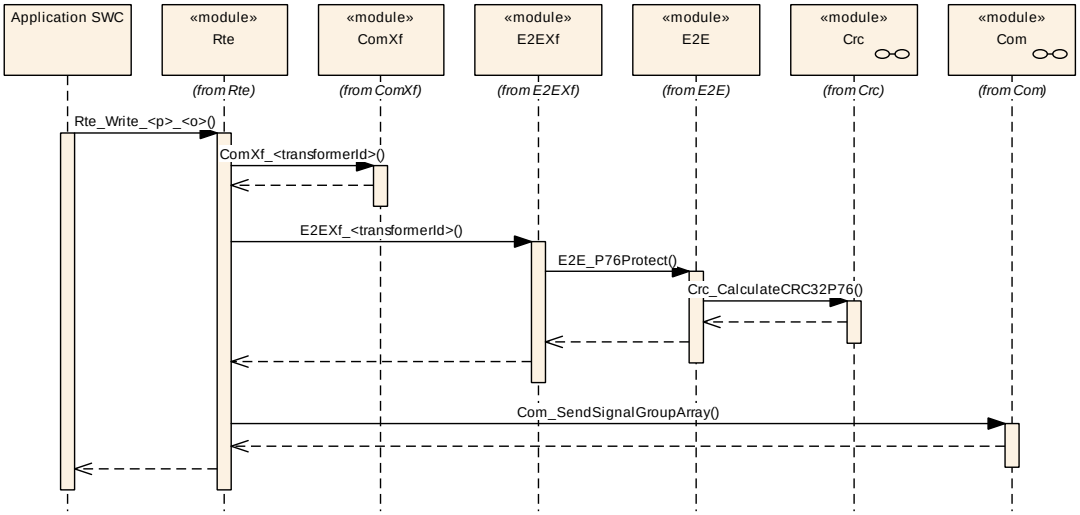


Figure 9.3: Transformation of Signal Groups for J1939Fscp Transmission

10 Configuration Specification

In general, this chapter defines configuration parameters and their clustering into containers. For general information about the definition of containers and parameters, refer to [19, SWS BSW General] 10.1 *"Introduction to configuration specification"*. For details about published information of the J1939Fscp, refer to [19, SWS BSW General] 10.3 *"Published Information"*.

The Chapter 10.1 specifies the structure (containers) and the parameters of the module J1939Fscp. Chapter 10.2 specifies some constraints on the configuration.

10.1 Containers and configuration parameters

The following subsections summarize all configuration parameters of the J1939Fscp. The detailed meaning of the parameters is described in chapters 7 and 8.

Some of these containers and parameters are derived from classes and attributes of the [1, CP TPS System Template], which also contains the rules for these derivations.

The following pictures show an overview of the configuration parameters available for J1939Fscp.

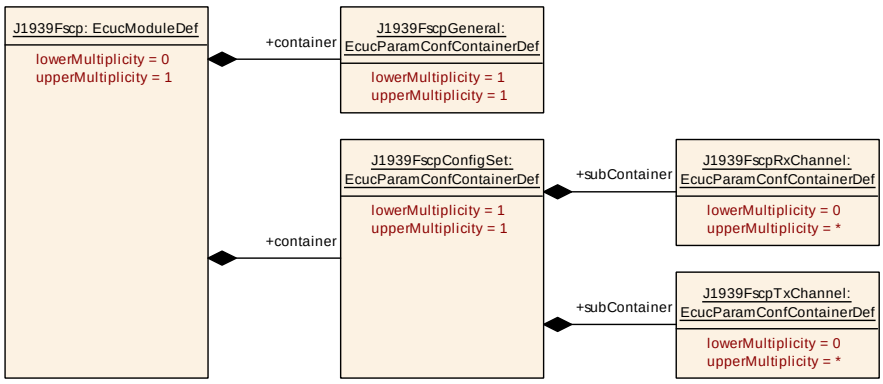


Figure 10.1: Module Configuration

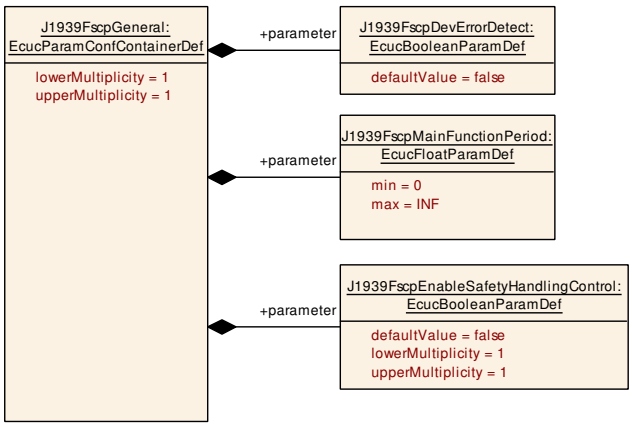


Figure 10.2: General Configuration

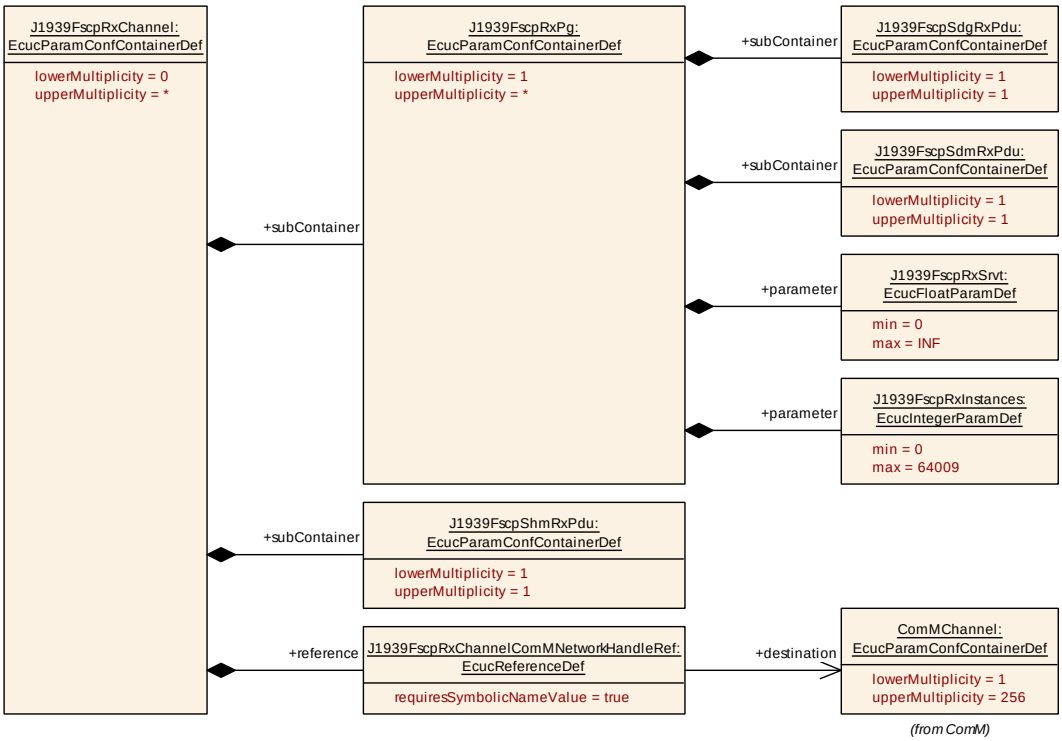


Figure 10.3: Configuration of Rx Channels

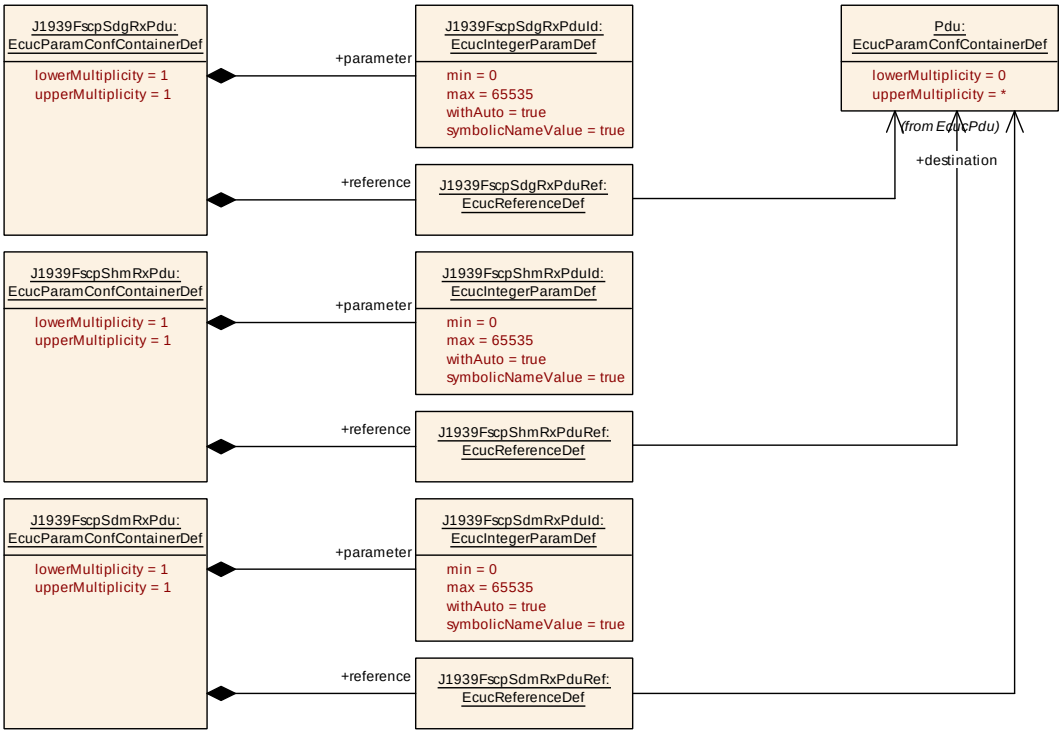


Figure 10.4: Configuration of Rx PDUs

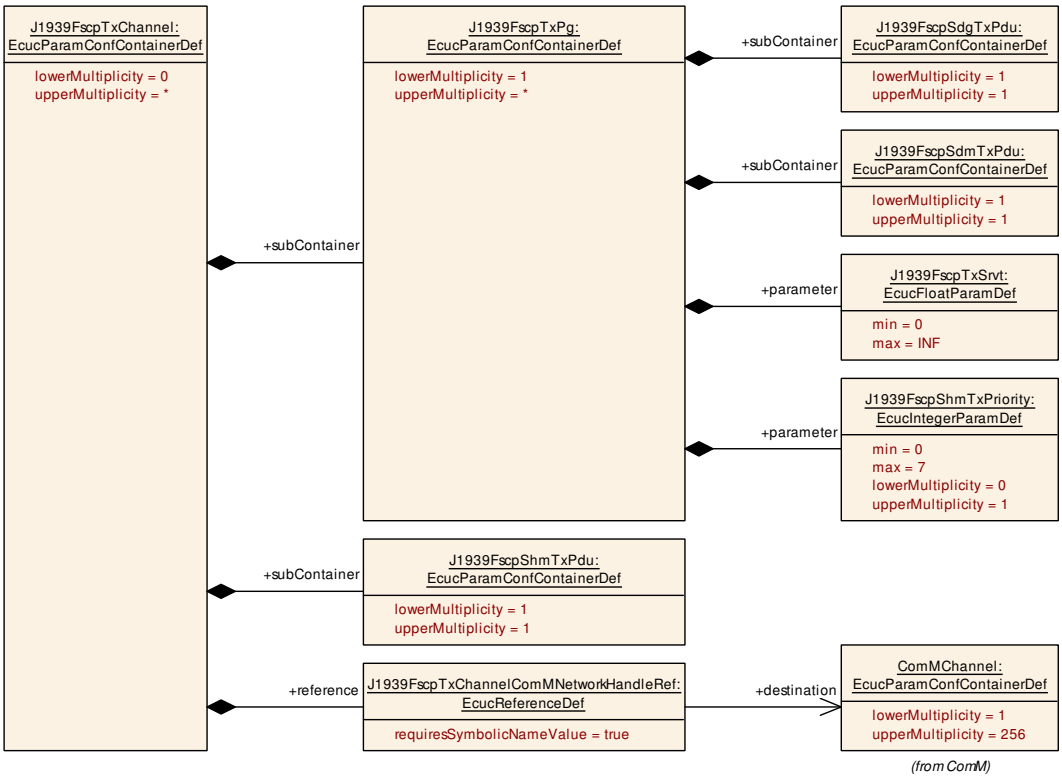


Figure 10.5: Configuration of Tx Channels

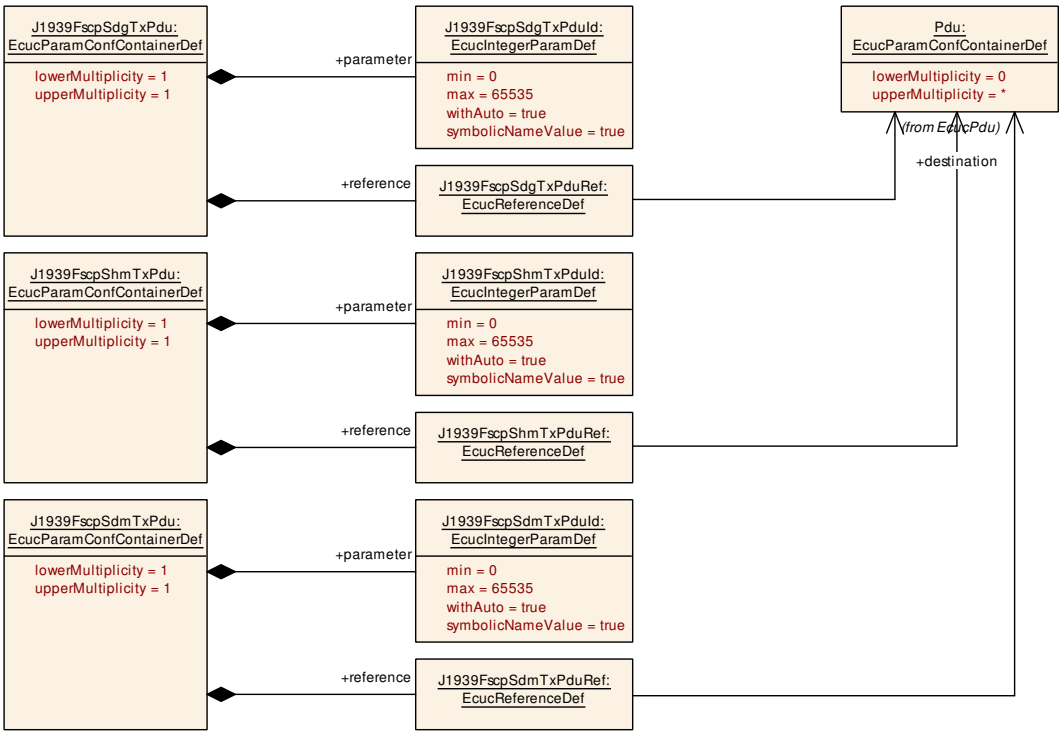


Figure 10.6: Configuration of Tx PDUs

10.1.1 J1939Fscp

[ECUC_J1939Fscp_00001] Definition of EcucModuleDef J1939Fscp

Status: DRAFT

⌈

Module Name	J1939Fscp
Description	The J1939 Functional Safety Communication Protocol covers the handling of SHM and SDM messages for E2E protected communication according to SAE J1939-76.
Post-Build Selectable Support	true
Post-Build Loadable Support	true

Included Containers		
Container Name	**Multiplicity**	**Description**
J1939FscpConfigSet	1	Configuration parameters and sub containers of the J1939Fscp module. **Tags:** atp.Status=draft
J1939FscpGeneral	1	General configuration parameters of the J1939Fscp module. **Tags:** atp.Status=draft

⌋

10.1.2 J1939FscpGeneral

[ECUC_J1939Fscp_00002] Definition of EcucParamConfContainerDef J1939Fscp General

Status: DRAFT

⌈

Container Name	J1939FscpGeneral
Parent Container	J1939Fscp
Upstream mapping defined	–
Description	General configuration parameters of the J1939Fscp module. **Tags:** atp.Status=draft
Multiplicity	1
Pre-Compile only	true
Configuration Parameters	

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpDevErrorDetect	1	[ECUC_J1939Fscp_00006]
J1939FscpEnableSafetyHandlingControl	1	[ECUC_J1939Fscp_00036]
J1939FscpMainFunctionPeriod	1	[ECUC_J1939Fscp_00008]

No Included Containers

⌋

[ECUC_J1939Fscp_00006] Definition of EcucBooleanParamDef J1939FscpDevErrorDetect

Status: DRAFT

⌈

Parameter Name	J1939FscpDevErrorDetect
Parent Container	J1939FscpGeneral
Upstream mapping defined	–
Description	Enables/disables the development error detection. **Tags:** atp.Status=draft
Multiplicity	1
Type	EcucBooleanParamDef
Default value	false
Pre-Compile only	true

⌋

[ECUC_J1939Fscp_00036] Definition of EcucBooleanParamDef J1939FscpEnableSafetyHandlingControl

Status: DRAFT

⌈

Parameter Name	J1939FscpEnableSafetyHandlingControl
Parent Container	J1939FscpGeneral
Upstream mapping defined	–
Description	Enables/disables safety handling control in J1939Fscp (J1939-76).Note: This parameter must be enabled only if E2E protection needs to be disabled for certain Safety data Groups (SDG). **Tags:** atp.Status=draft
Multiplicity	1
Type	EcucBooleanParamDef
Default value	false
Pre-Compile only	true

⌋

[ECUC_J1939Fscp_00008] Definition of EcucFloatParamDef J1939FscpMainFunctionPeriod ⌈

Parameter Name	J1939FscpMainFunctionPeriod	
Parent Container	J1939FscpGeneral	
Upstream mapping defined	–	
Description	Execution cycle of J1939Fscp_MainFunction.	
Multiplicity	1	
Type	EcucFloatParamDef	
Range	]0 .. INF[	

▽

△

Default value	–
Pre-Compile only	true

⌋

10.1.3 J1939FscpConfigSet

[ECUC_J1939Fscp_00003] Definition of EcucParamConfContainerDef J1939Fscp ConfigSet

Status: DRAFT

⌈

Container Name	J1939FscpConfigSet
Parent Container	J1939Fscp
Upstream mapping defined	–
Description	Configuration parameters and sub containers of the J1939Fscp module. **Tags:** atp.Status=draft
Multiplicity	1
Pre-Compile only	true
Configuration Parameters	

No Included Parameters

Included Containers		
Container Name	**Multiplicity**	**Description**
J1939FscpRxChannel	0..*	Physical CAN channel used for reception by J1939Fscp. **Tags:** atp.Status=draft
J1939FscpTxChannel	0..*	Physical CAN channel used for transmission by J1939Fscp. **Tags:** atp.Status=draft

⌋

10.1.4 J1939FscpRxChannel

[ECUC_J1939Fscp_00004] Definition of EcucParamConfContainerDef J1939Fscp RxChannel

Status: DRAFT

⌈

Container Name	J1939FscpRxChannel	
Parent Container	J1939FscpConfigSet	
Upstream mapping defined	–	
Description	Physical CAN channel used for reception by J1939Fscp. **Tags:** atp.Status=draft	
Multiplicity	0..*	
Post-Build Multiplicity	Loadable	Selectable
Configuration Parameters		

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpRxChannelComMNetworkHandleRef	1	[ECUC_J1939Fscp_00021]

Included Containers		
Container Name	**Multiplicity**	**Description**
J1939FscpRxPg	1..*	Contains the configuration of the received SDM and of the upper layer PDU. **Tags:** atp.Status=draft
J1939FscpShmRxPdu	1	Contains the configuration of the PDU used to receive the SHM PG. This PDU consumes a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft

⌋

[ECUC_J1939Fscp_00021] Definition of EcucReferenceDef J1939FscpRxChannelComMNetworkHandleRef

Status: DRAFT

⌈

Parameter Name	J1939FscpRxChannelComMNetworkHandleRef
Parent Container	J1939FscpRxChannel
Upstream mapping defined	–
Description	Reference to the ComMChannel which corresponds to the J1939FscpRxChannel. This parameter is useful for the validation of the J1939Fscp configuration. **Tags:** atp.Status=draft
Multiplicity	1
Type	Symbolic name reference to ComMChannel
Pre-Compile only	true

⌋

10.1.5 J1939FscpRxPg

[ECUC_J1939Fscp_00012] Definition of EcucParamConfContainerDef J1939FscpRxPg

Status: DRAFT

⌈

Container Name	J1939FscpRxPg	
Parent Container	J1939FscpRxChannel	
Upstream mapping defined	–	
Description	Contains the configuration of the received SDM and of the upper layer PDU. **Tags:** atp.Status=draft	
Multiplicity	1..*	
Post-Build Multiplicity	Loadable	Selectable
Configuration Parameters		

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpRxInstances	1	[ECUC_J1939Fscp_00020]
J1939FscpRxSrvt	1	[ECUC_J1939Fscp_00019]

Included Containers		
Container Name	**Multiplicity**	**Description**
J1939FscpSdgRxPdu	1	Contains the configuration of the PDU used to forward the received SDG to the upper layer. This PDU can produce a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
J1939FscpSdmRxPdu	1	Contains the configuration of the PDU used to receive the SDM PG. This PDU can consume a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft

⌋

[ECUC_J1939Fscp_00020] Definition of EcucIntegerParamDef J1939FscpRxInstances

Status: DRAFT

⌈

Parameter Name	J1939FscpRxInstances	
Parent Container	J1939FscpRxPg	
Upstream mapping defined	–	
Description	Configures the maximum number of SDGs that can be received in parallel with the same PGN. This parameter is only relevant if MetaData is configured for the J1939 FscpSdgRxPdu. **Tags:** atp.Status=draft	
Multiplicity	1	
Type	EcucIntegerParamDef	
Range	0 .. 64009	
Default value	–	
Post-Build Multiplicity	Loadable	Selectable

⌋

[ECUC_J1939Fscp_00019] Definition of EcucFloatParamDef J1939FscpRxSrvt

Status: DRAFT

⌈

Parameter Name	J1939FscpRxSrvt	
Parent Container	J1939FscpRxPg	
Upstream mapping defined	–	
Description	This parameter sets the maximum for the Safety-Relevant Validation Time (SRVT_ Maximum), which is used to determine a timeout of the corresponding SDM message after reception of an SHM message. After this timeout, the whole SDG is dropped. **Tags:** atp.Status=draft	
Multiplicity	1	
Type	EcucFloatParamDef	
Range	]0 .. INF[	
Default value	–	
Post-Build Value	Loadable	Selectable

⌋

10.1.6 J1939FscpSdgRxPdu

[ECUC_J1939Fscp_00013] Definition of EcucParamConfContainerDef J1939FscpSdgRxPdu

Status: DRAFT

⌈

Container Name	J1939FscpSdgRxPdu
Parent Container	J1939FscpRxPg
Upstream mapping defined	–
Description	Contains the configuration of the PDU used to forward the received SDG to the upper layer. This PDU can produce a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
Multiplicity	1
Pre-Compile only	true
Configuration Parameters	

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpSdgRxPduId	1	[ECUC_J1939Fscp_00014]
J1939FscpSdgRxPduRef	1	[ECUC_J1939Fscp_00015]

No Included Containers

⌋

[ECUC_J1939Fscp_00014] Definition of EcucIntegerParamDef J1939FscpSdgRxPduId

Status: DRAFT

⌈

Parameter Name	J1939FscpSdgRxPduId
Parent Container	J1939FscpSdgRxPdu
Upstream mapping defined	–
Description	The PDU identifier used for RxIndication to PduR. **Tags:** atp.Status=draft
Multiplicity	1
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)
Range	0 .. 65535
Default value	–
With Auto	true
Pre-Compile only	true

⌋

[ECUC_J1939Fscp_00015] Definition of EcucReferenceDef J1939FscpSdgRxPduRef

Status: DRAFT

⌈

Parameter Name	J1939FscpSdgRxPduRef
Parent Container	J1939FscpSdgRxPdu
Upstream mapping defined	–
Description	Reference to the global PDU. **Tags:** atp.Status=draft
Multiplicity	1
Type	Reference to Pdu
Pre-Compile only	true

⌋

10.1.7 J1939FscpSdmRxPdu

[ECUC_J1939Fscp_00016] Definition of EcucParamConfContainerDef J1939FscpSdmRxPdu

Status: DRAFT

⌈

Container Name	J1939FscpSdmRxPdu
Parent Container	J1939FscpRxPg
Upstream mapping defined	–
Description	Contains the configuration of the PDU used to receive the SDM PG. This PDU can consume a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
Multiplicity	1
Pre-Compile only	true
Configuration Parameters	

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpSdmRxPduId	1	[ECUC_J1939Fscp_00017]
J1939FscpSdmRxPduRef	1	[ECUC_J1939Fscp_00018]

No Included Containers

⌋

[ECUC_J1939Fscp_00017] Definition of EcucIntegerParamDef J1939FscpSdmRxPduId

Status: DRAFT

⌈

Parameter Name	J1939FscpSdmRxPduId
Parent Container	J1939FscpSdmRxPdu
Upstream mapping defined	–
Description	The PDU identifier used for RxIndication from PduR. **Tags:** atp.Status=draft
Multiplicity	1
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)
Range	0 .. 65535
Default value	–
With Auto	true
Pre-Compile only	true

⌋

[ECUC_J1939Fscp_00018] Definition of EcucReferenceDef J1939FscpSdmRxPduRef

Status: DRAFT

⌈

Parameter Name	J1939FscpSdmRxPduRef
Parent Container	J1939FscpSdmRxPdu
Upstream mapping defined	–

▽

△

Description	Reference to the global PDU. **Tags:** atp.Status=draft
Multiplicity	1
Type	Reference to Pdu
Pre-Compile only	true

⌋

10.1.8 J1939FscpShmRxPdu

[ECUC_J1939Fscp_00009] Definition of EcucParamConfContainerDef J1939FscpShmRxPdu

Status: DRAFT

⌈

Container Name	J1939FscpShmRxPdu
Parent Container	J1939FscpRxChannel
Upstream mapping defined	–
Description	Contains the configuration of the PDU used to receive the SHM PG. This PDU consumes a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
Multiplicity	1
Pre-Compile only	true
Configuration Parameters	

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpShmRxPduId	1	[ECUC_J1939Fscp_00010]
J1939FscpShmRxPduRef	1	[ECUC_J1939Fscp_00011]

No Included Containers

⌋

[ECUC_J1939Fscp_00010] Definition of EcucIntegerParamDef J1939FscpShmRxPduId

Status: DRAFT

⌈

Parameter Name	J1939FscpShmRxPduId
Parent Container	J1939FscpShmRxPdu
Upstream mapping defined	–

▽

△

Description	The PDU identifier used for RxIndication from PduR. **Tags:** atp.Status=draft	
Multiplicity	1	
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)	
Range	0 .. 65535	
Default value	–	
With Auto	true	
Pre-Compile only	true	

⌋

[ECUC_J1939Fscp_00011] Definition of EcucReferenceDef J1939FscpShmRxPduRef

Status: DRAFT

⌈

Parameter Name	J1939FscpShmRxPduRef
Parent Container	J1939FscpShmRxPdu
Upstream mapping defined	–
Description	Reference to the global PDU. **Tags:** atp.Status=draft
Multiplicity	1
Type	Reference to Pdu
Pre-Compile only	true

⌋

10.1.9 J1939FscpTxChannel

[ECUC_J1939Fscp_00005] Definition of EcucParamConfContainerDef J1939FscpTxChannel

Status: DRAFT

⌈

Container Name	J1939FscpTxChannel	
Parent Container	J1939FscpConfigSet	
Upstream mapping defined	–	
Description	Physical CAN channel used for transmission by J1939Fscp. **Tags:** atp.Status=draft	
Multiplicity	0..*	
Post-Build Multiplicity	Loadable	Selectable
Configuration Parameters		

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpTxChannelComMNetworkHandleRef	1	[ECUC_J1939Fscp_00035]

Included Containers		
Container Name	**Multiplicity**	**Description**
J1939FscpShmTxPdu	1	Contains the configuration of the PDU used to transmit the SHM PG. This PDU produces a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
J1939FscpTxPg	1..*	Contains the configuration of the transmitted SDM and of the upper layer PDU. **Tags:** atp.Status=draft

⌋

[ECUC_J1939Fscp_00035] Definition of EcucReferenceDef J1939FscpTxChannelComMNetworkHandleRef

Status: DRAFT

⌈

Parameter Name	J1939FscpTxChannelComMNetworkHandleRef
Parent Container	J1939FscpTxChannel
Upstream mapping defined	–
Description	Reference to the ComMChannel which corresponds to the J1939FscpTxChannel. This parameter is useful for the validation of the J1939Fscp configuration. **Tags:** atp.Status=draft
Multiplicity	1
Type	Symbolic name reference to ComMChannel
Pre-Compile only	true

⌋

10.1.10 J1939FscpTxPg

[ECUC_J1939Fscp_00025] Definition of EcucParamConfContainerDef J1939FscpTxPg

Status: DRAFT

⌈

Container Name	J1939FscpTxPg
Parent Container	J1939FscpTxChannel
Upstream mapping defined	–
Description	Contains the configuration of the transmitted SDM and of the upper layer PDU. **Tags:** atp.Status=draft
Multiplicity	1..*

▽

△

Post-Build Multiplicity	Loadable	Selectable
Configuration Parameters		

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpShmTxPriority	0..1	[ECUC_J1939Fscp_00033]
J1939FscpTxSrvt	1	[ECUC_J1939Fscp_00032]

Included Containers		
Container Name	**Multiplicity**	**Description**
J1939FscpSdgTxPdu	1	Contains the configuration of the PDU used to accept the transmitted SDG from the upper layer. This PDU can consume a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
J1939FscpSdmTxPdu	1	Contains the configuration of the PDU used to transmit the SDM PG. This PDU can produce a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft

⌋

[ECUC_J1939Fscp_00033] Definition of EcucIntegerParamDef J1939FscpShmTxPriority

Status: DRAFT

⌈

Parameter Name	J1939FscpShmTxPriority	
Parent Container	J1939FscpTxPg	
Upstream mapping defined	–	
Description	Configures the priority to be used for transmission of the SHM message. This parameter can be used to override the priority provided with MetaData from the J1939 FscpSdgTxPdu. **Tags:** atp.Status=draft	
Multiplicity	0..1	
Type	EcucIntegerParamDef	
Range	0 .. 7	
Default value	–	
Post-Build Multiplicity	Loadable	Selectable
Post-Build Value	Loadable	Selectable

⌋

[ECUC_J1939Fscp_00032] Definition of EcucFloatParamDef J1939FscpTxSrvt

Status: DRAFT

⌈

Parameter Name	J1939FscpTxSrvt	
Parent Container	J1939FscpTxPg	
Upstream mapping defined	–	
Description	This parameter sets the maximum for the Safety-Relevant Validation Time (SRVT_ Maximum), which is used to determine a time limit for the transmission of the corresponding SDM message after transmission of an SHM message. After this time, the SDM is dropped. **Tags:** atp.Status=draft	
Multiplicity	1	
Type	EcucFloatParamDef	
Range	]0 .. INF[	
Default value	–	
Post-Build Value	Loadable	Selectable

⌋

10.1.11 J1939FscpSdgTxPdu

[ECUC_J1939Fscp_00026] Definition of EcucParamConfContainerDef J1939Fscp SdgTxPdu

Status: DRAFT

⌈

Container Name	J1939FscpSdgTxPdu
Parent Container	J1939FscpTxPg
Upstream mapping defined	–
Description	Contains the configuration of the PDU used to accept the transmitted SDG from the upper layer. This PDU can consume a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
Multiplicity	1
Pre-Compile only	true
Configuration Parameters	

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpSdgTxPduId	1	[ECUC_J1939Fscp_00027]
J1939FscpSdgTxPduRef	1	[ECUC_J1939Fscp_00028]

No Included Containers

⌋

[ECUC_J1939Fscp_00027] Definition of EcucIntegerParamDef J1939FscpSdgTxPduId

Status: DRAFT

⌈

Parameter Name	J1939FscpSdgTxPduId
Parent Container	J1939FscpSdgTxPdu
Upstream mapping defined	–
Description	The PDU identifier used for Transmit from PduR. **Tags:** atp.Status=draft
Multiplicity	1
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)
Range	0 .. 65535
Default value	–
With Auto	true
Pre-Compile only	true

⌋

[ECUC_J1939Fscp_00028] Definition of EcucReferenceDef J1939FscpSdgTxPduRef

Status: DRAFT

⌈

Parameter Name	J1939FscpSdgTxPduRef
Parent Container	J1939FscpSdgTxPdu
Upstream mapping defined	–
Description	Reference to the global PDU. **Tags:** atp.Status=draft
Multiplicity	1
Type	Reference to Pdu
Pre-Compile only	true

⌋

10.1.12 J1939FscpSdmTxPdu

[ECUC_J1939Fscp_00029] Definition of EcucParamConfContainerDef J1939FscpSdmTxPdu

Status: DRAFT

⌈

Container Name	J1939FscpSdmTxPdu
Parent Container	J1939FscpTxPg
Upstream mapping defined	–
Description	Contains the configuration of the PDU used to transmit the SDM PG. This PDU can produce a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
Multiplicity	1
Pre-Compile only	true
Configuration Parameters	

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpSdmTxPduId	1	[ECUC_J1939Fscp_00030]
J1939FscpSdmTxPduRef	1	[ECUC_J1939Fscp_00031]

No Included Containers

⌋

[ECUC_J1939Fscp_00030] Definition of EcucIntegerParamDef J1939FscpSdmTxPduId

Status: DRAFT

⌈

Parameter Name	J1939FscpSdmTxPduId
Parent Container	J1939FscpSdmTxPdu
Upstream mapping defined	–
Description	The PDU identifier used for TxConfirmation to PduR. **Tags:** atp.Status=draft
Multiplicity	1
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)
Range	0 .. 65535
Default value	–
With Auto	true
Pre-Compile only	true

⌋

[ECUC_J1939Fscp_00031] Definition of EcucReferenceDef J1939FscpSdmTxPduRef

Status: DRAFT

⌈

Parameter Name	J1939FscpSdmTxPduRef
Parent Container	J1939FscpSdmTxPdu
Upstream mapping defined	–

▽

△

Description	Reference to the global PDU. **Tags:** atp.Status=draft
Multiplicity	1
Type	Reference to Pdu
Pre-Compile only	true

⌋

10.1.13 J1939FscpShmTxPdu

[ECUC_J1939Fscp_00022] Definition of EcucParamConfContainerDef J1939FscpShmTxPdu

Status: DRAFT

⌈

Container Name	J1939FscpShmTxPdu
Parent Container	J1939FscpTxChannel
Upstream mapping defined	–
Description	Contains the configuration of the PDU used to transmit the SHM PG. This PDU produces a meta data item of type CAN_ID_32. **Tags:** atp.Status=draft
Multiplicity	1
Pre-Compile only	true
Configuration Parameters	

Included Parameters		
Parameter Name	**Multiplicity**	**ECUC ID**
J1939FscpShmTxPduId	1	[ECUC_J1939Fscp_00023]
J1939FscpShmTxPduRef	1	[ECUC_J1939Fscp_00024]

No Included Containers

⌋

[ECUC_J1939Fscp_00023] Definition of EcucIntegerParamDef J1939FscpShmTxPduId

Status: DRAFT

⌈

Parameter Name	J1939FscpShmTxPduId
Parent Container	J1939FscpShmTxPdu
Upstream mapping defined	–

▽

△

Description	The PDU identifier used for TxConfirmation to PduR. **Tags:** atp.Status=draft
Multiplicity	1
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)
Range	0 .. 65535
Default value	–
With Auto	true
Pre-Compile only	true

⌋

[ECUC_J1939Fscp_00024] Definition of EcucReferenceDef J1939FscpShmTxPduRef

Status: DRAFT

⌈

Parameter Name	J1939FscpShmTxPduRef
Parent Container	J1939FscpShmTxPdu
Upstream mapping defined	–
Description	Reference to the global PDU. **Tags:** atp.Status=draft
Multiplicity	1
Type	Reference to Pdu
Pre-Compile only	true

⌋

10.2 Configuration Constraints

This section lists constraints on the configuration of the J1939Fscp.

[CP_SWS_J1939Fscp_CONSTR_00001] Timing Constraints

Status: DRAFT

⌈The J1939FscpMainFunctionPeriod shall be configured such that the cycle time is small enough to cope with all configured values for J1939FscpRxSrvt and J1939FscpTxSrvt.⌋

[CP_SWS_J1939Fscp_CONSTR_00002] MetaData Transmission Constraint

Status: DRAFT

⌈The two global Pdus that are referenced as J1939FscpSdgTxPduRef and J1939FscpSdmTxPduRef shall both refer to the same MetaDataType, or to no MetaDataType.⌋

[CP_SWS_J1939Fscp_CONSTR_00003] MetaData Reception Constraint

Status: DRAFT

⌈The two global `Pdu`s that are referenced as `J1939FscpSdgRxPduRef` and `J1939FscpSdmRxPduRef` shall both refer to the same `MetaDataType`, or to no `MetaDataType`.⌋

A Not applicable requirements

[CP_SWS_J1939Fscp_NA_00001] Requirements Not Applicable to this Specification

Status: DRAFT
Upstream requirements: SRS_BSW_00168

⌈These requirements are not applicable to this specification.⌋

B Change History of AUTOSAR Traceable Items

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

B.1 Traceable Item History of this Document According to AUTOSAR Release R26-11

B.1.1 Added Specification Items in R26-11

[CP_SWS_J1939Fscp_00029] [ECUC_J1939Fscp_00036] [SWS_J1939Fscp_90014] [SWS_J1939Fscp_90015]

B.1.2 Changed Specification Items in R26-11

[CP_SWS_J1939Fscp_00010] [CP_SWS_J1939Fscp_00011] [ECUC_J1939Fscp_00001] [ECUC_J1939Fscp_00002]

B.1.3 Deleted Specification Items in R26-11

[CP_SWS_J1939Fscp_90007] [ECUC_J1939Fscp_00007]

B.1.4 Added Constraints in R26-11

none

B.1.5 Changed Constraints in R26-11

none

B.1.6 Deleted Constraints in R26-11

none

B.2 Traceable Item History of this Document According to AUTOSAR Release R25-11

B.2.1 Added Specification Items in R25-11

none

B.2.2 Changed Specification Items in R25-11

[ECUC_J1939Fscp_00017]

B.2.3 Deleted Specification Items in R25-11

none

B.2.4 Added Constraints in R25-11

none

B.2.5 Changed Constraints in R25-11

none

B.2.6 Deleted Constraints in R25-11

none

B.3 Traceable Item History of this Document According to AUTOSAR Release R24-11

B.3.1 Added Specification Items in R24-11

[CP_SWS_J1939Fscp_00001] [CP_SWS_J1939Fscp_00002] [CP_SWS_J1939Fscp_00003] [CP_SWS_J1939Fscp_00004] [CP_SWS_J1939Fscp_00005] [CP_SWS_J1939Fscp_00006] [CP_SWS_J1939Fscp_00007] [CP_SWS_J1939Fscp_00008] [CP_SWS_J1939Fscp_00009] [CP_SWS_J1939Fscp_00010] [CP_SWS_J1939Fscp_00011] [CP_SWS_J1939Fscp_00012] [CP_SWS_J1939Fscp_00013]

[CP_SWS_J1939Fscp_00014] [CP_SWS_J1939Fscp_00015] [CP_SWS_J1939Fscp_00016] [CP_SWS_J1939Fscp_00017] [CP_SWS_J1939Fscp_00018] [CP_SWS_J1939Fscp_00020] [CP_SWS_J1939Fscp_00021] [CP_SWS_J1939Fscp_00022] [CP_SWS_J1939Fscp_00023] [CP_SWS_J1939Fscp_00024] [CP_SWS_J1939Fscp_00025] [CP_SWS_J1939Fscp_00026] [CP_SWS_J1939Fscp_00027] [CP_SWS_J1939Fscp_00028] [CP_SWS_J1939Fscp_90001] [CP_SWS_J1939Fscp_90002] [CP_SWS_J1939Fscp_90003] [CP_SWS_J1939Fscp_90004] [CP_SWS_J1939Fscp_90005] [CP_SWS_J1939Fscp_90006] [CP_SWS_J1939Fscp_90007] [CP_SWS_J1939Fscp_90008] [CP_SWS_J1939Fscp_90009] [CP_SWS_J1939Fscp_90010] [CP_SWS_J1939Fscp_90011] [CP_SWS_J1939Fscp_90012] [CP_SWS_J1939Fscp_90013] [ECUC_J1939Fscp_00001] [ECUC_J1939Fscp_00002] [ECUC_J1939Fscp_00003] [ECUC_J1939Fscp_00004] [ECUC_J1939Fscp_00005] [ECUC_J1939Fscp_00006] [ECUC_J1939Fscp_00007] [ECUC_J1939Fscp_00008] [ECUC_J1939Fscp_00009] [ECUC_J1939Fscp_00010] [ECUC_J1939Fscp_00011] [ECUC_J1939Fscp_00012] [ECUC_J1939Fscp_00013] [ECUC_J1939Fscp_00014] [ECUC_J1939Fscp_00015] [ECUC_J1939Fscp_00016] [ECUC_J1939Fscp_00017] [ECUC_J1939Fscp_00018] [ECUC_J1939Fscp_00019] [ECUC_J1939Fscp_00020] [ECUC_J1939Fscp_00021] [ECUC_J1939Fscp_00022] [ECUC_J1939Fscp_00023] [ECUC_J1939Fscp_00024] [ECUC_J1939Fscp_00025] [ECUC_J1939Fscp_00026] [ECUC_J1939Fscp_00027] [ECUC_J1939Fscp_00028] [ECUC_J1939Fscp_00029] [ECUC_J1939Fscp_00030] [ECUC_J1939Fscp_00031] [ECUC_J1939Fscp_00032] [ECUC_J1939Fscp_00033] [ECUC_J1939Fscp_00035]

B.3.2 Changed Specification Items in R24-11

none

B.3.3 Deleted Specification Items in R24-11

none

B.3.4 Added Constraints in R24-11

[CP_SWS_J1939Fscp_CONSTR_00001] [CP_SWS_J1939Fscp_CONSTR_00002] [CP_SWS_J1939Fscp_CONSTR_00003]

B.3.5 Changed Constraints in R24-11

none

B.3.6 Deleted Constraints in R24-11

none