VOLKSWAGEN

AKTIENGESELLSCHAFT

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Sichere on-board Kommunikation

Diagnosis specifications

Development, General Project-Independent Performance Specification: LAH.000.900.AM

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Contents

1 Introduction

1.1 Purpose of this Document

[I: SOK_DIAG_176]

This performance specification describes the diagnostic communication services of sichere on-board Kommunikation (SOK) which is carried out via the diagnostics connection with the SOK freshness manager (SOK-FM) [1]. Diagnostic communication is the link between testers and SOK-capable electronic control units (ECUs).

[I: SOK_DIAG_177]

SOK ensures the messages sent between ECUs are authentic. This is carried out by the creation and verification of symmetric signatures known as message authentication codes (MACs).

[I: SOK_DIAG_178]

It is important to distinguish between the AUTOSAR SecOC module and the SOK-FM with regard to the creation and verification of signatures. The cryptographic operations are carried out by the SecOC module. The SOK-FM supplies the SecOC module with freshness values to prevent replay attacks.

[I: SOK_DIAG_180]

The diagnostic information exchanged between the tester and the ECU includes status information about

- signature creation and verification
- the provision of freshness values including internal SOK-time management
- the status of the cryptographic keys used
- other general information about the SOK-FM

[I: SOK_DIAG_181]

This document concentrates on the information to be exchanged and the crucial requirements for the diagnostic communication.

[I: SOK_DIAG_182]

Details specific to the tester are not within the scope of this document's purpose.

[A: SOK_DIAG_348]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

This document is intended for ECUs using an AUTOSAR Classic environment which features certain components to provide diagnostic functions such as the AUTOSAR diagnostic event manager (DEM) and AUTOSAR diagnostic communication manager (DCM). If the integrating ECU does not feature such an environment then it must make sure that diagnostic communication is still ensured as described in this document.

[I: SOK_DIAG_349]

This may be realized integrating against the SOK-FM's interfaces just as the DCM and DEM would, and then emulating the necessary functionality.

1.2 Scope of the Diagnostic Communication

[I: SOK_DIAG_184]

The term "SOK diagnostic communication" refers to every SOK-FM communication with a communication partner outside the vehicle.

1.3 Relevant Documents

[A: SOK_DIAG_350]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The implementation of the following specifications is required to realize this document's functionality. Their respective versions are subject to project-specific agreements and are not relevant with respect to this document.

[A: SOK_DIAG_186]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

- Group Standard VW 80180-1: "Cryptographic Algorithms and Methods for Use in Electronic Control Units, Systems, Functions, and Supplier-Specific Packages"
- Group Standard VW 80180-2: "Implementation of Security Objective Classes for Security-Relevant Data and of Cryptographic Security Measures"
- LAH.DUM.909.G: "Unified Diagnostic Services Protocol (UDS)"
- LAH.DUM.909.A/J: "Standard Eigendiagnose elektronischer Fahrzeugsysteme"
- LAH.DUM.909.H: "Identifikation elektronischer Fahrzeugsysteme"

1.4 Referenced Documents

[I: SOK_DIAG_5]

Table 2: Referenced documents

Ref.	Document/Source	Version
[1]	LAH LAH.000.900.AL: Sichere on-board Kommunikation - Integrationslastenheft	4.0
[2]	LAH 893.910.A: Standardsoftware	5.0
[3]	LAH.000.900.N (Anhang A zu VW 80125): Standard Software Versionsausgabe	2.5

2 General Description

[I: SOK_DIAG_190]

This chapter explains the basic functions and requirements of diagnostics in the context of SOK.

[A: SOK_DIAG_191]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The entire communication of the SOK freshness manager with communication partners outside the vehicle must take place over the UDS interface according to the prescribed requirements laid out in the UDS protocol (SOK_DIAG_186).

2.1 Overview of the Diagnostic Functionality of SOK

[I: SOK_DIAG_193]

The individual SOK functionalities provided by the diagnostic service are introduced below.

[I: SOK_DIAG_195]

A compact overview of all measurement values of SOK is presented in the following table, including their mapping to the underlying API functions of the SOK-FM.

Diagnose-Funktion	DID	Parameterzeile	SOK-FM-API-Funktion
Measurement value SOK_verification_failed_list: Returns a list of PDU-IDs for PDUs which have failed verification	0x018B	Longname Verification_failed_error_code	SokFm_Read_VerificationFailedList_Status
		Longname Verification_failed_number	SokFm_Read_VerificationFailedList_Number
		Iteration über fehlgeschlagene Verifikationen	SokFm_Read_VerificationFailedList_Data
Measurement value SOK_signature_failed_list: Returns a list of PDU-IDs for PDUs which have failed signature creation attempts	0x018F	Longname Signature_failed_error_code	SokFm_Read_SignatureFailed-List_Status
		Longname Signature_failed_number	SokFm_Read_SignatureFailed-List_Number
		Iteration über fehlgeschlagene Signaturerstellungen	SokFm_Read_SignatureFailed-List_Data
Measurement value SOK_general_information: Returns a list with the following information - SOK_ecu_function - SOK_main_period	0x0190	Longname General_information_error_code	SokFm_Read_GeneralInfo_Status
		Longname General_information_ecu_function	SokFm_Read_GeneralInfo_EcuFunction
		Longname General_information_main_period	SokFm_Read_GeneralInfo_MainPeriod
Measurement value SOK_time_information: Returns a list with the following information: - SOK_time_is_valid - SOK_time - SOK_jitter_max_exceeded	0x0191	Longname Time_status	SokFm_Read_TimeInfo_Status
		Longname Time_validity	SokFm_Read_TimeInfo_Validity
		Longname Time_current_sok_time	SokFm_Read_TimeInfo_CurrentSokTime
		Longname Time_jitter_status	SokFm_Read_TimeInfo_Jitter-Status
Measurement value SOK_freshness_information: Returns a list with information about Freshness IDs	0x0192	Longname Freshness_status	SokFm_Read_FreshnessInfo_Status
		Longname Freshness_number	SokFm_Read_FreshnessInfo_Number
		Iteration über Freshness Values	SokFm_Read_FreshnessInfo_Data
Measurement value SOK_missing_key_list: Returns a list of IDs for the keys which SOK cannot access	0x0194	Longname Missing_keys_error_code	SokFm_Read_MissingKey-List_Status
		Longname Missing_keys_number	SokFm_Read_MissingKey-List_Number
		Iteration über fehlende Schlüssel	SokFm_Read_MissingKey-List_Data

[I: SOK_DIAG_351]

In addition to the measurement values, SOK uses the diagnostic routine SOK_function_deactivation.

[I: SOK_DIAG_196]

Individual diagnostic functions are explained below in detail.

2.1.1 Signature Verification Status

[A: SOK_DIAG_198]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

A tester must be able to read out a list with information (SOK-PDU-ID) about unsuccessful signature verification attempts from an SOK-relevant ECU.

[I: SOK_DIAG_199]

This information can be read out by a tester and can serve to resolve errors.

[A: SOK_DIAG_200]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

This information must be provided as a measurement value with the long-name SOK_verification_failed_list which can be called by ReadDataByIdentifier (22hex) over the UDS protocol. More details are found in the "Specific Requirements" section.

2.1.2 Signature Creation Status

[A: SOK_DIAG_75]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

A tester must be able to read out a list with information (SOK-PDU-ID) about unsuccessful signature creation attempts from an SOK-relevant ECU.

[A: SOK_DIAG_202]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

This information must be provided as a measurement value with the long-name SOK_signature_failed_list which can be called by ReadDataByIdentifier (22hex) over the UDS protocol. More details are found in the "Specific Requirements" section.

2.1.3 General Status Information

[A: SOK_DIAG_204]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

A tester must be able to read out general information about the configuration of the SOK-FM from an SOK-relevant ECU, such as the role of the SOK-participant and its call frequency period.

[I: SOK_DIAG_205]

This information can be read out by a tester and used to verify correct configuration.

[A: SOK_DIAG_206]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

This information must be provided as a measurement value with the long-name SOK_general_information which can be called by ReadDataByIdentifier (22hex) over the UDS protocol. More details are found in the "Specific Requirements" section.

2.1.4 General Information regarding the SOK-time

[A: SOK_DIAG_208]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

General information about the status of the internal SOK-time, such as its current value, must be readable from an SOK-relevant ECU by a tester.

[I: SOK_DIAG_209]

This information can be read out by a tester and used to verify proper functionality.

[A: SOK_DIAG_210]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

This information must be provided as a measurement value with the long-name SOK_time_information which can be called by ReadDataByIdentifier (22hex) over the UDS protocol. More details are found in the "Specific Requirements" section.

2.1.5 Freshness Value Status

[A: SOK_DIAG_212]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

A tester must be able to read out a list with information about the freshness IDs used by the SOK-FM from an SOK-relevant ECU.

[A: SOK_DIAG_213]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

This information must be provided as a measurement value with the long-name SOK_freshness_information which can be called by ReadDataByIdentifier (22hex) over the UDS protocol. More details are found in the "Specific Requirements" section.

2.1.6 Missing Keys List

[A: SOK_DIAG_215]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

A tester must be able to read out a list with missing keys needed by SOK from a SOK-relevant ECU.

[I: SOK_DIAG_216]

This information can be read out by a tester and used to resolve errors.

[A: SOK_DIAG_217]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

This information must be provided as a measurement value with the long-name SOK_missing_key_list which can be called by ReadDataByIdentifier (22hex) over the UDS protocol. More details are found in the "Specific Requirements" section.

2.1.7 Disable SOK functionality

[A: SOK_DIAG_353]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

A tester must be able to disable SOK (such that signature checks are ignored and default signatures are sent) in an SOK-relevant ECU and activate it again.

[I: SOK_DIAG_354]

This will be used in development to ensure that communication in the car is not blocked by SOK that is malfunctioning due to incomplete integration or missing keys.

[I: SOK_DIAG_355]

The disabling and enabling of SOK will be done via RoutineControl (31hex) with the routine with longname SOK_function_deactivation. More details can be found in the "Specific Requirements" section.

3 Specific Requirements

[I: SOK_DIAG_219]

This chapter defines the specific requirements of the diagnostic communication.

[A: SOK_DIAG_220]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

All the diagnostic objects described in this document are to be implemented according to the SOK diagnostic data table.

[A: SOK_DIAG_222]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

SOK diagnostic services must be implemented according to the ODX of the corresponding ECU variant (EV). The guidelines for this are found in the relevant SOK diagnostics data table.

3.1 SOK-relevant Entries in the Event Memory

[A: SOK_DIAG_224]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The SOK-FM must enter DTCs for various error events in the event memory. These are outlined in the event memory entries listed in the following table. The complete table including the DTC IDs can be found in the SOK diagnostics data table "SOK Ereignisspeicher".

Error Event (DTC-DFCC Text)	Qualifizierungs- / Fehlersetzbedingung	Rücksetzbedingung
SOK_timeserver_not_available	The authentic SOK time has not been received from the SOK time server	An authentic SOK time from the SOK time server has been received
SOK_signature_verification_failed	The signature of a message with a fixed PDU-ID could not be verified	The signature of a message with the same PDU-ID could be verified
SOK_key_not_available	At least one relevant key is not available (calling of VKMS_isTypeIdReady returns something other than VKMS_ERR_NONE for at least one TypeId)	All keys are available (calling of VKMS_isTypeIdReady returns the result VKMS_ERR_NONE for all TypeIds)
SOK_function_deactivated	The functionality of SOK has been (partially) disabled through SOK_function_deactivation (SokFm_deactivate_SOK has been called and execution was at least partially successful)	The functionality of SOK is not diabled or limited

[A: SOK_DIAG_346]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The diagnostic module (e.g. DEM) has to call the API SokFm_Dem_SignatureVerificationEventStatusChanged, if the statusbits of the DTC SOK_signature_verification_failed change.

3.2 SOK Freshness Manager Functional Requirements for Diagnostic-relevant Functionalities

3.2.1 UDS Communication Procedure between Tester and ECU

[A: SOK_DIAG_231]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The UDS diagnostic protocol (cf. SOK_DIAG_186) must be used in conjunction with the diagnostic service ReadDataByIdentifier (22hex) for the provision of lists of information by the ECU.

[A: SOK_DIAG_232]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

All measurement values accessed by the 22hex service must be readable only. Writing to a measurement value via 2Ehex must not be possible.

[A: SOK_DIAG_233]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

All measurement values must be created according to the requirements laid out in the SOK diagnostic data table.

3.2.2 SOK_verification_failed_list - Requests for Information about Failed Verifications

[I: SOK_DIAG_366]

This measurement value contains a list of all SecOC Data IDs for which verification has failed at least once since the last initialization of SOK-FM or the last fault memory clear (whichever was later).

[I: SOK_DIAG_236]

The SOK-FM provides the list of failed verifications upon request by the API-functions SokFm_Read_VerificationFailedList_Status, SokFm_Read_VerificationFailedList_Number and SokFm_Read_VerificationFailedList_Data.

[I: SOK_DIAG_304]

The functions mentioned above were designed for connection to the AUTOSAR diagnostic communication manager (DCM) and have the following structure:

Std_ReturnType <fctName> (uint8* data)

Std_ReturnType is defined by the AUTOSAR standard.

[I: SOK_DIAG_305]

If the diagnostic connection takes place over the AUTOSAR DCM, the parameter DcmDspDataUsePort should have the value USE_DATA_SYNCH_FNC.

[A: SOK_DIAG_237]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The list of failed verification attempts must be read out by the appropriate SOK-FM API-functions (cf. SOK_DIAG_236) according to SOK_DIAG_304. This must be provided by the measurement value with longname "SOK_verification_failed_list"

[A: SOK_DIAG_238]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Verification_failed_error_code" of the measurement value with longname "SOK_verification_failed_list" must contain the (1 byte long) error code returned by the last calling of the API-function SokFm_Read_VerificationFailedList_Status as its value.

[A: SOK_DIAG_239]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Verification_failed_number" of the measurement value with longname "SOK_verification_failed_list" must contain the value returned by the last calling of the API-function SokFm_Read_VerificationFailedList_Number

[A: SOK_DIAG_306]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The array element of the measurement value with longname "SOK_verification_failed_list" must contain the value last returned by calling the API-function SokFm_Read_VerificationFailedList_Data

[A: SOK_DIAG_307]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The API-Call SokFm_Read_VerificationFailedList_DataLength returns the dynamic length of the array element.

[I: SOK_DIAG_308]

The function SokFm_Read_VerificationFailedList_DataLength was designed for connection to the AUTOSAR diagnostic communication manager (DCM) and has the following structure:

Std_ReturnType SokFm_Read_VerificationFailedList_DataLength (P2VAR(uint16, AUTOMATIC, SOKFM_DCM_DATA) data)

Std_ReturnType is defined by the AUTOSAR standard.

[A: SOK_DIAG_240]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The content of the measurement value must be updated by calling the corresponding SokFm_Read_* functions according to SOK_DIAG_238, SOK_DIAG_239, SOK_DIAG_306 every time the measurement value is requested via UDS command 0x22 hex.

[A: SOK_DIAG_241]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

If the measurement value is stored in volatile memory, its content must be updated at every system startup by calling the appropriate API functions (cf. SOK_DIAG_236) such that it is available for retrieval after the diagnostic module has been started.

3.2.3 SOK_signature_failed_list - Requests for Information about Failed Signature Creation Attempts

[I: SOK_DIAG_367]

This measurement value contains a list of all SecOC Data IDs for which signature creation has failed at least once since the last initialization of SOK-FM or the last fault memory clear (whichever was later).

[I: SOK_DIAG_249]

The SOK-FM provides the list of failed attempts at creating signatures upon request by the API-functions SokFm_Read_SignatureFailedList_Status, SokFm_Read_SignatureFailedList_Number and SokFm_Read_SignatureFailedList_Data.

[I: SOK_DIAG_309]

The functions listed above were designed for connection with the AUTOSAR diagnostic communication manager (DCM) and have the following structure:

Std_ReturnType <fctName> (uint8* data)

Std_ReturnType is defined by the AUTOSAR standard.

[I: SOK_DIAG_310]

If the diagnostic connection takes place over the AUTOSAR DCM, the parameter DcmDspDataUsePort should have the value USE_DATA_SYNCH_FNC

[A: SOK_DIAG_250]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The list of failed attempts at signature creation must be read out by the appropriate SOK-FM API-functions (cf. SOK_DIAG_249) according to SOK_DIAG_309 and must be provided by the measurement value with longname "SOK_signature_failed_list"

[A: SOK_DIAG_251]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Signature_failed_error_code" of the measurement value with longname "SOK_signature_failed_list" must contain the (1 byte long) error code returned by the last calling of the API-function SokFm_Read_SignatureFailedList_Status.

[A: SOK_DIAG_252]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Signature_failed_number" of the measurement value with longname "SOK_signature_failed_list" must contain the value returned by the last calling of the API-function SokFm_Read_SignatureFailedList_Number as its value.

[A: SOK_DIAG_311]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The array element of the measurement value with longname "SOK_signature_failed_list" must contain the value last returned by calling the API-function SokFm_Read_SignatureFailedList_Data.

[A: SOK_DIAG_312]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The API-Call SokFm_Read_SignatureFailedList_DataLength returns the dynamic length of the array element.

[I: SOK_DIAG_313]

The function SokFm_Read_SignatureFailedList_DataLength was designed for connection with the AUTOSAR DCM and has the following structure:

Std_ReturnType SokFm_Read_SignatureFailedList_DataLength (P2VAR(uint16, AUTOMATIC, SOKFM_DCM_DATA) data)

Std_ReturnType is defined by the AUTOSAR standard.

[A: SOK_DIAG_253]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The content of the measurement value must be updated by calling the corresponding SokFm_Read_* functions according to SOK_DIAG_252, SOK_DIAG_253, SOK_DIAG_311 every time the measurement value is requested via UDS command 0x22 hex.

[A: SOK_DIAG_314]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

If the measurement value is stored in volatile memory, its content must be updated at every system startup by calling the appropriate API-functions (cf. SOK_DIAG_249) such that it is available for retrieval after the diagnostic module has been started.

3.2.4 SOK_general_information - Requests for General Information about the SOK Freshness Manager

[I: SOK_DIAG_260]

The SOK-FM provides general information upon request by the API-functions SokFm_Read_GeneralInfo_Status, SokFm_Read_GeneralInfo_EcuFunction and SokFm_Read_GeneralInfo_MainPeriod.

[I: SOK_DIAG_316]

The functions listed above were designed for connection with a the AUTOSAR diagnostic communication manager DCM and have the following structure:

Std_ReturnType <fctName> (uint8* data)

Std_ReturnType is defined by the AUTOSAR standard.

[I: SOK_DIAG_317]

If the diagnostic connection takes place over the AUTOSAR DCM, the parameter DcmDspDataUsePort should have the value USE_DATA_SYNCH_FNC.

[A: SOK_DIAG_261]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The general information must be read out by the appropriate SOK-FM API-functions (cf. SOK_DIAG_260) according to SOK_DIAG_316 and must be provided by the measurement value SOK_general_information with longname "SOK_general_information".

[A: SOK_DIAG_262]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "General_information_error_code" of the measurement value with longname "SOK_general_information" must contain the (1 byte long) error code returned by the last calling of the API-function SokFm_Read_GeneralInfo_Status as its value.

[A: SOK_DIAG_318]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "General_information_ecu_function" of the measurement value with longname "SOK_general_information" must contain the value returned by the last calling of the API-function SokFm_Read_GeneralInfo_EcuFunction.

[A: SOK_DIAG_319]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "General_information_main_period" of the measurement value with longname "SOK_general_information" must contain the value returned by the last calling of the API-function SokFm_Read_GeneralInfo_MainPeriod.

[I: SOK_DIAG_264]

Because the configuration of the SOK-FM cannot change at runtime, the content of this measurement value does not require regular updating by the ECU software.

[A: SOK_DIAG_265]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The content of the measurement value must at least be updated at the first use.

[A: SOK_DIAG_263]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

If the measurement value is stored in volatile memory, its content must be updated at every system startup by calling the appropriate API-functions (cf. SOK_DIAG_260) such that it is available for retrieval after the diagnostic module has been started.

3.2.5 SOK_time_information - Requests for Information about the Internal SOK-time

[I: SOK_DIAG_272]

The SOK-FM provides information about the internal SOK-time upon request by the API-functions SokFm_Read_TimeInfo_Status, SokFm_Read_TimeInfo_Validity, SokFm_Read_TimeInfo_CurrentSokTime and SokFm_Read_TimeInfo_JitterStatus.

[I: SOK_DIAG_321]

The functions listed above were designed for connection with the AUTOSAR DCM and have the following structure:

Std_ReturnType <fctName> (uint8* data)

Std_ReturnType is defined by the AUTOSAR standard.

[I: SOK_DIAG_322]

If the diagnostic connection takes place over the AUTOSAR DCM, the parameter DcmDspDataUsePort should have the value USE_DATA_SYNCH_FNC.

[A: SOK_DIAG_274]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The information about the internal SOK-time must be read out by the appropriate SOK-FM API-functions (cf. SOK_DIAG_272) according to SOK_DIAG_321 and must be provided by the measurement value with longname "SOK_time_information".

[A: SOK_DIAG_273]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Time_status" of the measurement value with longname "SOK_time_information" must contain the (1 byte long) error code returned by the last calling of the API-function SokFm_Read_TimeInfo_Status as its value.

[A: SOK_DIAG_323]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Time_current_sok_time" of the measurement value with longname "SOK_time_information" must contain the value returned by the last calling of the API-function SokFm_Read_TimeInfo_CurrentSokTime.

[A: SOK_DIAG_345]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Time_validity" of the measurement value with longname "SOK_time_information" must contain the value returned by the last calling of the API-function SokFm_Read_TimeInfo_Validity.

[A: SOK_DIAG_324]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Time_jitter_status" of the measurement value with longname "SOK_time_information" must contain the value returned by the last calling of the API-function SokFm_Read_TimeInfo_JitterStatus.

[A: SOK_DIAG_276]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The contents of the measurement value must be updated after every incrementation of the internal SOK-time.

[A: SOK_DIAG_275]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

If the measurement value is stored in volatile memory, its content must be updated at every system startup by calling the appropriate API-function (cf. SOK_DIAG_272) such that it is available for retrieval after the diagnostic module has been started.

3.2.6 SOK_freshness_information - Requests for a List with Information about Freshness Values

[I: SOK_DIAG_283]

The SOK-FM provides the list with freshness values upon request by the API-functions SokFm_Read_FreshnessInfo_Status, SokFm_Read_FreshnessInfo_Number and SokFm_Read_FreshnessInfo_Data.

[I: SOK_DIAG_326]

The functions listed above were designed for connection with the AUTOSAR DCM and have the following structure:

Std_ReturnType <fctName> (uint8* data)

Std_ReturnType is defined by the AUTOSAR standard.

[I: SOK_DIAG_327]

If the diagnostic connection takes place over the AUTOSAR DCM, the parameter DcmDspDataUsePort should have the value USE_DATA_SYNCH_FNC.

[A: SOK_DIAG_284]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The information about the freshness values must be read out by the appropriate SOK-FM API-functions (cf. SOK_DIAG_283) according to SOK_DIAG_326 and must be provided by the measurement value with longname "SOK_freshness_information".

[A: SOK_DIAG_285]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Freshness_status" of the measurement value with longname "SOK_freshness_information" must contain the (1 byte long) error code returned by the last calling of the API-function SokFm_Read_FreshnessInfo_Status as its value.

[A: SOK_DIAG_286]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Freshness_number" of the measurement value with longname "SOK_freshness_information" must contain the value returned by the last calling of the API-function SokFm_Read_FreshnessInfo_Number.

[A: SOK_DIAG_328]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The array element of the measurement value with longname "SOK_freshness_information" must contain the value last returned by calling the API-function SokFm_Read_FreshnessInfo_Data.

[I: SOK_DIAG_342]

The standard value 0xFFFF can also be a valid value for the element "Verbrauchte Counter Values". However, the standard value 0xFF for the element "Aktueller Counter Value" indicates that no valid counter value is present and so no bitfield is managed.

[A: SOK_DIAG_329]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The API-Call SokFm_Read_FreshnessInfo_DataLength returns the dynamic length of the array element.

[I: SOK_DIAG_330]

The function SokFm_Read_FreshnessInfo_DataLength was designed for connection with the AUTOSAR DCM and has the following structure:

Std_ReturnType SokFm_Read_FreshnessInfo_DataLength (P2VAR(uint16, AUTOMATIC, SOKFM_DCM_DATA) data)

Std_ReturnType is defined by the AUTOSAR standard.

[A: SOK_DIAG_287]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The content of the measurement value must be refreshed upon every request for a freshness value.

[A: SOK_DIAG_331]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

If the measurement value is stored in volatile memory, its content must be updated at every system startup by calling the appropriate API-functions (cf. SOK_DIAG_283) such that it is available for retrieval after the diagnostic module has been started.

3.2.7 SOK_missing_key_list - Requests for a List with Missing Keys

[I: SOK_DIAG_294]

The SOK-FM provides the list with missing keys upon request by the API-functions SokFm_Read_MissingKeyList_Status, SokFm_Read_MMissingKeyList_Number and SokFm_Read_MissingKeyList_Data.

[I: SOK_DIAG_333]

The functions listed above were designed for connection with the AUTOSAR DCM and have the following structure:

Std_ReturnType <fctName> (uint8* data)

Std_ReturnType is defined by the AUTOSAR standard.

[I: SOK_DIAG_334]

If the diagnostic connection takes place over the AUTOSAR DCM, the parameter DcmDspDataUse-Port should have the value USE_DATA_SYNCH_FNC.

[A: SOK_DIAG_295]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The list with missing keys must be read out by the appropriate SOK-FM API-functions (cf. SOK_DIAG_294) according to SOK_DIAG_333. This must be provided by the measurement value with longname "SOK_missing_key_list".

[A: SOK_DIAG_296]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Missing_keys_error_code" of the measurement value with longname "SOK_missing_key_list must" contain the (1 byte long) error code returned by the last calling of the API-function SokFm_Read_MissingKeyList_Status as its value.

[A: SOK_DIAG_297]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The element with longname "Missing_keys_number" of the measurement value with longname "SOK_missing_key_list" must contain the value returned by the last calling of the API-function SokFm_Read_MissingKeyList_Number.

[A: SOK_DIAG_335]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The array element of the measurement value with longname "SOK_missing_key_list" must contain the value last returned by calling the API-function SokFm_Read_MissingKeyList_Data.

[A: SOK_DIAG_336]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The API-Call SokFm_Read_MissingKeyList_DataLength returns the dynamic length of the array element.

[I: SOK_DIAG_337]

The function SokFm_Read_MissingKeyList_DataLength was designed for connection with the AU-TOSAR DCM and has the following structure:

Std_ReturnType SokFm_Read_MissingKeyList_DataLength (P2VAR(uint16, AUTOMATIC, SOKFM_DCM_DATA) data)

Std_ReturnType is defined by the AUTOSAR standard.

[A: SOK_DIAG_298]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The content of the measurement value must be updated after every startup/wake-up and after every new VKMS key injection.

[A: SOK_DIAG_338]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

If the measurement value is stored in volatile memory, its content must be updated at every system startup by calling the appropriate API-functions (cf. SOK_DIAG_294) such that it is available for retrieval after the diagnostic module has been started.

3.2.8 SOK_function_deactivation - Disable parts of SOK functionality

[A: SOK_DIAG_357]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

The routine must be available via UDS diagnostic service 0x31 (RoutineControl) as specified in the diagnostic data table.

[I: SOK_DIAG_358]

SOK-FM provides interfaces for RoutineStart and RequestResults for the routine SOK_function_deactivation designed for connection with AUTOSAR DCM. The exact names can be found in the documentation delivered with the SOK-FM software.

[A: SOK_DIAG_359]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

When the UDS client requests the subfunction "StartRoutine" (0x01), the UDS server in the ECU must check the parameters for correct format and values according to the diagnostic data table.

[A: SOK_DIAG_360]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

If the checks in SOK_DIAG_359 fail, the UDS server in the ECU must return a corresponding NRC according to the UDS standard.

[A: SOK_DIAG_361]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

If the checks in SOK_DIAG_359 are successful, the UDS server in the ECU must call the corresponding interface of SOK-FM (cf SOK_AUTOSAR_358) and fill its parameters as requested in the parameters of StartRoutine.

[A: SOK_DIAG_362]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

When the UDS client requests the subfunction "StopRoutine" (0x02), the UDS server in the ECU must refuse this with NRC 0x12 (SubFunctionNotSupported).

[A: SOK_DIAG_363]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

When the UDS client requests the subfunction "RequestResult" (0x03), the UDS server in the ECU must execute the following steps:

[A: SOK_DIAG_364]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

- If the routine was not previously succesfully started, the UDS server in the ECU must return an appropriate NRC according to the UDS standard.

[A: SOK_DIAG_365]

[BsM-E.D: nein, BsM-E.L: nein, BsM-E.T: nein, BsM-O: nein, BsM-Sa.FuSi: nein]

- Else if the routine was previously successfully started, the UDS server in the ECU must call the corresponding interface of SOK-FM (cf SOK_DIAG_358) and must populated the RoutineStatusRecord with the information output by SOK-FM.

4 Appendix

4.1 Revision History

[I: SOK_DIAG_45]

The changelog listed here gives an overview of the major changes implemented with each version of the document.

[I: SOK_DIAG_3]

Table 1: Revision History

Date	Version	Chapter	Description	Author
19.05.2017	1.0	-	Ersterstellung	Tschache, Alexander (EEKS/5) Schneider, Michael Peter (Escrypt)
14.06.2017	1.1	-	Anpassung an Änderungen der Diagnosetabellen	Tschache, Alexander (EEKS/5) Schneider, Michael Peter (Escrypt)
04.08.2017	1.2	-	Korrekturen für Q-LAH Prozess; keine funktionalen Änderungen	Tschache, Alexander (EEKS/5)
06.09.2018	4.0	-	Translation into English; assorted fixes	Tschache, Alexander (EEKS/T1)
22.08.2019	4.1	-	Improve DTC handling	Tschache, Alexander (EESC/1)
11.02.2020	4.2	-	Re-addition and update of german version	Fernandez, Aljoscha (EESC/3)
02.02.2021	5.0	-	Removal of DTC signature_creation_failed	Stadtmüller, Christoph (extern: escrypt for EESC/3)
01.10.2021	6.0	-	Add Routine for function deactivation. Corresponding DTC. Minor clarifications	Stadtmüller, Christoph (extern: escrypt for EESC/3)