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Contents

1 Scope of Document

This document defines general rules and formats for requirements specification within AUTOSAR. It shall be used as a basis for each requirements document.

The AUTOSAR Requirements on XCP specifies the XCP feature-set, which shall be supported by the AUTOSAR XCP Software Specification document.

A detailed list can be found on Chapter 4.2 "Functional Requirements".

2 Conventions to be used

The representation of requirements in AUTOSAR documents follows the table specified in [TPS_STDT_00078], see Standardization Template, chapter Support for Traceability ([1]).

In requirements, the following specific semantics shall be used (based on the Internet Engineering Task Force IETF).

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as follows.

Note that the requirement level of the document in which they are used modifies the force of these words.

- MUST: This word, or the adjective "LEGALLY REQUIRED", means that the definition is an absolute requirement of the specification due to legal issues.
- MUST NOT: This phrase, or the phrase "MUST NOT", means that the definition is an absolute prohibition of the specification due to legal issues.
- SHALL: This phrase, or the adjective "REQUIRED", means that the definition is an absolute requirement of the specification.
- SHALL NOT: This phrase means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective "RECOMMENDED", means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase "NOT RECOMMENDED", means that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
- MAY: This word, or the adjective "OPTIONAL", means that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item.

An implementation, which does not include a particular option, SHALL be prepared to interoperate with another implementation, which does include the option, though perhaps with reduced functionality. In the same vein an implementation, which does include a particular option, SHALL be prepared to interoperate with another implementation, which does not include the option (except, of course, for the feature the option provides.)

3 Requirements Specification

3.1 Functional Overview

XCP is an ASAM standard for calibration purpose of an ECU. This protocol provides the following functionality:

XCP provides the following basic features:

- Synchronous data acquisition
- Synchronous data stimulation
- Online memory calibration (read / write access)
- Calibration data page initialization and switching
- Flash Programming for ECU development purposes
- Various transportation layers (CAN, Ethernet (TCP/IP, UDP), USB,...)
- Block communication mode
- Interleaved communication mode
- Dynamic data transfer configuration
- Timestamped data transfer
- Synchronization of data transfer
- Priorization of data transfer
- Atomic bit modification
- Bitwise data stimulation

XCP improves the following features compared to CCP 2.1:

- compatibility and specification
- efficiency and throughput
- power-up data transfer
- data page freezing
- auto configuration
- flash programming.

XCP was designed according to the following principles:

- Minimal Slave resource consumption (RAM, ROM, runtime)
- Efficient communication
- Simple Slave implementation

3.2 Functional Requirements

3.2.1 General

[SRS_Xcp_29001] The AUTOSAR XCP module shall be located above the bus interfaces / Socket Adaptor

Status: OBSOLETE
Use instead: SRS_Xcp_29030
Upstream requirements: RS_BRF_01016, RS_BRF_01656

⌈

Description:	Within the AUTOSAR layered architecture, the AUTOSAR XCP module shall be located above the bus specific interfaces (CAN, FlexRay) and for Ethernet on top of the Socket Adaptor.
Rationale:	Due to performance reason, the AUTOSAR XCP is located as low as possible within the layered architecture.
Use Case:	–
Dependencies:	–
Supporting Material:	BSW Layered Software Architecture

⌋

[SRS_Xcp_29030] The AUTOSAR XCP module shall be located above the PduR

Status: DRAFT
Replaces: SRS_Xcp_29001
Upstream requirements: RS_BRF_01016, RS_BRF_01656

⌈

Description:	Within the AUTOSAR layered architecture, the AUTOSAR XCP module shall be located above the PduR.
Rationale:	Due to performance reason, the AUTOSAR XCP is located as low as possible within the layered architecture.
Use Case:	–
Dependencies:	–

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Supporting Material:	BSW Layered Software Architecture

⌋

[SRS_Xcp_29002] The AUTOSAR XCP shall make use of the data transmit- and receive APIs of the Bus Interfaces

Status: OBSOLETE
Use instead: SRS_Xcp_29031
Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	For sending and transmission of XCP Messages, the corresponding APIs provided by the bus specific interfaces shall be used
Rationale:	Usage of available APIs
Use Case:	Transmit and receive XCP Messages
Dependencies:	–
Supporting Material:	SWS FlexRay Interface, SWS CAN Interface, SWS Socket Adaptor

⌋

[SRS_Xcp_29031] The AUTOSAR XCP shall make use of the data transmit- and receive APIs of the PduR

Status: DRAFT
Replaces: SRS_Xcp_29002
Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	For sending and transmission of XCP Messages, the corresponding APIs provided by the PduR shall be used
Rationale:	Usage of available APIs
Use Case:	Transmit and receive XCP Messages
Dependencies:	–
Supporting Material:	PDU-Router

⌋

[SRS_Xcp_29003] The AUTOSAR XCP messages shall be identified by unique PDU-IDs

Upstream requirements: RS_BRF_01656, RS_BRF_01024

⌈

Description:	Unique PDU-IDs have to be assigned to the the XCP messages by configuration
Rationale:	PDU-IDs are used by the LSduR and PduR to route the PDUs to the assigned target AUTOSAR modules (LSDUR, PDUR, NM, TP, XCP, CDD)
Use Case:	Routing / Scheduling
Dependencies:	–
Supporting Material:	BSW Layered Software Architecture

⌋

[SRS_Xcp_29004] The XCP Specification Version 1.1 shall be used

Upstream requirements: RS_BRF_01656

⌈

Description:	The XCP Specification Version 1.1 shall be used for implementation
Rationale:	XCP Specification Version 1.1 is the latest Version available for AUTOSAR at this time
Use Case:	Calibration purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29005] XCP on CAN shall be supported

Upstream requirements: RS_BRF_01656, RS_BRF_01704

⌈

Description:	XCP on CAN shall be supported as described within the ASAM "XCP Transport Layer on CAN" specification
Rationale:	It shall be possible to exchange XCP data using the CAN communications bus
Use Case:	Calibration/Stimulation purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=239&memberlogin=

⌋

[SRS_Xcp_29006] XCP on FlexRay shall be supported

Upstream requirements: RS_BRF_01656, RS_BRF_01752

⌈

Description:	XCP on FlexRay shall be supported as described within the ASAM "XCP Transport Layer on FlexRay" specification
Rationale:	It shall be possible to exchange XCP data using the FlexRay communications bus
Use Case:	Calibration/Stimulation purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=376&memberlogin=

⌋

[SRS_Xcp_29007] XCP on Ethernet shall be supported

Upstream requirements: RS_BRF_01656, RS_BRF_01776

⌈

Description:	XCP on Ethernet shall be supported as described within the ASAM "XCP Transport Layer on Ethernet" specification, using TCP/IP and/or UDP
Rationale:	It shall be possible to exchange XCP data using the Ethernet communications bus
Use Case:	Calibration/Stimulation purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=240&memberlogin=

⌋

3.2.2 Features

[SRS_Xcp_29008] The code generator of the XCP Module shall generate the A2L IF_DATA section

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	The code generator of the XCP Module shall generate the A2L IF_DATA section, based on the configuration of XCP.
Rationale:	The configuration information of the XCP Slave (AUTOSAR XCP Module) should also be used for the configuration of the XCP Master.
Use Case:	Ensure consistency of XCP Master and XCP Slave configuration.
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=240&memberlogin=

⌋

[SRS_Xcp_29009] The slave shall transfer the contents of the elements defined in each ODT of the DAQ-list to the master

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	The slave has to transfer the contents of the elements defined in each ODT of the DAQ-list to the master.
Rationale:	-
Use Case:	Calibration purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29010] Synchronous Data Stimulation shall be the inverse mode of Synchronous Data Acquisition

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	Synchronous Data Stimulation is the inverse mode of Synchronous Data Acquisition. The master has to transfer the contents of the elements defined in each ODT of the DAQ-list to the slave.
Rationale:	-

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Use Case:	Stimulation purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29011] Multiple direct successive packets without acknowledge shall be sent / received

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	Multiple direct successive packets without acknowledge can be sent / received
Rationale:	Speed up memory uploads and downloads
Use Case:	Stimulation/Calibration purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29012] The XCP master shall already send the next request before having received the response on the previous request

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	The XCP master may already send the next request before having received the response on the previous request.
Rationale:	Speed up data transfer
Use Case:	Stimulation/Calibration purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29013] It shall be possible to configure the DAQ Lists dynamically

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	It shall be possible to configure the DAQ Lists dynamically
Rationale:	Allow flexibility for selection of different data/signal values to be transmitted
Use Case:	Stimulation/Calibration purpose
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29014] It shall be possible to transmit a timestamp within the XCP packet

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	It shall be possible to transmit a timestamp within the XCP packet
Rationale:	Timing information of the XCP packets are important for the XCP master to be able to reorder the received XCP packets if necessary
Use Case:	Reordering received XCP packets
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29015] It shall be possible to bypass data by making use of Synchronous Data Acquisition and Synchronous Data Stimulation simultaneously

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	It shall be possible to bypass data by making use of Synchronous Data Acquisition and Synchronous Data Stimulation simultaneously.
Rationale:	Including additional calculation / manipulation of data
Use Case:	Calibration / Stimulation purpose
Dependencies:	Support of Synchronous Data Acquisition and Synchronous Data Stimulation, interaction with AUTSAR RTE required
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin= SWS RTE

⌋

[SRS_Xcp_29016] The feature "Seed&Key" shall be used for protection handling purpose

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	The feature "Seed&Key" is used for protection handling purpose.
Rationale:	Secure access to the XCP slave's memory
Use Case:	The need for information hiding is different, depending on the project phase
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29018] Page switching shall be supported

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	The master can request the slave to answer the current active PAGE. The XCP slave shall be able to switch to another page if this is requested by the XCP master at any point in time.
Use Case:	Data Page switching is required for high end ECUs because of the huge amount of different data/variables to be transmitted via XCP
Dependencies:	–
Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29019] DAQ configuration storing with power-up data transfer (RESUME mode) shall be supported

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	The XCP master requests the XCP slave to set the RESUME bit of selected DAQ lists. After power-up, the slave has to restore the DAQ lists and indicate the RESUME mode to the XCP master autonomously.
Rationale:	The purpose of the resume mode is to enable automatic data transfer (DAQ, STIM) directly after the power up of the XCP slave
Use Case:	Calibration data are immediately needed after power-up of an ECU for optimization purpose (e.g. optimization of engine start behaviour).
Dependencies:	–

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Supporting Material:	http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=

⌋

[SRS_Xcp_29021] The XCP shall provide a feature to enable and disable communication on specific channel

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	The XCP shall provide a feature to enable and disable communication on specific channel (TX capabilities)
Use Case:	Allowing only requested channel communication in order to use bandwidth effectively
Dependencies:	–
Supporting Material:	–

⌋

[SRS_Xcp_29020] Flash Programming for ECU development purposes

Upstream requirements: RS_BRF_01656, RS_BRF_02264

⌈

Description:	XCP shall support flash programming as described within the ASAM "XCP Protocol Layer Specification".
Rationale:	Speeding up ECU development purposes through enabling programming feature.
Use Case:	–
Dependencies:	–
Supporting Material:	ASAM_XCP_Part2-Protocol-Layer-Specification_V1-1-0.pdf

⌋

3.2.3 Initialisation

[SRS_Xcp_29017] The AUTOSAR XCP module shall implement an interface for initialization.

Upstream requirements: RS_BRF_01656, RS_BRF_02264, RS_BRF_01136

⌈

Description:	The AUTOSAR XCP module implements an interface for initialization. This service shall initialize all global variables of the module.
Rationale:	Basic functionality.
Use Case:	Set the AUTOSAR XCP module into a defined state
Dependencies:	–
Supporting Material:	–

⌋

3.2.4 Normal Operation

The AUTOSAR XCP module shall operate as described within the ASAM XCP Specification Version 1.1. Please refer to `http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=`.

3.2.5 Shutdown Operation

The AUTOSAR XCP module shall operate as described within the ASAM XCP Specification Version 1.1. Please refer to `http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=`.

3.2.6 Fault Operation

The AUTOSAR XCP module shall operate as described within the ASAM XCP Specification Version 1.1. Please refer to `http://www.asam.net/doc_int/getfile/getfile.php?id=238&memberlogin=`.

3.3 Non-Functional Requirements (Qualities)

Not applicable.

4 Requirements Tracing

The following table references the features specified in [2] and links to the fulfillments of these.

Requirement	Description	Satisfied by
[RS_BRF_01016]	AUTOSAR shall provide a modular design inside software layers	[SRS_Xcp_29001] [SRS_Xcp_29030]
[RS_BRF_01024]	AUTOSAR shall provide naming rules for public symbols	[SRS_Xcp_29003]
[RS_BRF_01136]	AUTOSAR shall support variants of configured BSW data resolved after system start-up	[SRS_Xcp_29017]
[RS_BRF_01656]	AUTOSAR communication shall support XCP	[SRS_Xcp_29001] [SRS_Xcp_29002] [SRS_Xcp_29003] [SRS_Xcp_29004] [SRS_Xcp_29005] [SRS_Xcp_29006] [SRS_Xcp_29007] [SRS_Xcp_29008] [SRS_Xcp_29009] [SRS_Xcp_29010] [SRS_Xcp_29011] [SRS_Xcp_29012] [SRS_Xcp_29013] [SRS_Xcp_29014] [SRS_Xcp_29015] [SRS_Xcp_29016] [SRS_Xcp_29017] [SRS_Xcp_29018] [SRS_Xcp_29019] [SRS_Xcp_29020] [SRS_Xcp_29021] [SRS_Xcp_29030] [SRS_Xcp_29031]
[RS_BRF_01704]	AUTOSAR communication shall support the CAN communication bus	[SRS_Xcp_29005]
[RS_BRF_01752]	AUTOSAR communication shall support FlexRay	[SRS_Xcp_29006]
[RS_BRF_01776]	AUTOSAR communication shall support Ethernet	[SRS_Xcp_29007]
[RS_BRF_02264]	AUTOSAR shall support XCP for setting measurement and calibration data	[SRS_Xcp_29002] [SRS_Xcp_29008] [SRS_Xcp_29009] [SRS_Xcp_29010] [SRS_Xcp_29011] [SRS_Xcp_29012] [SRS_Xcp_29013] [SRS_Xcp_29014] [SRS_Xcp_29015] [SRS_Xcp_29016] [SRS_Xcp_29017] [SRS_Xcp_29018] [SRS_Xcp_29019] [SRS_Xcp_29020] [SRS_Xcp_29021] [SRS_Xcp_29031]

Table 4.1: Requirements Tracing

5 References

[1] Standardization Template
AUTOSAR_FO_TPS_StandardizationTemplate

[2] Requirements on AUTOSAR Features
AUTOSAR_CP_RS_Features

A 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.

A.1 Requirement History of this Document According to AUTOSAR Release R22-11

A.1.1 Added Specification Items in R22-11

Number	Heading
[SRS_Xcp_29001]	The AUTOSAR XCP module shall be located above the bus interfaces / Socket Adaptor
[SRS_Xcp_29002]	The AUTOSAR XCP shall make use of the data transmit- and receive APIs of the Bus Interfaces
[SRS_Xcp_29003]	The AUTOSAR XCP messages shall be identified by unique PDU-IDs
[SRS_Xcp_29004]	The XCP Specification Version 1.1 shall be used
[SRS_Xcp_29005]	XCP on CAN shall be supported
[SRS_Xcp_29006]	XCP on FlexRay shall be supported
[SRS_Xcp_29007]	XCP on Ethernet shall be supported
[SRS_Xcp_29008]	The code generator of the XCP Module shall generate the A2L IF_DATA section
[SRS_Xcp_29009]	The slave shall transfer the contents of the elements defined in each ODT of the DAQ-list to the master
[SRS_Xcp_29010]	Synchronous Data Stimulation shall be the inverse mode of Synchronous Data Acquisition
[SRS_Xcp_29011]	Multiple direct successive packets without acknowledge shall be sent / received
[SRS_Xcp_29012]	The XCP master shall already send the next request before having received the response on the previous request
[SRS_Xcp_29013]	It shall be possible to configure the DAQ Lists dynamically
[SRS_Xcp_29014]	It shall be possible to transmit a timestamp within the XCP packet
[SRS_Xcp_29015]	It shall be possible to bypass data by making use of Synchronous Data Acquisition and Synchronous Data Stimulation simultaneously
[SRS_Xcp_29016]	The feature "Seed&Key" shall be used for protection handling purpose
[SRS_Xcp_29017]	The AUTOSAR XCP module shall implement an interface for initialization.
[SRS_Xcp_29018]	Page switching shall be supported
[SRS_Xcp_29019]	DAQ configuration storing with power-up data transfer (RESUME mode) shall be supported
[SRS_Xcp_29020]	Flash Programming for ECU development purposes

△

Number	Heading
[SRS_Xcp_29021]	The XCP shall provide a feature to enable and disable communication on specific channel

Table A.1: Added Specification Items in R22-11

A.1.2 Changed Specification Items in R22-11

none

A.1.3 Deleted Specification Items in R22-11

none

A.2 Requirement History of this Document According to AUTOSAR Release R23-11

A.2.1 Added Requirements in R23-11

Number	Heading
[SRS_Xcp_29001]	The AUTOSAR XCP module shall be located above the bus interfaces / Socket Adaptor
[SRS_Xcp_29002]	The AUTOSAR XCP shall make use of the data transmit- and receive APIs of the Bus Interfaces
[SRS_Xcp_29003]	The AUTOSAR XCP messages shall be identified by unique PDU-IDs
[SRS_Xcp_29004]	The XCP Specification Version 1.1 shall be used
[SRS_Xcp_29005]	XCP on CAN shall be supported
[SRS_Xcp_29006]	XCP on FlexRay shall be supported
[SRS_Xcp_29007]	XCP on Ethernet shall be supported
[SRS_Xcp_29008]	The code generator of the XCP Module shall generate the A2L IF_DATA section
[SRS_Xcp_29009]	The slave shall transfer the contents of the elements defined in each ODT of the DAQ-list to the master
[SRS_Xcp_29010]	Synchronous Data Stimulation shall be the inverse mode of Synchronous Data Acquisition
[SRS_Xcp_29011]	Multiple direct successive packets without acknowledge shall be sent / received
[SRS_Xcp_29012]	The XCP master shall already send the next request before having received the response on the previous request

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△

Number	Heading
[SRS_Xcp_29013]	It shall be possible to configure the DAQ Lists dynamically
[SRS_Xcp_29014]	It shall be possible to transmit a timestamp within the XCP packet
[SRS_Xcp_29015]	It shall be possible to bypass data by making use of Synchronous Data Acquisition and Synchronous Data Stimulation simultaneously
[SRS_Xcp_29016]	The feature "Seed&Key" shall be used for protection handling purpose
[SRS_Xcp_29017]	The AUTOSAR XCP module shall implement an interface for initialization.
[SRS_Xcp_29018]	Page switching shall be supported
[SRS_Xcp_29019]	DAQ configuration storing with power-up data transfer (RESUME mode) shall be supported
[SRS_Xcp_29020]	Flash Programming for ECU development purposes
[SRS_Xcp_29021]	The XCP shall provide a feature to enable and disable communication on specific channel

Table A.2: Added Requirements in R23-11

A.2.2 Changed Requirements in R23-11

none

A.2.3 Deleted Requirements in R23-11

none

A.3 Requirement History of this Document According to AUTOSAR Release R24-11

A.3.1 Added Requirements in R24-11

Number	Heading
[SRS_Xcp_29030]	The AUTOSAR XCP module shall be located above the PduR
[SRS_Xcp_29031]	The AUTOSAR XCP shall make use of the data transmit- and receive APIs of the PduR

Table A.3: Added Requirements in R24-11

A.3.2 Changed Requirements in R24-11

Number	Heading
[SRS_Xcp_29001]	The AUTOSAR XCP module shall be located above the bus interfaces / Socket Adaptor
[SRS_Xcp_29002]	The AUTOSAR XCP shall make use of the data transmit- and receive APIs of the Bus Interfaces
[SRS_Xcp_29003]	The AUTOSAR XCP messages shall be identified by unique PDU-IDs

Table A.4: Changed Requirements in R24-11

A.3.3 Deleted Requirements in R24-11

none