System Interface Specification

Customer

Project

**Revision History**

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# Introduction

This specification applies to project <name of project> . It is bindingly applicable to all stages of project development.

Information of general importance for the project (e.g. deviations, structure adaptions etc.) shall be placed here.

## Definitions, Glossary

Usually only a link to the global glossary of the project should be inserted here. Exceptions might be specific definitions which are only used in this document.

## References

Complete list of all documents referenced or concerned, including date and version (e.g. customer standards, specification of relevant system components, communication databases etc.) shall be given here.

# External System Interfaces

*All inputs and outputs of the system shall be specified here.*

Remark:

This interface specification module focuses on electrical interfaces.

This means that mechanical interfaces (e.g. fixing, housing etc.) can be included (e.g. to give an overview), but usually they should be described in the SysRS module due to their special specification types and values from mechanical design point of view and just corresponding links should be inserted in this document. (Refer to SI90 "Mechanical Interfaces").



## Overview

An overview of the interfaces which are detailed in the following chapters shall be given here:

Examples:

Number and type of connectors (with links to detailed specifications like drawings etc., which should be specified in the SysRS module).

Number and type of communication interfaces

## Physical interfaces

*In this chapter all electrical interfaces (i.e. mainly connector based) shall be specified.*

Tailoring Hint:

Dependent on the actual project (e.g. complexity) the structure of this chapter can be adapted e.g. to choose a connector focussed allocation.

Nomenclature:

It is important that the names of external interfaces shall be uniquely defined here and are consistently used in the whole project (e.g. HW architecture and circuit diagram).



### Power Supply

All power supply lines (e.g. including redundant power supplies, separated power supply for electronics and loads, etc.) shall be specified here.

Cl\_30\_L **(EXAMPLE)**

### Inputs

All physical inputs of the system shall be specified here. According to different types suitable substructures are pre-defined.

#### Signals

##### Digital

Examples: Contacts, switches, ...

Door\_FL\_Status **(EXAMPLE)**

##### Analog

Examples: Analog voltage inputs, resistor coded switches, ...

#### Sensors

Examples: Temperature sensor, ...

#### Other Input Interfaces

In this subsection only external interfaces shall be described, if they are not covered by the other pre-defined subsections in this chapter.

### Outputs

All physical outputs of the system shall be specified here. According to different types suitable substructures are pre-defined.

#### Signals

##### Digital

Examples: Signal lines to other ECUs, ...

##### Analog

Examples: Analog voltage outputs to other ECUs, ...

#### Actuators and Loads

##### Ohmic

Examples: Lamps, ...

##### Inductive

Examples: Motors, ...

Window\_Lifter\_Motor\_L1 **(EXAMPLE)**

#### Other Output Interfaces

### Communication interfaces (Physical)

In this subsection the bidirectional interfaces with their corresponding HW-lines (e.g. TX, RX, handshake lines, ...) of the device shall be specified. Additionally the used interface protocol shall be defined here.

**Remark:**

Logical communication signals which are transmitted or received via a communication are specified as external interfaces in chapter 2.3. Communication interfaces.

## Communication interfaces (Logical)

*All signals which are received or sent via communication bus(es) shall be specified here.*

Remark:

The purpose of this chapter is to specify the required communication data from system point of view, e.g. an information about the state of Clamp 15 is required within a maximum time interval and is received via a CAN signal. Usually the communication interface details are stored in database files provided by the OEM (e.g. "dbc"-format) with additional detailed information like Bit position in the message etc. Such information does not have to be included in this Doors module if it is not relevant to the system, because usually the internal Communication SW is configured or generated automatically to use these information. Additionally a link to the corresponding database file should be inserted.



### <Bus 1> (e.g. CAN)

#### Received Signals

Dependent on the amount of signals and the bus topology the signals can be clustered according messages and/or ECUs.

BSL\_ZAS\_Kl\_15 (EXAMPLE)

#### Transmitted Signals

Dependent on the amount of signals and the bus topology the signals can be clustered according messages and/or ECUs.

### <Bus n> (eg. LIN n)

#### Received Signals

Dependent on the amount of signals and the bus topology the signals can be clustered according messages and/or ECUs.

#### Transmitted Signals

Dependent on the amount of signals and the bus topology the signals can be clustered according messages and/or ECUs.

## Test Interfaces

Often test interfaces have to be implemented to be used e.g. during development, production or service. To make clear that these interfaces are not part of the normal usage of the system (or e.g. only exist in development stage) they should be separated in these subsection.

## Other Interfaces

In this subsection further types of external interfaces shall be described, which are not covered by the other pre-defined subsections in this chapter:

e.g. optical (camera based images), environmental (temperature, humidity, magnetism, acoustics, ...),

Remark:

Usually these kind of interfaces have to be described in very specific ways. Therefore and due to their variety it is not feasible to give pre-defined standardized specifications here.

## Mechanical Interfaces

This interface specification module focuses on electrical interfaces.

This means that mechanical interfaces (e.g. fixing, housing etc.) can be included (e.g. to give an overview), but usually they should be described in the SysRS module due to their special specification types and values from mechanical design point of view (e.g. shape, tolerances, material, ...) and just corresponding links should be inserted in this document.

# Configuration

In this chapter all configuration data (i.e. coding values and parameter which are implemented in the system) shall be specified. This configuration data influences the behaviour of the system and therefore it is considered as further special class of interfaces.

**Nomenclature:**

In the pre-defined substructure the following distinction is made:

* Coding Parameter

This type of parameters usually consists of a boolean information to enable or disable a functionality. A more general defintion is that the allowed values are members of an enumeration but no continuous range is defined.

Example:

cp\_<Functionality n>\_enabled can be set only to True (1) or False (0)

* Parameter

This type of parameters usually consists of a defined range of continous or discrete values, e.g. a specific time can be set within a minimal and maximal range.

Example:

p\_**t**\_<Max-Activation-**Time** n> can be set between 100ms and 500ms in 5ms steps

p\_**n**\_<Max-Activation-**Number** n>



## System

In this subsection configuration data shall be specified which is defined on system level i.e. affect the whole system.

Examples:

* variants (e.g. different PCB mounting variants)
* special modes (e.g. enabling/disabling of "transport"-mode to minimize current consumption)
* ...

### Coding Parameter

See explanation of nomenclature above.

### Parameter

See explanation of nomenclature above.

## Sub-Systems

In this subsection configuration data shall be specified which is designed for a sub-system only, i.e. this configuration data affect only the behaviour of its dedicated subsystem and/or functionality.

Examples:

* Timing values for control logic
* Enabling or disabling of functional features
* ....

### <Sub-System 1>

#### Coding Parameter

#### Parameter

### <Sub-System n>

#### Coding Parameter

#### Parameter

# Internal System Interfaces



## Logical Interfaces

***Preface:***

*Often a functionality (subsystem) which is specified in the separated Doors-module SysRS (chapter 5) do not directly use the external interfaces as specified here (in Chapter 2 in this Doors-module) as inputs. In fact mostly a “transformed” signal is used:*

*Examples for transformations:*

* Conversions (e.g. other range, resolution, update intervals, …)*

* Combinations (e.g. plausibility checks with other signals, compound signals, …)*

*In this case it is recommended to separate this transformation operation in a dedicated function called “IST” (****I****nput* ***S****ignal* ***T****ransformation) for incoming signals and “OST” (****O****utput* ***S****ignal* ***T****ransformation) for outgoing signals.*

*These transformation operations are specified as dedicated subsystems “Input Signal Transformation” and “Output Signal Transformation” in the SysRS Doors-module (chapter 5.6).*

*In this subsection these transformed signals which are used inside the system (i.e. they shall be linked with the functional specifications in the SysRS Doors-module in this case) shall be specified.*

*Examples:*

* *Debounced and validated Cl15 state*
* *Logical Power supply classes (under-, normal-, undervoltage)*
* *...*

### Transformed Input Signals

In this subsection all transformed signals which are used as inputs by the functional subsystems shall be specified here.

A sub-structure (e.g. clustering due to functionalities, ...) should be added if suitable.

### Transformed Output Signals

In this subsection all transformed signals which are used as outputs by the functional subsystems shall be specified here.

A sub-structure (e.g. clustering due to functionalities, ...) should be added if suitable.

## HW/HW-Interfaces

In this chapter the internal interfaces between HW modules shall be specified.

**Tailoring Hint:**

Initially the internal HW interfaces are defined in the HW-architecture of course. Therefore, depending on the complexity of the HW-architecture the internal HW interfaces can be specified in the HW architecture specification and/or the HW module specification. In this case an explanation and a reference to the corresponding document(s) should be inserted here.

## HW/SW-Interfaces

**Preface:**

In this subsection the internal system interfaces between HW- and SW-modules shall be specified.

The clustering on the highest level is based on the SW containing devices of the system (e.g. µC1, DSP, ASIC, ...).

For standard microcontrollers there are excel sheets in NIS and confluence that can ease the work to fill in the required information tremendously. Thus, if you are using a standard controller it is encouraged to use the prepared templates for them.

### <µC1>

#### Input Signals

#### Output Signals

VCC\_sw\_digit\_out **(EXAMPLE)**

#### Bidirectional Signals

In this subsection the bidirectional interfaces with their corresponding HW-lines (e.g. TX, RX, handshake lines, ...) of the device shall be specified. Additionally the used interface protocol shall be defined here.

**Remark:**

Logical communication signals which are transmitted or received via a communication are specified as external interfaces in chapter 2.3. Communication interfaces.

##### <Communication Interface> (e.g. UART, JTAG, ...)

###### Input Signals

###### Output Signals

###### Bidirectional Signals

###### Protocol

#### Not connected and unused Signals

To complete this specification all remaining pins of the device, which are accessible via SW but are not listed as functional interfaces above, shall be specified here.

In other words all pins of the device which are not covered yet but which have to be controlled by SW (e.g. usually initialized only) have to be listed.

Only pins which are pure HW interfaces of the device (e.g. power supply, etc.) do not have to be listed here.

### <DSP>

## SW/SW-Interfaces

***Preface:***

In this chapter the internal interfaces between SW modules shall be specified. In the pre-defined substructure the following distinction is made:

* Module interfaces

Interfaces of non AUTOSAR conform modules

* RTE interfaces

Interfaces of AUTOSAR conform components.

This chapter represents a data dictionary of the system from SW point of view.

A sub-structure (e.g. clustering due to functionalities, ...) should be added if suitable.

**Tailoring Hint:**

Initially the internal SW interfaces are defined in the SW-architecture of course. Therefore, depending on the complexity of the SW-architecture and the development environment (e.g. model based development) the internal SW interfaces can be specified in the SW architecture specification. In this case an explanation and a reference to the corresponding document should be inserted here.

### Module Interfaces

For definition refer to preface above.

### RTE Interfaces

For definition refer to preface above.

## HW/MD (Actuators) Interfaces

Define the force transmission.

## MD/MD-Interfaces

E.g. fixing of the housing and the electronics fulfills the requirements of the g-force.

# Component Interfaces

*This chapter is required only if several components in a distributed system are developed and provided from MHE.*

*In this case on the one hand these interfaces are "internal" from complete system point of view (i.e. OEM), but on the other hand they are "external" from ECU point of view.*

*Examples:*

* *Keyless Entry System (ECU, Remote-Key, Antennas)*
* *Advanced Frontlighting System (ECU, Actuators, Sensors)*

In such distributed systems these interfaces to other components (sensors, actuators, ...) should be specified in this chapter.

**Tailoring Hint:**

Usually in systems which consist of one ECU only and all other components are external from MHE point of view this chapter can be deleted.

## Sensor

Define the force transmission.

## Actuators

## Other