



EULYNX Initiative



Europe's Rail Joint Undertaking

Generic interface and subsystem requirements for SMI

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Generic interface and subsystem requirements for SMI			
ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.1	Head	1 Introduction	
Eu.Gen-SMI.2	Head	1.1 Release information	
Eu.Gen-SMI.3	Info	[Eu.Doc.120] EULYNX Generic interface and subsystem requirements for SMI CENELEC Phase: 4 Version: 1.2 (1.A) Approval date: 02.06.2025	
Eu.Gen-SMI.4	Info	Version history	
Eu.Gen-SMI.176	Info	version number: 1.0 (0.A) date: 16.05.2022 author: Dennis Kunz, Filip Giering generic profile version: 18 review: CCB changes: EUAR-508, EUAR-510, EUAR-512, EUAR-520, EUAR-521, EUAR-523, EUAR-524, EUAR-527, EUAR-528, EUAR-532, EUAR-535	
Eu.Gen-SMI.185	Info	version number: 1.0 (1.A) date: 04.04.2023 author: Filip Giering generic profile version: 21 review: changes: EUAR-553, EUAR-564	
Eu.Gen-SMI.187	Info	version number: 1.0 (2.A) date: 11.05.2023 author: Filip Giering, Dominik Smajgl model version: 22 review: cluster changes: EUAR-589, EUAR-590	
Eu.Gen-SMI.189	Info	version number: 1.0 (3.A) date: 28.06.2023 author: Filip Giering model version: 22 review: TCCS+TACS Mirror Group changes: EUAR-586, EUAR-594, EUAR-602, EUAR-606, EUAR-612, EUAR-613	
Eu.Gen-SMI.190	Info	version number: 1.0 (4.A) date: 15.12.2023 author: Filip Giering model version: 25 review: M&T changes: EUAR-550, EUAR-660, EUAR-662, EUAR-663, EUAR-664, EUAR-665, EUAR-666, EUAR-667, EUAR-668, EUAR-675	
Eu.Gen-SMI.202	Info	version number: 1.0 (5.A) date: 04.03.2024 author: Philipp Wolber, Filip Giering model version: 25 review: changes: EUAR-434, EUAR-609, EUAR-620, EUAR-638, EUAR-639, EUAR-640, EUAR-642, EUAR-644, EUAR-658, EUAR-698	
Eu.Gen-SMI.224	Info	version number: 1.0 (6.A) date: 30.04.2024 author: Philipp Wolber, Filip Giering model version: 26 review: cluster changes: EUAR-643, EUAR-681, EUAR-697, EUAR-708, EUAR-713, EUAR-714	
Eu.Gen-SMI.225	Info	version number: 1.1 (0.A) date: 18.06.2024 author: Philipp Wolber, Filip Giering model version: 26 review: TCCS+TACS Mirror Group changes: EUAR-701, EUAR-740, EUAR-746, EUAR-750	
Eu.Gen-SMI.226	Info	version number: 1.2 (0.A) date: 25.03.2025 author: Philipp Wolber model version: 26 review: cluster changes: EUAR-720, EUAR-761, EUAR-762, EUAR-763, EUAR-768	
Eu.Gen-SMI.227	Info	version number: 1.2 (1.A) date: 19.06.2025 author: Philipp Wolber model version: 29 review: TCCS+TACS Mirror Group changes: EUAR-766, EUAR-787, EUAR-791, EUAR-795, EUAR-802	
Eu.Gen-SMI.6	Head	1.2 Impressum	
Eu.Gen-SMI.7	Info	Publishers: Europe's Rail Joint Undertaking https://rail-research.europa.eu EULYNX Initiative https://eulynx.eu/	

Generic interface and subsystem requirements for SMI			
ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.8	Info	Responsible for this document: EU-Rail System Pillar Transversal CCS Components domain	
Eu.Gen-SMI.9	Info	<p>This document is drafted by and belongs to EU Rail.</p> <p>EU Rail encourages the distribution and re-use of this document, the technical specifications and the information it contains. EU Rail holds several intellectual property rights, such as copyright and trade mark rights, which need to be considered when this document is used.</p> <p>EU Rail authorizes you to re-publish, re-use, copy and store this document without changing it, provided that you indicate its source and include the following mention [EU Rail trade mark, title of the document, year of publication, version of document].</p> <p>EU Rail makes no representation or warranty as to the accuracy or completeness of the information contained within these documents. EU Rail shall have no liability to any party as a result of the use of the information contained herein. EU Rail will have no liability whatsoever for any indirect or consequential loss or damage, and any such liability is expressly excluded.</p> <p>You may study, research, implement, adapt, improve and otherwise use the information, the content and the models in this document for your own purposes. If you decide to publish or disclose any adapted, modified or improved version of this document, any amended implementation or derivative work, then you must indicate that you have modified this document, with a reference to the document name and the terms of use of this document. You may not use EU Rail’s trade marks or name in any way that may state or suggest, directly or indirectly, that EU Rail is the author of your adaptations. EU Rail cannot be held responsible for your product, even if you have used this document and its content. It is your responsibility to verify the quality, completeness and the accuracy of the information you use, for your own purposes.</p>	
Eu.Gen-SMI.10	Head	1.3 Purpose	
Eu.Gen-SMI.11	Info	The purpose of the document is the specification of generic requirements for the development of the EULYNX System. The generic requirements complement the specific interface and subsystem requirements.	
Eu.Gen-SMI.12	Info	This document describes: <ul style="list-style-type: none">generic functional requirements for the interface SMI-XX between an EULYNX field element Subsystem and Subsystem - Maintenance and Data Management	
Eu.Gen-SMI.13	Info	This document is intended for the following users: <ul style="list-style-type: none">safety authoritiesinfrastructure managerssafety assessorssignalling system suppliersvalidators	
Eu.Gen-SMI.14	Info	This document is the basis for the implementation by the supplier and for approval by the infrastructure manager.	
Eu.Gen-SMI.188	Info	This document is applicable for both the EU-Rail System Pillar target architecture and the EULYNX architecture. The document is delivered as a single specification fitting both the System Pillar documentation sets and the EULYNX documentation sets. EU-Rail System Pillar is the technical authority for this document.	
Eu.Gen-SMI.15	Head	1.4 Applicable standards and regulations	
Eu.Gen-SMI.16	Info	A list of applicable standards and regulations used in EULYNX is listed in the EULYNX Reference Document List [Eu.Doc.12].	
Eu.Gen-SMI.17	Head	1.5 Applicable documents	
Eu.Gen-SMI.18	Info	The current versions of documents used as input or related to this document are listed in the EULYNX Documentation Plan [Eu.Doc.11]. The relationships between the documents are displayed in the Appendix A1 Documentation plan and structure [Eu.Doc.11_A1].	
Eu.Gen-SMI.19	Head	1.6 Terms and abbreviations	
Eu.Gen-SMI.20	Info	The terms and abbreviations are listed in the EULYNX Glossary [Eu.Doc.9].	
Eu.Gen-SMI.21	Head	1.7 Variability management	
Eu.Gen-SMI.22	Info	This document describes harmonised requirements. Variability management is not applicable. The specific applicability of requirements is captured in individual interface specifications.	
Eu.Gen-SMI.23	Head	1.8 Definition of object types	
Eu.Gen-SMI.24	Info	The following definition for object types is applied in this document:	
Eu.Gen-SMI.25	Info	<ul style="list-style-type: none">"Req" - This denotes a mandatory requirement.	
Eu.Gen-SMI.191	Info	<ul style="list-style-type: none">"Def" - This denotes referenceable model elements that are used in the model-based creation of requirements	
Eu.Gen-SMI.26	Info	<ul style="list-style-type: none">"Info" - This denotes additional information to help understand the specification. These objects do not specify any additional requirements.	
Eu.Gen-SMI.27	Info	<ul style="list-style-type: none">"Head" - This denotes chapter headings.	
Eu.Gen-SMI.28	Head	1.9 Modelling	
Eu.Gen-SMI.29	Info	The section "Generic requirements for SMI" follows a model based systems engineering process using Systems Modelling Language (SysML) and defines the functional system requirements for the EULYNX field element Subsystem in stimulus-response form. Furthermore the information objects (stimuli and responses) exchanged over the interfaces of the EULYNX field element Subsystem, Subsystem - Electronic Interlocking and the adjacent systems are defined.	
Eu.Gen-SMI.30	Info	The diagrams presented in this document are modelled in SysML [SysML].	
Eu.Gen-SMI.31	Info	The rules for the interpretation of the model based parts of specification are defined in [Eu.Doc.29].	
Eu.Gen-SMI.32	Info	In chapter 3 "Generic requirements for SMI" the functional system requirements, defined in the form of a SysML model in the PTC Integrity Modeler are depicted as a surrogate of this model in the form of DOORS-objects.	
Eu.Gen-SMI.33	Info	A requirement thereby consists of the respective SysML model element, for instance a SysML diagram, and if necessary an additional extension of the requirement.	
Eu.Gen-SMI.34	Info	In the column “Requirement Part 1” the particular SysML model element is depicted and in the column “Requirement Part 2” the corresponding extension of the definition is given. The stated object type normally applies both to “Requirement Part 1” and to “Requirement Part 2”.	
Eu.Gen-SMI.35	Info	There are requirements with type "Req" given, where the column "Requirement Part 2" or a part of it is provided with the heading "Information". In this case, the defined type only applies to the column "Requirement Part 1" and the part of "Requirement Part 2", which is not labelled as "Information".	
Eu.Gen-SMI.192	Info	State machines or several state machines linked together in a Functional Architecture define the totality of all functional requirements of an SUS or an SIUS in a coherent and consistent manner. State diagrams of a corresponding state machine are marked with the object type “Req”. For the later design and implementation, it is not the description language SysML that is binding, but the domain-specific meaning expressed by it. The specified behaviour can be converted into a vendor specific language but must retain the domain specific meaning describing the functional requirements. The specific model elements are additionally specified and defined by object type “Def” to allow for traceability to supplier designs or test cases. The compliance of products to the specifications must be demonstrated by testing against EULYNX test cases, which are derived from the functionality specified by the models.	
Eu.Gen-SMI.36	Head	2 Conditions of use	

ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.171	Def	Registrations_Ready	Event from Subsystem - Maintenance and Data Management to EULYNX field element Subsystem to inform the EfeS that the registration of [OPC] status variables has been finished.
Eu.Gen-SMI.173	Def	Start_Async_Preload	Event from Subsystem - Maintenance and Data Management to EULYNX field element Subsystem to start a transfer that can be performed in parallel to the safe railway operation of an EfeS.
Eu.Gen-SMI.40	Head	3.1.1.3 SMI-XX EfeS - Functional Viewpoint	
Eu.Gen-SMI.163	Head	3.1.1.3.1 Definition of time values	
Eu.Gen-SMI.164	Def	Con_tmax_DataInstallation	Con_tmax_DataInstallation is a configurable time value for each configuration item. If the installation of the Engineering Data and Configuration Data on the particular EULYNX field element Subsystem is not completed within this configured time period after the activation of the data is initiated, the activation is aborted.
Eu.Gen-SMI.165	Def	Con_tmax_DataTransmission	Con_tmax_DataTransmission is a configurable time value for each configuration item. If the transmission of Engineering Data and Configuration Data from Subsystem - Maintenance and Data Management is not completed within this configured time period, the transmission of the data is aborted. Note: The service function Loading Procedure may restart the transmission of the same Engineering Data and Configuration Data.
Eu.Gen-SMI.166	Def	Con_tmax_Response_MDM	If, on the interface SMI-XX the Subsystem - Maintenance and Data Management doesn't perform any action on the EULYNX field element Subsystem during this configured time period, the EULYNX field element Subsystem will become available to establish a connection with the Subsystem - Electronic Interlocking.
Eu.Gen-SMI.167	Def	Con_tmax_SMI_Connection	If the Subsystem - Maintenance and Data Management doesn't establish the connection on the interface SMI-XX to the EULYNX field element Subsystem within this configured time period the EULYNX field element Subsystem will become available to establish a connection with the Subsystem - Electronic Interlocking.
Eu.Gen-SMI.41	Head	3.1.1.3.2 SMI-XX EfeS - Functional Context	

ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.186	Info	<div><div>[Package] SMI-XX - Functional Context [Interface Definition - UseCases - Initialisation]</div><div>uc [Package] SMI-XX - Functional Context [Interface Definition - UseCases - Initialisation]</div><div><p>The diagram shows a dashed box labeled 'SMI-XX EfeS' containing five use cases: 'SMI-XX IFUC 1.1: Establish SMI connection', 'SMI-XX IFUC 1.2: Synchronous loading and activation of data', 'SMI-XX IFUC 1.3: Asynchronous preloading of data', 'SMI-XX IFUC 1.4: Reset EfeS', and 'SMI-XX IFUC 1.5: Initiate maintenance'. Two external subsystems, 'Subsystem - Maintenance and Data Management' and 'EULYNX field element Subsystem', are connected to these use cases. 'Subsystem - Maintenance and Data Management' is connected to IFUC 1.1, 1.3, and 1.5. 'EULYNX field element Subsystem' is connected to IFUC 1.1, 1.2, 1.4, and 1.5.</p></div></div>	
Eu.Gen-SMI.42	Info	SMI-XX IFUC 1.1: Establish SMI connection	
Eu.Gen-SMI.43	Info	<div><div>[Interaction] SMI-XX IFUC 1.1 - Alternative Scenario [SMI-XX IF SD 1.1.1]</div><div>sd [Interaction] SMI-XX IFUC 1.1 - Alternative Scenario [SMI-XX IF SD 1.1.1]</div><div><p>The sequence diagram shows the interaction between 'Subsystem - Maintenance and Data Management' and ':EULYNX field element Subsystem'. The process starts with 'reverse_connect' from the subsystem to the management, followed by 'Establish_OPC_UA_connection'. A loop labeled 'loop' contains three iterations: 1. 'Subscribe_Data_Change_Event' and 'readPreloadState'. 2. 'Subscribe_Data_Change_Event' and 'readActivationState'. 3. 'Subscribe_Data_Change_Event' and 'readUpdateInitStateChanged'. After the loop, 'readOperationState' is called, followed by 'Registrations_Ready'.</p></div><div><p>Alternative Scenario: Field element triggered connection</p><p>Precondition: EULYNX field element Subsystem is in state WAITING_FOR_DATA_UPDATE.</p><p>Interaction 1.1.1.A:</p><ol style="list-style-type: none">EULYNX field element Subsystem initiated OPC UA reverse connect.Subsystem - Maintenance and Data Management initiates the OPC UA connection.Subsystem - Maintenance and Data Management detects, that OPC UA connection is established.<p>loop (for each Config Item in List)</p><ol style="list-style-type: none">Subsystem - Maintenance and Data Management sends subscription regarding "PreloadState".Subsystem - Maintenance and Data Management reads "PreloadState".Subsystem - Maintenance and Data Management sends subscription regarding "ActivationState".Subsystem - Maintenance and Data Management reads "ActivationState".<p>end loop</p><ol style="list-style-type: none">Subsystem - Maintenance and Data Management sends subscription regarding "UpdateInitStateChanged".Subsystem - Maintenance and Data Management reads "UpdateInitStateChanged".Subsystem - Maintenance and Data Management sends subscription regarding "OperationState".Subsystem - Maintenance and Data Management reads "OperationState".Subsystem - Maintenance and Data Management sends "Registrations_Ready".<p>Postcondition: SMI connection is established.</p></div></div>	

ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.44	Info	<p>[Interaction] SMI-XX IFUC 1.1 - Alternative Scenario [SMI-XX IF SD 1.1.2]</p> <p>sd [Interaction] SMI-XX IFUC 1.1 - Alternative Scenario [SMI-XX IF SD 1.1.2]</p> <p>Alternative Scenario: MDM triggered connection</p> <p>Precondition:</p> <p>Interaction 1.1.2.A:</p> <ol style="list-style-type: none"> Subsystem - Maintenance and Data Management initiated OPC UA connect. Subsystem - Maintenance and Data Management detects, that OPC UA connection is established. <p>loop (for each Config Item in List)</p> <ol style="list-style-type: none"> Subsystem - Maintenance and Data Management sends subscription regarding "PreloadState". Subsystem - Maintenance and Data Management reads "PreloadState". Subsystem - Maintenance and Data Management sends subscription regarding "ActivationState". Subsystem - Maintenance and Data Management reads "ActivationState". <p>end loop</p> <ol style="list-style-type: none"> Subsystem - Maintenance and Data Management sends subscription regarding "UpdateInitStateChanged". Subsystem - Maintenance and Data Management reads "UpdateInitStateChanged". Subsystem - Maintenance and Data Management sends subscription regarding "OperationState". Subsystem - Maintenance and Data Management reads "OperationState". Subsystem - Maintenance and Data Management sends "registrations_ready". <p>Postcondition:</p> <p>SMI connection is established.</p> <pre> sequenceDiagram actor Actor participant Subsystem as :EULYNX field element Subsystem Actor->>Subsystem: Establish_OPC_UA_connection activate Subsystem deactivate Subsystem loop Actor->>Subsystem: Subscribe_Data_Change_Event activate Subsystem deactivate Subsystem Actor->>Subsystem: readPreloadState activate Subsystem deactivate Subsystem Actor->>Subsystem: Subscribe_Data_Change_Event activate Subsystem deactivate Subsystem Actor->>Subsystem: readActivationState activate Subsystem deactivate Subsystem end Actor->>Subsystem: Subscribe_Data_Change_Event activate Subsystem deactivate Subsystem Actor->>Subsystem: readUpdateInitStateChanged activate Subsystem deactivate Subsystem Actor->>Subsystem: Subscribe_Data_Change_Event activate Subsystem deactivate Subsystem Actor->>Subsystem: readOperationState activate Subsystem deactivate Subsystem Actor->>Subsystem: Registrations_Ready activate Subsystem deactivate Subsystem </pre>	
Eu.Gen-SMI.45	Info	SMI-XX IFUC 1.2: Synchronous loading and activation of data	

[illegible]

[illegible]

ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.48	Info	<div><div><div>[Interaction] SMI-XX IFUC 1.2 - Alternative Scenario [SMI-XX IF SD 1.2.3]</div><div>sd [Interaction] SMI-XX IFUC 1.2 - Alternative Scenario [SMI-XX IF SD 1.2.3]</div><div><div>Subsystem - Maintenance and Data Management</div><div>:EULYNX field element Subsystem</div></div><div><p>Alternative Scenario: Synchronous activation of data</p><p>Precondition:</p><p>EULYNX field element Subsystem is in state WAITING_FOR_DATA_UPDATE.</p><p>Interaction 1.2.3.A:</p><p>opt [SMI connection is not established]</p><p>1. The EULYNX field element Subsystem initiates the establishment of the SMI connection.</p><p>end opt</p><p>2. EULYNX field element Subsystem sends operation state "maintenance".</p><p>loop (for each Config Item in List)</p><p>3. EULYNX field element Subsystem sends preload state "NotYetPreloadable".</p><p>4. EULYNX field element Subsystem sends activation state "ReadyForActivation".</p><p>end loop</p><p>5. EULYNX field element Subsystem sends that initialisation is done.</p><p>loop (for each Config Item in List)</p><p>6. Subsystem - Maintenance and Data Management reads "PreloadedVersion".</p><p>7. Subsystem - Maintenance and Data Management informs about activating item.</p><p>8. EULYNX field element Subsystem sends activation state "Activating".</p><p>9. EULYNX field element Subsystem sends activation state "NotYetActivatable".</p><p>10. Subsystem - Maintenance and Data Management reads "CurrentVersion".</p><p>end loop</p><p>11. Subsystem - Maintenance and Data Management informs about "MaintainingFinished".</p><p>Postcondition:</p><p>Data update process complete</p></div><div></div></div></div>	
Eu.Gen-SMI.49	Info	SMI-XX IFUC 1.3: Asynchronous preloading of data	

ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.50	Info	<div><div>[Interaction] SMI-XX IFUC 1.3 - Alternative Scenario [SMI-XX IF SD 1.3.1]</div><div><div>sd [Interaction] SMI-XX IFUC 1.3 - Alternative Scenario [SMI-XX IF SD 1.3.1]</div><div><div><div>Subsystem - Maintenance and Data Management</div><div><div>:EULYNX field element Subsystem</div></div></div></div><div><p>Alternative Scenario: Asynchronous preloading of data</p><p>Precondition:</p><p>SMI connection is established</p><p>Interaction 1.3.1.A:</p><p>1. Subsystem - Maintenance and Data Management starts asynchronous preload.</p><p>loop (for each Config Item in List)</p><p>2. EULYNX field element Subsystem sends preload state "ReadyForPreload".</p><p>end loop</p><p>3. EULYNX field element Subsystem sends that initialisation is done.</p><p>loop (for each Config Item in List)</p><p>4. Subsystem - Maintenance and Data Management reads "CurrentVersion".</p><p>5. Subsystem - Maintenance and Data Management reads "PreloadedVersion".</p><p>6. Subsystem - Maintenance and Data Management opens preload file.</p><p>7. EULYNX field element Subsystem sends preload state "Preloading"</p><p>8. Subsystem - Maintenance and Data Management writes preload file.</p><p>9. Subsystem - Maintenance and Data Management closes preload file.</p><p>10. EULYNX field element Subsystem verifies the integrity and authenticity of the received preload file. The verification is successful.</p><p>11. EULYNX field element Subsystem sends preload state "NotYetPreloadable".</p><p>12. EULYNX field element Subsystem sends activation state "ReadyForActivation".</p><p>end loop</p><p>12. Subsystem - Maintenance and Data Management informs about "MaintainingFinished".</p><p>Postcondition:</p><p>Data update process complete</p></div></div></div>	
Eu.Gen-SMI.177	Info	SMI-XX IFUC 1.4: Reset EfeS	
Eu.Gen-SMI.178	Info	<div><div>[Interaction] SMI-XX IFUC 1.4 - Main Success Scenario [SMI-XX IF SD 1.4.1]</div><div><div>sd [Interaction] SMI-XX IFUC 1.4 - Main Success Scenario [SMI-XX IF SD 1.4.1]</div><div><div><div>Subsystem - Maintenance and Data Management</div><div><div>:EULYNX field element Subsystem</div></div></div></div><div><p>Main Success Scenario: Requested reset by MDM</p><p>Precondition:</p><p>SMI connection is established.</p><p>The EULYNX field element Subsystem is in the state FALLBACK_MODE.</p><p>Interaction 1.4.1.A:</p><p>1. Subsystem - Maintenance and Data Management requests a reset.</p><p>Postcondition:</p><p>The EULYNX field element Subsystem is in the state BOOTING.</p></div></div></div>	This reset is only possible if the device is having a working SMI connection while in the state FALLBACK_MODE.
Eu.Gen-SMI.179	Info	SMI-XX IFUC 1.5: Initiate maintenance	

ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.180	Info	<div><div>[Interaction] SMI-XX IFUC 1.5 - Main Success Scenario [SMI-XX IF SD 1.5.1]</div><div><div>sd [Interaction] SMI-XX IFUC 1.5 - Main Success Scenario [SMI-XX IF SD 1.5.1]</div><div><div><div>Subsystem - Maintenance and Data Management</div><div><div>:EULYNX field element Subsystem</div></div></div><div><div><div></div><div></div><div></div></div><div><div>MDM_Safe_Maintenance</div></div></div></div></div><div><p>Main Success Scenario: Set EfeS to maintenance</p><p>Precondition: SMI connection is established. The EULYNX field element Subsystem is in the state WAITING_FOR_PDI_OR_MAINTENANCE.</p><p>Interaction 1.5.1.A: 1. Subsystem - Maintenance and Data Management sets EULYNX field element Subsystem to safe maintenance.</p><p>Postcondition: The EULYNX field element Subsystem is in the state WAITING_FOR_DATA_UPDATE.</p></div></div>	
Eu.Gen-SMI.51	Head	3.1.1.3.3 SMI-XX EfeS - Functional Entities	
Eu.Gen-SMI.52	Info	F_SMI_EfeS	
Eu.Gen-SMI.53	Req	<div><div>[Block] F_SMI_EfeS [Functional Viewpoint - Interface Requirements - Functional Entity]</div><div><div>ibd [Block] F_SMI_EfeS [Functional Viewpoint - Interface Requirements - Functional Entity]</div><div><div><div>«functional entity» F_SMI_EfeS Operation</div><div>«Operation» cOp1_init ()</div></div><div><div><div>T1in_Maintaining_finished : PulsedIn</div><div>T2in_Preload_file_i_open : PulsedIn</div><div>T3in_Preload_file_i_close : PulsedIn</div><div>T4in_Activating_item_i : PulsedIn</div><div>T5in_Data_installation_item_i_finished : PulsedIn</div><div>T6in_Update_process_aborted : PulsedIn</div><div>T19in_Start_async_preload : PulsedIn</div><div>T23in_SMI_Connection_closed : PulsedIn</div><div>T30in_MDM_Request_Reset : PulsedIn</div><div>T32in_Registrations_Ready : PulsedIn</div><div>T36in_MDM_Safe_Maintenance : PulsedIn</div><div>D25in_Con_tmax_DataTransmission : Integer</div><div>D26in_Con_tmax_DataInstallation : Integer</div><div>D28in_Direct_Reboot_necessary : Boolean</div><div>D2in_Con_tmax_Response_MDM : Integer</div><div>D3in_Con_tmax_SMI_Connection : Integer</div><div>D22in_item_I_activation_readiness : Boolean</div></div><div><div>T17out_Start_SMI_Connection : PulsedOut</div><div>D33out_Initialisation_done : Boolean</div><div>D8out_Preload_State : String</div><div>D9out_Activation_State : String</div><div>D10out_Operation_State : String</div><div>p3inout : ~EST_SMI_GEN</div></div></div></div></div></div>	
Eu.Gen-SMI.54	Def	<div>/* cOp1_init */ Update_performed := FALSE;</div>	cOp1_init
Eu.Gen-SMI.131	Def	T1in_Maintaining_finished	The port T1in_Maintaining_finished refines the FlowProperty Maintaining_finished.
Eu.Gen-SMI.133	Def	T2in_Preload_file_i_open	The port T2in_Preload_file_i_open refines the FlowProperty PreloadFile.Open.
Eu.Gen-SMI.138	Def	T3in_Preload_file_i_close	The port T3in_Preload_file_i_close refines the FlowProperty PreloadFile.Close.
Eu.Gen-SMI.139	Def	T4in_Activating_item_i	The port T4in_Activating_item_i refines the FlowProperty Activating_item_i.

Generic interface and subsystem requirements for SMI			
ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.140	Def	T5in_Data_installation_item_i_finished	The port T5in_Data_installation_item_i_finished signalizes that the installation of an item i on EfeS has been successfully done.
Eu.Gen-SMI.141	Def	T6in_Update_process_aborted	The port T6in_Update_process_aborted refines the FlowProperty Update_process_aborted.
Eu.Gen-SMI.130	Def	T19in_Start_async_preload	The port T19in_Start_async_preload refines the FlowProperty Start_Async_Preload.
Eu.Gen-SMI.132	Def	T23in_SMI_Connection_closed	The port T23in_SMI_Connection_closed represents the event of the closed SMI connection.
Eu.Gen-SMI.134	Def	T30in_MDM_Request_Reset	The port T30in_MDM_Request_Reset refines the FlowProperty MDM_Request_Reset.
Eu.Gen-SMI.135	Def	T32in_Registrations_Ready	The port T32in_Registrations_Ready refines the FlowProperty Registrations_Ready.
Eu.Gen-SMI.137	Def	T36in_MDM_Safe_Maintenance	The port T36in_MDM_Safe_Maintenance refines the FlowProperty MDM_Safe_Maintenance.
Eu.Gen-SMI.57	Def	D25in_Con_tmax_DataTransmission	The port D25in_Con_tmax_DataTransmission refines the time value Con_tmax_DataTransmission.
Eu.Gen-SMI.58	Def	D26in_Con_tmax_DataInstallation	The port D26in_Con_tmax_DataInstallation refines the time value Con_tmax_DataInstallation.
Eu.Gen-SMI.59	Def	D28in_Direct_Reboot_necessary	The port D28in_Direct_Reboot_necessary signalizes that the installation of an item i on EfeS requires a reboot of the EfeS.
Eu.Gen-SMI.60	Def	D2in_Con_tmax_Response_MDM	The port D2in_Con_tmax_Response_MDM refines the time value Con_tmax_Response_MDM.
Eu.Gen-SMI.62	Def	D3in_Con_tmax_SMI_Connection	The port D3in_Con_tmax_SMI_Connection refines the time value Con_tmax_SMI_Connection.
Eu.Gen-SMI.56	Def	D22in_item_I_activation_readiness	The port D22in_item_I_activation_readiness signalizes that an activation of an item i on EfeS is possible.
Eu.Gen-SMI.129	Def	T17out_Start_SMI_Connection	The port T17out_Start_SMI_Connection represents event of the start of the SMI connection. This is realised with an [OPC] reverse connect.
Eu.Gen-SMI.136	Def	D33out_Initialisation_done	The port D33out_Initialisation_done represents the event that initialisation is done. Realised as UpdateInitState in [OPC] Information Model.
Eu.Gen-SMI.63	Def	D8out_Preload_State	The port D8out_Preload_State represents the preload state.
Eu.Gen-SMI.64	Def	D9out_Activation_State	The port D9out_Activation_State represents the activation state.
Eu.Gen-SMI.55	Def	D10out_Operation_State	The port D10out_Operation_State represents the operation state.
Eu.Gen-SMI.127	Def	p3inout	
Eu.Gen-SMI.65	Info	F_SMI_EfeS - Behaviour	

ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.111	Req	<p>Functional Viewpoint - Interface Requirements - Functional Entity</p> <p>stm [State Machine] F_SMI_EfeS - Behaviour [Functional Viewpoint - Interface Requirements - Functional Entity]</p>	<p>This state machine diagram describes the requirements for the following functionalities:</p> <ul style="list-style-type: none"> - Establish communication between MDM and EfeS - Load configuration data into EfeS and activate these <p>The state machine starts after waiting for the PDI connection established, either in safe maintenance mode or data update mode and then mainly receives Signals from the MDM, which guide through the update process.</p> <p>Note: Item i is a configuration item and is therefore representative for example for the default luminosity of a Light Signal or a software update of a subsystem controller.</p>

ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.112	Def	Initial0	
Eu.Gen-SMI.113	Def	/cOp1_init ();{Initial0 - NO_SMI_CONNECTION}	
Eu.Gen-SMI.114	Def	NO_SMI_CONNECTION	
Eu.Gen-SMI.115	Def	EST_Ready_For_Maintenance/{NO_SMI_CONNECTION - ESTABLISH_SMI_CONNECTION}	
Eu.Gen-SMI.116	Def	entry/D10out_Operation_State := "NotMaintenance"; D33out_Initialisation_done := FALSE;{State-internal in NO_SMI_CONNECTION}	
Eu.Gen-SMI.118	Def	when(T12_Data_Update_After_Operational)/{NO_SMI_CONNECTION - ESTABLISH_SMI_CONNECTION}	
Eu.Gen-SMI.119	Def	when(T18_Data_Update_In_Initialising)/{NO_SMI_CONNECTION - ESTABLISH_SMI_CONNECTION}	
Eu.Gen-SMI.120	Def	when(T32in_Registrations_Ready)/{NO_SMI_CONNECTION - SMI_CONNECTION_ESTABLISHED}	
Eu.Gen-SMI.121	Def	SMI_CONNECTION_ESTABLISHED	
Eu.Gen-SMI.122	Def	/ {SMI_CONNECTION_ESTABLISHED - ESTABLISH_SMI_CONNECTION}	
Eu.Gen-SMI.123	Def	EST_Ready_For_Maintenance/D10out_Operation_State := "Maintenance";{SMI_CONNECTION_ESTABLISHED - DATA_UPDATE}	
Eu.Gen-SMI.124	Def	when(T19in_Start_async_preload)/{SMI_CONNECTION_ESTABLISHED - DATA_UPDATE}	
Eu.Gen-SMI.125	Def	when(T23in_SMI_Connection_closed)/{SMI_CONNECTION_ESTABLISHED - NO_SMI_CONNECTION}	
Eu.Gen-SMI.126	Def	when(T36in_MDM_Safe_Maintenance)/ send MDM_Commanded_Maintenance to p3inout;{SMI_CONNECTION_ESTABLISHED - SMI_CONNECTION_ESTABLISHED}	
Eu.Gen-SMI.160	Def	when(T30in_MDM_Request_Reset)/ send MDM_Triggered_Reset to p3inout;{State-internal in SMI_CONNECTION_ESTABLISHED}	
Eu.Gen-SMI.108	Def	ESTABLISH_SMI_CONNECTION	
Eu.Gen-SMI.109	Def	after(D3in_Con_tmax_SMI_Connection)/ send Data_Update_Finished to p3inout;{ESTABLISH_SMI_CONNECTION - NO_SMI_CONNECTION}	
Eu.Gen-SMI.110	Def	when(T32in_Registrations_Ready)/ D10out_Operation_State := "Maintenance";{ESTABLISH_SMI_CONNECTION - DATA_UPDATE}	
Eu.Gen-SMI.159	Def	entry/T17out_Start_SMI_Connection := TRUE;{State-internal in ESTABLISH_SMI_CONNECTION}	
Eu.Gen-SMI.66	Def	DATA_UPDATE	
Eu.Gen-SMI.67	Def	/send Data_Update_Finished to p3inout; D33out_Initialisation_done := FALSE; D10out_Operation_State := "NotMaintenance";{DATA_UPDATE - SMI_CONNECTION_ESTABLISHED}	
Eu.Gen-SMI.68	Def	Data_Update_Stop/ send Data_Update_Finished to p3inout; D33out_Initialisation_done := FALSE; D10out_Operation_State := "NotMaintenance";{DATA_UPDATE - SMI_CONNECTION_ESTABLISHED}	
Eu.Gen-SMI.70	Def	Initial1	
Eu.Gen-SMI.71	Def	/ {Initial1 - INITIALIZATION}	
Eu.Gen-SMI.72	Def	INITIALIZATION	
Eu.Gen-SMI.73	Def	/D33out_Initialisation_done := TRUE;{INITIALIZATION - MDM_INTERACTION_FOR_ITEM_i}	
Eu.Gen-SMI.157	Def	entry/For all i : D8out_Preload_State := "ReadyForPreload"; if (D22in_item_I_activation_readiness = TRUE) D9out_Activation_State := "readyForActivation"; else D9out_Activation_State := "NotYetActivatable"; end if{State-internal in INITIALIZATION}	
Eu.Gen-SMI.74	Def	MDM_INTERACTION_FOR_ITEM_i	
Eu.Gen-SMI.75	Def	after(D2in_Con_tmax_Response_MDM)/{MDM_INTERACTION_FOR_ITEM_i - Final0}	
Eu.Gen-SMI.76	Def	entry/For all i;{State-internal in MDM_INTERACTION_FOR_ITEM_i}	
Eu.Gen-SMI.77	Def	when(T1in_Maintaining_finished ;){Update_performed}/ T14_Data_installation_item_i := TRUE;{MDM_INTERACTION_FOR_ITEM_i - Final0}	
Eu.Gen-SMI.79	Def	when(T1in_Maintaining_finished;)/{MDM_INTERACTION_FOR_ITEM_i - Final0}	
Eu.Gen-SMI.80	Def	when(T2in_Preload_file_i_open)/{MDM_INTERACTION_FOR_ITEM_i - PRELOADING}	
Eu.Gen-SMI.81	Def	when(T4in_Activating_item_i) [D10out_Operation_State := "Maintenance";]/{MDM_INTERACTION_FOR_ITEM_i - ACTIVATING}	
Eu.Gen-SMI.69	Def	Final0	
Eu.Gen-SMI.82	Def	UPDATE_ITEM_i	
Eu.Gen-SMI.83	Def	/ {UPDATE_ITEM_i - MDM_INTERACTION_FOR_ITEM_i}	
Eu.Gen-SMI.84	Def	ACTIVATING	
Eu.Gen-SMI.85	Def	after(D26in_Con_tmax_DataInstallation)/ D9out_Activation_State := "ActivationAborted";{ACTIVATING - Final1}	
Eu.Gen-SMI.86	Def	entry/Item_i.D9out_Activation_State := "Activating";{State-internal in ACTIVATING}	

Generic interface and subsystem requirements for SMI			
ID	Type	Requirement Part 1	Requirement Part 2
Eu.Gen-SMI.87	Def	when(D28in_Direct_Reboot_necessary = TRUE)/ send Reboot_Required to p3inout; D33out_Initialisation_done := FALSE; D10out_Operation_State := "NotMaintenance";{ACTIVATING - SMI_CONNECTION_ESTABLISHED}	
Eu.Gen-SMI.88	Def	when(T5in_Data_installation_item_i_finished)[D28in_Direct_Reboot_necessary = FALSE]/ D9out_Activation_State := "NotYetActivatable";{ACTIVATING - Final1}	
Eu.Gen-SMI.89	Def	when(T6in_Update_process_aborted)/ D9out_Activation_State := "ActivationAborted";{ACTIVATING - Final1}	
Eu.Gen-SMI.94	Def	PRELOADING	
Eu.Gen-SMI.95	Def	after(D25in_Con_tmax_DataTransmission)/ Item_i.D8out_Preload_State := "PreloadingAborted"; D22in_item_I_activation_readiness := FALSE;{PRELOADING - Final1}	
Eu.Gen-SMI.96	Def	entry/Item_i.D8out_Preload_State := "Preloading";{State-internal in PRELOADING}	
Eu.Gen-SMI.98	Def	when(T3in_Preload_file_i_close)/verify checksum{PRELOADING - Junction}	
Eu.Gen-SMI.99	Def	when(T6in_Update_process_aborted)/ Item_i.D8out_Preload_State := "PreloadingAborted"; D22in_item_I_activation_readiness := FALSE;{PRELOADING - Final1}	
Eu.Gen-SMI.91	Def	Final1	
Eu.Gen-SMI.206	Def	Junction	
Eu.Gen-SMI.207	Def	[verify checksum not successfull]/D8out_Preload_State := "PreloadingAborted"; D22in_item_I_activation_readiness := FALSE;{Junction - Final1}	
Eu.Gen-SMI.208	Def	[verify checksum successfull]/D8out_Preload_State := "NotYetPreloadable"; D9out_Activation_State := "ReadyForActivation"; D22in_item_I_activation_readiness := TRUE;{Junction - Final1}	
Eu.Gen-SMI.181	Head	3.1.1.3.3.1 Additional requirements for the behaviour	
Eu.Gen-SMI.182	Req	After preloading the data the EfeS shall validate the integrity and authenticity of the transferred data.	
Eu.Gen-SMI.183	Req	If the integrity and authenticity validation fails, the EfeS shall prevent the activation of the configuration item.	
Eu.Gen-SMI.209	Info	The calculation method of the integrity and authenticity validation mechanism may be chosen by the supplier of the connected system, in accordance with [SP-SEC-CompSpec].	
Eu.Gen-SMI.217	Head	4 Technical requirements	
Eu.Gen-SMI.218	Head	4.1 Configuration and engineering data	
Eu.Gen-SMI.219	Head	4.1.1 Value configuration	
Eu.Gen-SMI.220	Req	Con_tmax_DataInstallation The time value shall be configured in accordance with: Resolution of configuration: 30 s Configurable range: between 30 and 300 s The default value for the configurable period Con_tmax_DataInstallation is 60 s. Con_tmax_DataInstallation is defined in Eu.Gen-SMI.164.	
Eu.Gen-SMI.221	Req	Con_tmax_DataTransmission The time value shall be configured in accordance with: Resolution of configuration: 60 s Configurable range: between 60 and 1800 s The default value for the configurable period Con_tmax_DataTransmission is 300 s. Con_tmax_DataTransmission is defined in Eu.Gen-SMI.165.	
Eu.Gen-SMI.222	Req	Con_tmax_Response_MDM The time value shall be configured in accordance with: Resolution of configuration: 1 s Configurable range: between 1 and 30 s The default value for the configurable period Con_tmax_Response_MDM is 10 s. Con_tmax_Response_MDM is defined in Eu.Gen-SMI.166.	
Eu.Gen-SMI.223	Req	Con_tmax_SMI_Connection The time value shall be configured in accordance with: Resolution of configuration: 1 s Configurable range: between 1 and 60 s The default value for the configurable period Con_tmax_SMI_Connection is 20 s. Con_tmax_SMI_Connection is defined in Eu.Gen-SMI.167.	