




ERJU SYSTEM PILLAR

System Interface Description_SDI-P information model_toolchain_demo (SERA Version)



System Interface Description_SDI-P information model_toolchain_demo (SERA Version)

Author(s)	Karl-Albrecht Klinge , Wegele, Stefan (SMO RI ML ADC I&C) , Stalin Chriss Castelino
Abstract	This document describes the as required per SPPRAMSS-349 - EN 50126-1:2017 phase 5 (Architecture and apportionment of system requirements) between the and the .
Config Item	System Interface Description
Document ID	TCCS Service Function Diagnostics _SFD_ L5/TCCS System Interface SDI-P information model_toolchain_demo_SERA Version#723877  System Interface Description_SDI-P information model_toolchain_demo (SERA Version)
Classification	Public
Status	In Review by System Pillar
Version	1.0
Revision	723877
Last Change Date	02.10.2025
Copyright	Brussels: Europe's Rail Joint Undertaking, 2025

© Europe's Rail Joint Undertaking, 2025

This document is drafted by and belongs to EU Rail.

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.

EU Rail authorises you to re-publish, re-use, copy and store this document without changing it, provided that you indicate its source and include the following: EU Rail trade mark, title of the document, year of publication, version of document.

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.

You may study, research, implement, adapt, improve and otherwise use the information, the content and the models in the 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.

INFO: History table is not displayed, because this document is in status **doc_contentApproval**.


RULE: History table is not displayed, in statuses: { draft doc_open doc_inprogress doc_contentApproval doc_contentDecision }

CONTACT: For more information contact Administrator

Review description

Attachments	REMINDER_[ERJU SP] Request to review SC2.4 List of deliverables - Task 2_ Transversal Systems .pdf , Review and Approval Jens Kilian.pdf , Review and Approval Virgil Lostun.pdf
Approvals	Kilian Jens : Waiting , SANGO Marc (SNCF / DIR TECHNOLOGIES INNOVATION ET PROJETS GROUPE / IR DIR RECHERCHE - PSF) : Waiting , DE NICOLA, Giuseppe : Waiting , KEFALAS, Georgios : Waiting , Julien Bois : Waiting , Oliver Knapp : Waiting , Wischy, Markus Alexander (SMO RI R&D F IL) : Waiting , HENON Frédéric : Waiting , TEKE, Emre : Waiting , Renato Rodrigues : Waiting , IOVINO, Salvatore : Waiting , Davinder Bhatia : Waiting , BITSCH Friedemann : Waiting , Roman R Treydel : Waiting , Golebniak, Udo (SMO RI ML ADC I&C) : Waiting , Mirko Blazic : Waiting , Benameur, Malik (SMO NEE RC-CH RI PLM SYS) : Waiting , MOTTOLA, Giuseppe Diodato : Waiting , Jack Schneider : Waiting , Zeeshan Z Ansar : Waiting , LOSTUN Virgil : Waiting , Patrick Konix : Waiting , NANNI Marco : Waiting , DE MARCO TELESE Giancarlo : Waiting , Tione, Roberto : Waiting , Andreeva-Moschen Emilia (HOLDING) : Waiting
Type of Approval	 Document Review

Approval description

Attachments	REMINDER__[ERJU SP] Request to review SC2.4 List of deliverables - Task 2_ Transversal Systems .pdf , Review and Approval Jens Kilian.pdf , Review and Approval Virgil Lostun.pdf
Type of Approval	 Document Approval

1	Preamble	4
1.1	Scope and intended audience	4
1.2	Purpose	5
1.3	Glossary	5
2	Overview	5
2.1	Overall description	5
2.2	Non-functional characteristics / non-functional requirements	6
3	SDI-P interface requirements	6
3.1	Data description	6
3.2	SDI-P Information Model	6
3.2.1	Package "SDI-P"	6
3.2.1.1	Package Header	6
3.2.1.2	Point Model	6
3.2.1.3	Meta Data Table	11
3.2.1.4	Data Model	11
3.2.1.5	NodeSet2 OPC UA Information Model	11
3.2.2	Alternative View of the SDI-P Information Model	11
3.3	Interdependencies to other interface layers	11
4	Appendix	11
4.1	Input documents	11
4.2	Standards and References	11

Figure 1. Tree View of Point

1 Preamble

1.1 Scope and intended audience

This document is provided for demonstration purposes only. The TACS Interface specification SDI-P is the applicable specification. The content, format and structure shown herein are intended solely to illustrate the toolchain to generate future versions of the applicable specification. All information is subject to change without notice and does not represent a finalised or authorised specification.

The information model presented in this document is subject to change due to ongoing development of the TCCS toolchain, Polarion template and formatting. The information model could be analysed by reading this document. For a comprehensive analysis of the artefacts generated by the TCCS toolchain, please refer to the alternative view of the information model.

This document defines the requirements for the Standard Diagnostic Interface (SDI) of a point specific diagnosable building block (SDI-P) to the Service Function Diagnostics based on the OPC UA protocol and SDI-GEN, as outlined in Part 1 of the SDI Companion Specification.

This specification is derived from and aligned with the following key documents:

- The System Definition, which describes the overall architecture and objectives of the SDI-based integration approach.
- The System Requirements Specification, which outlines functional, operational, and non-functional expectations for SDI implementations.
- The System Architecture Definition, which provides the structural blueprint for how system components interact, communicate, and are organized.

Intended Audience:

- System Architects and Integrators, responsible for the design and alignment of interoperable interfaces and data models across systems.
- Product Manufacturers and Suppliers, especially those contributing equipment or software components that expose OPC UA-based interfaces according to SDI standards.
- OPC UA Modelers and Developers, implementing companion models in NodeSet2 XML, transforming UML diagrams into OPC UA Information Models, and maintaining semantic consistency.
- Operators and Maintainers, who rely on standardized and interpretable data interfaces for diagnostics, monitoring, and operational decision-making.
- Standards Bodies and Certification Authorities, reviewing and validating SDI-based models for compliance, compatibility, and long-term maintainability.

The scope of this document covers the detailed structure of the NodeSet2 file and the information model for the point specific diagnosable building block (SDI-P). This document builds on the SDI for a generic diagnosable building block to the SFD, general modeling and communication requirements, including semantic standardization, reference modeling, versioning strategies, and structural adaptation rules for mapping domain-specific models into OPC UA, which are provided in separate parts of the companion specification (e.g., SDI-GEN, SDI-XX and Part 1 SDI Specification documents).

1.2 Purpose

This document describes the Standard Diagnostic Interface - Point (SDI-P) in accordance with the requirements of – EN 50126-1:2017, Phase 5: Architecture and Apportionment of System Requirements. The described interface defines the communication and data exchange between the service function diagnostics and a point specific diagnosable building block, forming a fundamental part of the system architecture.

The purpose of this document is to provide:

- A general and sufficiently detailed description of the system interface;
- Justification for the architectural and design decisions taken;
- A clear explanation of how the interface contributes to meeting the overall system requirements;
- A basis for consistent implementation, integration, and verification activities across different suppliers or subsystems.

This document aims to ensure a shared understanding of the architectural principles and interface structure, focusing on the rationale that led to the selected approach. It supports traceability from high-level system requirements to concrete technical solutions, particularly those realized using OPC UA.

Note: This Interface Definition may cover specific layer(s) of the overall system interface stack where appropriate, allowing reuse across multiple subsystems or interface definitions.

Depending on the context:

- For external interfaces, it serves as an extension of the System Definition, describing interactions from the perspective of the System Under Consideration (SuC).
- For internal interfaces, it complements the System Architecture Document, detailing the internal communication structure within the SuC.

This document is a key input for the development of product-specific OPC UA companion specifications and information models (e.g., SDI-P), and provides the foundation for implementing semantically consistent OPC UA-based interfaces across the system.

1.3 Glossary

This section provides definitions for key terms and abbreviations used throughout this document. All definitions are based on the official System Pillar Glossary. To ensure consistency and traceability, terms referenced here are aligned with existing definition work items and maintained according to the Glossary Usage Guidelines.

SDI – Standard Diagnostic Interface	A standardized OPC UA-based interface framework for the integration of diagnostic, condition monitoring, and asset-related data across different subsystems and suppliers.
OPC UA – OPC Unified Architecture	A machine-to-machine communication protocol for industrial automation, designed for interoperability, scalability, and platform-independence.
NodeSet2	The XML-based format used to describe OPC UA Information Models for exchange between tools and implementations.
TurnEvent	Summarises data for one respective turn cycle.

2 Overview

2.1 Overall description

The interface is based on OPC UA defining the application layer and using the lower levels of the TCP/IP stack.

The SDI-P information model consists of the Point Model.

The information model is described by:

1. A class diagram of the model
2. CCS/TMS data model format representation of the model
3. Table representation of the model meta data for the attributes and classes
4. NodeSet2 XML OPC UA Information Model

The SDI-XX and SDI-GEN requirements apply.

2.2 Non-functional characteristics / non-functional requirements

Decisions and rationales

3 SDI-P interface requirements

The  SPT2TS-129409 - System Structure and Interface Modeling apply [SPT2TS-130219]

3.1 Data description

SDI-P is a product group model for a point specific diagnosable building block. It builds on the generic diagnosable building block and describes the diagnostic using the OPC UA interface for a logical point component.

3.2 SDI-P Information Model

3.2.1 Package "SDI-P"

3.2.1.1 Package Header



SPT2TS-131352 - Package specification

```
{
"$schema": "prefix",
"isDefinedBy": "http://ERJU/datamodel/0.1/point",
"name": "sdi_p",
"prefix": "sdi_p",
"version": "4.3.1-r02",
"intId": 21,
"enums": [], "structs": []
} []
```


3.2.1.2 Point Model

SPMS-7393 - Point

The class represents the Subsystem - Point. [The object owns the properties listed below:


auxiliaryInput :  SPMS-7345 - AuxiliaryInput [0 .. *] (inherited from  SPMS-7384 - FieldElement)

No description available.

basicDataReadable : BasicDataReadable (inherited from  SPMS-7384 - FieldElement)

Indicates the status of the basic configuration data required for the subsystem functionality.
BasicDataReadable enumeration values:


Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	NotReadable	The data cannot be read
2	Incomplete	The data is not complete
3	FormallyCorrect	The data is formally correct

operationStatus : FieldElementOperationStatus (inherited from  SPMS-7384 - FieldElement)


Indicates the operations status of the logical EfeS according to the essential state machine (see Eu.Gen.3294 in [Eu.Doc.20]).

FieldElementOperationStatus enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	Booting	Field element is booting
2	InitialisingWaitingForPdiOrMaintenance	Field element is initialising and waiting for PDI or maintenance
3	InitialisingWaitingForPdi	Field element is initialising and waiting for PDI
4	InitialisingWaitingForDataUpdate	Field element is initialising and waiting for data update
5	InitialisingWaitingForNoMaintenanceTimeout	Field element is initialising and waiting for no maintenance timeout
6	Operational	Field element is operational
7	FallbackMode	Field element is in fallback mode

fieldElementSpecificationRevision : string (inherited from  SPMS-7384 - FieldElement)

Indicates the version of the EULYNX field element subsystem Requirements specification for subsystem XX which was used for development and production of the EULYNX field element subsystem. For example the EULYNX field element subsystem is developed and produced based on Requirements specification for subsystem XX version 1.6 (1.A), the fieldElementSpecificationRevision has the value "1.6 (1.A)".


statusTechnical : StatusTechnical (inherited from  SPMS-7383 - Subsystem)

Technical Status of the system, that represents the aggregated status of all hierarchical lower systems. This allows to have a top level information on the status of the system which can be drilled down if the system is in any other state than "Ok"


StatusTechnical enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	Ok	System serves all primary functions and has no deviations, errors or failures
2	Warning	All subsystems are working as intended, but the system detects unexpected behaviour (e.g. deviation from expected values).
3		


Value	Enumeration Literal	Description
	FailureNonCritical	At least one error in one of the (sub)systems, but on this system level all functions are available
4	FailureCritical	At least one function is not available; operational consequences possible

subsystemIdentification : string (inherited from  SPMS-7383 - Subsystem)


The technical identifier of the subsystem or adjacent systems (see Eu.SAS.77 in [Eu.Doc.16]).

statusTechnicalManufacturerSpecificMessage : uint16 [0 .. 1] (inherited from  SPMS-7383 - Subsystem)


Must be used by the supplier to describe the reasons for a StatusTechnical != OK, that cannot be explained by existing datapoints (NOT including IM and manufacturer specific diagnostic messages). This Information MUST be provided from the supplier. This should provide flexibility for future uses. Multiple states can be indicated at the same time if multiple diagnosis have not been included in the model during the design phase. The supplier specific reason may not overlap with reasons already covered in other attributes.

isTimeSynchronised : boolean [0 .. 1] (inherited from  SPMS-7383 - Subsystem)

Indicates whether the last time synchronisation was successful or not. This is important for the subsystem communication and diagnostic data gathering. TRUE: Current time of this subsystem is synchronised

logEventSubsystemEvent :  SPMS-7349 - LogEventSubsystemEvent [0 .. *]

No description available.

pointTurnEvent :  SPMS-7389 - PointTurnEvent [0 .. *]

No description available.

aggregateAbleToMoveStatus : PointAbleToMoveStatus [0 .. 1]

Reports the aggregated ability to move status, considering the ability to move of the Subsystem - Point and all the configured Point Machines.

PointAbleToMoveStatus enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	Able	Point is able to move
2	NotAble	Point is unable to move

pointAbleToMoveStatus : PointAbleToMoveStatus [0 .. 1]

Reports the ability to move status of the internal logic of the Subsystem - Point.

PointAbleToMoveStatus enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	Able	Point is able to move
2	NotAble	Point is unable to move

lastCommandedPosition : PointCommandedPosition

Reports the last point position commanded at the point by the interlocking
PointCommandedPosition enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	Left	Point is commanded LEFT
2	Right	Point is commanded RIGHT

driveCutoffPrinciple : PointDriveCutOffPrinciple [0 .. 1]

Reports whether the point uses individual drive or common drive as cut-off principle.
PointDriveCutOffPrinciple enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	Individual	The Subsystem - Point is configured to stop driving Point Machines individually
2	Common	The Subsystem - Point is configured to stop driving Point Machines according to common drive

movementStatus : PointMovementStatus

Reports the movement status of the point.
PointMovementStatus enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	MovingToLeft	Point is moving to the left
2	MovingToRight	Point is moving to the right
3	NotMoving	Point is not moving

position : PointPosition

Reports the position of the point
PointPosition enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	Left	
2	Right	
3	NoEndposition	Point is in no end position
4	UnintendedPosition	Point is in an unintended position

positionDegraded : PointPositionDegraded

Reports the degraded point position
PointPositionDegraded enumeration values:

Value	Enumeration Literal	Description
0	Unknown	The status unknown is used when the state is not yet established e.g. if connection to the system is lost
1	DegradedLeft	Point is degraded at left position
2	DegradedRight	Point is degraded at right position
3	NotDegraded	Point is not degraded
4	NotApplicable	Degraded status is not applicable to the point

pointOperationTimer : float

Timer that defines the maximum time period the Point has to arrive to an End position, starting with the command moving to the point machine.

pSamplingInterval : float

The time between measurements in the PointTurnEvent in [sec].

turnCounter : uint64 [0 .. 1]

the number of executed point movement since the first installation

isUsingRedrive : boolean

True: The Subsystem - Point is using redrive.

pointMachine : PointMachineType [1 .. *]

No description available.

operationalIdentifier : bytes

Operational identifier of the connected subsystem.

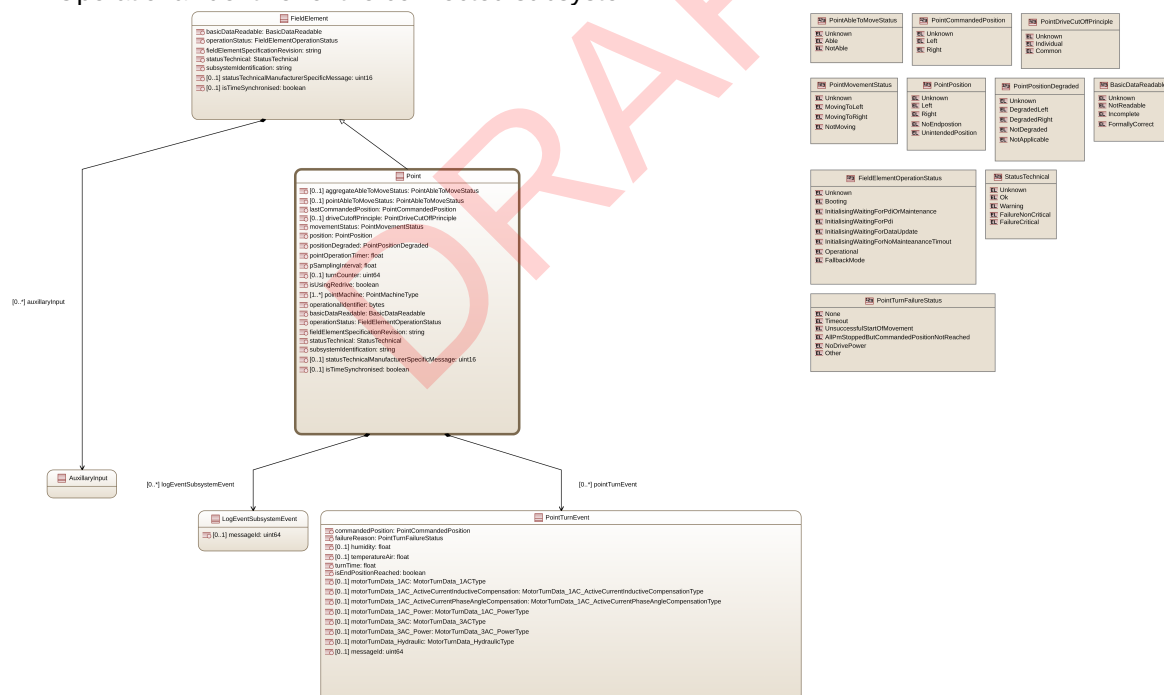


Figure 1 Tree View of Point

1

3.2.1.3 Meta Data Table



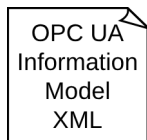
Meta Data Table is present here. [SPT2TS-131355]

3.2.1.4 Data Model

POLARION
Data Model

Data Model is present here. [SPT2TS-131357]

3.2.1.5 NodeSet2 OPC UA Information Model



NodeSet2 OPC UA Information Model is present here. [SPT2TS-131359]

3.2.2 Alternative View of the SDI-P Information Model

GENERATED CONTENT FOR INFORMATION MODEL ARE PRESENT HERE AS THREE ARTEFACTS

The data present here is described in three artefacts:

- A UML class diagram representing the static structure of the types used including the hierarchical and non-hierarchical (functional relationships (references)).
- A table according to the following meta data attributes
- A Nodeset2 XML OPC UA information model

[SPT2TS-130224]

3.3 Interdependencies to other interface layers

SDI-P uses variables and types from SDI-GEN. [SPT2TS-130223]

4 Appendix

4.1 Input documents

4.2 Standards and References