EULYNX Initiative

Europe's Rail Joint Undertaking

Interface specification SDI-IO

Document number: Eu.Doc.82
Version: 4.2 (0.A)

Contents

1 Introduction **1**

1.1 Release information 1

1.2 Impressum 1

1.3 Purpose 1

1.4 Applicable standards and regulations 2

1.5 Applicable documents 2

1.6 Appendices 2

1.7 Terms and abbreviations 2

1.8 Variability management 2

1.9 Definition of object types 2

2 Telegram SDI **2**

2.1 Definition of columns 2

2.2 Telegrams SDI-IO 3

2.3 Enumeration 4

2.4 IO class diagram 5

ID	Type	Requirement	Meaning	Model Type	Data Type	Trigger	Attribute Type	Sampling	Optionality	Func. Pkg.
Eu.SDI-IO.1	Head	**1 Introduction**								
Eu.SDI-IO.5	Head	**1.1 Release information**								
Eu.SDI-IO.7	Info	[Eu.Doc.82] Interface specification SDI-IO CENELEC Phase: 5 Version: 4.2 (0.A) Approval date: 29.05.2024								
Eu.SDI-IO.6	Info	**Version history**								
Eu.SDI-IO.133	Info	version number: 3.0 (0.A) date: 16.05.2022 author: Jorge Block review: CCB changes: -								
Eu.SDI-IO.322	Info	version number: 3.1 (0.A) date: 08.06.2023 author: SDI task force review: changes: EUIO-373, EUIO-374, EUIO-377, EUIO-389								
Eu.SDI-IO.336	Info	version number: 4.0 (0.A) date: 27.06.2023 author: SDI task force review: TACS Mirror Group changes: EUIO-392, EUIO-395, EUIO-398								
Eu.SDI-IO.449	Info	version number: 4.1 (0.A) date: 01.04.2024 author: SDI task force review: cluster changes: EUIO-400, EUIO-401, EUIO-422, EUIO-424, EUIO-425, EUIO-426								
Eu.SDI-IO.452	Info	version number: 4.2 (0.A) date: 20.06.2024 author: SDI task force review: TACS Mirror Group changes: EUIO-423, EUIO-433, EUIO-437, EUIO-438								
Eu.SDI-IO.3	Head	**1.2 Impressum**								
Eu.SDI-IO.4	Info	Publisher: **Europe's Rail Joint Undertaking** https://rail-research.europa.eu/ **EULYNX Initiative** https://eulynx.eu/								
Eu.SDI-IO.2	Info	Responsible for this document: EU-Rail System Pillar Trackside Assets Control and Supervision domain								
Eu.SDI-IO.9	Info	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 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]. 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 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.								
Eu.SDI-IO.10	Head	**1.3 Purpose**								
Eu.SDI-IO.11	Info	This document specifies the diagnostic messages (data point IDs and values) as parts of the telegram contents of the standardised diagnosis interface for a communication between the Subsystem - Maintenance and Data Management and Subsystem – Generic IO (SDI-IO).								

ID	Type	Requirement	Meaning	Model Type	Data Type	Trigger	Attribute Type	Sampling	Optionality	Func. Pkg.
Eu.SDI-IO.93	Info	This document contains the Subsystem - Generic IO specific diagnostic messages. The specifications defined in this document shall be complemented by the generic specification defined in Interface specification SDI Generic [Eu.Doc.94].								
Eu.SDI-IO.95	Info	Some items, referring to "interface-related" functionality of the communication partners, have been added to this specification as information, providing an overview only. In any case these are subject to appropriate systems (national) specification.								
Eu.SDI-IO.13	Info	This document is intended for the following users: • safety authorities • infrastructure managers • safety assessors • signalling system suppliers • validators								
Eu.SDI-IO.326	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.SDI-IO.14	Head	**1.4 Applicable standards and regulations**								
Eu.SDI-IO.96	Info	The applicable standards and regulations used in EULYNX are listed in the EULYNX Reference Document List [Eu.Doc.12].								
Eu.SDI-IO.15	Info	The references listed in the EULYNX Reference Document List [Eu.Doc.12] shall be considered where they are indicated as being applicable to SDI in the "Applies to" column of the EULYNX Reference Document List [Eu.Doc.12].								
Eu.SDI-IO.16	Head	**1.5 Applicable documents**								
Eu.SDI-IO.17	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.SDI-IO.18	Head	**1.6 Appendices**								
Eu.SDI-IO.19	Info	*- intentionally left blank -*								
Eu.SDI-IO.20	Head	**1.7 Terms and abbreviations**								
Eu.SDI-IO.21	Info	The terms and abbreviations are listed in the EULYNX Glossary [Eu.Doc.9].								
Eu.SDI-IO.22	Head	**1.8 Variability management**								
Eu.SDI-IO.23	Info	This document describes harmonised requirements. Variability management is not applicable.								
Eu.SDI-IO.24	Head	**1.9 Definition of object types**								
Eu.SDI-IO.25	Info	The following definition for object types is applied in this document:								
Eu.SDI-IO.26	Info	• "Req" - This denotes a mandatory requirement.								
Eu.SDI-IO.27	Info	• "Info" - This denotes additional information to help understand the specification. These objects do not specify any additional requirements.								
Eu.SDI-IO.28	Info	• "Head" - This denotes chapter headings.								
Eu.SDI-IO.30	Head	**2 Telegram SDI**								
Eu.SDI-IO.129	Req	All references to [Eu.Doc.94] refer to Interface specification SDI Generic version 4.2 (0.A).								Basic IO
Eu.SDI-IO.31	Info	This chapter defines the diagnostic messages - specifically the data points and values applied in the SDI-IO telegrams. The generic data points are defined in [Eu.Doc.94].								Basic IO
Eu.SDI-IO.130	Info	The defined diagnostic messages are mandatory only when the physical interfaces related to the specific diagnostic message are available on the Subsystem – Generic IO.								Basic IO
Eu.SDI-IO.327	Head	**2.1 Definition of columns**								
Eu.SDI-IO.328	Info	**Model Type:** Column that marks whether an entry is a model class (Class), a diagnostic data point (Attribute), an enumeration header (ValueType (Enumeration)) or an enumeration value (Enumeration Literal).								Basic IO
Eu.SDI-IO.329	Info	**Data Type:** Column that indicates the data type for the diagnostic data points. Enumeration values are defined in the section 'Enumeration'.								Basic IO
Eu.SDI-IO.330	Info	**Trigger:** Column that indicates the precision of data that shall be provided by the back-end to the OPC UA server on a subsystem. It represents the minimum level of change of the measures or reported value that shall trigger an update of the data point on the OPC UA server. For discrete data types (Boolean, enumeration, string), any change shall trigger an update on the OPC UA server. This is expressed as 'current value' in the column. For data that is part of an event class, the value 'on event' is used.								Basic IO
Eu.SDI-IO.331	Info	**Attribute Type:** Column that indicates the type of diagnostic information contained in the data point. Values are: **raw data**: uninterpreted data that is measured. **diagnosis**: an attribute with discrete values (enumeration or Boolean) that interprets the status of a system. There must be a table that directly links diagnostic enumeration values to statusTechnical values of that system.								Basic IO

ID	Type	Requirement	Meaning	Model Type	Data Type	Trigger	Attribute Type	Sampling	Optionality	Func. Pkg.
		configuration: data that is not measured but often set by the manufacturer or operator; it describes characteristics of the system. **counter:** diagnostic information that counts occurrences of a specific data measurement or event.								
Eu.SDI-IO.451	Info	**Sampling:** Column that indicates the required sampling interval of the data point, that is how often the OPC UA Server determines the values for an attribute, provided by the back-end. Value in milliseconds.								Basic IO
Eu.SDI-IO.332	Info	**Optionality:** Column that indicates whether a diagnostic data point is mandatory inside the model class, or optional. The diagnostic data of optional attributes may be required by national specifications. If an equipment or subsystem has the capability to collect and report the related diagnostic data, it must be reported in this data point. Note: In future phases of the System Pillar, national specifications will be replaced by harmonised specifications.								Basic IO
Eu.SDI-IO.34	Head	**2.2 Telegrams SDI-IO**								
Eu.SDI-IO.286	Req	PhysicalChannelConnection		Class						Basic IO
Eu.SDI-IO.287	Req	channelType	Indicates whether the physical channels acts as reference or validation channel.	Attribute	channelType : PhysicalChannelTwoChannelsType	Current value	configuration	1000	Mandatory	Basic IO
Eu.SDI-IO.237	Req	GenericIO	The class represents the Subsystem - Generic IO.	Class						Basic IO
Eu.SDI-IO.438	Req	label	It is assigned to all classes representing physically identifiable entities. This string, corresponding to a physically identifiable label, facilitates consistent reference between the physical entities in the field and their digital representations within the model.	Attribute	label : String	Current value	configuration	1000	Optional	Basic IO
Eu.SDI-IO.254	Req	LogicalChannel	The abstract class generalises all logical channels.	Class						Basic IO
Eu.SDI-IO.255	Req	index	The index expresses the numbered order of channels per Adjacent IO System, as used in the SCI-IO telegrams (see Eu.IO.7609 and Eu.IO.7610 in [Eu.Doc.45] and Eu.SCI-IO.PDI.164, Eu.SCI-IO.PDI.178 and Eu.SCI-IO.PDI.192 in [Eu.Doc.46]).	Attribute	index : Integer	Current value	configuration	1000	Mandatory	Basic IO
Eu.SDI-IO.256	Req	operationalIdentifierAdjacentSystem	Operational identifier of the connected adjacent IO system (see Eu.SAS.1784 in [Eu.Doc.16]).	Attribute	operationalIdentifierAdjacentSystem : Byte [20]	Current value	configuration	1000	Mandatory	Basic IO
Eu.SDI-IO.257	Req	statusTechnical	Indicates the generic technical status of the logical channel. Note: Enumeration values defined in Interface specification SDI Generic [Eu.Doc.94].	Attribute	statusTechnical : StatusTechnical	Current value	diagnosis	1000	Mandatory	Basic IO
Eu.SDI-IO.258	Req	statusTechnicalManufacturerSpecificMessage	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.	Attribute	statusTechnicalManufacturerSpecificMessage : MultiStateDiscreteTypeSupplier	Current value	diagnosis	1000	Optional	Basic IO
Eu.SDI-IO.252	Req	LogicalInputChannel	The abstract class generalises all logical input channels.	Class						Basic IO
Eu.SDI-IO.260	Req	logicalInputValue	Reports the current state of the Input Channel.	Attribute	logicalInputValue : LogicalInputValue	Current value	diagnosis	250	Mandatory	Basic IO
Eu.SDI-IO.261	Req	LogicalInputChannelSingleChannel	Representation of a logical input channel with one physical channel.	Class						Basic IO
Eu.SDI-IO.265	Req	LogicalInputChannelTwoChannels	Representation of a logical input channel with two physical channels.	Class						Basic IO
Eu.SDI-IO.269	Req	isValenceFailure	True: Depending on the set valence type, a valency error results when the corresponding timer has expired. Example: Physical channels (reference and validation) have the same value, although antivalence is set.	Attribute	isValenceFailure : Boolean	Current value	diagnosis	250	Mandatory	Basic IO
Eu.SDI-IO.270	Req	valenceType	Valence type of a dual channel	Attribute	valenceType : ValenceType	Current value	configuration	1000	Mandatory	Basic IO
Eu.SDI-IO.249	Req	LogicalOutputChannel	The abstract class generalises all logical output channels.	Class						Basic IO
Eu.SDI-IO.272	Req	dutyRatioFixedConfiguration	Con_Flash_Duty_Cycle as defined in Eu.IO.7683 in [Eu.Doc.45].	Attribute	dutyRatioFixedConfiguration : DutyRatioFixedConfiguration	Current value	configuration	1000	Mandatory	Option flashing
Eu.SDI-IO.273	Req	flashingPeriodFixedConfiguration	Con_t_Flash_Period as defined in Eu.IO.7684 in [Eu.Doc.45].	Attribute	flashingPeriodFixedConfiguration : FlashingPeriodFixedConfiguration	Current value	configuration	1000	Mandatory	Option flashing
Eu.SDI-IO.274	Req	logicalOutputValueCommanded	Reports the state of the logical output channel commanded by the electronic interlocking.	Attribute	logicalOutputValueCommanded : LogicalOutputValue	Current value	diagnosis	250	Mandatory	Basic IO
Eu.SDI-IO.275	Req	outputStatus	Reports the status related to disturbance of the Output Channels.	Attribute	outputStatus : OutputDisturbanceStatus	Current value	diagnosis	250	Mandatory	Basic IO

ID	Type	Requirement	Meaning	Model Type	Data Type	Trigger	Attribute Type	Sampling	Optionality	Func. Pkg.
Eu.SDI-IO.276	Req	LogicalOutputChannelSingleChannel	Representation of a logical output channel with one physical channel.	Class						Basic IO
Eu.SDI-IO.280	Req	LogicalOutputChannelTwoChannels	Representation of a logical output channel with two physical channels.	Class						Basic IO
Eu.SDI-IO.284	Req	isValenceFailure	True: Depending on the set valence type, a valency error results when the corresponding timer has expired. Example: Physical channels (reference and validation) have the same value, although antivalence is set.	Attribute	isValenceFailure : Boolean	Current value	diagnosis	250	Mandatory	Basic IO
Eu.SDI-IO.285	Req	valenceType	Valence type of a dual channel.	Attribute	valenceType : ValenceType	Current value	configuration	1000	Mandatory	Basic IO
Eu.SDI-IO.290	Head	**2.3 Enumeration**								
Eu.SDI-IO.291	Req	PhysicalChannelTwoChannelsType	Enumeration: Role of one physical channel within a logical channels with two physical channels.	ValueType (Enumeration)						Basic IO
Eu.SDI-IO.292	Req	ReferenceChannel	1	Enumeration Literal						Basic IO
Eu.SDI-IO.293	Req	ValidationChannel	2	Enumeration Literal						Basic IO
Eu.SDI-IO.294	Req	DutyRatioFixedConfiguration	Enumeration: Configurable value of the Con_Flash_Duty_Cycle for each logical output channel	ValueType (Enumeration)						Option flashing
Eu.SDI-IO.323	Req	Unknown	0: The status unknown is used when the state is not yet established e.g. if connection to the system is lost	Enumeration Literal						Option flashing
Eu.SDI-IO.295	Req	75%on	1: 75% on, 25% off	Enumeration Literal						Option flashing
Eu.SDI-IO.296	Req	50%on	2: 50% on, 50% off	Enumeration Literal						Option flashing
Eu.SDI-IO.297	Req	25%on	3: 25% on, 75% off	Enumeration Literal						Option flashing
Eu.SDI-IO.334	Req	NotConfigured	4	Enumeration Literal						Option flashing
Eu.SDI-IO.299	Req	FlashingPeriodFixedConfiguration	Enumeration: Configurable central value of the Con_t_Flash_Period for one Subsystem - Generic IO.	ValueType (Enumeration)						Option flashing
Eu.SDI-IO.324	Req	Unknown	0: The status unknown is used when the state is not yet established e.g. if connection to the system is lost	Enumeration Literal						Option flashing
Eu.SDI-IO.302	Req	2000ms	1	Enumeration Literal						Option flashing
Eu.SDI-IO.301	Req	1333ms	2	Enumeration Literal						Option flashing
Eu.SDI-IO.300	Req	1000ms	3	Enumeration Literal						Option flashing
Eu.SDI-IO.303	Req	800ms	4	Enumeration Literal						Option flashing
Eu.SDI-IO.335	Req	NotConfigured	5	Enumeration Literal						Option flashing
Eu.SDI-IO.305	Req	LogicalInputValue	Enumeration: Value of the logical input channel	ValueType (Enumeration)						Basic IO
Eu.SDI-IO.309	Req	Unknown	0: The status unknown is used when the state is not yet established e.g. if connection to the system is lost	Enumeration Literal						Basic IO
Eu.SDI-IO.307	Req	SwitchedOff	1	Enumeration Literal						Basic IO
Eu.SDI-IO.308	Req	SwitchedOn	2	Enumeration Literal						Basic IO
Eu.SDI-IO.306	Req	Disturbed	3	Enumeration Literal						Basic IO
Eu.SDI-IO.310	Req	LogicalOutputValue	Enumeration: Value of the logical output channel	ValueType (Enumeration)						Basic IO
Eu.SDI-IO.314	Req	Unknown	0: The status unknown is used when the state is not yet established e.g. if connection to the system is lost	Enumeration Literal						Basic IO
Eu.SDI-IO.312	Req	SwitchedOff	1	Enumeration Literal						Basic IO
Eu.SDI-IO.313	Req	SwitchedOn	2	Enumeration Literal						Basic IO
Eu.SDI-IO.311	Req	Flashing	3	Enumeration Literal						Option flashing
Eu.SDI-IO.315	Req	OutputDisturbanceStatus	Enumeration: Disturbance status of the logical output channel	ValueType (Enumeration)						Basic IO
Eu.SDI-IO.318	Req	Unknown	0: The status unknown is used when the state is not yet established e.g. if connection to the system is lost	Enumeration Literal						Basic IO
Eu.SDI-IO.316	Req	NotPhysicallyDisturbed	1	Enumeration Literal						Basic IO
Eu.SDI-IO.317	Req	PhysicallyDisturbed	2	Enumeration Literal						Basic IO
Eu.SDI-IO.319	Req	ValenceType	Enumeration: Indicates whether digital signals are transmitted as antivalent or equivalent.	ValueType (Enumeration)						Basic IO
Eu.SDI-IO.325	Req	Unknown	0: The status unknown is used when the state is not yet established e.g. if connection to the system is lost	Enumeration Literal						Basic IO
Eu.SDI-IO.320	Req	Antivalence	1: Two physical channels are switched to antivalent values. Opposite values are expected. Equal values lead to errors.	Enumeration Literal						Basic IO

ID	Type	Requirement	Meaning	Model Type	Data Type	Trigger	Attribute Type	Sampling	Optionality	Func. Pkg.
Eu.SDI-IO.321	Req	Equivalence	2: Two physical channels are switched to equivalent. Equal values are expected. Opposite values lead to errors.	Enumeration Literal						Basic IO
Eu.SDI-IO.333	Head	**2.4 IO class diagram**								
Eu.SDI-IO.450	Info	In the class diagram, classes presented in yellow indicate classes from the generic SDI model and are covered in [Eu.Doc.94]. Classes presented in blue are specific classes and covered in this document.								Basic IO
Eu.SDI-IO.236	Info	IO class diagram See Figure 1 on page 6.	The class diagram represents the static structure of the Subsystem - Generic IO from the point of view of diagnostics.	Class Diagram						Basic IO

Figure 1: From object 236 on page 5.