



EULYNX Initiative

EULYNX System architecture specification

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ID	Type	Requirement
Eu.SAS.11	Head	1 Introduction
Eu.SAS.1321	Head	1.1 Release information
Eu.SAS.1322	Info	[Eu.Doc.16] EULYNX System architecture specification Cenelec Phase: 4 Version: 2.4 (0.A) Approval date: 29.05.2024
Eu.SAS.1629	Info	Version history
Eu.SAS.2159	Info	version number: 2.0 (0.A) date: 16.05.2022 author: Nico Huurman review: CCB changes: EUAR-354, EUAR-448, EUAR-508, EUAR-509, EUAR-516, EUAR-522, EUAR-526, EUAR-535
Eu.SAS.2165	Info	version number: 2.1 (0.A) date: 31.03.2023 author: Nico Huurman review: changes: EUAR-545, EUAR-547, EUAR-558, EUAR-559, EUAR-564, EUAR-567, EUAR-568, EUAR-570, EUAR-575, EUAR-577, EUAR-579, EUAR-580
Eu.SAS.2185	Info	version number: 2.1 (1.A) date: 10.05.2023 author: Nico Huurman review: cluster changes: EUAR-588
Eu.SAS.2186	Info	version number: 2.2 (0.A) date: 27.06.2023 author: Nico Huurman review: CCB changes: EUAR-585, EUAR-604, EUAR-606, EUAR-613

ID	Type	Requirement
Eu.SAS.2187	Info	version number: 2.3 (0.A) date: 20.02.2024 author: Nico Huurman review: cluster changes: EUAR-518, EUAR-617, EUAR-619, EUAR-622, EUAR-682, EUAR-684, EUAR-689, EUAR-693
Eu.SAS.2190	Info	version number: 2.4 (0.A) date: 18.06.2024 author: Nico Huurman review: CCB changes: EUAR-681, EUAR-682, EUAR-691, EUAR-710, EUAR-734, EUAR-742, EUAR-743
Eu.SAS.1323	Head	1.2 Impressum
Eu.SAS.1324	Info	Publisher: EULYNX Initiative A full list of the EULYNX Partners can be found on https://eulynx.eu/ .
Eu.SAS.1325	Info	Responsible for this document: EULYNX Project Management Office www.eulynx.eu
Eu.SAS.1630	Info	Copyright EULYNX Partners All information included or disclosed in this document is licensed under the European Union Public Licence EUPL, Version 1.2 or later.
Eu.SAS.12	Head	1.3 Purpose
Eu.SAS.1778	Info	The EULYNX System architecture specification refines the standard reference architecture defined through the EULYNX System Definition [Eu.Doc.7].
Eu.SAS.13	Info	The document contains: <ul style="list-style-type: none"> • the definition of the EULYNX System architecture • the requirements and definitions applied in the development process of the EULYNX System. • the requirements for standardised interfaces in the EULYNX System • the generic (e.g. generic technical functions and generic interface functions) and specific architecture requirements for the EULYNX field element subsystems, electronic interlocking and adjacent systems
Eu.SAS.14	Info	The EULYNX System architecture specification is a Phase 4 document according to [EN 50126].
Eu.SAS.15	Info	This document is the reference document in the development of the requirements specifications within the EULYNX System.

ID	Type	Requirement
Eu.SAS.2045	Info	This document is intended for the following users: <ul style="list-style-type: none"> • safety authorities • infrastructure managers • safety assessors • signalling system suppliers • validators
Eu.SAS.17	Head	1.4 Applicable standards and regulations
Eu.SAS.18	Info	A list of applicable standards and regulations used in EULYNX is listed in the EULYNX Reference Document List [Eu.Doc.12].
Eu.SAS.21	Head	1.5 Applicable documents
Eu.SAS.22	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.SAS.19	Head	1.6 Terms and abbreviations
Eu.SAS.20	Info	The terms and abbreviations are listed in the EULYNX Glossary [Eu.Doc.9].
Eu.SAS.1631	Head	1.7 Variability management
Eu.SAS.1632	Info	This document is valid for the complete EULYNX System. Variability management is not used in this document. In implementation projects that apply the EULYNX specifications, it is possible to implement only parts of the architecture of the EULYNX System described in this document. The Infrastructure Manager initiating an implementation project, can use project documentation to indicate which parts of the architecture of the EULYNX System are applicable in a specific project.
Eu.SAS.723	Head	1.8 Definition of object types
Eu.SAS.724	Info	The following definition for object types is applied in this document:
Eu.SAS.725	Info	<ul style="list-style-type: none"> • "Req" - This denotes a mandatory requirement.
Eu.SAS.728	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.SAS.729	Info	<ul style="list-style-type: none"> • "Head" - This denotes chapter headings.
Eu.SAS.1646	Head	2 Technical definitions for the EULYNX System
Eu.SAS.41	Head	2.1 System and subsystem definitions

ID	Type	Requirement
Eu.SAS.1554	Info	<p>In the EULYNX domain, three terms are used to describe the systems in the EULYNX System architecture:</p> <ul style="list-style-type: none"> • EULYNX subsystem • EULYNX field element subsystem • adjacent system <p>The EULYNX field element subsystems are a subgroup of the EULYNX subsystems.</p>
Eu.SAS.42	Info	<p>The technical system EULYNX System is subdivided as follows:</p> <ul style="list-style-type: none"> • Subsystem - Electronic Interlocking • Subsystem - Maintenance and Data Management (MDM) • EULYNX field element subsystems • Subsystem - Communication System • Subsystem - Security Services Platform (SSP)
Eu.SAS.1688	Info	<p>The term "EULYNX field element subsystems" is used as a term in the description of the system when stating generic requirements equally valid for all these subsystems.</p>
Eu.SAS.1433	Info	<p>The interacting functionality of a EULYNX field element subsystem is specified on the interface with the Subsystem - Electronic Interlocking. The core functionality of a EULYNX field element subsystem is specified to a defined level of standardisation for each subsystem.</p>
Eu.SAS.1437	Info	<p>Only the interacting functionality of an adjacent system is specified on the interface with the Subsystem - Electronic Interlocking, core functionality of the adjacent system is not specified.</p>
Eu.SAS.1436	Info	<p>The EULYNX System contains the following EULYNX field element subsystems:</p> <ul style="list-style-type: none"> • Subsystem - Light Signal • Subsystem - Point • Subsystem - Generic IO • Subsystem - Train Detection System • Subsystem - Level Crossing
Eu.SAS.1435	Info	<p>The EULYNX System is connected to the following adjacent systems via a specified EULYNX interface:</p> <ul style="list-style-type: none"> • Traffic Control System (TCS) • Adjacent Interlocking System • Radio Block Centre (RBC) • Centralised ETCS L1 Controller (CEC) • Trackworker Safety System (TSS) • External Level Crossing System
Eu.SAS.2167	Info	<p>The generic parts of the interacting functionality and the core functionality for the EULYNX field element subsystem described in this document are also valid for the adjacent system External Level Crossing System, unless otherwise indicated.</p>

ID	Type	Requirement
Eu.SAS.2081	Info	<p>Furthermore, the EULYNX System is connected to the following adjacent systems and actors:</p> <ul style="list-style-type: none"> • Documentation System • Power supply • Diagnostic System • Maintainer • Train Driver • Basic Data Identifier • Point Machine • Legacy train protection system • Eurobalise • Indicator • Wheel • Adjacent IO System • Configuration Data Carrier • Train Detection System in adjacent interlocking area • Level crossing protection facility • Detection element • Local operator • Security service interaction <p>Note: These interfaces are not specified by EULYNX and may be subject to national specifications.</p>
Eu.SAS.44	Head	2.2 Infrastructure definitions
Eu.SAS.733	Req	The data exchange between the subsystems within the EULYNX System and the adjacent systems of the EULYNX System shall be implemented by means of the Subsystem - Communication System. The guideline for the network architecture is specified in [Eu.Doc.25].
Eu.SAS.734	Req	The subsystems within the EULYNX System and the adjacent systems of the EULYNX System shall be connected to the PoS-Signalling (Point of Service - Signalling), as specified in [Eu.Doc.100], to connect to the Subsystem - Communication System and be able to communicate with each other.
Eu.SAS.56	Req	<p>The subsystems within the EULYNX System shall be connected to the Point of Power - Output (PoP-O) to obtain the power supply.</p> <p>Note: The PoP-O is specified by national requirements.</p>
Eu.SAS.38	Info	The security concept for the EULYNX System is specified in the EULYNX Security Concept [Eu.Doc.15].
Eu.SAS.1438	Head	3 Standardised interfaces in the EULYNX System

ID	Type	Requirement
Eu.SAS.1441	Info	The following four interface types of the EULYNX System architecture are standardised: <ul style="list-style-type: none"> • Process data interface • Diagnostic interface • Maintenance interface • Security interface
Eu.SAS.1442	Info	The Process data interface is standardised as Standard Communication Interface, designated as SCI-XX.
Eu.SAS.1443	Info	The Diagnostic interface is standardised as Standard Diagnostic Interface, designated as SDI-XX.
Eu.SAS.1444	Info	The Maintenance interface is standardised as Standard Maintenance Interface, designated as SMI-XX.
Eu.SAS.2091	Info	The Security interface is standardised as Standard Security Interface, designated as SSI-XX.
Eu.SAS.1689	Info	The designation -XX is used for the description of the interfaces when stating generic requirements equally valid for all interfaces of the same type.
Eu.SAS.1439	Head	3.1 Process data interface
Eu.SAS.1698	Req	The Process data interface shall be used to exchange functional information between the communication partners.
Eu.SAS.59	Req	The technical implementation of the Process data interface contains the protocol stack as depicted in Eu.SAS.736.

ID	Type	Requirement
Eu.SAS.736	Req	<p>Figure of the protocol stack of the SCI-XX in the EULYNX System</p> <p>Variant 1</p> <p>Variant 2</p> <p>SCI-XX</p> <p>PoS-Signalling</p> <p>Application layer = SCI-XX.PDI</p> <p>Safety, retransmission and redundancy layer = RaSTA</p> <p>Transport layer = UDP</p> <p>Network layer</p> <p>Data link layer</p> <p>Physical layer</p>
Eu.SAS.61	Req	For the use of the interfaces SCI-XX the following definitions shall be applied.
Eu.SAS.1647	Req	The higher layers (transport layer, safety, retransmission and redundancy layer and application layer) together form the Standard Communication Interface (SCI), designated as SCI-XX. They are defined in [Eu.Doc.92].
Eu.SAS.1648	Req	The lower layers (network layer, data link layer and physical layer) are defined by the PoS-Signalling, as defined in [Eu.Doc.100].
Eu.SAS.62	Req	The application layer of the SCI-XX shall be designated as SCI-XX.PDI (PDI - Process Data Interface protocol). The communication connection between two communication partners (Subsystem - Electronic Interlocking with another subsystem or Subsystem - Electronic Interlocking with an adjacent system) at the application layer shall be designated as a PDI connection. The telegram specification for transmitting the logical information objects is defined in the PDI.
Eu.SAS.2046	Req	The Process Data Interface protocol relies on the safety, retransmission and redundancy layer to guarantee the safe communication according to [EN 50159]. The safety, retransmission and redundancy layer shall be implemented with a protocol that provides these guarantees.
Eu.SAS.1690	Info	The protocol used to implement the safety, retransmission and redundancy layer is called a Safe communication protocol (SCP) within these specifications.
Eu.SAS.63	Req	The Safe communication protocol (SCP) shall be implemented with the RaSTA protocol [RaSTA].

ID	Type	Requirement
Eu.SAS.64	Info	The communication between systems which takes place via a RaSTA protocol is called a safe communication (SC) within these specifications.
Eu.SAS.1447	Head	3.1.1 Communication partner requirements
Eu.SAS.1649	Req	The PDI connection is a connection between two communication partners. One of the two sides shall act as primary communication partner and the other side as secondary communication partner.
Eu.SAS.1451	Req	The primary communication partner shall have the role to:
Eu.SAS.1452	Req	<ul style="list-style-type: none"> • Initiate the establishment of the PDI connection
Eu.SAS.1453	Req	<ul style="list-style-type: none"> • Supervise the PDI connection for connection losses (by means of RaSTA)
Eu.SAS.1454	Req	<ul style="list-style-type: none"> • Re-establish the PDI connection after a connection loss
Eu.SAS.1701	Req	The secondary communication partner shall have the role to:
Eu.SAS.1702	Req	<ul style="list-style-type: none"> • Monitor the PDI connection for connection losses (by means of RaSTA)
Eu.SAS.1650	Req	<p>For the PDI connection between the Subsystem - Electronic Interlocking and a EULYNX field element subsystem, the following shall be applied:</p> <ul style="list-style-type: none"> • The Subsystem - Electronic Interlocking shall be the primary communication partner • The EULYNX field element subsystem shall be the secondary communication partner
Eu.SAS.1651	Req	<p>For the PDI connection between the Subsystem - Electronic Interlocking and an adjacent system (excluding Adjacent Interlocking System and External Level Crossing System), the following shall be applied:</p> <ul style="list-style-type: none"> • The adjacent system shall be the primary communication partner • The Subsystem - Electronic Interlocking shall be the secondary communication partner
Eu.SAS.1481	Req	For the PDI connection for SCI-ILS, with two equal communication partners, the primary and secondary communication partners shall be defined by configuration.
Eu.SAS.1488	Req	The Subsystem - Electronic Interlocking can be connected to more than one Adjacent Interlocking System. The designation of primary and secondary is independent for each instance of the connection.
Eu.SAS.2092	Head	3.1.2 Handling the Safe communication protocol
Eu.SAS.781	Req	As soon as the primary communication partner runs in compliance with the required safety integrity level (SIL), the safe communication shall be established in accordance with the specifications in [RaSTA].

ID	Type	Requirement
Eu.SAS.2093	Req	As soon as the secondary communication partner runs in compliance with the required safety integrity level (SIL), it shall be ready to establish the safe communication in accordance with the specifications in [RaSTA].
Eu.SAS.105	Req	If the safe communication to the secondary communication partner terminates, the primary communication partner shall re-establish the connection in accordance with [RaSTA] unless specified otherwise for individual cases.
Eu.SAS.2094	Info	It is possible to have more than one PDI connection on one instance of the safe communication protocol.
Eu.SAS.2095	Req	If the safe communication terminates, the communication partner shall consider all assigned PDI connections to be closed.
Eu.SAS.1445	Head	3.1.3 Requirements for the Process Data Interface protocol
Eu.SAS.1741	Head	3.1.3.1 General requirements
Eu.SAS.1742	Req	The maximum telegram length shall be 1024 bytes.
Eu.SAS.1743	Req	A telegram shall consist of the telegram header, followed by the telegram payload.
Eu.SAS.1744	Req	The telegram header shall have a length of 43 bytes (bytes 00 until 42). It shall consist of: <ul style="list-style-type: none"> • Protocol Type (1 byte) • Message Type (2 bytes) • Sender Identifier (20 bytes) • Receiver Identifier (20 bytes)
Eu.SAS.1745	Req	The telegram payload may be empty or consist of a sequence of payload parameters.
Eu.SAS.1505	Head	3.1.3.2 Protocol Type
Eu.SAS.737	Info	To associate the system specific telegrams defined in the SCI-XX.PDI with their respective telegram specification and their system safely, in every telegram a value called "Protocol Type" is specified as a unique protocol identifier. For the different SCI-XX, the Protocol Types are defined in [Eu.Doc.93]
Eu.SAS.2180	Req	The values 0xE0 until 0xEF shall not be used to define EULYNX Protocol Types. Note: The values in this range may be used in national specifications for migration purposes.
Eu.SAS.1746	Head	3.1.3.3 Message Type
Eu.SAS.1747	Req	The Message Type specifies the unique message identifier of each telegram within a Protocol Type.

ID	Type	Requirement
Eu.SAS.1748	Req	The Message Type shall have a length of 2 bytes. The definition of the Message Types is provided in the interface specification of the respective SCI-XX.
Eu.SAS.2181	Req	The values 0xE000 until 0xEFFF shall not be used to define EULYNX Message Types. Note: The values in this range may be used in national specifications for migration purposes.
Eu.SAS.1699	Head	3.1.3.4 Sender and Receiver Identifiers
Eu.SAS.1769	Req	The sending and receiving entity shall be indicated in each telegram.
Eu.SAS.1770	Req	The sender and receiver shall be identified either by a technical or by an operational identifier.
Eu.SAS.2084	Req	Technical identifiers shall follow the formatting defined in Eu.SAS.77.
Eu.SAS.2085	Req	Operational identifiers shall follow the formatting defined in Eu.SAS.1784.
Eu.SAS.1771	Req	The interface specification of the respective SCI-XX shall define for each telegram whether the technical or the operational identifiers apply.
Eu.SAS.1506	Head	3.1.3.5 Payload parameter requirements
Eu.SAS.1507	Req	The payload of the PDI telegrams is expressed as a series of parameters. There are 4 types of parameters:
Eu.SAS.1508	Req	• Information parameter
Eu.SAS.1509	Req	• Numerical range parameter
Eu.SAS.1510	Req	• Text parameter
Eu.SAS.1511	Req	• Element ID parameter
Eu.SAS.2064	Req	In telegrams that convey a status message and contain multiple status parameters, the values of all status parameters shall reflect the status as currently known by the sender.
Eu.SAS.1513	Head	3.1.3.5.1 Information parameter requirements
Eu.SAS.1750	Req	An information parameter shall be expressed as an enumeration. It shall be used as a qualifier to further specify the information transferred by the telegram.
Eu.SAS.1514	Req	The length of an information parameter is one byte.
Eu.SAS.1516	Req	The byte value 0x00 shall not be used.

ID	Type	Requirement
Eu.SAS.1517	Req	The byte value 0xFF shall only be used to express 'Information parameter not applicable'.
Eu.SAS.1518	Req	The value 'Information parameter not applicable' shall be used if a message type is applicable to an IM and the specific information parameter within the payload is not applicable to that IM.
Eu.SAS.1519	Head	3.1.3.5.2 Numerical range parameter requirements
Eu.SAS.1520	Req	The parameter length shall be a whole number of bytes.
Eu.SAS.1521	Req	The maximum length of a numerical range parameter shall be 4 bytes.
Eu.SAS.1522	Req	The parameter value 0x00..00 shall express the numerical value 0 of its range.
Eu.SAS.1523	Req	The parameter values 0x00..01 until 0xFF..FE are the useable range of the numerical value.
Eu.SAS.1738	Req	Within the useable range it is allowed to define limited range(s).
Eu.SAS.1739	Req	<p>Within the useable range it is allowed to assign specific meanings to specific values that are outside of the defined limited range(s).</p> <p>Example 1: 0x00 to 0x78 defined as 'Train speed in 5km/h increments' (0 km/h to 600 km/h) 0x79 to 0xFF not used</p> <p>Example 2: 0x0000 defined as 'Timer not running' 0x0001 to 0xFFFF defined as 'Timer in seconds' (1 s to 65534 s) 0xFFFF not used</p>
Eu.SAS.1524	Req	The parameter value 0xFF..FF shall be reserved to express 'Numerical range parameter not applicable'.
Eu.SAS.1525	Req	The value 'Numerical range parameter not applicable' shall only be used if a message type is applicable to an IM and the specific numerical range parameter within the payload is not applicable to that IM.
Eu.SAS.1526	Head	3.1.3.5.3 Text parameter requirements
Eu.SAS.1527	Req	The parameter length shall be a whole number of bytes.
Eu.SAS.1528	Req	The maximum length of a text parameter shall be 255 bytes.
Eu.SAS.1534	Req	Text parameters shall only be used to express text strings that have no defined meaning for any of the EULYNX subsystems or adjacent systems. The text string shall only be meant to be displayed to a human operator.

ID	Type	Requirement
Eu.SAS.1751	Req	The first byte shall express the length of the text string that follows. The maximum value shall be 254 characters (0xFE).
Eu.SAS.1530	Req	Starting from the second byte, the text string shall be filled in left-adjusted with trailing whitespace covered with the NULL character (0x00).
Eu.SAS.1529	Req	The text string shall be expressed compliant with the "latin 1" character set, ISO IEC 8859-1:1998.
Eu.SAS.1532	Req	The byte value of 0x00 of the first byte shall express an empty text field. All following bytes shall be filled with the NULL character (0x00).
Eu.SAS.1531	Req	The byte value 0xFF of the first byte shall express 'Text parameter not applicable'. All following bytes shall be filled with the 'ÿ' character (0xFF).
Eu.SAS.1535	Head	3.1.3.5.4 Payload element ID parameters
Eu.SAS.1537	Req	Payload element ID parameters are used to identify physical or operational elements of the railway system (field elements, routes, areas, etc.), as defined in Eu.SAS.1764.
Eu.SAS.1536	Req	The parameter length shall be 20 bytes.
Eu.SAS.1539	Req	The parameter consists of 20 characters, ISO IEC 8859-1:1998 left justified, empty spaces to be filled with the NULL character (0x00).
Eu.SAS.1541	Req	The parameter value consisting of the NULL character (0x00) for all its bytes shall not be used to identify an element.
Eu.SAS.1540	Req	The content of every parameter value is defined by data preparation, subject to national requirements.
Eu.SAS.784	Head	3.1.4 Establishing and closing the PDI connection
Eu.SAS.785	Info	This section describes the process of establishing and closing the PDI connection between the communication partners. Note: This functionality is specified in detail as model-based requirements in the Generic interface and subsystem requirements for SCI [Eu.Doc.119].
Eu.SAS.786	Req	The primary communication partner shall send a command PDI-Version check, including the configured version of the Process Data Interface protocol (PDIVER), to the secondary communication partner as soon as the safe communication is available and the PDI connection to the secondary communication partner is not impermissible or disabled.
Eu.SAS.1711	Req	When the secondary communication partner receives the command PDI-Version check, and is ready to establish the PDI connection, it shall: <ul style="list-style-type: none"> • Compare the reported PDI-Version sent by the primary communication partner to its own version, and; • Send to the primary communication partner a message PDI-Version check, containing the result of the PDI-Version comparison, the version of the Process Data Interface protocol (PDIVER) it has configured and checksum data. <p>Note: The readiness for PDI connection is only applicable for EULYNX field element subsystems.</p>

ID	Type	Requirement
Eu.SAS.2096	Req	For interfaces to EULYNX field element subsystems, the secondary communication partner shall issue the message PDI Not Available as soon as it receives the command PDI-Version check, if the secondary communication partner is not ready to establish the PDI connection. It shall consider the PDI connection suspended.
Eu.SAS.787	Req	<p>When the primary communication partner receives the message PDI-Version check, it shall:</p> <ul style="list-style-type: none"> • Check the PDI-Version comparison result, and; • Compare the reported checksum data sent by the secondary communication partner with its own stored checksum data. <p>If the PDI-Version comparison is a match and the checksum data are identical, the primary communication partner shall send a command Initialisation Request to the secondary communication partner.</p>
Eu.SAS.1752	Req	The telegrams of the command PDI-Version check and the message PDI-Version check shall be independent of the PDI-Version. They shall be identical for all PDI-Versions of the protocol.
Eu.SAS.1712	Req	As soon as it has received a command Initialisation Request, the secondary communication partner shall send a message Start Initialisation to the primary communication partner, followed by all required Report Status messages.
Eu.SAS.2051	Req	<p>For interfaces to EULYNX field element subsystems, the secondary communication partner shall send a message Initialisation Completed after sending all required Report Status messages.</p> <p>Note: The required Report Status messages to be sent by the secondary communication partner are defined in the requirements specification of each interface.</p>
Eu.SAS.2052	Req	<p>For interfaces to adjacent systems, the secondary communication partner shall send a message Status Report Completed after sending all required Report Status messages. The primary communication partner shall process the received Report Status messages and then send all its required Report Status messages, followed by a message Status Report Completed.</p> <p>The secondary communication partner shall send a message Initialisation Completed only after receiving and processing all required Report Status messages from the primary communication partner.</p> <p>Note: The required Report Status messages to be sent by each communication partner are defined in the requirements specification of each interface. In case there are no Report Status messages to be sent, the message Status Report Completed must still be sent.</p>
Eu.SAS.2188	Req	If a change of state occurs whilst establishing the PDI connection and the corresponding status message for the previous state has already been sent, a new status message shall be sent to the communication partner as soon as the PDI connection has been established
Eu.SAS.108	Req	The PDI connection is established if the following conditions are satisfied:
Eu.SAS.109	Req	<ul style="list-style-type: none"> • the safe communication to the communication partner is available
Eu.SAS.110	Req	<ul style="list-style-type: none"> • the PDIVer shall be identical for both communication partners

ID	Type	Requirement
Eu.SAS.1736	Req	<ul style="list-style-type: none"> the checksum data shall be identical for both communication partners
Eu.SAS.112	Req	<ul style="list-style-type: none"> for interfaces to EULYNX field element subsystems, a command Initialisation Request has been issued to the secondary communication partner and the messages about initialisation start, reported status and initialisation completed shall have been received by the primary communication partner in full as defined by the requirement specifications for each interface within a configurable time.
Eu.SAS.2053	Req	<ul style="list-style-type: none"> for interfaces to adjacent systems, a command Initialisation Request has been issued to the secondary communication partner and the messages about initialisation start, reported status and status report completed shall have been received by the primary communication partner in full as defined by the requirements specifications for each interface. The reported status and status report completed have been issued to the secondary communication partner in full as defined by the requirements specifications for each interface and the message initialisation completed shall have been received by the primary communication partner within a configurable time.
Eu.SAS.1968	Req	<p>For interfaces to EULYNX field element subsystems, status reports shall be required for all operationally addressable objects.</p> <p>Note: Operationally addressable objects are objects that can be addressed using an operational identifier (see Eu.SAS.1764).</p>
Eu.SAS.1967	Req	<p>For interfaces to adjacent systems, status reports shall be required for all permanent operational objects. Status reports shall be optional for all volatile operational objects.</p> <p>Note: Permanent operational objects are for example light signals, TVP sections, points. Volatile operational objects are for example routes.</p>
Eu.SAS.788	Req	If the PDIVer comparison gives a negative result, the primary communication partner shall terminate the establishment of the PDI connection:
Eu.SAS.2097	Req	<ul style="list-style-type: none"> For interfaces to EULYNX field element subsystems, if the primary communication partner contains in its configuration another PDI version to establish the PDI connection to the secondary communication partner, it shall issue the command Close PDI, including the reason for closing, and re-initiate the establishment of the PDI connection with another configured PDI version in accordance with Eu.SAS.786.
Eu.SAS.2098	Req	<ul style="list-style-type: none"> For interfaces to EULYNX field element subsystems, if the primary communication partner contains in its configuration no other PDI version to establish the PDI connection to the secondary communication partner, it shall issue the command Release PDI For Maintenance. It shall consider the PDI connection suspended.
Eu.SAS.1970	Req	<ul style="list-style-type: none"> For interfaces to adjacent systems, the primary communication partner shall issue the command Close PDI, including the reason for closing, and shall not re-initiate the establishment of the PDI connection. It shall consider the PDI connection impermissible.
Eu.SAS.789	Req	If the checksum data are not identical, the primary communication partner shall terminate the establishment of the PDI connection:
Eu.SAS.1971	Req	<ul style="list-style-type: none"> For interfaces to EULYNX field element subsystems, the primary communication partner shall issue the command Release PDI For Maintenance. It shall consider the PDI connection suspended.
Eu.SAS.1972	Req	<ul style="list-style-type: none"> For interfaces to adjacent systems, the primary communication partner shall issue the command Close PDI, including the reason for closing, and shall not re-initiate the establishment of the PDI connection. It shall consider the PDI connection impermissible.

ID	Type	Requirement
Eu.SAS.782	Req	If several connections are to be established simultaneously, the primary communication partner shall distribute the establishment in a manner that the response times required for the signalling system (e.g. in case of signal stop) continue to be guaranteed for the communication partners not affected by establishing the connection.
Eu.SAS.790	Req	If the establishment of the PDI connection, measured from the sending of the command PDI-Version check until the receipt of the message Initialisation Completed is not completed within a configurable time, the primary communication partner shall terminate the establishment of the PDI connection by issuing the command Close PDI, including the reason for closing. A diagnostic message shall be issued. The primary communication partner shall re-initiate the establishment of the PDI connection in accordance with Eu.SAS.786.
Eu.SAS.2156	Req	For interfaces for EULYNX field element subsystems, the primary communication partner shall issue the command Close PDI, including the reason for closing, if the PDI connection is no longer needed for operation.
Eu.SAS.2157	Req	For interfaces for EULYNX field element subsystems, the primary communication partner shall issue the command Release PDI for Maintenance, if the EULYNX field element subsystem must contact the Subsystem - Maintenance and Data Management to update its configuration and engineering data or device software.
Eu.SAS.2099	Req	The secondary communication partner shall consider the PDI connection closed as soon as it receives the message Close PDI. It shall remain available for re-initiation of the PDI connection.
Eu.SAS.2100	Req	For interfaces to EULYNX field element subsystems, the secondary communication partner shall issue the message PDI Not Available as soon as it is no longer ready to establish the PDI connection during establishing of the PDI connection or while the PDI connection is established. It shall consider the PDI connection suspended.
Eu.SAS.2101	Req	For interfaces to EULYNX field element subsystems, the secondary communication partner shall issue the message PDI Available as soon as it is ready to establish the PDI connection while the PDI connection is suspended.
Eu.SAS.2102	Req	For interfaces to EULYNX field element subsystems, the secondary communication partner shall consider the PDI connection suspended as soon as it receives the command Release PDI For Maintenance.
Eu.SAS.2103	Req	For interfaces to EULYNX field element subsystems, the primary communication partner shall consider the PDI connection suspended as soon as it receives the message PDI Not Available.
Eu.SAS.2104	Req	For interfaces to EULYNX field element subsystems, the primary communication partner shall re-initiate the establishment of the PDI connection in accordance with Eu.SAS.786 as soon as it receives the message PDI Available while the PDI connection is suspended.
Eu.SAS.116	Req	As long as the PDI connection is established, the following functions shall be available:
Eu.SAS.1450	Req	<ul style="list-style-type: none"> • both communication partners shall issue commands and/or messages according to the respective interface specifications.
Eu.SAS.1653	Req	<ul style="list-style-type: none"> • both communication partners shall receive and process commands and/or messages according to the respective interface specifications.
Eu.SAS.783	Req	<ul style="list-style-type: none"> • both communication partners may only send telegrams which have been defined as valid for the aligned PDI version of the PDI connection.

ID	Type	Requirement
Eu.SAS.1833	Head	3.1.5 Repetition of PDI telegrams
Eu.SAS.1834	Info	To avoid overloading of the network, sending commands or messages that are identical to a command or message that has already been sent shortly before should be avoided.
Eu.SAS.2033	Info	In the context of repetition, commands or messages are considered identical if: <ul style="list-style-type: none"> • they refer to the same operational component • they interact with the operational component in the same way (e.g. they both command or report a state) • they command or report the same state of the operation component
Eu.SAS.119	Req	<p>A communication partner shall not send a command or message which is identical to the last sent command or message referring to the same operational component unless:</p> <ul style="list-style-type: none"> • The PDI connection has been re-established since the last identical command or message was sent • The identical command or message is caused by different external inputs (e.g. state change or action by signaller) • At least 30 seconds have passed since the last identical command or message was sent, in order not to overload the network. <p>Note 1: The definition of operational component differs for each SCI-XX. Note 2: The mentioned 30 seconds in the third exception is not a critical value that needs to be supervised. It is a guideline value for network overloading.</p> <p>Example for the second exception: The Subsystem - Electronic Interlocking receives a message that a component for route monitoring is no longer in the required state and, almost at the same time, receives a command from the signaller to revoke the route entry signal. Both external inputs cause the Subsystem - Electronic Interlocking to send a command with a stop aspect to the Subsystem – Light Signal for the same signal. Both commands are identical, but as they are caused by different external inputs, they are allowed to be sent both.</p>
Eu.SAS.2078	Req	When receiving a command or message which is identical to the last received command or message referring to the same operational component, a communication partner shall send a diagnostic message via its diagnostics interface.
Eu.SAS.1989	Req	For interfaces to EULYNX field element subsystems (not including the External Level Crossing System), the operational components are equal to the operational identifiers, as defined in [Eu.SAS.1767]
Eu.SAS.1904	Info	For interfaces to adjacent systems, the definition of operational components will be developed at a later stage.
Eu.SAS.1567	Head	3.1.6 Handling of communication errors
Eu.SAS.1569	Req	When a communication partner receives a telegram that does not meet the requirements of the communication protocol, the appropriate reaction is defined, depending on the character of the communication error.
Eu.SAS.1668	Req	If one of the errors described in this section occurs in the PDI connection, the communication partner shall send a diagnostic message via its diagnostics interface.

ID	Type	Requirement
Eu.SAS.2183	Req	If a EULYNX subsystems or adjacent systems has more than one instance of SCI-XX, meaning it communicates with multiple communication partners on the Process data interface, the requirements of the communication protocol shall be checked independently for each instance of SCI-XX.
Eu.SAS.2184	Req	For one instance of SCI-XX, only those messages that have been received from the expected communication partner (i.e. the configured network addresses and/or the certificate common name) shall be processed. Note: IT Security requirements ensure that the relation between the certificate common name and physical devices can be trusted.
Eu.SAS.1669	Head	3.1.6.1 Protocol errors
Eu.SAS.1656	Req	<p>Protocol error "incomplete activation"</p> <p>In interfaces to EULYNX field element subsystems, the primary communication partner detects, during the establishment of the PDI connection, that it receives the message "Msg_Initialisation_Completed" without complete receipt of the status messages from the secondary communication partner.</p> <p>In interfaces to adjacent systems, a communication partner detects, during the establishment of the PDI connection, that it receives the message "Msg_Status_Report_Completed" without complete receipt of the status messages from the other communication partner.</p> <p>Example 1: The Subsystem - Electronic Interlocking receives from the Subsystem - Light Signal, during the establishment of the PDI connection, the message "Msg_Indicated_Signal_Aspect" followed by the message "Msg_Initialisation_Completed". It did not receive the message "Msg_Set_Luminosity".</p> <p>Example 2: The adjacent system Radio Block Centre receives from the Subsystem - Electronic Interlocking, during the establishment of the PDI connection, several status messages followed by the message "Msg_Status_Report_Completed". It did not receive the message "Msg_Point_Status" for all elements for which this status report is required as given by data preparation.</p>
Eu.SAS.1666	Req	<p>Protocol error "improper message sequence"</p> <p>A communication partner detects that a telegram, which is correct in matters of form and content and with a known message type, which is allowed to be used in the current state, but which is not allowed to be received in the given sequence.</p> <p>Example 1: The Subsystem - Electronic Interlocking has received a message "Msg_Start_Initialisation" and then a message "Msg_PDI_Version_Check".</p> <p>Example 2: While establishing the PDI connection, the EULYNX field element subsystem receives the command "Cd_PDI_Version_Check" after having sent the message "Msg_PDI_Version_Check"</p>
Eu.SAS.1663	Req	<p>Protocol error "message at improper instant case"</p> <p>Case 1:</p> <p>A communication partner detects, after the PDI connection has been established, that a telegram, which is correct in matters of form and content with a known message type, has been received, which is expected to be received only while establishing the PDI connection.</p> <p>Case 2:</p>

ID	Type	Requirement
		<p>A communication partner detects, while establishing the PDI connection, that a telegram, which is correct in matters of form and content with a known message type, has been received, which is expected to be received only after the PDI connection has been established.</p> <p>Example 1: The Subsystem - Electronic Interlocking sends a command to the EULYNX field element subsystem to change its state. The Subsystem - Electronic Interlocking then receives a message "Msg_Start_Initialisation".</p> <p>Example 2: The Subsystem - Light Signal sends the telegram "Msg_Start_Initialisation" and receives sequentially the telegram "Cd_Indicate_Signal_Aspect" (command indicate the transmitted signal aspect)".</p>
Eu.SAS.1670	Head	3.1.6.2 Formal telegram errors
Eu.SAS.1658	Req	<p>Formal telegram error "deviating message type"</p> <p>A communication partner detects that the message type, given in a received telegram does not belong to the set of message types, specified for the compared combination of protocol type and PDI-Version.</p> <p>Example 1: In the specification SCI-LS, the message types 0x0001 to 0x0004 and 0x0021 to 0x0025 are defined. A message type outside these ranges is a wrong message type.</p> <p>Example 2: In the specification SCI-TDS, the message type 0x0009 is defined, but not applicable to IM 007000. A message type 0x0009 is a wrong message type for this IM.</p>
Eu.SAS.1657	Req	<p>Formal telegram error "deviating protocol type"</p> <p>A communication partner detects that the protocol type given in a received telegram does not match the protocol type implemented or configured on this PDI connection.</p> <p>Example: The SCI-LS has the protocol type 0x30. The Subsystem - Electronic Interlocking receives from the Subsystem - Light Signal a telegram with protocol type 0x20.</p>
Eu.SAS.1665	Req	<p>Formal telegram error "message length"</p> <p>A communication partner detects that the length of a received telegram does not match the specified length for the given message type.</p> <p>Example: The telegram "Cd_Indicate_Signal_Aspect" to Subsystem - Light Signal, the length of 60 bytes is specified. The length of the received telegram is 50 bytes.</p>
Eu.SAS.1659	Req	<p>Formal telegram error "unknown sender or receiver identifier"</p> <p>A communication partner detects that the given identifier of sender and/or receiver does not match the identifier provided by the configuration and engineering data.</p>
Eu.SAS.1671	Head	3.1.6.3 Content telegram errors

ID	Type	Requirement
Eu.SAS.1660	Req	<p>Content-telegram-error "improper value"</p> <p>A communication partner detects, that the value of the payload-byte of a received telegram is out of the specified range.</p> <p>Example 1: For the payload parameter in byte 43 of the telegram "Msg_Set_Luminosity" values of 0x01, 0x02 and 0xFE have been specified in the SCI-LS. A value of 0x33 in the payload parameter in byte 43 is an impermissible value.</p> <p>Example 2: For the payload parameter Mode of FC (byte 43) of the telegram Command "FC" the values of 0x01 to 0x05 have been specified in the SCI-TDS, but only value 0x02 is valid for IM 008200. A value of 0x01 in the payload parameter Mode of FC (byte 43) is an impermissible value for this IM.</p>
Eu.SAS.1661	Req	<p>Content-telegram-error "locally improper value"</p> <p>A communication partner detects, that a received telegram contains values in the payload bytes which are allowed according to the specification, but are not applicable to a particular configuration of this communication partner (e.g. a telegram addressed to an ID, where the ID takes the correct form, but does not exist in the configuration).</p> <p>Example: The Subsystem - Electronic Interlocking receives from a Subsystem - Light Signal a message "Msg_Indicated_Signal_Aspect" with a signal aspect which has not been planned in the Subsystem - Electronic Interlocking.</p>
Eu.SAS.1662	Req	<p>Content-telegram-error "improper combination of values"</p> <p>A communication partner detects, that it received a telegram, which is formally correct, but the combination of values in the payload-bytes is forbidden.</p> <p>Example: The Subsystem - Level Crossing receives from the Subsystem - Electronic Interlocking a command "Cd_Activation" with the value 0x1F for Activation type and the value 0xFF for Track index. This combination of values is not allowed.</p>
Eu.SAS.1775	Head	3.1.6.4 Reaction to communication errors
Eu.SAS.1823	Req	<p>A secondary communication partner shall issue the message Reset PDI, including the reason for closing, in case of the following communication errors:</p> <ul style="list-style-type: none"> • Protocol errors • Formal telegram errors • Content-telegram errors
Eu.SAS.1777	Req	<p>A primary communication partner shall issue the command Close PDI, including the reason for closing, and shall not re-initiate the establishment of the PDI connection. It shall consider the PDI connection impermissible in case of the following communication errors:</p> <ul style="list-style-type: none"> • Protocol errors • Formal telegram errors • Content-telegram-errors

ID	Type	Requirement
Eu.SAS.2105	Req	When a primary communication partner receives the message Reset PDI, it shall not re-initiate the establishment of the PDI connection. It shall consider the PDI connection impermissible.
Eu.SAS.2189	Req	The primary communication partner shall consider a PDI connection as impermissible until it receives an internal trigger to reset the severe error that causes the impermissible state. Note: EULYNX does not specify the implementation of this 'severe error reset' trigger, it is defined by national specifications.
Eu.SAS.1781	Head	3.1.7 RaSTA parameters
Eu.SAS.1782	Info	The following parameters are defined for the configuration of RaSTA. The values of these parameters are defined in [Eu.Doc.92]. Note: These parameters have been derived from existing small scale DB implementations. They have to be proven by further operational experience on larger scales. Deviating values can be used for specific interfaces.
Eu.SAS.1779	Info	Configurable parameters: <ul style="list-style-type: none"> • Tseq Buffering time (used in the redundancy layer), used to reorder messages that were received out-of-order due to different paths Rationale: the value must be tailored to the expected quality and behaviour of the network • Th Heartbeat Rationale: the CPU must be able to handle enough connections • Tmax Maximum age of a message • SC Safety code Rationale: the probability of undetected errors in the message must be sufficiently low • Nsendmax Maximum number of messages that may be sent before the first response Rationale: the value must be tailored to the load profile of the connection • MWA Maximum number of messages that may be received before a response must be sent Rationale: the value must be smaller than Nsendmax • NmaxPaket Maximum number of messages that may be combined in a transmission

ID	Type	Requirement
		<p>Rationale: the value must be tailored to the load profile of the connection</p> <ul style="list-style-type: none"> • Check Code <p>Selection of a checking mechanism in the redundancy layer</p> <p>Rationale: the value must be tailored to the selection of the safety code</p>
Eu.SAS.1555	Head	3.2 Diagnostics interface
Eu.SAS.1691	Req	The diagnostics interface shall be used for communication with the service function Diagnostics collector.
Eu.SAS.2106	Req	The diagnostics interface shall be used for communication with the service function Time synchronisation.
Eu.SAS.1692	Req	The service function Diagnostics collector shall be capable of collecting and processing event-based and preventive diagnostic data from the connected systems.
Eu.SAS.1697	Req	The service function Time synchronisation shall provide a uniform time base for all connected systems.
Eu.SAS.1693	Info	The service function Diagnostics collector may be realised in the Subsystem - Maintenance and Data Management or in a system defined by national requirements.
Eu.SAS.2107	Info	The service function Time synchronisation may be realised in the Subsystem - Maintenance and Data Management or in a system defined by national requirements.
Eu.SAS.1672	Req	The technical implementation of the diagnostics interface contains the protocol stack as depicted in Eu.SAS.1673.

ID	Type	Requirement
Eu.SAS.1673	Req	<p>Figure of the protocol stack of the SDI-XX in the EULYNX System</p> <p>The diagram illustrates the SDI-XX protocol stack. It consists of two main parts: service functions and lower layers. The service functions are divided into two columns: 'Diagnostics collector' and 'Time synchronisation'. The 'Diagnostics collector' stack includes an 'Application layer, including security = OPC UA SC' and a 'Transport layer = TCP'. The 'Time synchronisation' stack includes an 'Application layer = NTP' and a 'Transport layer = UDP'. Below these service function stacks are three common layers: 'Network layer', 'Data link layer', and 'Physical layer'. A vertical bracket on the left labeled 'SDI-XX' spans the two service function stacks. Another vertical bracket on the left labeled 'PoS-Signalling' spans the three common layers.</p>
Eu.SAS.1674	Req	For the use of the interfaces SDI-XX the following definitions shall be applied.
Eu.SAS.1675	Req	The higher layers (transport layer and application layer) together form the Standard Diagnostics Interface (SDI), designated as SDI-XX. They are defined in [Eu.Doc.77].
Eu.SAS.1676	Req	The lower layers (network layer, data link layer and physical layer) are defined by the PoS-Signalling, as defined in [Eu.Doc.100].
Eu.SAS.1559	Req	The protocol OPC UA with binary binding via OPC UA Secure Connection shall be used to transfer diagnostic data from the connected systems to the service function Diagnostics collector.
Eu.SAS.1715	Req	The diagnostic data shall be expressed with data point IDs and data point values, provided in the device-specific diagnostic model (the assignment of data point IDs to sub-objects of the connected system).
Eu.SAS.1716	Req	The device-specific diagnostic model shall be provided by the manufacturer of the connected system.
Eu.SAS.1717	Info	The specification of diagnostic data (XML scheme) is created by the infrastructure manager, according to national requirements.
Eu.SAS.840	Req	Communication errors shall be recorded as diagnostic message.

ID	Type	Requirement
Eu.SAS.2059	Req	The protocol NTP shall be used for the service function Time synchronisation.
Eu.SAS.1556	Head	3.3 Maintenance interface
Eu.SAS.1694	Req	The maintenance interface shall be used for communication with the service function Loading procedure.
Eu.SAS.1695	Req	The service function Loading procedure shall support the provision of engineering and configuration data and device software for the connected systems.
Eu.SAS.1696	Req	The service function Loading procedure shall be realised in the Subsystem - Maintenance and Data Management.
Eu.SAS.1680	Req	The technical implementation of the maintenance interface contains the protocol stack as depicted in Eu.SAS.1681.
Eu.SAS.1681	Req	<p>Figure of the protocol stack of the SMI-XX in the EULYNX System</p> <p>Service function Loading procedure</p>
Eu.SAS.1682	Req	For the use of the interfaces SMI-XX the following definitions shall be applied.
Eu.SAS.1683	Req	The higher layers (transport layer and application layer) together form the Standard Maintenance Interface (SMI), designated as SMI-XX. They are defined in [Eu.Doc.76].

ID	Type	Requirement
Eu.SAS.2079	Req	The protocol OPC UA with binary binding via OPC UA Secure Connection shall be used to provide engineering and configuration data from the service function Loading procedure to the connected systems.
Eu.SAS.1684	Req	The lower layers (network layer, data link layer and physical layer) are defined by the PoS-Signalling, as defined in [Eu.Doc.100].
Eu.SAS.1563	Info	The Standard Maintenance Interface is identical for all connected systems in terms of functionality.
Eu.SAS.837	Req	Communication errors shall be recorded as diagnostic message.
Eu.SAS.2108	Head	3.4 Security interface
Eu.SAS.2109	Req	The security interface shall be used for communication with the service functions Identity and Access Management, Public Key Infrastructure Management, Security Logging and Backup Services.
Eu.SAS.2111	Req	The service function Identity and Access Management shall enable centralized management and timely updates to grant or revoke access to a device, service, or functionality.
Eu.SAS.2112	Req	The service function Public Key Infrastructure shall manage certificates used for public-key cryptography (encryption and integrity protection).
Eu.SAS.2113	Req	The service function Security Logging shall provide the data storage for all security related log and monitoring information. It stores the data and provides data to systems entitled to use them based on the service function Identity and Access Management. It ensures confidentiality, integrity, availability and non-repudiation of the data received.
Eu.SAS.2160	Req	The service function Backup Services shall provide backup of data from the connected systems for IT security.
Eu.SAS.2116	Req	The service functions Identity and Access Management, Public Key Infrastructure Management, Security Logging and Backup Services shall be realised in the Subsystem - Security Services Platform.
Eu.SAS.2118	Req	The technical implementation of the security interface contains the protocol stack as defined in the EULYNX Security Specifications [Eu.Doc.114].
Eu.SAS.2119	Req	For the use of the interfaces SSI-XX the following definitions shall be applied.
Eu.SAS.2120	Req	The higher layers (transport layer and application layer) together form the Standard Security Interface (SSI), designated as SSI-XX. They are defined in [Eu.Doc.117].
Eu.SAS.2121	Req	The lower layers (network layer, data link layer and physical layer) are defined by the PoS-Signalling, as defined in [Eu.Doc.100].
Eu.SAS.1654	Head	4 Data in the EULYNX System
Eu.SAS.755	Head	4.1 Configuration and engineering data

ID	Type	Requirement
Eu.SAS.1577	Info	The configuration data are data, that on one hand are used to execute technical components of the EULYNX System, such as network addresses and protocol versions, on the other hand contain parameters and values explicitly given in requirement specifications as configuration data. Configuration data are independent from the structure of the railway system. If changes of parameters and values shall be made during operation, they can be done without changing engineering data.
Eu.SAS.756	Info	Engineering data are the data to describe a railway system as monitored and controlled by a EULYNX System.
Eu.SAS.1582	Req	For the communication with other EULYNX subsystems and adjacent systems, each EULYNX subsystem or adjacent system shall be provided with configuration and engineering data.
Eu.SAS.1755	Req	The configuration and engineering data of EULYNX subsystems and adjacent systems shall include the following information:
Eu.SAS.1756	Req	<ul style="list-style-type: none"> • unique technical identifier of the subsystem or adjacent system (SubS_ID) <p>Note: The term 'SubS_ID' can also apply to adjacent systems, because they are also subsystems in a broader perspective (outside one EULYNX system)</p>
Eu.SAS.1759	Req	<ul style="list-style-type: none"> • own network addresses of the subsystem or adjacent system <p>Note: Because of 2 network channels and up to 4 virtual LANs, there could be up to 8 network addresses.</p>
Eu.SAS.84	Req	<ul style="list-style-type: none"> • network addresses of the communication partners (including corresponding routing)
Eu.SAS.754	Req	<ul style="list-style-type: none"> • network addresses of the Subsystem - Maintenance and Data Management (including corresponding routing) <p>Note: Only applicable if the EULYNX System uses a Subsystem - Maintenance and Data Management.</p>
Eu.SAS.86	Req	<ul style="list-style-type: none"> • configuration data for the Process data interface (e.g. configuration data for RaSTA)
Eu.SAS.758	Req	<ul style="list-style-type: none"> • configuration data for the diagnostics interface
Eu.SAS.759	Req	<ul style="list-style-type: none"> • configuration data for the maintenance interface
Eu.SAS.2123	Req	<ul style="list-style-type: none"> • configuration data for the security interface
Eu.SAS.1763	Req	<ul style="list-style-type: none"> • configuration data for IT security <p>Note 1: This may not be needed in Category 2 networks [EN 50159].</p> <p>Note 2: This includes the certificate common name of the subsystem or adjacent system and of the communication partners</p>
Eu.SAS.87	Req	<ul style="list-style-type: none"> • the national specifications of the infrastructure managers and manufacturer-specific engineering data

ID	Type	Requirement
Eu.SAS.2016	Req	<ul style="list-style-type: none"> the technical and operational identifiers as defined by the interface specifications of SCI-XX <p>Note: This includes the technical and operational identifiers of the communication partners</p>
Eu.SAS.2182	Req	<p>If a EULYNX subsystems or adjacent systems has more than one instance of SCI-XX, meaning it communicates with multiple communication partners on the Process data interface, the configuration and engineering data shall uniquely define the relationships between identifiers on different layers of the communication stack.</p> <p>Note: This includes network addresses, configuration data for IT security, configuration data for the Process data interface, technical and operational identifiers of SCI-XX.</p>
Eu.SAS.74	Req	<p>The basic data is a part of the configuration data and shall include as a minimum the unique technical identifier, the own network addresses and either the network addresses of the communication partners or the network addresses of the Subsystem - Maintenance and Data Management.</p> <p>Note: In case a EULYNX System uses a Subsystem - Maintenance and Data Management, the network addresses of other communication partners can be provided through the connection to the Subsystem - Maintenance and Data Management.</p>
Eu.SAS.1655	Head	4.2 Basic data identifier
Eu.SAS.2057	Req	The provision of basic data to a subsystem controller shall ensure an unambiguous allocation of this data to the identified field element.
Eu.SAS.75	Req	The basic data of the EULYNX field element subsystem shall be stored on a data carrier (Basic Data identifier).
Eu.SAS.76	Req	<p>The Basic Data identifier shall be permanently assigned to the slot of the component of the subsystem (subsystem controller). To avoid erroneous assignments, the Basic Data identifier shall be attached to the subsystem in a manner that it remains assigned to that subsystem when a subsystem controller (or part of it) is replaced.</p> <p>Note: The implementation of the Basic Data identifier is left to the suppliers. This is not specified by EULYNX.</p>
Eu.SAS.2058	Req	The basic data identifier shall be identifiable (at least type and name of the field element) by the maintainer without the need to use additional hard- or software systems.
Eu.SAS.1764	Head	4.3 Identifiers
Eu.SAS.1765	Req	Identifiers are used to identify senders and receivers of telegrams. A distinction shall be made between technical identifiers, operational identifiers and payload element identifiers.
Eu.SAS.1766	Req	A technical identifier uniquely identifies a EULYNX subsystem or an adjacent system.
Eu.SAS.1767	Req	An operational identifier identifies an operational element that is controlled by a EULYNX subsystem or adjacent system.
Eu.SAS.2072	Req	A payload element identifier identifies an operational or logical element that is referred to by an adjacent system.

ID	Type	Requirement
Eu.SAS.77	Req	<p>The technical identifier shall be unique. The following schema shall be implemented:</p> <p>[country code][area designator][system type][code][tag][sequence no]</p> <p>Country code: 2 bytes Area designator: 5 characters ISO IEC 8859-1:1998, left justified, empty space to be filled with underscore (0x5F) System type: 5 characters ISO IEC 8859-1:1998, left justified, empty space to be filled with underscore (0x5F), as per list below Code: 2 characters ISO IEC 8859-1:1998, decimal 00-99 Tag: 2 characters ISO IEC 8859-1:1998, fixed "##" Sequence no.: 4 characters ISO IEC 8859-1:1998 decimal, empty spaces filled with "0"</p> <p>It is recommended to use ISO 3166 Alpha-2 country codes, 2 characters ISO IEC 8859-1:1998, left justified.</p> <p>The following system types are to be used:</p> <p>LS Subsystem - Light Signal P Subsystem - Point TDS Subsystem - Train Detection System IO Subsystem - Generic IO LC Subsystem - Level Crossing EIL Subsystem - Electronic Interlocking MDM Subsystem - Maintenance and Data Management TCS adjacent system Traffic Control System RBC adjacent system Radio Block Centre TSS adjacent system Trackworker Safety System CEC adjacent system Centralised ETCS L1 Controller LX adjacent system External Level Crossing System</p> <p>Note: The scope of the adjacent system Traffic Control System shall be defined by national requirements. It shall be possible to add additional system types to cover subsystems of the Traffic Control System.</p>
Eu.SAS.78	Info	<p>Example:</p> <p>A Subsystem - Generic IO 5 in Germany in area HG2_X in operating location 37 has the identifier:</p> <p>[country code][area designator][system type][code][tag][sequence no]</p> <p>DEHG2_XIO__37##0005.</p>
Eu.SAS.1768	Req	The operational identifier shall be unique within the designated area.
Eu.SAS.1784	Req	The operational identifier consists of 20 characters ISO IEC 8859-1:1998 left justified, empty spaced to be filled with underscore (0x5F).
Eu.SAS.1783	Req	The operational identifier shall be assigned according to national requirements.

ID	Type	Requirement
Eu.SAS.2073	Req	The payload element identifier shall be unique within the designated area.
Eu.SAS.2074	Req	The payload element identifier consists of 20 characters ISO IEC 8859-1:1998 left justified, empty spaced to be filled with the NULL character (0x00).
Eu.SAS.2075	Req	The payload element identifier shall be assigned according to national requirements.
Eu.SAS.2076	Req	If a payload element identifier is used on more than one Process Data Interface, one operational or logical element shall have the same identifier on all Process Data Interfaces.
Eu.SAS.2077	Info	<p>A payload element identifier can be a superset of other payload element identifiers. The definition of the superset is provided in the interface specification of the respective SCI-XX.</p> <p>Example: The payload element identifier "Element ID" can be any identifier from the types "Signal / Signalling point ID", "Powered Moveable Element ID", "Track ID" or "Diamond Crossing ID".</p>
Eu.SAS.219	Head	5 Subsystem and adjacent system architecture requirements
Eu.SAS.220	Info	This section describes the architecture requirements for the subsystems of the EULYNX System and for adjacent systems.
Eu.SAS.95	Head	5.1 Generic functions of the Subsystem - Electronic Interlocking
Eu.SAS.1993	Req	The Subsystem - Electronic Interlocking shall be connected to the PoS-Signalling to communicate with the EULYNX field element subsystems and with the adjacent systems.
Eu.SAS.1994	Req	<p>The Subsystem - Electronic Interlocking shall be connected to the PoS-Signalling to communicate with the service functions for diagnostics, maintenance and security.</p> <p>Note: The requirements for the service functions for diagnostics and maintenance will be developed at a later stage. Note: Requirements for the service functions for security are defined in the EULYNX Security specification [Eu.Doc.114]</p>
Eu.SAS.2161	Info	A Connection Manager may be used to terminate network traffic within the formal boundaries of the Subsystem - Electronic Interlocking.
Eu.SAS.1795	Req	The Subsystem - Electronic Interlocking shall perform control and monitoring of the EULYNX field element subsystems.
Eu.SAS.1808	Req	The Subsystem - Electronic Interlocking shall provide connection to adjacent systems.
Eu.SAS.1732	Req	If the internal link between the safe communication and the core system of the Subsystem - Electronic Interlocking is interrupted, the safe communication shall be terminated.

ID	Type	Requirement
Eu.SAS.1983	Info	The functionality of the Subsystem - Electronic Interlocking is defined by national specifications. EULYNX defines only the minimum requirements related to the interface functionality.
Eu.SAS.1583	Head	5.2 Generic functions of EULYNX field element subsystems
Eu.SAS.133	Head	5.2.1 General requirements
Eu.SAS.134	Req	The EULYNX field element subsystems shall have implemented functions for the following subsystem states:
Eu.SAS.135	Req	• Booting
Eu.SAS.136	Req	• Initialising
Eu.SAS.137	Req	• Operational
Eu.SAS.138	Req	• Fallback mode
Eu.SAS.1332	Req	The subsystem states mentioned above and the conditions for transitions between these subsystem states are specified in the requirements specifications of the EULYNX field element subsystems (as modelled generic requirements).
Eu.SAS.1333	Req	If the EULYNX field element subsystem is not supplied with voltage in the required range for operation, it shall get into a subsystem and manufacturer specific "safe state" according to [EN 50129]. Especially all existing output channels shall be switched off or set according to national requirements.
Eu.SAS.2163	Req	If the EULYNX field element subsystem is not supplied with voltage in the required range for operation, it shall terminate the safe communication between the EULYNX field element subsystem and the Subsystem - Electronic Interlocking, unless the reaction in Eu.SAS.2164 is technically possible.
Eu.SAS.2164	Req	If it is technically possible to send PDI telegrams on the safe communication when the EULYNX field element subsystem is not supplied with voltage in the required range for operation, the PDI connection between the EULYNX field element subsystem and the Subsystem - Electronic Interlocking shall be terminated by the EULYNX field element subsystem by issuing the message PDI Not Available when the supply voltage is lost. The EULYNX field element subsystem shall remain not ready for PDI connection until it is supplied with voltage in the required range for operation.

ID	Type	Requirement
Eu.SAS.2043	Req	<p>In the states "Initialising", "Operational" and "Fallback mode" it shall be possible to reset the EULYNX field element subsystem. When reset, the EULYNX field element subsystem shall enter the state "Bootng".</p> <p>Note: The reset may be triggered by the Subsystem - Maintenance and Data Management, see Eu.SAS.2134.</p> <p>Note: EULYNX does not specify the implementation of other 'reset' triggers. Other triggers can be an internal or external stimulus. An example of an external stimulus can be a command.</p>
Eu.SAS.1334	Req	If the EULYNX field element subsystem is in state "Bootng" or "Initialising" and an initial state of outputs is not yet set, the EULYNX field element subsystem shall maintain a subsystem and manufacturer specific "safe state" according to [EN 50129]. Especially all existing output channels shall be switched off or set according to national requirements.
Eu.SAS.147	Req	<p>The initial state of outputs is a defined state of the output channels (lamps and contacts) of the EULYNX field element subsystem. The initial state of outputs shall be set while the subsystem is in the state "Bootng" or in "Initialising" as soon as the subsystem is able to operate according to its configuration data, at the latest however before the subsystem sends status reports during the establishment of the PDI connection in the state "Initialising".</p> <p>The subsystem maintains the initial state of outputs until it receives a command from the Subsystem - Electronic Interlocking to change the outputs.</p>
Eu.SAS.1905	Req	The EULYNX field element subsystem shall be connected to the PoS-Signalling to communicate with the Subsystem - Electronic Interlocking and with the service functions for diagnostics, maintenance and security.
Eu.SAS.139	Head	5.2.2 Functions in the state "Bootng"
Eu.SAS.140	Req	The following functions shall be implemented in the state "Bootng":
Eu.SAS.142	Req	<ul style="list-style-type: none"> • The EULYNX basic data of the subsystem shall be read and checked to be formally correct and complete.
Eu.SAS.143	Req	<ul style="list-style-type: none"> • The subsystem shall run in compliance with the required safety integrity level (SIL). <p>Note: This could for example mean performing and positively completing a self test.</p>
Eu.SAS.1990	Req	<ul style="list-style-type: none"> • The connection to the PoS-Signalling shall be established.
Eu.SAS.2124	Req	<ul style="list-style-type: none"> • The subsystem shall be ready to establish the safe communication to the Subsystem - Electronic Interlocking in accordance with the specifications in [RaSTA]
Eu.SAS.809	Req	<ul style="list-style-type: none"> • The time synchronisation shall be initiated.
Eu.SAS.1981	Req	When all the functions of the state "Bootng" have been completed, the EULYNX field element subsystem shall enter the state "Initialising".
Eu.SAS.144	Head	5.2.3 Functions in state "Initialising"

ID	Type	Requirement
Eu.SAS.148	Req	If a EULYNX field element subsystem uses the service function Loading procedure, the following functions shall be implemented in the state "Initialising":
Eu.SAS.1985	Req	<ul style="list-style-type: none"> The EULYNX field element subsystem shall provide the maintenance interface for the Subsystem - Maintenance and Data Management to access all relevant information of the configuration and engineering data or new device software.
Eu.SAS.154	Req	<ul style="list-style-type: none"> The EULYNX field element subsystem shall provide the maintenance interface to load or pre-load new configuration and engineering data or new device software if the Subsystem - Maintenance and Data Management declares the currently pre-loaded or activated version of the configuration and engineering data as not valid.
Eu.SAS.2125	Req	<ul style="list-style-type: none"> The EULYNX field element subsystem shall provide the maintenance interface to activate loaded or pre-loaded configuration and engineering data or new device software if the Subsystem - Maintenance and Data Management declares the currently activated version of the configuration and engineering data as not valid.
Eu.SAS.820	Info	<ul style="list-style-type: none"> When activating new configuration and engineering data or new device software, the subsystem may re-enter the state "Booting", if this is needed to complete the activation.
Eu.SAS.2126	Req	<ul style="list-style-type: none"> Loading or activation of new configuration and engineering data or new device software shall not be permitted while the EULYNX field element subsystem is in the process of establishing the PDI connection.
Eu.SAS.146	Req	The following functions shall be implemented in the state "Initialising":
Eu.SAS.811	Req	<ul style="list-style-type: none"> The EULYNX field element subsystem shall be ready to establish the PDI connection as defined in Eu.SAS.784 to the Subsystem - Electronic Interlocking, when the EULYNX field element subsystem has a valid version of the configuration and engineering data and the device software.
Eu.SAS.829	Req	<ul style="list-style-type: none"> A PDI connection to the Subsystem - Electronic Interlocking shall not be permitted while the EULYNX field element subsystem performs updating of configuration and engineering data or new device software.
Eu.SAS.1335	Req	When the PDI connection has been established, the EULYNX field element subsystem shall enter the state "Operational".
Eu.SAS.158	Head	5.2.4 Functions in state "Operational"
Eu.SAS.159	Req	The following functions shall be implemented in the state "Operational":
Eu.SAS.160	Req	<ul style="list-style-type: none"> Processing of commands received from the Subsystem - Electronic Interlocking.
Eu.SAS.161	Req	<ul style="list-style-type: none"> Generation of messages to the Subsystem - Electronic Interlocking.
Eu.SAS.194	Req	If the PDI connection has been terminated during the state "Operational", the EULYNX field element subsystem shall change to the state "Initialising". Functions not related to the PDI connection shall remain active, unless specified otherwise for individual cases.

ID	Type	Requirement
Eu.SAS.163	Head	5.2.5 Functions in state "Fallback mode"
Eu.SAS.164	Req	The EULYNX field element subsystem shall change to the state "Fallback mode" if one of the following conditions has been met:
Eu.SAS.165	Req	<ul style="list-style-type: none"> the required safety integrity level (SIL) has not been reached (during start-up)
Eu.SAS.822	Req	<ul style="list-style-type: none"> the required safety integrity level (SIL) was present and is no longer present
Eu.SAS.823	Req	<ul style="list-style-type: none"> the EULYNX basic data are invalid
Eu.SAS.166	Req	The safe communication between the EULYNX field element subsystem and the Subsystem - Electronic Interlocking shall be terminated by the EULYNX field element subsystem when the state of the EULYNX field element subsystem is changed to "Fallback mode", unless the reaction in Eu.SAS.2162 is technically possible. It is not permitted to re-establish the safe communication in the state "Fallback mode".
Eu.SAS.2162	Req	If it is technically possible to send PDI telegrams on the safe communication while entering "Fallback mode", the PDI connection between the EULYNX field element subsystem and the Subsystem - Electronic Interlocking shall be terminated by the EULYNX field element subsystem by issuing the message PDI Not Available when the state of the EULYNX field element subsystem is changed to "Fallback mode". The EULYNX field element subsystem shall remain not ready for PDI connection in the state "Fallback mode".
Eu.SAS.1336	Req	In the state "Fallback mode", the EULYNX field element subsystem shall get into a subsystem and manufacturer specific "safe state" according to [EN 50129].
Eu.SAS.1995	Head	5.2.6 Functions at the diagnostics interface
Eu.SAS.838	Head	5.2.6.1 Generic functions at the diagnostics interface
Eu.SAS.2047	Req	The EULYNX field element subsystem shall execute the communication with the service function Diagnostics collector in accordance with the specifications for SDI-XX in [Eu.Doc.77].
Eu.SAS.2127	Req	The EULYNX field element subsystem shall execute the communication with the service function Time synchronisation in accordance with the specifications for SDI-XX in [Eu.Doc.77].
Eu.SAS.1991	Req	The diagnostics interface shall be available as soon as the subsystem is connected to the Pos-Signalling.
Eu.SAS.2048	Req	The diagnostics interface shall use one or two network channels, as defined in [Eu.Doc.100].
Eu.SAS.2050	Req	The network channel used for the diagnostics interface shall be continuously monitored for interruptions and degradation.
Eu.SAS.2049	Req	If two network channels are used for the diagnostics interface:
Eu.SAS.1929	Req	<ul style="list-style-type: none"> both network channels shall be continuously monitored for interruptions and degradation

ID	Type	Requirement
Eu.SAS.2003	Req	• a communication process shall always be initiated using the primary network channel
Eu.SAS.2004	Req	• in case the primary network channel is detected as unavailable by the continuous monitoring, communication shall be (re-)initiated using the secondary network channel
Eu.SAS.2005	Req	• in case the primary network channel after an interruption is detected as available again by the continuous monitoring, the next communication process at this interface shall again employ the primary network channel
Eu.SAS.172	Head	5.2.6.2 Event-driven diagnostic data
Eu.SAS.175	Req	The EULYNX field element subsystem shall have a diagnostics interface in accordance with the specification in SDI-XX through which event-driven diagnostic data can be sent to the service function Diagnostics collector.
Eu.SAS.173	Req	The EULYNX field element subsystem shall record event-driven all irregularities (including rectification of irregularities) during the states "Booting", "Initialising", "Operational" and "Fallback mode" (if technically possible) and send them as diagnostic message to the service function Diagnostics collector.
Eu.SAS.176	Req	The event-driven diagnostic data shall be permanently assessed and sent immediately without storage.
Eu.SAS.825	Req	If the communication on the diagnostics interface fails or is not yet available, the event-driven diagnostic data shall be stored for at least 6 hours. After the SDI-XX connection has been restored, the stored diagnostic data shall be accessible with OPC UA.
Eu.SAS.826	Req	If the memory is full during the connection failure period, the respective oldest messages shall be discarded.
Eu.SAS.827	Req	If synchronised real time is not available, the diagnostic data shall be sent or stored with the available clock time.
Eu.SAS.177	Head	5.2.6.3 Preventive diagnostic data
Eu.SAS.178	Req	During the state "Operational" the EULYNX field element subsystem shall record measured data continuously (in accordance with a configurable schedule) for preventative maintenance.
Eu.SAS.179	Req	The EULYNX field element subsystem shall have a diagnostic interface in accordance with the specification in SDI-XX through which the measuring data can be sent to the service function Diagnostics collector.
Eu.SAS.180	Req	The preventive diagnostic data shall be sent immediately without storage.
Eu.SAS.828	Req	The preventive diagnostic data shall not be temporarily stored if the SDI-XX connection fails.
Eu.SAS.1996	Head	5.2.7 Functions at the maintenance interface
Eu.SAS.1930	Head	5.2.7.1 Generic functions at the maintenance interface

ID	Type	Requirement
Eu.SAS.1132	Req	The EULYNX field element subsystem shall execute the communication with the Subsystem - Maintenance and Data Management for the service function Loading procedure in accordance with the specifications for SMI-XX in [Eu.Doc.76].
Eu.SAS.1992	Req	The maintenance interface shall be available as soon as the subsystem is connected to the PoS-Signalling.
Eu.SAS.2054	Req	The maintenance interface shall use one or two network channels, as defined in [Eu.Doc.100].
Eu.SAS.2055	Req	The network channel used for the maintenance interface shall be continuously monitored for interruptions and degradation.
Eu.SAS.2056	Req	If two network channels are used for the maintenance interface:
Eu.SAS.1931	Req	<ul style="list-style-type: none"> • both network channels shall be continuously monitored for interruptions and degradation
Eu.SAS.1863	Req	<ul style="list-style-type: none"> • a communication process shall always be initiated using the primary network channel
Eu.SAS.2006	Req	<ul style="list-style-type: none"> • in case the primary network channel is detected as unavailable by the continuous monitoring, communication shall be (re-)initiated using the secondary network channel
Eu.SAS.2007	Req	<ul style="list-style-type: none"> • in case the primary network channel after an interruption is detected as available again by the continuous monitoring, the next communication process at this interface shall again employ the primary network channel
Eu.SAS.149	Head	5.2.7.2 Updating the configuration and engineering data or device software
Eu.SAS.1737	Req	For EULYNX field element subsystems using the service function Loading procedure, the following functions shall be implemented in the state "Initialising":
Eu.SAS.2089	Req	<ul style="list-style-type: none"> • After booting or after receiving the command Release PDI for maintenance, the EULYNX field element subsystem shall trigger the opening of the OPC UA connection to the Subsystem - Maintenance and Data Management via reverse connect, unless the SMI connection is already established.
Eu.SAS.2087	Req	<ul style="list-style-type: none"> • If the Subsystem - Maintenance and Data Management doesn't establish the connection within a configurable time after the trigger by the EULYNX field element subsystem, the EULYNX field element subsystem shall become ready to establish the PDI connection as defined in Eu.SAS.784.
Eu.SAS.2128	Req	<ul style="list-style-type: none"> • When the SMI connection is established, the EULYNX field element subsystems shall allow the service function Loading Procedure to perform loading and activation of configuration and engineering or new device software, unless the EULYNX field element subsystem is in the process of establishing the PDI connection
Eu.SAS.2088	Req	<ul style="list-style-type: none"> • If there is no action performed by the service function Loading procedure within a configurable time, the EULYNX field element subsystem shall become ready to establish the PDI connection as defined in Eu.SAS.784.

ID	Type	Requirement
Eu.SAS.817	Req	<ul style="list-style-type: none"> • If the transmission of the configuration and engineering data or new device software from the service function Loading procedure cannot be completed within a configurable time, the transmission of the current configuration item shall be aborted.
Eu.SAS.818	Req	<ul style="list-style-type: none"> • The EULYNX field element subsystem shall install the data items that are activated by the service function Loading procedure. If the installation cannot be completed within a configurable installation time, a diagnostic message shall be issued.
Eu.SAS.819	Req	<ul style="list-style-type: none"> • The configuration and engineering data and the device software shall be stored for the operation of the EULYNX field element subsystem in such a way in the subsystem that they are also available after a power failure and do not need to be reloaded.
Eu.SAS.2129	Head	5.2.7.3 Pre-loading the configuration and engineering data or device software
Eu.SAS.2133	Req	The EULYNX field element subsystems shall not allow the service function Loading Procedure to perform activation of configuration and engineering or new device software, unless the EULYNX field element subsystem is in the state "Initialising" and not in the process of establishing the PDI connection.
Eu.SAS.2131	Req	The EULYNX field element subsystems shall allow the Subsystem - Maintenance and Data Management to establish the OPC UA connection whenever the maintenance interface is available.
Eu.SAS.2132	Info	<p>When the SMI connection is established, the EULYNX field element subsystems may allow the service function Loading Procedure to perform loading of configuration and engineering or new device software.</p> <p>Note: This functionality is not part of the mandatory system requirements. Signalling system suppliers may decide whether their EfeS product supports downloading in parallel to safe railway operation.</p>
Eu.SAS.2134	Head	5.2.7.4 MDM triggered reset
Eu.SAS.2135	Req	For EULYNX field element subsystems using the service function Loading procedure, the following functions shall be implemented in the state "Fallback mode":
Eu.SAS.2136	Req	<ul style="list-style-type: none"> • The EULYNX field element subsystems shall enter the state 'Booting' when receiving a remote reset trigger from the Subsystem - Maintenance and Data Management.
Eu.SAS.2137	Head	5.2.8 Functions at the security interface
Eu.SAS.2138	Head	5.2.8.1 Generic functions at the security interface
Eu.SAS.2139	Req	The EULYNX field element subsystem shall execute the communication with the Subsystem - Security Services Platform for the service functions Identity and Access Management, Public Key Infrastructure Management, Security Logging and Backup Services in accordance with the specifications for SSI-XX in [Eu.Doc.117].
Eu.SAS.2141	Req	The security interface shall be available as soon as the subsystem is connected to the PoS-Signalling.

ID	Type	Requirement
Eu.SAS.2142	Req	The security interface shall use one or two network channels, as defined in [Eu.Doc.100].
Eu.SAS.2143	Req	The network channel used for the security interface shall be continuously monitored for interruptions and degradation.
Eu.SAS.2144	Req	If two network channels are used for the security interface:
Eu.SAS.2145	Req	<ul style="list-style-type: none"> • both network channels shall be continuously monitored for interruptions and degradation
Eu.SAS.2146	Req	<ul style="list-style-type: none"> • a communication process shall always be initiated using the primary network channel
Eu.SAS.2147	Req	<ul style="list-style-type: none"> • in case the primary network channel is detected as unavailable by the continuous monitoring, communication shall be (re-)initiated using the secondary network channel
Eu.SAS.2148	Req	<ul style="list-style-type: none"> • in case the primary network channel after an interruption is detected as available again by the continuous monitoring, the next communication process at this interface shall again employ the primary network channel
Eu.SAS.2149	Head	5.2.8.2 Security Services
Eu.SAS.2150	Info	Requirements for the service functions for security are defined in the EULYNX Security specification [Eu.Doc.114]
Eu.SAS.181	Head	5.2.9 Local status display of the EULYNX field element subsystem
Eu.SAS.182	Req	<p>The EULYNX field element subsystem shall have a local display at which the state of defined functionalities of the EULYNX field element subsystem and connected elements is displayed as soon as the EULYNX field element subsystem is in state "Booting".</p> <p>The local display requirements shall be defined by national specifications.</p> <p>Note: This display is used primarily as an interface to the maintainer to get a quick overview of the subsystem status.</p>
Eu.SAS.1785	Head	5.3 Generic functions of adjacent systems
Eu.SAS.1997	Req	The adjacent system shall be connected to the PoS-Signalling to communicate with the Subsystem - Electronic Interlocking.
Eu.SAS.1825	Req	The adjacent system shall provide connection to the Subsystem - Electronic Interlocking.
Eu.SAS.1786	Req	If the internal link between the safe communication and the core system of the adjacent system is interrupted, the safe communication shall be terminated.
Eu.SAS.1984	Info	The functionality of the adjacent systems is defined by national specifications. EULYNX defines only the minimum requirements related to the interface functionality.
Eu.SAS.223	Head	5.4 Specific functions of the Subsystem - Electronic Interlocking

ID	Type	Requirement
Eu.SAS.367	Head	5.4.1 Functions for PDI connections to EULYNX field element subsystems
Eu.SAS.842	Head	5.4.1.1 Connection to Subsystem - Light Signal
Eu.SAS.877	Req	The Subsystem - Electronic Interlocking shall execute the communication with the Subsystem - Light Signal in accordance with the specifications for SCI-LS in [Eu.Doc.33].
Eu.SAS.2020	Info	The interface related functional apportionment assumes the following functionality from the Subsystem - Electronic Interlocking:
Eu.SAS.1966	Info	<ul style="list-style-type: none"> • Detection of irregularities, by comparison between the commanded signal aspect and the reported state, and reaction according to national specifications.
Eu.SAS.1974	Info	<ul style="list-style-type: none"> • Detection of irregularities, by comparison between the commanded luminosity and the reported state, and reaction according to national specifications.
Eu.SAS.880	Req	If no PDI connection to the Subsystem - Light Signal is present, the light signal shall be handled by the Subsystem - Electronic Interlocking according to national specifications.
Eu.SAS.845	Head	5.4.1.2 Connection to Subsystem - Point
Eu.SAS.336	Req	The Subsystem - Electronic Interlocking shall execute the communication with the Subsystem - Point in accordance with the specifications for SCI-P in [Eu.Doc.38].
Eu.SAS.2028	Info	The interface related functional apportionment assumes the following functionality from the Subsystem - Electronic Interlocking:
Eu.SAS.1975	Info	<ul style="list-style-type: none"> • Detection of irregularities, by comparison between the commanded point position and the reported state, and reaction according to national specifications
Eu.SAS.1976	Info	<ul style="list-style-type: none"> • Reaction on reported failed movement according to national specifications
Eu.SAS.1977	Info	<ul style="list-style-type: none"> • Reaction on reported unintended position according to national specifications
Eu.SAS.2151	Info	<ul style="list-style-type: none"> • Reaction on reported degraded point position according to national specifications
Eu.SAS.917	Req	If no PDI connection to the Subsystem - Point is present, the point shall be handled by the Subsystem - Electronic Interlocking according to national specifications.
Eu.SAS.1950	Head	5.4.1.3 Connection to Subsystem - Generic IO
Eu.SAS.929	Req	The Subsystem - Electronic Interlocking shall execute the communication with the Subsystem - Generic IO in accordance with the specifications for SCI-IO in [Eu.Doc.46].

ID	Type	Requirement
Eu.SAS.2029	Info	The interface related functional apportionment assumes the following functionality from the Subsystem - Electronic Interlocking:
Eu.SAS.1978	Info	<ul style="list-style-type: none"> • Reaction on reported disturbance of monitored output channels according to national specifications
Eu.SAS.931	Req	If no PDI connection to the Subsystem - Generic IO is present, the IO elements shall be handled by the Subsystem - Electronic Interlocking according to national specifications.
Eu.SAS.1951	Head	5.4.1.4 Connection to Subsystem - Train Detection System
Eu.SAS.844	Req	The Subsystem - Electronic Interlocking shall execute the communication with the Subsystem - Train Detection System in accordance with the specifications for SCI-TDS in [Eu.Doc.44].
Eu.SAS.2030	Info	The interface related functional apportionment assumes the following functionality from the Subsystem - Electronic Interlocking:
Eu.SAS.1979	Info	<ul style="list-style-type: none"> • Detection of irregularities, by comparison between the commanded Force Clear process and the reported state, and reaction according to national specifications
Eu.SAS.847	Req	If no PDI connection to the Subsystem - Train Detection System monitoring the TVP sections is present, the status of the TVP sections and Train Detection Points shall be handled by the Subsystem - Electronic Interlocking according to national specifications.
Eu.SAS.1952	Head	5.4.1.5 Connection to Subsystem - Level Crossing
Eu.SAS.1034	Req	The Subsystem - Electronic Interlocking shall execute the communication with the Subsystem - Level Crossing in accordance with the specifications for SCI-LC in [Eu.Doc.109].
Eu.SAS.2031	Info	The interface related functional apportionment assumes the following functionality from the Subsystem - Electronic Interlocking:
Eu.SAS.1980	Info	<ul style="list-style-type: none"> • Detection of irregularities, by comparison between the commanded activation and protection status and the reported state, and reaction according to national specifications
Eu.SAS.1836	Req	If no PDI connection to the Subsystem - Level Crossing monitoring the level crossing is present, the status of the level crossing shall be handled by the Subsystem - Level Crossing according to national specifications.
Eu.SAS.1953	Head	5.4.2 Functions for PDI connections to adjacent systems
Eu.SAS.369	Head	5.4.2.1 Functions for SCI-ILS
Eu.SAS.1031	Req	The Subsystem - Electronic Interlocking shall execute the communication with the adjacent system Adjacent Interlocking System in accordance with the specifications for SCI-ILS in [Eu.Doc.42].
Eu.SAS.2023	Req	The Subsystem - Electronic Interlocking shall ensure that the direction handling on the boundary is managed in cooperation with the Adjacent Interlocking System.

ID	Type	Requirement
Eu.SAS.371	Head	5.4.2.2 Functions for SCI-CC
Eu.SAS.1032	Req	The Subsystem - Electronic Interlocking shall execute the communication with the adjacent system Traffic Control System in accordance with the specifications for SCI-CC in [Eu.Doc.50].
Eu.SAS.393	Req	The Subsystem - Electronic Interlocking shall execute the communication with the adjacent system Trackworker Safety System in accordance with the specifications for SCI-CC in [Eu.Doc.50].
Eu.SAS.382	Head	5.4.2.3 Functions for SCI-RBC
Eu.SAS.383	Req	The Subsystem - Electronic Interlocking shall execute the communication with the adjacent system Radio Block Centre in accordance with the specifications for SCI-RBC in [Eu.Doc.48].
Eu.SAS.1955	Req	The Subsystem - Electronic Interlocking shall execute the communication with the adjacent system Centralised ETCS L1 Controller in accordance with the specifications for SCI-RBC in [Eu.Doc.48].
Eu.SAS.2066	Head	5.4.2.4 Functions for SCI-LX
Eu.SAS.2067	Req	The Subsystem - Electronic Interlocking shall execute the communication with the adjacent system External Level Crossing System in accordance with the specifications for SCI-LX in [Eu.Doc.112].
Eu.SAS.1633	Head	5.5 Specific functions of EULYNX field element subsystems
Eu.SAS.424	Head	5.5.1 Subsystem - Light signal
Eu.SAS.428	Head	5.5.1.1 Description of the Subsystem - Light Signal
Eu.SAS.1932	Info	The Subsystem - Light Signal controls and monitors a light signal, to convey information to the train driver about train movement and route conditions.
Eu.SAS.429	Info	<p>The Subsystem - Light Signal consists of the light signal object controller and the optical system.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1. The mechanical parts of a light signal, and the physical properties of the optical system, are not specified by EULYNX. 2. The light signal object controller may consist of several components and can be scalable with respect to the number of supported lamps; at the interfaces specified by EULYNX (SCI-LS, maintainer,...) however, it shall be regarded as a single unit.
Eu.SAS.1933	Req	The Subsystem - Light Signal shall implement the control, monitoring and energy supply of one light signal.
Eu.SAS.1121	Req	The control of the Eurobalises via interface C shall be in accordance with the UNISIG and IM specifications valid for the ERTMS level selected by the IM.

ID	Type	Requirement
Eu.SAS.1112	Info	The Subsystem - Light Signal receives its power via the PoP-O interface for Subsystem - Light Signal. Note: The PoP-O is specified by national requirements.
Eu.SAS.442	Head	5.5.1.2 Functions in the Subsystem - Light Signal
Eu.SAS.443	Info	The essential subsystem states, the functional division and the generic functions have been defined in the generic functions of EULYNX field element subsystem [Eu.SAS.1583]. The section below defines the specific functions for the Subsystem - Light Signal in detail. The detailed implementation of these functions is described in the requirements specification for Subsystem - Light Signal [Eu.Doc.32].
Eu.SAS.469	Req	The Subsystem - Light Signal shall show exactly the signal aspect that is commanded by the Subsystem - Electronic Interlocking, unless in case of lamp failures described in [Eu.SAS.470].
Eu.SAS.472	Req	During the switching from one indicated signal aspect to another signal aspect, invalid aspects or no aspect may be visible for at most one second.
Eu.SAS.1119	Req	The control of the Eurobalises shall be in line with the commanded signal aspects and any accompanying auxiliary information according to national specifications.
Eu.SAS.470	Req	If the Subsystem - Light Signal detects that, due to one or more lamp failures, it cannot show the currently commanded signal aspect, it shall activate a less permissive "substitute" aspect as defined in the configuration and engineering data. This process of "downgrading" the signal aspect shall be repeated until either the newly derived signal aspect can be fully shown, or the signal is dark. In some cases, in order to derive the right substitution aspect, the Subsystem - Light signal shall employ "dynamic", route-dependent information which is in these cases transmitted by the Subsystem - Electronic Interlocking as part of the command for the signal aspect.
Eu.SAS.483	Req	The Subsystem - Light Signal shall, unless defined otherwise by its configuration and engineering data, activate the luminosity commanded by the Subsystem - Electronic Interlocking (day or night luminosity).
Eu.SAS.1122	Req	If the luminosity commanded by the Subsystem - Electronic Interlocking cannot be activated for the entire optical system, the Subsystem - Light Signal shall retain or activate the originally activated luminosity (alternative luminosity).
Eu.SAS.1124	Req	If the configuration and engineering data for a Subsystem - Light Signal define that only one single luminosity shall be used, this Subsystem - Light Signal shall permanently activate this luminosity. Note: this concept applies in particular to all light signals placed in a tunnel; they are permanently operated with night luminosity without the Subsystem - Electronic Interlocking having to take this into account.
Eu.SAS.463	Req	The following items shall be continuously monitored by the Subsystem - Light Signal:
Eu.SAS.464	Req	<ul style="list-style-type: none"> • signal aspect currently indicated at the light signal

ID	Type	Requirement
Eu.SAS.465	Req	<ul style="list-style-type: none"> • luminosity currently employed by the light signal
Eu.SAS.1835	Req	If the PDI connection to the Subsystem - Electronic Interlocking is lost, the Subsystem - Light Signal shall set its outputs to the same state as the initial state of outputs.
Eu.SAS.444	Req	The following outputs define the initial state of outputs of the Subsystem - Light Signal:
Eu.SAS.445	Req	<ul style="list-style-type: none"> • at the optical system, the most restrictive signal aspect (including "dark" for standalone indicators) or no signal aspect (in case of lamp failure) is activated
Eu.SAS.446	Req	<ul style="list-style-type: none"> • at the optical system, the default luminosity (as specified in the configuration and engineering data) is activated (normally day, e.g. for tunnel signals night luminosity)
Eu.SAS.448	Req	<ul style="list-style-type: none"> • the indicators, if installed, shall be controlled in accordance with the most restrictive signal aspect
Eu.SAS.449	Req	<ul style="list-style-type: none"> • the Eurobalises, if installed, shall be controlled in accordance with the most restrictive signal aspect
Eu.SAS.447	Req	<ul style="list-style-type: none"> • the outputs to legacy train protection systems, if installed, shall be controlled in accordance with the most restrictive signal aspect
Eu.SAS.486	Req	The following outputs are mandatory in the subsystem specific "safe state" of the Subsystem - Light Signal:
Eu.SAS.1872	Req	<ul style="list-style-type: none"> • depending on national specifications, either the most restrictive signal aspect or no signal aspect shall be activated at the optical system.
Eu.SAS.1884	Req	<ul style="list-style-type: none"> • indicators, Eurobalises and legacy train protection systems shall be controlled according to national specifications
Eu.SAS.497	Head	5.5.1.3 Process data interface to the Subsystem - Electronic Interlocking
Eu.SAS.1125	Req	The Subsystem - Light Signal shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-LS in [Eu.Doc.33].
Eu.SAS.1126	Head	5.5.1.4 Diagnostics interface
Eu.SAS.1128	Req	The Subsystem - Light Signal shall execute the communication with the service function Diagnostics collector in accordance with the specifications for SDI-LS in [Eu.Doc.77] and [Eu.Doc.78]. [Eu.Doc.77] defines the full telegram structure and [Eu.Doc.78] defines the diagnostic messages specific for the Subsystem - Light Signal.
Eu.SAS.513	Head	5.5.2 Subsystem - Point
Eu.SAS.516	Head	5.5.2.1 Description of the Subsystem - Point
Eu.SAS.1935	Info	The Subsystem - Point controls and monitors moveable devices in the track, including points, diamond crossings and derailleurs.

ID	Type	Requirement
Eu.SAS.517	Info	The Subsystem - Point consists of the point object controller. Note: The mechanical parts of a point, and the point machine, are not specified by EULYNX.
Eu.SAS.518	Req	The Subsystem - Point shall implement the control, monitoring and energy supply of one point with 1 or several point mechanisms. It shall be possible to install only the number of mechanism control units required for the concrete use case in a Subsystem - Point.
Eu.SAS.1136	Info	The Subsystem - Point receives its power via the PoP-O interface for Subsystem - Point. Note: The PoP-O is specified by national requirements.
Eu.SAS.522	Head	5.5.2.2 Functions in the Subsystem - Point
Eu.SAS.523	Info	The essential subsystem states, the functional division and the generic functions have been defined in the generic functions of EULYNX field element subsystem [Eu.SAS.1583]. The section below defines the specific functions for the Subsystem - Point in detail. The detailed implementation of these functions is described in the requirements specification for Subsystem - Point [Eu.Doc.36].
Eu.SAS.546	Req	The Subsystem - Point shall ensure that the point movement is activated directionally if this has been commanded by the Subsystem - Electronic Interlocking.
Eu.SAS.547	Req	The Subsystem - Point shall deactivate the point movement if one of the following conditions has been met:
Eu.SAS.548	Req	<ul style="list-style-type: none"> the commanded point end position (left or right) has been reached and monitored
Eu.SAS.549	Req	<ul style="list-style-type: none"> the point movement has failed (message "movement failed")
Eu.SAS.551	Req	Commanding an opposite point movement during a point movement process shall be possible.
Eu.SAS.553	Req	The Subsystem - Point shall continuously monitor the point system.
Eu.SAS.1144	Req	The point shall never move independently to a position different from the last position commanded by the Subsystem - Electronic Interlocking. Note: This means that, except for redrive, a point movement shall only be initiated after receiving a command from the Subsystem - Electronic Interlocking.
Eu.SAS.538	Req	The following items shall be continuously monitored by the Subsystem - Point:
Eu.SAS.539	Req	<ul style="list-style-type: none"> point end position (right/left/no-end-position)
Eu.SAS.542	Req	<ul style="list-style-type: none"> unintended position of the point (if detection of unintended position is available)
Eu.SAS.2152	Req	<ul style="list-style-type: none"> degraded end position (degraded right/degraded left/no degraded position, if non-crucial point machines are available)

ID	Type	Requirement
Eu.SAS.544	Req	<ul style="list-style-type: none"> • movement failure
Eu.SAS.564	Req	If the PDI connection to the Subsystem - Electronic Interlocking is lost while a point movement is ongoing due to a previous command or due to redrive, the Subsystem - Point shall continue the point movement until either the intended end position (left or right) is reached, or it cuts off the power for the point machine because the end position is not reached in time.
Eu.SAS.1735	Req	The following outputs define the initial state of outputs of the Subsystem - Point:
Eu.SAS.1837	Req	<ul style="list-style-type: none"> • no point movement shall be initiated
Eu.SAS.1916	Req	The following outputs are mandatory in the subsystem specific "safe state" of the Subsystem - Point:
Eu.SAS.2012	Req	<ul style="list-style-type: none"> • ongoing point movement shall be deactivated
Eu.SAS.2008	Req	<ul style="list-style-type: none"> • no point movement shall be initiated
Eu.SAS.565	Head	5.5.2.3 Process data interface to the Subsystem - Electronic Interlocking
Eu.SAS.1143	Req	The Subsystem - Point shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-P in [Eu.Doc.38].
Eu.SAS.1145	Head	5.5.2.4 Diagnostics interface
Eu.SAS.1147	Req	The Subsystem - Point shall execute the communication with the service function Diagnostics collector in accordance with the specifications for SDI-P in [Eu.Doc.77] and [Eu.Doc.80]. [Eu.Doc.77] defines the full telegram structure and [Eu.Doc.80] defines the diagnostic messages specific for the Subsystem - Point.
Eu.SAS.583	Head	5.5.3 Subsystem - Generic IO
Eu.SAS.587	Head	5.5.3.1 Description of the Subsystem - Generic IO
Eu.SAS.588	Info	The Subsystem - Generic IO controls and monitors (mainly relay based) devices along the track (e.g. keylocks, digital sensors, indicators and pushbuttons). These devices are called Adjacent IO systems.
Eu.SAS.589	Info	The Subsystem - Generic IO consists of an IO object controller.
Eu.SAS.1938	Info	One Subsystem - Generic IO can control and/or monitor more than one Adjacent IO System. Each Adjacent IO system is addressed as a separate operational object using operational identifiers.

ID	Type	Requirement
Eu.SAS.1963	Req	<p>For the purposes of controlling and monitoring the Adjacent IO systems, the Subsystem - Generic IO implements control of output channels and implements monitoring of input channels and, if configured, of output channels.</p> <p>Each input and each output channel shall be assigned to a specific Adjacent IO system. Multiple input and/or output channels can be assigned to the same Adjacent IO system.</p>
Eu.SAS.603	Req	A Subsystem - Generic IO shall be capable of controlling several adjacent IO systems simultaneously; these adjacent IO systems may be homogeneous or heterogeneous.
Eu.SAS.1939	Req	The maximum number of IO input and output channels controlled and monitored and the maximum number of Adjacent IO Systems controlled and monitored by the Subsystem - Generic IO shall be specified by national specifications.
Eu.SAS.610	Req	The following types of output channels and input channels shall be implemented in the Subsystem - Generic IO:
Eu.SAS.613	Req	<ul style="list-style-type: none"> • Single
Eu.SAS.611	Req	<ul style="list-style-type: none"> • Antivalent
Eu.SAS.612	Req	<ul style="list-style-type: none"> • Equivalent
Eu.SAS.617	Req	The output channel type "Single" shall be implemented with one physical output channel.
Eu.SAS.614	Req	The output channel types "Antivalent" and "Equivalent" shall be implemented as dual channel through two physical output channels.
Eu.SAS.1159	Info	<p>The Subsystem - Generic IO receives its power via the PoP-O interface for Subsystem - Generic IO.</p> <p>Note: The PoP-O is specified by national requirements.</p>
Eu.SAS.605	Head	5.5.3.2 Functions in the Subsystem - Generic IO
Eu.SAS.606	Info	<p>The essential subsystem states, the functional division and the generic functions have been defined in the generic functions of EULYNX field element subsystem [Eu.SAS.1583]. The section below defines the specific functions for the Subsystem - Generic IO in detail.</p> <p>The detailed implementation of these functions is described in the requirements specification for Subsystem - Generic IO [Eu.Doc.45].</p>
Eu.SAS.665	Req	<p>The Subsystem - Generic IO shall set the logical output channel to the state commanded by the Subsystem - Electronic Interlocking.</p> <p>Note: The possible logical states are switched on, switched off and flashing.</p>

ID	Type	Requirement
Eu.SAS.667	Req	<p>It shall be possible to assign delay times for each output channel for switching on and/or switching off for special applications. The Subsystem - Generic IO shall delay the switching on or switching off of the respective output channels by the timer value assigned in the configuration and engineering data.</p> <p>Note: This allows to adapt for timing needs of adjacent IO systems.</p>
Eu.SAS.2153	Req	It shall be possible to assign the flashing frequency that is valid for all output channels of the Subsystem - Generic IO.
Eu.SAS.2154	Req	If more than one logical output channel is commanded to flash, the flashing shall be in phase.
Eu.SAS.2155	Req	It shall be possible to assign the duty cycle for flashing for each output channel.
Eu.SAS.1961	Req	<p>It shall be possible to assign different timer values for each input channel.</p> <p>There are three configurable timers for input channels:</p> <ul style="list-style-type: none"> • activation/deactivation debounce timer • antivalence/equivalence violation timer • message delay timer
Eu.SAS.1175	Req	During the evaluation of a physical input channel a configurable time period (debounce timer) shall be waited separately for switching on and switching off before the monitored state change is considered as valid and then evaluated further.
Eu.SAS.669	Req	During the evaluation of a dual input channel a violation of the antivalence or equivalence conditions shall be tolerated for a configurable time period (antivalence/equivalence violation timer) before the input channel shall be reported as Disturbed.
Eu.SAS.670	Req	<p>From the moment that an input channel has changed status (after waiting debounce time and restoring of antivalence/equivalence conditions) a configurable time period (message delay timer) shall be waited before sending a status message.</p> <p>The message delay timer shall not be applied when a dual input channel is evaluated as disturbed after expiration of the antivalence/equivalence violation timer or when a disturbance is revoked. In those cases, a status message shall be sent immediately.</p>
Eu.SAS.1161	Req	It shall be possible to connect an adjacent IO system to several Subsystems - Generic IO if the required number of input and output channels cannot be provided by a single Subsystem - Generic IO.
Eu.SAS.1162	Req	If an adjacent IO system is connected to more than one Subsystem - Generic IO, the assignment of the input and output channels shall be such that the time sequence of the reported or commanded states of the input and output channels is not distorted by the individual signal runtimes of the Subsystems - Generic IO used.
Eu.SAS.658	Req	The following items shall be continuously monitored by the Subsystem - Generic IO:
Eu.SAS.659	Req	<ul style="list-style-type: none"> • current states of the configured input channels (Switched On/Switched Off/Disturbed)

ID	Type	Requirement
Eu.SAS.1900	Req	<ul style="list-style-type: none"> current states of the output channels to be monitored according to the configuration and engineering data (Not Physically Disturbed/Physically Disturbed)
Eu.SAS.1824	Req	If the PDI connection to the Subsystem - Electronic Interlocking is lost, the Subsystem - Generic IO shall switch off all physical output channels.
Eu.SAS.1838	Req	The following outputs define the initial state of outputs of the Subsystem - Generic IO:
Eu.SAS.1165	Req	<ul style="list-style-type: none"> all physical output channels shall be switched off
Eu.SAS.2009	Req	The following outputs are mandatory in the subsystem specific "safe state" of the Subsystem - Generic IO:
Eu.SAS.2010	Req	<ul style="list-style-type: none"> all physical output channels shall be switched off
Eu.SAS.681	Head	5.5.3.3 Process data interface to the Subsystem - Electronic Interlocking
Eu.SAS.1178	Req	The Subsystem - Generic IO shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-IO in [Eu.Doc.46].
Eu.SAS.1179	Head	5.5.3.4 Diagnostics interface
Eu.SAS.1181	Req	The Subsystem - Generic IO shall execute the communication with the service function Diagnostics collector in accordance with the specifications for SDI-IO in [Eu.Doc.77] and [Eu.Doc.82]. [Eu.Doc.77] defines the full telegram structure and [Eu.Doc.82] defines the diagnostic messages specific for the Subsystem - Generic IO.
Eu.SAS.695	Head	5.5.4 Subsystem - Train Detection System
Eu.SAS.696	Head	5.5.4.1 Description of the Subsystem - Train Detection System
Eu.SAS.1940	Info	The Subsystem - Train Detection System controls and monitors detection points or track circuits, in order to provide information about the occupancy status of TVP sections.
Eu.SAS.697	Info	The Subsystem - Train Detection System consists of monitoring devices for TVP sections and Train Detection Points.
Eu.SAS.1942	Info	One Subsystem - Train Detection System addresses one or several TVP sections and/or several Train Detection Points. Each TVP section or Train Detection Point is addressed as a separate operational object using operational identifiers.
Eu.SAS.1843	Req	The maximum number of TVP sections and/or Train Detection Points monitored by the Subsystem - Train Detection System shall be specified by national specifications.

ID	Type	Requirement
Eu.SAS.1403	Info	The Subsystem - Train Detection System receives its power via the PoP-O interface for Subsystem - Train Detection System. Note: The PoP-O is specified by national requirements.
Eu.SAS.1191	Head	5.5.4.2 Functions in the Subsystem - Train Detection System
Eu.SAS.1405	Info	The essential subsystem states, the functional division and the generic functions have been defined in the generic functions of EULYNX field element subsystem [Eu.SAS.1583]. The section below defines the specific functions for the Subsystem - Train Detection System in detail. The detailed implementation of these functions is described in the requirements specification for Subsystem - Train Detection System [Eu.Doc.43].
Eu.SAS.1851	Req	The Subsystem - Train Detection System shall ensure that the force clear process is followed as it is commanded by the Subsystem - Electronic Interlocking.
Eu.SAS.2014	Req	The Subsystem - Train Detection System shall ensure that a restriction to force a TVP section to clear is disabled as it is commanded by the Subsystem - Electronic Interlocking.
Eu.SAS.1846	Req	The following items shall be continuously monitored by the Subsystem - Train Detection System:
Eu.SAS.1847	Req	• TVPS occupancy status (vacant/occupied/disturbed)
Eu.SAS.1849	Req	• TVPS ability to be forced to clear
Eu.SAS.1956	Req	• TVPS filling level
Eu.SAS.1848	Req	• status of the TVPS force clear process (waiting for sweeping train/sweeping train detected/waiting for acknowledgement)
Eu.SAS.2158	Req	• TDP passing state
Eu.SAS.2013	Req	If the PDI connection to the Subsystem - Electronic Interlocking is lost, the Subsystem - Train Detection System shall maintain full operation of all autonomous functions.
Eu.SAS.1844	Info	The Subsystem - Train Detection System has no specific initial state of outputs.
Eu.SAS.1193	Head	5.5.4.3 Process data interface to the Subsystem - Electronic Interlocking
Eu.SAS.1195	Req	The Subsystem - Train Detection System shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-TDS in [Eu.Doc.44].
Eu.SAS.1196	Head	5.5.4.4 Diagnostics interface

ID	Type	Requirement
Eu.SAS.1197	Req	The Subsystem - Train Detection System shall execute the communication with the service function Diagnostics collector in accordance with the specifications for SDI-TDS in [Eu.Doc.77] and [Eu.Doc.81]. [Eu.Doc.77] defines the full telegram structure and [Eu.Doc.81] defines the diagnostic messages specific for the Subsystem - Train Detection System.
Eu.SAS.1709	Head	5.5.5 Subsystem - Level Crossing
Eu.SAS.1864	Head	5.5.5.1 Description of the Subsystem - Level Crossing
Eu.SAS.1949	Info	The Subsystem - Level Crossing controls and monitors level crossing protection systems, employing e.g. lamps and barriers, in order to prevent collisions between trains and road users.
Eu.SAS.1710	Info	The Subsystem - Level Crossing consists of a level crossing object controller.
Eu.SAS.1865	Req	The Subsystem - Level Crossing shall implement the control and monitoring of one level crossing protection facility.
Eu.SAS.1867	Info	The Subsystem - Level Crossing receives its power via the PoP-O interface for Subsystem - Level Crossing. Note: The PoP-O is specified by national requirements.
Eu.SAS.1868	Head	5.5.5.2 Functions in the Subsystem - Level Crossing
Eu.SAS.1869	Info	The essential subsystem states, the functional division and the generic functions have been defined in the generic functions of EULYNX field element subsystem [Eu.SAS.1583]. The section below defines the specific functions for the Subsystem - Level Crossing in detail. The detailed implementation of these functions is described in the requirements specification for Subsystem - Level Crossing [Eu.Doc.108].
Eu.SAS.1875	Req	The Subsystem - Level Crossing shall activate and deactivate the level crossing protection facility as it is commanded by the Subsystem - Electronic Interlocking.
Eu.SAS.1873	Req	The following items shall be continuously monitored by the Subsystem - Level Crossing:
Eu.SAS.1874	Req	• Functional status of the level crossing protection facility, required for interaction with the interlocking logic of the Subsystem - Electronic Interlocking
Eu.SAS.2017	Req	• Monitoring status of the level crossing protection facility, required for displaying information to the signaller
Eu.SAS.2018	Req	• Failure status of the level crossing
Eu.SAS.1866	Req	If the PDI connection to the Subsystem - Electronic Interlocking is lost, the Subsystem - Level Crossing shall either activate the level crossing protection facility and, after expiration of a configurable delay time, deactivate the level crossing protection facility or it shall have no functional reaction, according to the configuration and engineering data.
Eu.SAS.1870	Req	The following outputs define the initial state of outputs of the Subsystem - Level Crossing.

ID	Type	Requirement
Eu.SAS.2069	Req	• the level crossing protection facility shall be activated or deactivated, according to the configuration and engineering data
Eu.SAS.2011	Req	The subsystem specific "safe state" of the Subsystem - Level Crossing shall be defined by national specifications.
Eu.SAS.1882	Head	5.5.5.3 Process data interface to the Subsystem - Electronic Interlocking
Eu.SAS.1883	Req	The Subsystem - Level Crossing shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-LC in [Eu.Doc.109].
Eu.SAS.1898	Head	5.5.5.4 Diagnostics interface
Eu.SAS.1899	Req	The Subsystem - Level Crossing shall execute the communication with the service function Diagnostics collector in accordance with the specifications for SDI-LC in [Eu.Doc.77] and [Eu.Doc.110]. [Eu.Doc.77] defines the full telegram structure and [Eu.Doc.110] defines the diagnostic messages specific for the Subsystem - Level Crossing.
Eu.SAS.1906	Head	5.6 Specific functions of the adjacent systems
Eu.SAS.1907	Head	5.6.1 Traffic Control System
Eu.SAS.1902	Req	The adjacent system Traffic Control System shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-CC in [Eu.Doc.50].
Eu.SAS.1922	Head	5.6.2 Adjacent Interlocking System
Eu.SAS.1901	Req	The adjacent system Adjacent Interlocking System shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-ILS in [Eu.Doc.42].
Eu.SAS.1914	Head	5.6.3 Radio Block Centre (RBC)
Eu.SAS.1903	Req	The adjacent system Radio Block Centre shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-RBC in [Eu.Doc.48].
Eu.SAS.1926	Head	5.6.4 Centralised ETCS L1 Controller (CEC)
Eu.SAS.1918	Req	The adjacent system Centralised ETCS L1 Controller shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-RBC in [Eu.Doc.48].
Eu.SAS.1920	Head	5.6.5 Trackworker Safety System

ID	Type	Requirement
Eu.SAS.1928	Req	The adjacent system Trackworker Safety System shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-CC in [Eu.Doc.50].
Eu.SAS.2070	Head	5.6.6 External Level Crossing System
Eu.SAS.2168	Head	5.6.6.1 Description of the External Level Crossing System
Eu.SAS.2169	Info	The External Level Crossing System controls and monitors level crossing protection systems, employing e.g. lamps and barriers, in order to prevent collisions between trains and road users, either by own activation and deactivation functionality, or in combination with the activation and deactivation functionality commanded by the Subsystem - Electronic Interlocking.
Eu.SAS.2170	Info	The External Level Crossing System is defined as an adjacent system, applying the generic functions of EULYNX field element subsystem.
Eu.SAS.2171	Head	5.6.6.2 Functions in the External Level Crossing System
Eu.SAS.2172	Info	The essential subsystem states, the functional division and the generic functions have been defined in the generic functions of EULYNX field element subsystem [Eu.SAS.1583]. The section below defines the specific functions for the External Level Crossing System. The detailed implementation of these functions is described in the requirements specification for External Level Crossing System [Eu.Doc.111].
Eu.SAS.2173	Req	The specific functions of the External Level Crossing System shall be defined by national specifications.
Eu.SAS.2174	Req	If the PDI connection to the Subsystem - Electronic Interlocking is lost, the reaction of the External Level Crossing System shall be defined by national specifications.
Eu.SAS.2175	Req	The initial state of outputs of the External Level Crossing System shall be defined by national specifications.
Eu.SAS.2176	Req	The specific "safe state" of the External Level Crossing System shall be defined by national specifications.
Eu.SAS.2177	Head	5.6.6.3 Process data interface to the Subsystem - Electronic Interlocking
Eu.SAS.2071	Req	The adjacent system External Level Crossing System shall execute the communication with the Subsystem - Electronic Interlocking in accordance with the specifications for SCI-LX in [Eu.Doc.112].
Eu.SAS.2178	Head	5.6.6.4 Diagnostics interface
Eu.SAS.2179	Req	The External Level Crossing System shall execute the communication with the service function Diagnostics collector in accordance with the specifications in [Eu.Doc.77], which defines the full telegram structure. The diagnostic messages specific for the External Level Crossing System shall be defined by national specifications.
Eu.SAS.1912	Head	5.6.7 Documentation System

ID	Type	Requirement
Eu.SAS.1913	Req	The adjacent system Documentation System shall execute the communication with the Subsystem - Electronic Interlocking in accordance with national specifications.
Eu.SAS.698	Head	5.7 Specific functions of the Subsystem - Maintenance and Data Management
Eu.SAS.1635	Info	The requirements for the Subsystem - Maintenance and Data Management are specified in the Maintenance and data management specification [Eu.Doc.18].
Eu.SAS.2166	Info	The Subsystem - Maintenance and Data Management realises the service functions Loading procedure, Diagnostics collector, Time synchronisation and Logging.
Eu.SAS.2034	Head	5.8 General timing requirements
Eu.SAS.2035	Req	The safety response time for an undisturbed EULYNX system shall be defined by national requirements.
Eu.SAS.2036	Info	For a EULYNX field element subsystem, the time span between detection of a status change at the control interface (e.g. status of lamps, point position, wheel sensor) and the sending of an SCI-XX message at the PoS-Signalling reporting this change is defined in the requirements specification of the EULYNX field element subsystems.
Eu.SAS.2037	Info	For a EULYNX field element subsystem, the time span between reception of an SCI-XX command at the PoS-Signalling and the respective reaction at the control interface (e.g. turning lamps on or off, start of point movement) is defined in the requirements specification of the EULYNX field element subsystems.
Eu.SAS.2041	Info	The delay between the sender and the receiver at a PoS-Signalling is defined in [Eu.Doc.100] (see Eu.PoS.11).
Eu.SAS.2061	Req	In case a disturbance is present inside the EULYNX system, the safety response time shall be defined by national requirements. Note: The safety response time in case of disturbance may be derived from the RaSTA Tmax, defined in [Eu.Doc.92].