IO-Link Test

Specification

Related to
IO-Link Interface and System
Specification V1.1.2

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This specification has been prepared by the IO-Link test team and released by the IO-Link community as final version**.** It covers all Change Requests up to CR-ID161.

Any comments, proposals, requests on this document are appreciated. Please use the database www.io-link-projects.com for your entries and provide **name** and **email address**. Please be aware, that change requests concluded by the IO-Link core team and approved by the IO-Link consortium are mandatory for the performance of the tests.
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Important notes:

NOTE 1 The IO-Link Consortium Rules shall be observed prior to the development and marketing of IO-Link products. The document can be downloaded from the www.io-link.com portal.

NOTE 2 Any IO-Link device shall provide an associated IODD file. Easy access to the file and potential updates shall be possible. It is the responsibility of the IO-Link Device manufacturer to test the IODD file with the help of the IODD-Checker tool available per download from www.io-link.com.

NOTE 3 Any IO-Link Master or Device shall provide an associated manufacturer declaration on the conformity of the device with the "IO-Link Interface and System" specification V1.1 (IEC 61131-9). The manufacturer declaration is available for download from www.io-link.com.

Conventions:

In this specification the following key words (in **bold** text) will be used:
may: indicates flexibility of choice with no implied preference.
should: indicates flexibility of choice with a strongly preferred implementation.
shall: indicates a mandatory requirement. Designers **shall** implement such mandatory requirements to ensure interoperability and to claim conformity with this specification.

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0 Introduction

0.1 General

This document together with its parent IEC 61131-9 is part of a series of standards on programmable controllers and the associated peripherals and should be read in conjunction with the other parts of the series.

IEC 61131-9 specifies the Single-Drop digital Communication Interface (IO-Link™[1]) technology as a generic interface for connecting digital/analog sensors and actuators to a Master unit, which may be combined with gateway capabilities to become a fieldbus remote I/O node.

The SDCI physical interface is backward compatible with the usual 24 V I/O signalling specified in IEC 61131-2 and allows in addition digital point-to-point communication at transmission rates of 4,8 kbit/s, 38,4 kbit/s and 230,4 kbit/s.

The SDCI technology specifies parameterization, cyclic exchange of process data, and diagnosis as well as parameter Data Storage capabilities.

This subpart specifies the test cases and associated test environments for SDCI Master and Devices designed and developped according to IEC 61131-9. It provides the necessary preconditions for conformity testing to ensure interoperability and enables manufacturers of Master and Devices to sign a corresponding conformity declaration.

The structure of this document is described in clause 4.2.

Where a conflict exists between this and other IEC standards (except basic safety standards), the provisions of this standard should be considered to govern in the area of programmable controllers and their associated peripherals.

Conformity with IEC 61131-9 cannot be claimed unless the requirements of this document are met.

Terms of general use are defined in IEC 61131-1 or in [1]. More specific terms are defined in each part.

0.2 Patent declaration

There are no known patents related to the content of this document.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The IO-Link Community shall not be held responsible for identifying any or all such patent rights.

1 IO-Link™ is a trade name of the "IO-Link Community". Compliance to this standard does not require use of the registered logos for IO-Link™. Use of the registered logos for IO-Link™ requires permission of the "IO-Link Community".

PROGRAMMABLE CONTROLLERS —

Test specification for Master and Devices according to IEC 61131-9 (Single-drop Digital Communication Interface - SDCI)

1 Scope

The single-drop digital communication interface (SDCI) technology described in part 9 of the IEC 61131 series focuses on simple sensors and actuators in factory automation, which are nowadays using small and cost-effective microcontrollers. With the help of the SDCI technology, the existing limitations of traditional signal connection technologies such as switching 0/24 V, analog 0 to 10 V, etc. can be turned into a smooth migration. Classic sensors and actuators are usually connected to a fieldbus system via input/output modules in so-called remote I/O peripherals. The (SDCI) Master function enables these peripherals to map SDCI Devices onto a fieldbus system or build up direct gateways. Thus, parameter data can be transferred from the PLC level down to the sensor/actuator level and diagnosis data transferred back in turn by means of the SDCI communication. This is a contribution to consistent parameter storage and maintenance support within a distributed automation system. SDCI is compatible to classic signal switching technology according to part 2 of the IEC 61131 series.

This subpart specifies the test cases and associated test environments for Master and Devices designed and developped according to IEC 61131-9. It provides the necessary preconditions for conformity testing to ensure interoperability and allows manufacturers of Master and Devices to sign a corresponding conformity declaration.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60947-5-2, *Low-voltage switchgear and controlgear – Part 5-2: Control circuit Devices and switching elements – Proximity switches*

IEC 61131-2, *Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61131-9, *Programmable controllers – Part 9: Single-drop digital communication interface for small sensors and actuators (SDCI)*

3 Terms, definitions, symbols, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions in addition to those given in IEC 61131-1, IEC 61131-2, and IEC 61131-9 apply.

3.1.1
address
part of the M-sequence control to reference data within data categories of a communication channel

3.1.2
application layer (AL)
<SDCI> part of the protocol responsible for the transmission of Process Data objects and On-Request Data objects

3.1.3
block parameter
consistent parameter access via multiple Indices or Subindices

3.1.4
checksum
<SDCI> complementary part of the overall data integrity measures in the data link layer in addition to the UART parity bit

3.1.5
CHKPDU
integrity protection data within an ISDU communication channel generated through XOR processing the octets of a request or response

3.1.6
coded switching
SDCI communication, based on the standard binary signal levels of IEC 61131-2

3.1.7
COM1
SDCI communication mode with transmission rate of 4,800 kbit/s

3.1.8
COM2
SDCI communication mode with transmission rate of 38,400 kbit/s

3.1.9
COM3
SDCI communication mode with transmission rate of 230,400 kbit/s

3.1.10
COMx
one out of three possible SDCI communication modes COM1, COM2, or COM3

3.1.11
communication error
unexpected disturbance of the SDCI transmission protocol

3.1.12
cycle time
time to transmit a frame between a Master and its Device including the following idle time

3.1.13
communication channel
logical connection between Master and Device

NOTE Four communication channels are defined: process channel, page and ISDU channel (for parameters) and diagnostic channel.

3.1.14
Device
single passive peer to a Master such as a sensor or actuator

NOTE Uppercase "Device" is used for SDCI equipment, while lowercase "Device" is used in a generic manner.

3.1.15
direct parameters
directly (page) addressed parameters transferred acyclically via the page communication channel without acknowledgement

3.1.16
dynamic parameter
part of a Device's parameter set defined by on-board user interfaces such as teach-in buttons or control panels in addition to the static parameters

3.1.17
event
an instance of a change of conditions

NOTE An event is indicated via the event flag within the Device's status cyclic information, then acyclic transfer of event data (typically diagnostics information) is conveyed through the diagnostic communication channel.

[IEC 61158-5-x, modified]

3.1.18
fallback
transition of a port from coded switching to switching signal mode

3.1.19
framing error
perturbed UART frames (physical layer)

3.1.20
interleave
segmented cyclic data exchange for process data with more than 2 octets through subsequent cycles

3.1.21
ISDU
indexed service data unit used for acyclic acknowledged transmission of parameters that can be segmented in a number of M-sequences

3.1.22
Legacy-Device
Device developed according to version V1.0 [13], the predecessor of [9]

3.1.23
Legacy-Master
Master developed according to version V1.0 [13], the predecessor of [9]

3.1.24
Master
active peer connected through ports to one up to n Devices and which provides an interface to the gateway to the upper level communication systems or PLCs

NOTE Uppercase "Master" is used for SDCI equipment, while lowercase "Master" is used in a generic manner.

3.1.25
message
<SDCI> coherent set of data octets transferred either from a Master to its Device or vice versa following the rules of the SDCI protocol

3.1.26
M-sequence
sequence of two messages comprising a Master message and its subsequent Device message

3.1.27
M-sequence control
first octet in a Master message indicating the read/write operation, the type of the communication channel, and the address, for example offset or flow control

3.1.28
M-sequence error
unexpected or wrong message content, or no response

3.1.29
M-sequence type
one particular M-sequence format out of a set of specified M-sequence formats

3.1.30
on-request data
acyclically transmitted data upon request of the Master application consisting of parameters or event data

3.1.31
PHY-3W ((IEC 61131-9 → 3-wire system)
three wire connection to Devices for power, ground, communication and/or switching signals defined in IEC 60947-5-2

3.1.32
physical layer
part of the communication protocol concerned with transmitting raw bits over a communication channel

NOTE Physical layer provides means for wake-up and fallback procedures.

3.1.33
port
communication medium interface of the Master to one Device

3.1.34
port operating mode
state of a Master's port that can be either INACTIVE, DO, DI, SDCI, or ScanMode

3.1.35
process data
input or output values from or to a discrete or continuous automation process cyclically transferred with high priority and in a configured schedule automatically after start-up of a Master

3.1.36
process data cycle
complete transfer of all process data from or to an individual Device that may comprise several cycles in case of segmentation (interleave)

3.1.37
single parameter
independent parameter access via one single Index or Subindex

3.1.38
SIO
port operation mode in accordance with digital input and output defined in IEC 61131-2 that is established after power-up or fallback or unsuccessful communication attempts

3.1.39
static parameter
part of a Device's parameter set to be saved in a Master for the case of replacement without engineering tools

3.1.40
switching signal
binary signal from or to a Device when in SIO mode (as opposed to the "coded switching" SDCI communication)

3.1.41
system management (SM)
<SDCI> means to control and coordinate the internal communication layers and the exceptions within the Master and its ports, and within each Device

3.1.42
UART frame
<SDCI> bit sequence starting with a start bit, followed by eight bits to carry a data octet, followed by an even parity bit and ending with one stop bit

3.1.43
wake-up
procedure for causing a Device to change its mode from SIO to SDCI

3.1.44
wake-up request (WURQ)
physical layer service used by the Master to initiate wake-up of a Device, and put it in a receive ready state

3.2 Symbols and abbreviated terms

Δf_{DTR}	Permissible deviation from data transfer rate, measured in %
ΔPS	Power supply ripple, measured in V
AL	Application Layer
BEP	Bit error probability
C/Q	Connection for communication (C) or switching (Q) signal (SIO)
CL_{eff}	Effective total cable capacity, measured in nF
CQ	Input capacity at C/Q connection, measured in nF
DI	Digital input
DL	Data Link Layer
DO	Digital output
f_{DTR}	Data transfer rate, measured in bit/s
H/L	High/low signal at receiver output
I/O	Input / output
ILL	Input load current at input C/Q to V0, measured in A
IQ	Driver current in saturated operating status ON, measured in A
IQH	Driver current on high-side driver in saturated operating status ON, measured in A
IQL	Driver current on low-side driver in saturated operating status ON, measured in A
IQPK	Maximum driver current in unsaturated operating status ON, measured in A
IQPKH	Maximum driver current on high-side driver in unsaturated operating status ON, measured in A
IQPKL	Maximum driver current on low-side driver in unsaturated operating status ON, measured in A
IQQ	Quiescent current at input C/Q to V0 with inactive output drivers, measured in A
IQ_{WU}	Amplitude of Master's wake-up request current, measured in A
IS	Supply current at V+, measured in A
ISIR	Current pulse supply capability at V+, measured in A
LED	Light emitting diode
L-	Ground connection
L+	Power supply connection
NRZ	Non return to zero
n_{WU}	Wake-up retry count
On/Off	Driver's ON/OFF switching signal
ON-REQ	On-request data
OVD	Signal Overload Detect
PDCT	Port and Device configuration tool
PL	Physical layer
PLC	Programmable logic controller
PS	Power supply, measured in V
r	Time to reach a stable level with reference to the beginning of the start bit, measured in TBIT

RL_{eff}	Loop resistance of cable, measured in Ω	
s	Time to exit a stable level with reference to the beginning of the start bit, measured in TBIT	
SDCI	Single-drop digital communication interface	
SIO	Standard Input Output (digital switching mode)	[IEC 61131-2]
SM	System Management	
t_1	Character transfer delay on Master, measured in TBIT	
t_2	Character transfer delay on Device, measured in TBIT	
t_A	Response delay on Device, measured in TBIT	
T_{BIT}	Bit time, measured in s	
t_{CYC}	Cycle time on M-sequence level, measured in s	
t_{DF}	Fall time, measured in s	
T_{DMT}	Delay time while establishing Master port communication, measured in TBIT	
t_{DR}	Rise time, measured in s	
T_{DSIO}	Delay time on Device for transition to SIO mode following wake-up request, measured in s	
T_{DWU}	Wake-up retry delay, measured in s	
$t_{M\text{-}sequence}$	M-sequence duration, measured in TBIT	
t_{idle}	Idle time between two M-sequences, measured in s	
t_H	Detection time for high level, measured in s	
t_L	Detection time for low level, measured in s	
t_{ND}	Noise suppression time, measured in s	
T_{OFS}	Temporal offset for process data processing on the Device with reference to start of cycle, measured in s	
T_{PON}	Ramp-up time following power ON, measured in s	
T_{RDL}	Wake-up readiness following power ON, measured in s	
T_{REN}	Receive enable, measured in s	
T_{SD}	Device detect time, measured in s	
T_{WU}	Pulse duration of wake-up request, measured in s	
UART	Universal asynchronous receiver transmitter	
UML	Unified modelling language	
V+	Voltage at L+	
V0	Voltage at L-	
VD-	Voltage drop on the line between the L- connections on Master and Device, measured in V	
VD+	Voltage drop on the line between the L+ connections on Master and Device, measured in V	
VDQ	Voltage drop on the line between the C/Q connections on Master and Device, measured in V	
VHYS	Hysteresis of receiver threshold voltage, measured in V	
VI	Input voltage at connection C/Q with reference to V0, measured in V	
VIH	Input voltage range at connection C/Q for high signal, measured in V	
VIL	Input voltage range at connection C/Q for low signal, measured in V	
VRQ	Residual voltage on driver in saturated operating status ON, measured in V	
VRQH	Residual voltage on high-side driver in operating status ON, measured in V	
VRQL	Residual voltage on low-side driver in saturated operating status ON, meas-	

	ured in V
VTH	Threshold voltage of receiver with reference to V0, measured in V
VTHH	Threshold voltage of receiver for safe detection of a high signal, measured in V
VTHL	Threshold voltage of receiver for safe detection of a low signal, measured in V
WURQ	Wake-up request pulse

200

201 3.3 Conventions

202 3.3.1 Test case template

203 This document uses a dedicated template as shown in Table 1 for the particular test cases.

204 **Table 1 – Test case template**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_nnnn (nnnn = 4 digit consecutive number starting with 0001)
Name	Characteristic name of the test case (see 3.3.1.1)
Purpose (short)	Short description of the purpose of the test case (one line maximum)
Equipment under test (EUT)	Master, Device, or SDCI communication
Test case version	Starts with 1.0. Incremented first number indicates significant changes due to new functionality, the second one indicates changes within the test case
Category / type	See 3.3.1.2
Specification (clause)	[Bibliography, nn], clause or subclause, figure, table, chart, etc.
Configuration / setup	E.g. Master-Tester ("Device") shall detect all transmission rates and measure the corresponding delays. It shall not react to the requests.

205

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Comprehensive description of the purpose of the test case (can be several lines).
Precondition	Mode of the test set (EUT and test environment) or ID of previous test
Procedure	Step by step description of the test
Input parameter	For example of an ISDU: Index, Subindex, Length, Data
Post condition	Mode of the EUT and its environment

206

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Expected reaction of the EUT and permitted ranges
Test passed	Describe reaction and check whether deviations can be tolerated
Test failed (examples)	Describe reaction and describe the reasons for failing
Results	Timings, voltages, currents, pulses, message sequences, etc.

207 The table contains explanations on how to use items.

208 3.3.1.1 Name of a test case

209 Figure 1 shows the structure of the name of a test case.

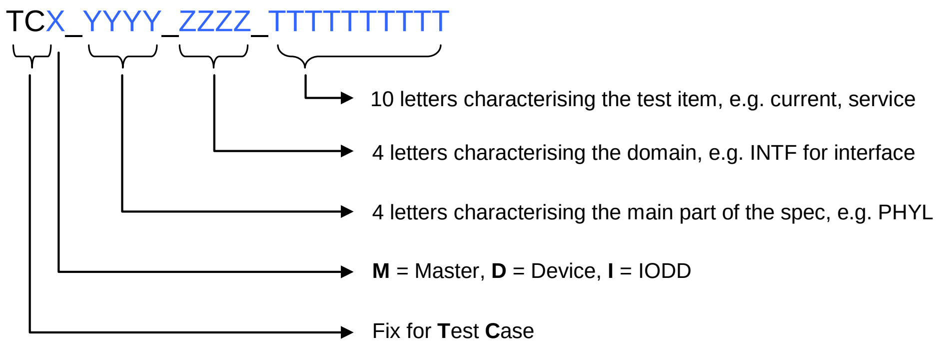

Figure 1 – Structure of the test case name

3.3.1.2 Categories and types of test cases

Table 2 shows the used test case categories within this document.

Table 2 – Test case categories

Category	Definition
Master Physical Layer test	Measure port voltages, currents, and timings
Device Physical Layer test	Measure Device voltages, currents, and timings
ASIC	These test cases are relevant for manufacturers of integrated circuits
Master DL protocol test	Check Master protocol on DL level
Device DL protocol test	Check Device protocol on DL level
Master/Device protocol test	Master/Device interaction test on DL level
Device PREOPERATE test	Device protocol test in PREOPERATE mode
Device OPERATE test	Device protocol test in OPERATE mode
Device ISDU test	Device ISDU protocol test
Device Event test	Test of Device Event handling
Device Direct Parameter test	Test of Device's Direct Parameter page handling
Device application test	Test of Device's application behavior
IODD verification test	Test whether IODD and the real Device parameter are matching
Master Data Storage test	Test of Master's Data Storage mechanisms

Table 3 shows the used test case types within this document

Table 3 – Test case types

Category	Definition
Test to pass	Positive test. A function shall perform as specified.
Test to fail	Negative test. A function shall react for example with an error indication when boundary conditions are exceeded

3.3.2 Names of variables

Due to the possible implementation of the test cases in software, all used symbols and abbreviated terms in this document (see 3.2) are written in upper case letters without superscript or subscript.

3.3.3 Memory and transmission octet order

Figure 2 demonstrates the order that shall be used when transferring WORD based data types from memory to transmission and vice versa.

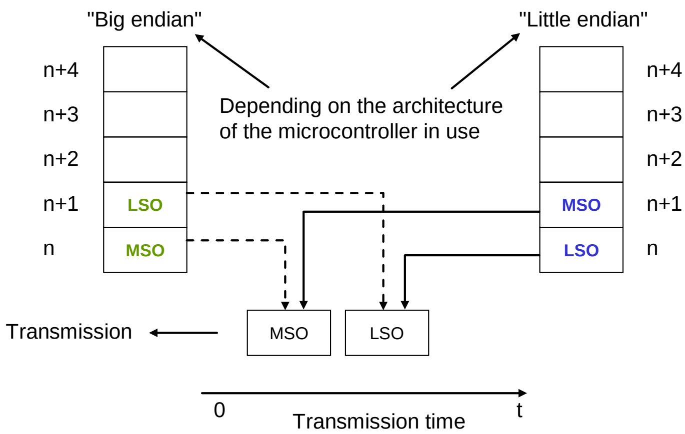

Figure 2 – Memory and transmission octet order

3.3.4 Behavioral descriptions

For the behavioral descriptions the notations of UML 2 [5] are used, mainly timing diagrams.

4 Test strategy for SDCI (IO-Link™[2]) Master and Devices

4.1 Purpose of this specification

This specification describes the test cases and specifies the necessary test equipment in conjunction with its parent document IEC 61131-9. The functionality of legacy Devices according to [13] is covered also. Necessary supplements or clarifications regarding [13] are covered in Annex B.

This document provides the necessary information for the development of test instructions for a particular test set in test laboratories.

4.2 Structure of this document

Clause 0 describes the test cases for the physical layer test of Master and Devices. Thea are mainly requiring individual manual tests with variable power supplies, individual capacitive and resistive loads, voltage and current meters as well as oscilloscopes and logic analyzers.

Clause 0 describes the test cases for the Device protocol tests, which can be performed nearly automatically via a Device-Tester.

Clause 0 describes the XML schema and business rules tests for IODDs. Additional test cases verify the consistency of the particular IODD and the real parameters within the associated Device.

Clause 8 describes the test cases for the Master protocol tests, which can be performed automatically via a Master-Tester.

Clause 9 defines the standards for the environmental tests of Master and Devices. Annex A describes the test tools, their requirements, and the test configurations. Annex B contains a few supplementary specifications filling the gaps of [13]. Annex C provides cross reference listings for test case IDs and test case names. Annex D provides information about an SDCI support organization.

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2 IO-Link™ is a trade name of the "IO-Link Community". Compliance to this standard does not require use of the registered logos for IO-Link™. Use of the registered logos for IO-Link™ requires permission of the "IO-Link Community".

4.3 Conformity classes

4.3.1 Legacy Devices (V1.0)

Devices designed and implemented according to [13] shall pass all test cases marked correspondingly in this document.

4.3.2 Devices without ISDU

Devices designed and implemented according to [9] that are not supporting the ISDU feature shall either require no parameters or provide a system conform mechanism for the Device replacement without tools. These Devices shall pass all test cases marked correspondingly in this document.

4.3.3 Devices with ISDU

Devices designed and implemented according to [9] shall pass all test cases marked correspondingly in this document. If they omit to implement the Data Storage mechanism according to [9] they still shall provide access to Index 3 and shall provide system conform means for the Device replacement without tools. These Devices shall pass all test cases marked correspondingly in this document.

4.3.4 Legacy Master

Master designed and implemented according to [13] are providing a subset of the features in [9], usually no Data Storage, no PREOPERATE state, no Events type 2, and reduced M-sequence types. All the test cases within this document for Legacy Master apply.

4.3.5 Master

Master designed and implemented according to [9] shall provide all the specified features. All test cases within this document for Master apply.

4.4 Test of Devices

The test of Devices consists of four steps: Physical layer test, IODD test, protocol test, and environmental test. The protocol tests of SDCI Devices can be performed by a Device-Tester that shall be approved by the organization noted in Annex D. The requirements for Device-Tester are specified in Annex A.2.2.

Figure 3 shows step 1 of the Device test. It contains references to the relevant clauses in this specification and consists of a visual check and manually performed measurements.

If the Device shows specific connectors, cables, or color codings, these deviations shall be documented within the user manual in respect to the original definitions in the standard [9].

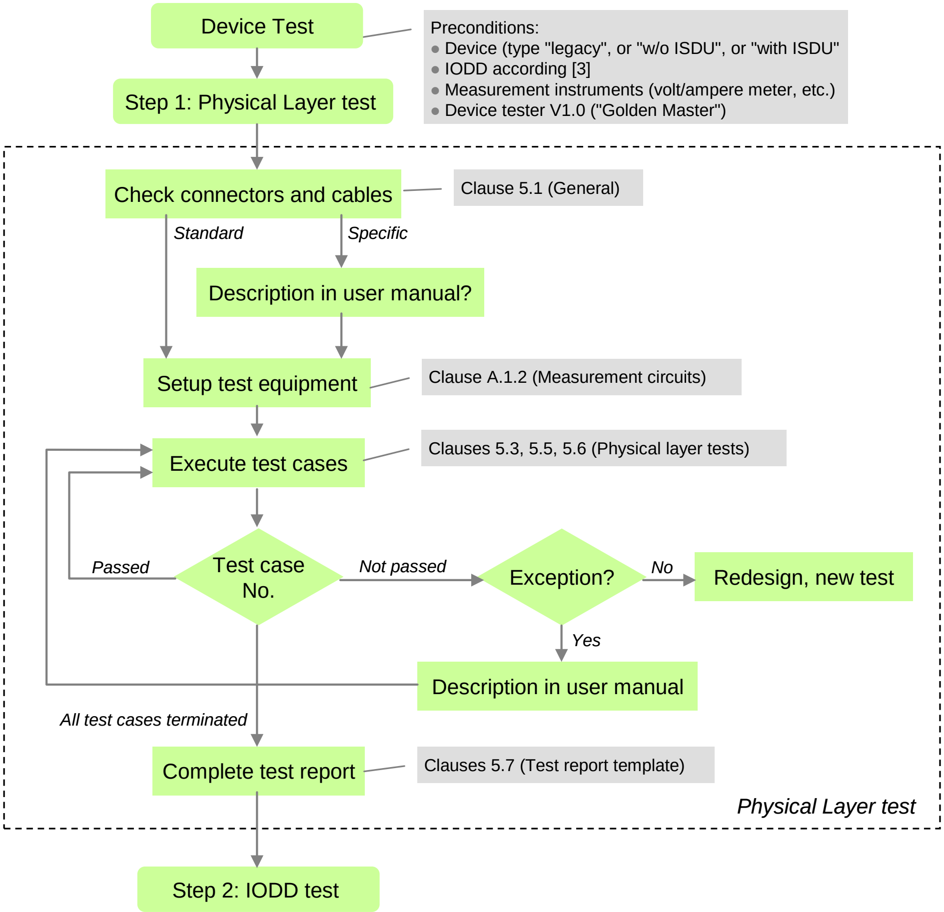

Figure 3 – Step 1 of the Device test sequence (PL)

If a Device did not pass a certain test case due to measurement values close to the tolerance limits or similar situations it is possible to send an informal request to the organization listed in Annex D. This request shall be comprehensive enough for the experts to allow for an exception under certain conditions or clarification of the specifications. If an exception applies, it shall be documented in the user manual mentioning the possible implications.

Instead of pursuing such a time-consuming and uncertain way, it is highly recommended for the applicant to rather strive for a robust implementation and conformity of the Device.

Figure 4 shows step 2 of the Device test. It contains references to the relevant clauses in this specification and consists of an IODD-Test with a so-called IODD-Checker-Tool (Annex A.3) and a parameter verification test with the help of the protocol test (Device Tester).

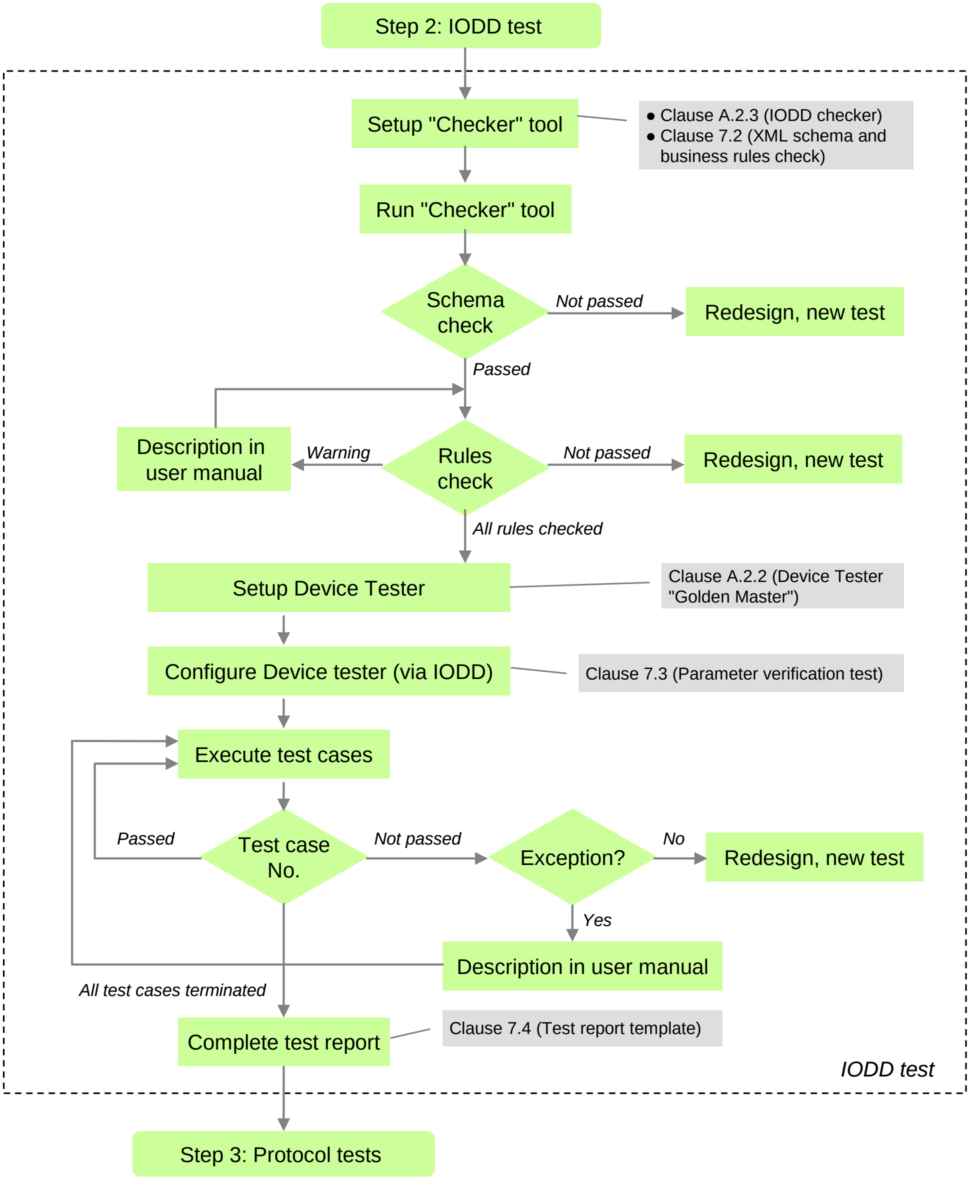

Figure 4 – Step 2 of the Device test sequence (IODD)

Figure 5 shows step 3 of the Device test. It contains references to the relevant clauses in this specification and consists of an automated protocol test with the help of the Device Tester defined in A.2.2.

Three different sets of test cases are necessary to adjust the tests for the three Device conformity classes: Legacy Devices developed according to [13], Devices without the ISDU feature developed according to [9], and Devices with ISDU support developed according to [9].

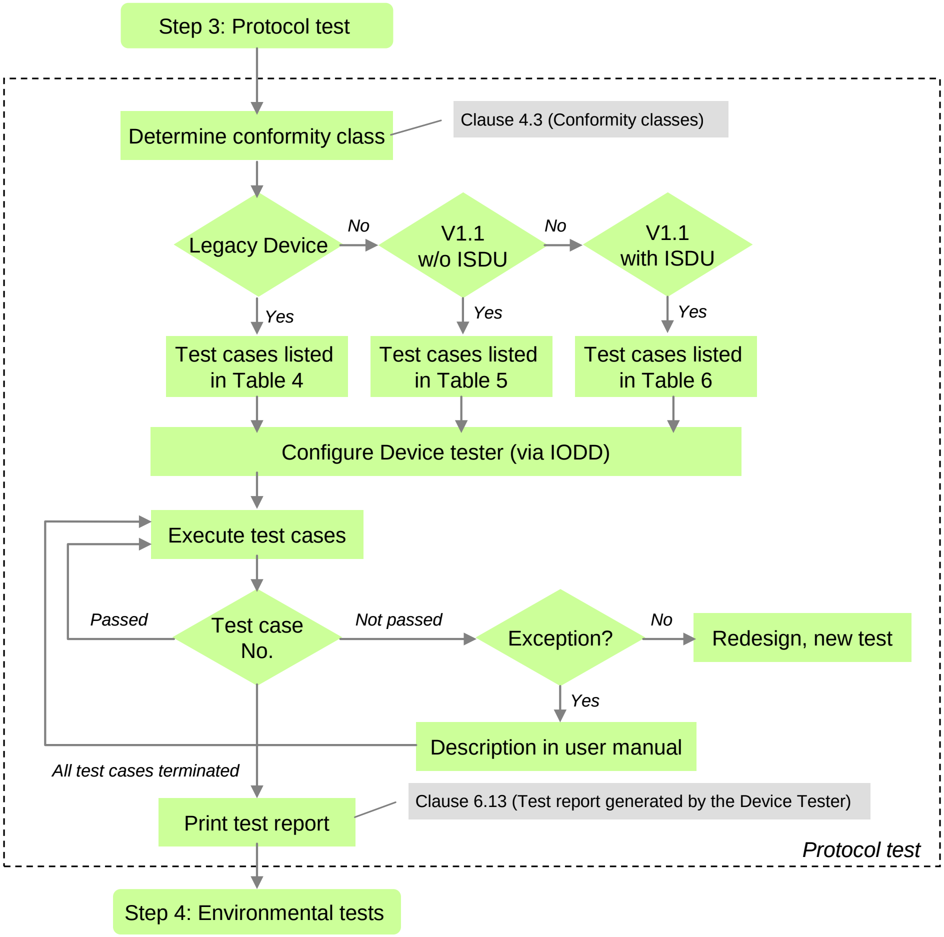

Figure 5 – Step 3 of the Device test sequence (protocol)

The set of test cases for Legacy Devices is defined in Table 4.

Table 4 – Set of test cases for Legacy Devices (V1.0)

Major feature	Test cases	Remarks
STARTUP	TC_0034 to TC_0038	
OPERATE	TC_0049	TC_0051 removed from list
ISDU	TC_0052 to TC_0054 TC_0055 to TC_0062 TC_0065 TC_0066 TC_0067, TC_0068	 If tested in OPERATE mode If tested with ErrorCode 0x5600 If tested in OPERATE mode If tested in OPERATE mode. Abort not mentioned in state machine, but behavior shall be fulfilled.
Events	TC_0069, TC_0071 TC_0074, TC_0075	Exceptions exist (see 6.6.1)
Legacy Master (V1.0)	TC_0085 to TC_0087	Exceptions for PDInvalid exist (see Table 108)
Direct Parameter page 1	TC_0089, TC_0090 TC_0092 to TC_0097 TC_0100 to TC_0101	If restricted to 134 ms
Predefined parameters	TC_0104, TC_0105 TC_0114 to TC_0121 TC_0122 to TC_0123 TC_0124 TC_0132 to TC_0133 TC_0140	 If length < 16 permitted
IODD based tests	TC_0149 to TC_0152 TC_0155, TC_0157	

The set of test cases for Devices without ISDU support is defined in Table 5.

Table 5 – Set of test cases for Devices without ISDU support

Major feature	Test cases	Remarks
STARTUP	TC_0034 to TC_0038, TC_0306	New TC_0306 for test of revision management
PREOPERATE	TC_0039 to TC_0044	
OPERATE	TC_0045 to TC_0049	TC_0051 removed from list
Events	TC_0069 to TC_0076	Exceptions exist (see 6.6.1)
Legacy Master (V1.0)	TC_0085 to TC_0087	If restricted to 134 ms; Exceptions for PDInvalid exist (see Table 108)
Direct Parameter page 1	TC_0089 to TC_0097 TC_0100 to TC_0101	

The set of test cases for Devices with ISDU support is defined in Table 6.

Table 6 – Set of test cases for Devices with ISDU support

Major feature	Test cases	Remarks
STARTUP	TC_0034 to TC_0038 TC_0306	New TC_0306 for test of revision management
PREOPERATE	TC_0039 to TC_0044	
OPERATE	TC_0045 to TC_0049	TC_0051 removed from list.
ISDU	TC_0052 to TC_0068	
Events	TC_0069 to TC_0076	Exceptions exist (see 6.6.1)
Data Storage	TC_0077 to TC_0084	
Legacy Master (V1.0)	TC_0085 to TC_0087	If compatible; Exceptions for PDInvalid exist (see Table 108)
Direct Parameter page 1	TC_0089 to TC_0097 TC_0100 to TC_0101	
Predefined parameters	TC_0104 to TC_0105 TC_0107 to TC_0124 TC_0128 to TC_0137 TC_0140 to TC_0142	
Block parameter	TC_0143 to TC_0145 TC_0147 to TC_0148	
IODD based tests	TC_0149 to TC_0152 TC_0155 to TC_0157	

Figure 6 shows step 4 of the Device test. It contains references to the relevant clauses in this specification and consists of an EMC test defined in [9] and possible tests according to relevant product standards such as for example the IEC 60947 series. A successfully terminated Device test can be completed by a manufacturer declaration as defined in [9].

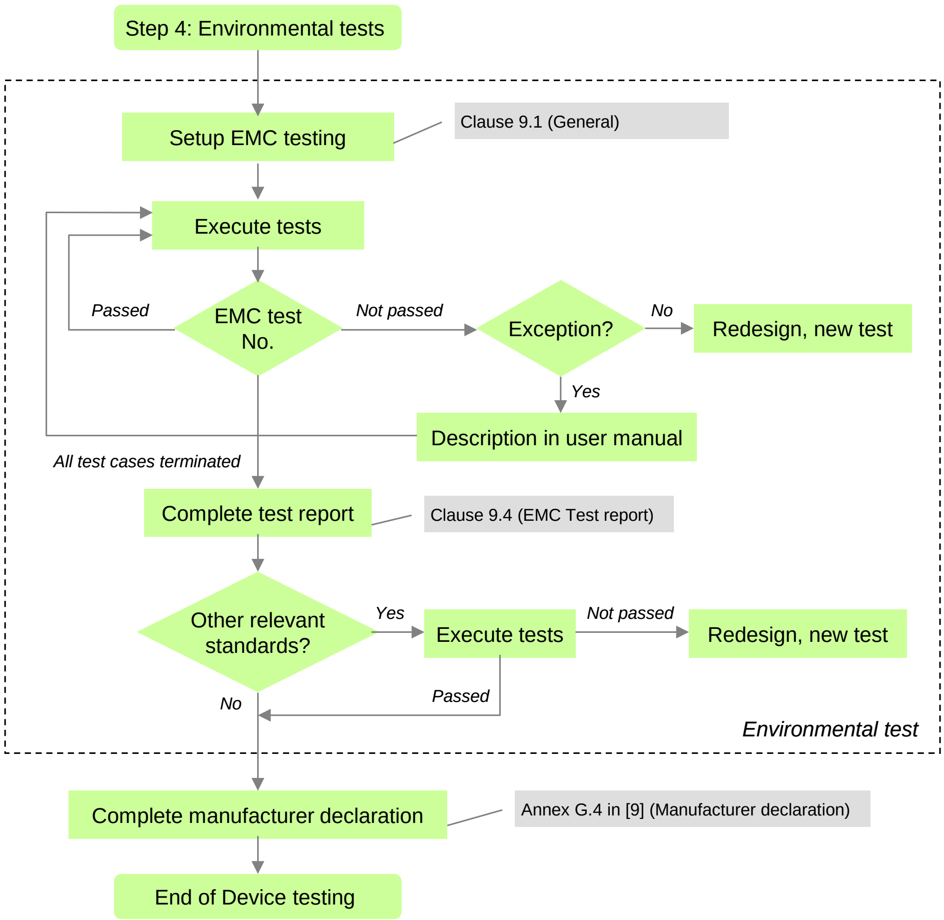

Figure 6 – Step 4 of the Device test sequence (environment)

4.5 Test of SDCI Masters

The test of SDCI Masters consists of four steps: Physical layer test, protocol test, IODD interpreter test, and environmental test. The protocol tests of SDCI Master can be performed by a Master-Tester that shall be approved by the organization noted in Annex D. The requirements for Master-Tester are specified in Annex A.4.

Figure 7 shows step 1 of the Master test sequence. It contains references to the relevant clauses in this specification and consists of a visual check and manually performed measurements.

If the Master shows specific connectors, cables, or color codings, these deviations shall be documented within the user manual in respect to the original definitions in the standard [9].

If a Master did not pass a certain test case due to measurement values close to the tolerance limits or similar situations it is possible to send an informal request to the organization listed in Annex D. This request shall be comprehensive enough for the experts to allow for an exception under certain conditions or clarification of the specifications. If an exception applies, it shall be documented in the user manual mentioning the possible implications.

Instead of pursuing such a time-consuming and uncertain way, it is highly recommended for an applicant to rather strive for a robust implementation and conformity of the Device.

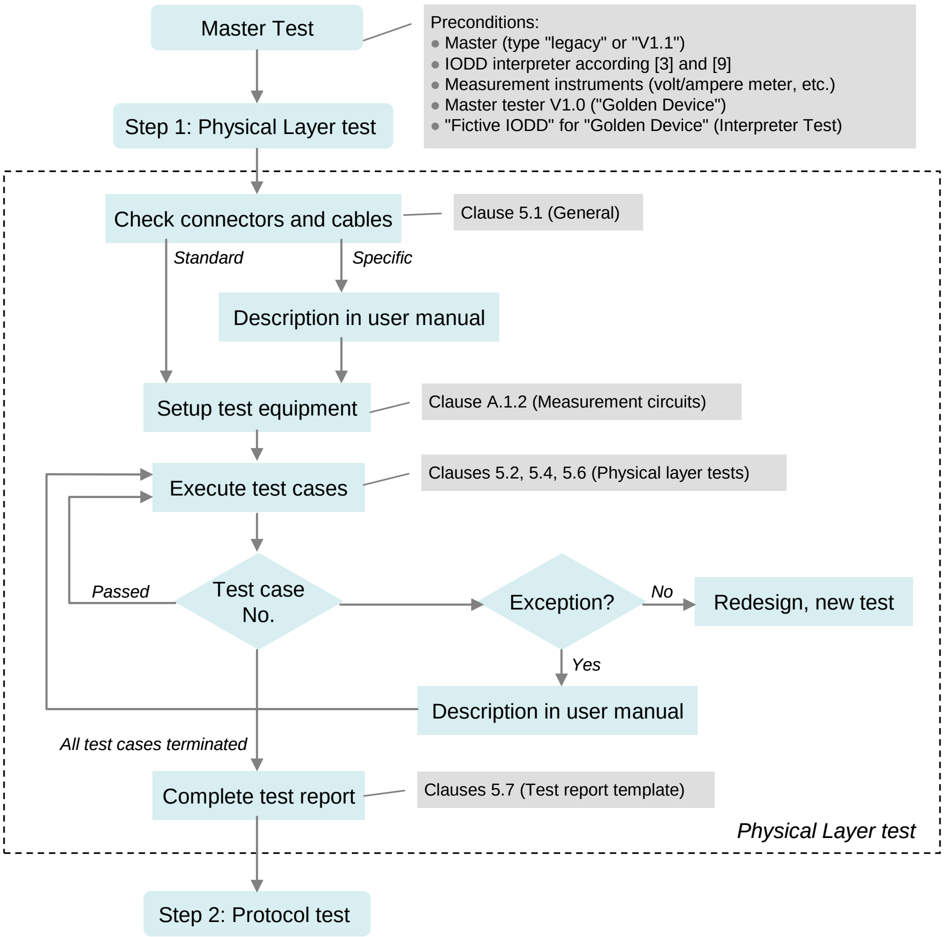

Figure 7 – Step 1 of the Master test sequence (PL)

Figure 8 shows step 2 of the Master test sequence. It contains references to the relevant clauses in this specification and consists of an automated protocol test with the help of a Master Tester tool defined in Annex A.4.

Two different sets of test cases are necessary to adjust the tests for the two Master conformity classes: Legacy Masters developed according to [13] and Masters developed according to [9].

The set of test cases for Legacy Masters is defined in Table 7.

Table 7 – Set of test cases for Legacy Masters (V1.0)

Major feature	Test cases	Remarks
Timings	TC_0158 to TC_0167	
Process Data (PD)	TC_0168 to TC_0176, TC_0298	
STARTUP	TC_0183, TC_0195	
OPERATE	TC_0210 to TC_0212	
Fallback	TC_0215 to TC_0216	
Retry	TC_0217 to TC_0222	TC_0217 to TC_0220 without test execution while in PREOPERATE mode.
ISDU (application errors)	TC_0223 to TC_0238	
ISDU (derived errors)	TC_0239 to TC_0242 TC_0244	
ISDU (Limit checks)	TC_0243 TC_0245 to TC_0246	

Major feature	Test cases	Remarks
	TC_0248 to TC_0255	
Events	TC_0256 to TC_0267	
Legacy Device (V1.0)	TC_0285 to TC_0291	

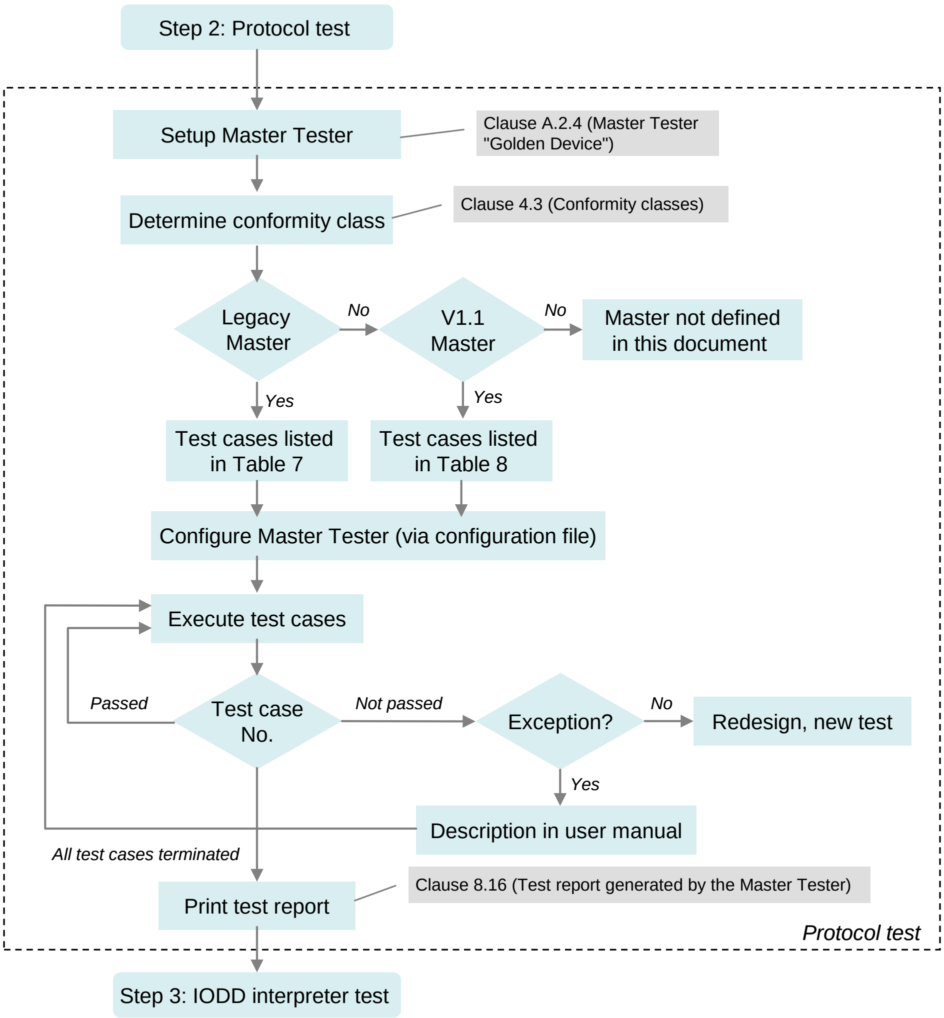

Figure 8 – Step 2 of the Master test sequence (PL)

The set of test cases for Masters is defined in Table 8.

Table 8 – Set of test cases for Masters (V1.1)

Major feature	Test cases	Remarks
Timings	TC_0158 to TC_0167	
Process Data (PD)	TC_0168 to TC_0178, TC_0298	
On-request Data (OD)	TC_0179 to TC_0182	
STARTUP	TC_0183 to TC_0196 TC_0307	New TC_0307 for test of revision management
PREOPERATE	TC_0198 to TC_0209	TC_0200 and TC_0201 are optional
OPERATE	TC_0210 to TC_0212	
Fallback	TC_0213 to TC_0216	TC_0213 and TC_0214 are optional
Retry	TC_0217 to TC_0222	

Major feature	Test cases	Remarks
ISDU (application errors)	TC_0223 to TC_0238	
ISDU (derived errors)	TC_0239 to TC_0242 TC_0244	
ISDU (Limit checks)	TC_0243 TC_0245 to TC_0246 TC_0248 to TC_0255	
Events	TC_0256 to TC_0267	TC_0268 and TC_0269 are for future use.
Data Storage	TC_0270 to TC_0284	
Legacy Device (V1.0)	TC_0285 to TC_0291	

Figure 9 shows step 3 of the Master test sequence. It contains references to the relevant clauses in this specification. The Master Tester tool ("Golden Device") defined in Annex A.4 provides a "Fictive IODD". The user manual of the tool demonstrates how this IODD shall be presented to the user in respect to completeness and correctness.

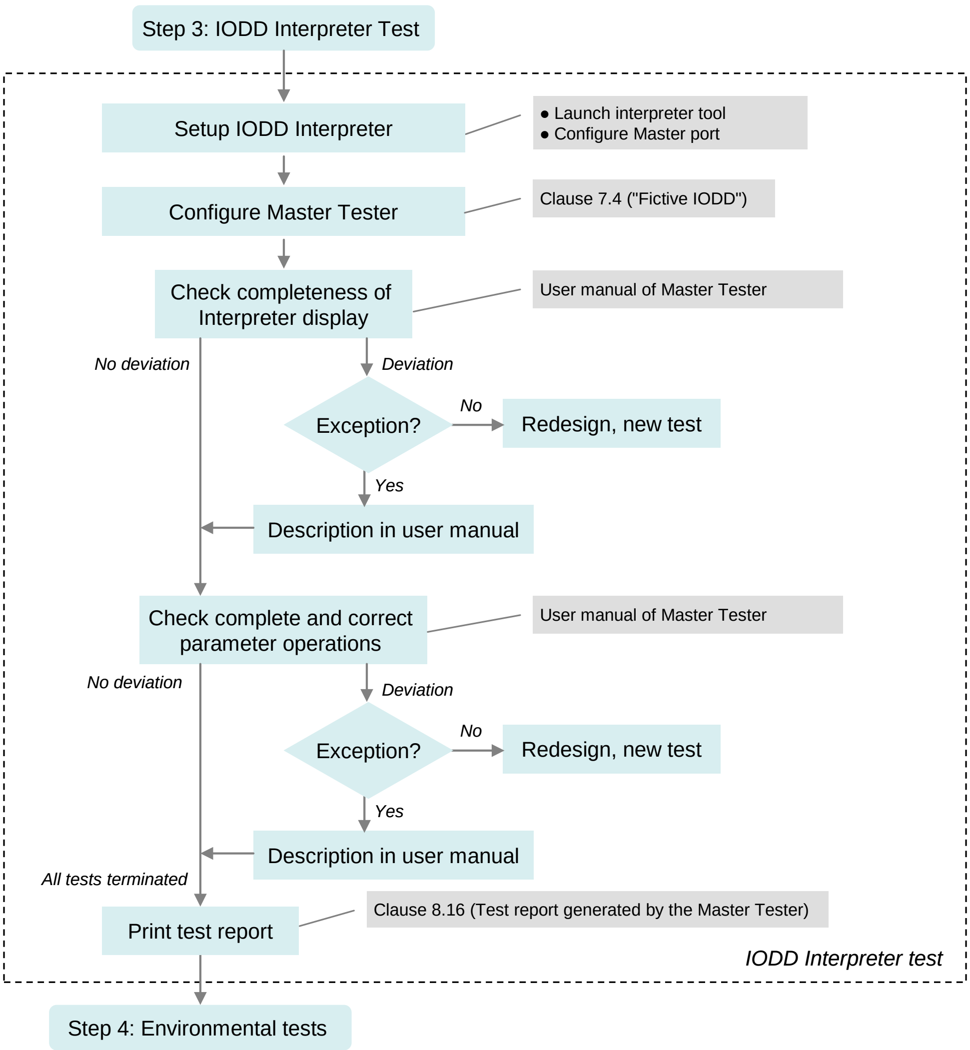

Figure 9 – Step 3 of the Master test sequence (Interpreter)

Figure 10 shows step 4 of the Master test. It contains references to the relevant clauses in this specification and consists of an EMC test defined in [9] and possible tests according to relevant product standards such as for example the IEC 61131-2. A successfully terminated Master test can be completed by a manufacturer declaration as defined in [9].

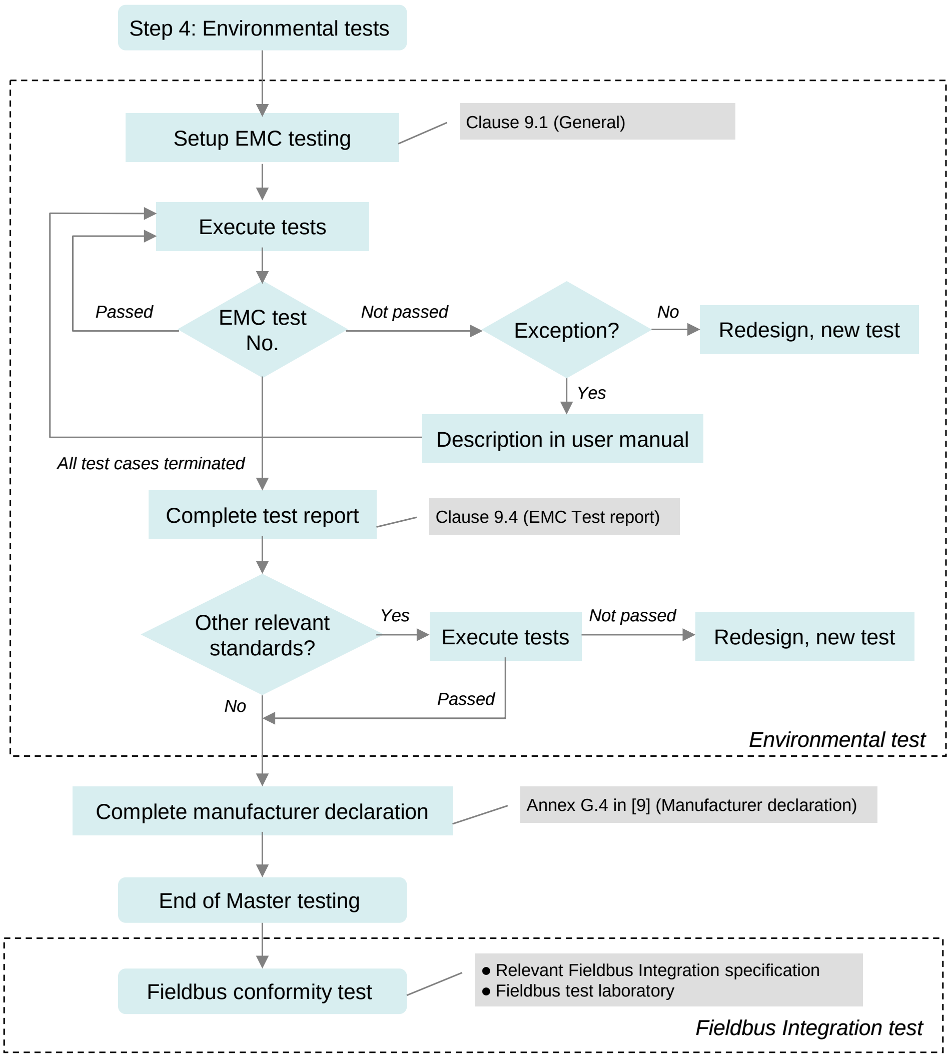

Figure 10 – Step 4 of the Master test sequence (environment)

5 Physical Layer (PL) tests

5.1 General

The physical layer tests comprise a visual inspection of the type of connector, cable, maximum cable length and color coding of the wires. If customer specific or region specific connectors, cable, and the color coding of the wires deviate from the specifications in [9], the user manual of the Device shall document clearly the differences in comparison with the definitions in the standard.

The physical layer tests comprise also measurements of voltage levels and currents as well as timing limits, slopes and line and message signals. The necessary measurement instruments are defined in Annex A.1.1 and the necessary measurement circuits are defined in Annex A.1.2.

Physical layer tests are carried out at room temperature (15 °C to 35 °C). However, the tests shall pass within the whole operating temperature range for a Device specified by the manufacturer.

5.2 Static parameters of the Master interface

5.2.1 DC supply current capability of Master L+ port

Table 9 defines the test conditions for this test case.

Table 9 – DC supply current capability of Master L+ port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0001
Name	TCM_PHYL_INTF_ISM
Purpose (short)	Test of DC supply current capability at Master port
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6
Configuration / setup	The supply current at the Master port is monitored.

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Driver capability of the Master port L+ supply. Monitor supply current drawn from the Master port.
Precondition	Master port set to SIO mode. L+ supply is switched on.
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply maximum dc supply current load (current sink 200 mA) to L+ terminal c) Monitor current ISM from L+ terminal d) Check if ISM is constantly flowing for 30 s e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	The supply current shall not be interrupted by the Master.
Test passed	Current ISM is constantly flowing
Test failed (examples)	Current ISM is interrupted
Results	ISM capability (VSM = 20 V): <pass/fail> ISM capability (VSM = 30 V): <pass/fail>

5.2.2 Power-On supply current capability of Master L+ port

Table 10 defines the test conditions for this test case.

Table 10 – Power-On supply current capability of Master L+ port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0002
Name	TCM_PHYL_INTF_ISIRM
Purpose (short)	Test of power-on / port turn-on supply current capability at Master port
Equipment under test (EUT)	Master and Legacy Master (see B.2).
Test case version	1.1
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6
Configuration / setup	The supply current at the Master port is monitored (see A.1.2.2)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Driver capability of the Master port L+ supply at power-on or switch-on of Port L+ line. Monitor supply current drawn from the Master port.
Precondition	Master port in SIO mode
Procedure	a) Apply minimum voltage for power supply of the Master (VSM = 20 V) b) Apply resistive load with 1 Ohm to L+ terminal c) Monitor current ISIRM from L+ terminal d) Check if ISIRM (min. 400 mA) is flowing for a minimum of 50 ms e) Repeat test with maximum voltage (VSM = 30 V) and an appropriate load
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The supply current shall not be interrupted by the Master.
Test passed	Current ISIRM is flowing for a minimum of 50 ms after switching-on power supply
Test failed (examples)	Current ISIRM is interrupted before 50 ms after switching-on power supply (see B.2).
Results	ISM capability (VSM = 20 V): <pass/fail> ISM capability (VSM = 30 V): <pass/fail>

5.2.3 Load current at Master C/Q port

Table 11 defines the test conditions for this test case.

Table 11 – Load current at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0003
Name	TCM_PHYL_INTF_ILLM
Purpose (short)	Test of load current at C/Q of Master port
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6
Configuration / setup	The input current at C/Q at the Master port is monitored
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Load or discharge current at the Master port C/Q output in input mode. Monitor current flowing into C/Q terminal.
Precondition	Master port set SIO mode – digital input
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply voltage VIM at C/Q terminal of 5 V c) Measure current ILLM into C/Q d) Check whether ILLM is below 15 mA e) Apply voltage VIM at C/Q terminal of 5,1 V f) Measure current ILLM into C/Q g) Check whether ILLM is between 5 mA and 15 mA h) Apply voltage VIM at C/Q terminal of 15 V i) Measure current ILLM into C/Q j) Check whether ILLM is between 5 mA and 15 mA k) Apply voltage VIM = VSM at C/Q terminal l) Measure current ILLM into C/Q m) Check whether ILLM is between 5 mA and 15 mA n) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The supply current shall not exceed specified limits.
Test passed	Current ILLM is ≤ 15 mA Current ILLM is ≥ 5 mA for VIM = 5,1 V, 15 V, and VSM
Test failed (examples)	Current ILLM is > 15 mA Current ILLM is < 5 mA for VIM = 5,1 V, 15 V, and VSM
Results	ILLM (VIM = 5 V, VSM = 20 V): <value> <pass/fail> ILLM (VIM = 5,1 V, VSM = 20 V): <value> <pass/fail> ILLM (VIM = 15 V, VSM = 20 V): <value> <pass/fail> ILLM (VIM = VSM = 20 V): <value> <pass/fail> ILLM (VIM = 5 V, VSM = 30 V): <value> <pass/fail> ILLM (VIM = 5,1 V, VSM = 30 V): <value> <pass/fail> ILLM (VIM = 15 V, VSM = 30 V): <value> <pass/fail> ILLM (VIM = VSM = 30 V): <value> <pass/fail>

5.2.4 High-side residual voltage at Master C/Q port

Table 12 defines the test conditions for this test case.

Table 12 – High-side residual voltage at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0004
Name	TCM_PHYL_INTF_VREShigh
Purpose (short)	Test of static high-side driver capability
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6
Configuration / setup	The output level at the Master C/Q output is measured.
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Driver capability of the Master port high-side driver. Measurement of the voltage drop between positive supply L+ and C/Q output.
Precondition	Master set to SIO mode – digital output C/Q output is high
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply maximum DC driver load (current sink - Master specification) to C/Q c) Measure voltage VRQHM between positive supply L+ and C/Q d) Check whether VRQHM is lower than the limit of 3 V e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The output level shall be within specified limits.
Test passed	Voltage VRQHM less than or equal specification value (≤ 3,0 V)
Test failed (examples)	Voltage VRQHM greater than specification value (> 3,0 V)
Results	VRQHM (VSM = 20 V): <value> VRQHM (VSM = 30 V): <value>

5.2.5 Low-side residual voltage at Master C/Q port

Table 13 defines the test conditions for this test case.

Table 13 – Low-side residual voltage at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0005
Name	TCM_PHYL_INTF_VRESLOW
Purpose (short)	Test of static low-side driver capability
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6
Configuration / setup	The output level at the Master C/Q output is measured.
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Driver capability of the Master port low-side driver. Measurement of the voltage drop between C/Q output and negative supply L-.
Precondition	a) Master set to SIO mode – digital output b) C/Q output is low
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply maximum DC driver load (current source - Master specification) to C/Q c) Measure voltage VRQLM between negative supply L- and C/Q d) Check whether VRQLM is lower than the limit of 3 V e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The output level shall be within specified limits.
Test passed	Voltage VRQLM less than or equal specification value (≤ 3,0 V)
Test failed (examples)	Voltage VRQLM greater than specification value (> 3,0 V)
Results	VRQLM (VSM = 20 V): <value> VRQLM (VSM = 30 V): <value>

5.2.6 High-level input threshold voltage at Master C/Q port

Table 14 defines the test conditions for this test case.

Table 14 – High-level input threshold voltage at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0006
Name	TCM_PHYL_INTF_VTHHM
Purpose (short)	Test of static input high-level threshold at C/Q
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.2, Table 5
Configuration / setup	The digital input signal for C/Q input is monitored
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Measurement of the threshold voltage for high-level at the C/Q terminal.
Precondition	Master set to SIO mode – digital input
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Sweep voltage VIM at C/Q from 5 V to 15 V c) Monitor digital input signal from C/Q d) Measure VIM for transition of digital input signal 'low'→'high' e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The input signal transition shall be 'low'→'high'
Test passed	Voltage VIM within specification value of VTHHM (10,5 to 13,0 V)
Test failed (examples)	Voltage VIM outside specification value of VTHHM (10,5 to 13,0 V)
Results	VIM@VTHHM (VSM = 20 V): <value> VIM@VTHHM (VSM = 30 V): <value>

5.2.7 Low-level input threshold voltage at Master C/Q port

Table 15 defines the test conditions for this test case.

Table 15 – Low-level input threshold voltage at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0007
Name	TCM_PHYL_INTF_VTHLM
Purpose (short)	Test of static input low-level threshold at C/Q
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.2, Table 5
Configuration / setup	The digital input signal for C/Q input is monitored
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Measurement of the threshold voltage for low-level at the C/Q terminal.
Precondition	Master set to SIO mode – digital input
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Sweep voltage VIM at C/Q from 15 V to 5 V c) Monitor digital input signal from C/Q d) Measure VIM for transition of digital input signal 'high'→'low' e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The input signal transition shall be 'high'→'low'
Test passed	Voltage VIM within specification value of VTHLM (8,0 to 11,5 V)
Test failed (examples)	Voltage VIM outside specification value of VTHLM (8,0 to 11,5 V)
Results	VIM@VTHLM (VSM = 20 V): <value> VIM@VTHLM (VSM = 30 V): <value>

5.2.8 Input hysteresis voltage at Master C/Q port

Table 16 defines the test conditions for this test case.

Table 16 – Input hysteresis voltage at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0008
Name	TCM_PHYL_INTF_VHYSM
Purpose (short)	Calculation of input hysteresis at C/Q
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.2, Table 5
Configuration / setup	Comparison of values from SDCI_TC_0006 and SDCI_TC_0007
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Calculation of the hysteresis voltage at the C/Q terminal.
Precondition	Test T_PHY_MST_VTHHM passed Test T_PHY_MST_VTHLM passed
Procedure	-
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	VHYSM = value(T_PHY_MST_VTHHM) - value(T_PHY_MST_VTHLM)
Test passed	Voltage VHYSM is ≥ 0 V
Test failed (examples)	Voltage VHYSM is < 0 V
Results	VHYSM (VSM = 20 V): <value> VHYSM (VSM = 30 V): <value>

5.2.9 High-side peak current capability at Master C/Q port

Table 17 defines the test conditions for this test case.

Table 17 – High-side peak current capability at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0009
Name	TCM_PHYL_INTF_IQPKHM
Purpose (short)	Test of high-side peak current driver capability
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6
Configuration / setup	The output level at the Master C/Q output is measured.

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Peak current driver capability of the Master port high-side driver (wake-up request). Measurement of the voltage between negative supply L- and C/Q output. The driver shall drive a defined resistive load to a voltage level greater than the input high threshold level.
Precondition	Master set to SIO mode
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply an equivalent resistive load Rload between C/Q and L-: Rload = VTHHDmax / IQPKMmin; *Rload = 13 V / 0,5 A = 26 Ohm (51 Ohm shunted by 51 Ohm)* c) Set Master to IO-Link-Mode (generate WURQ) d) Measure voltage VIM between negative supply L- and C/Q at TWU_{min} = 75 µs after voltage has exceeded the 13 V threshold d) Check whether VIM is greater than the maximum limit of VTHHD (> 13 V) e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	The output level shall be within specified limits.
Test passed	Voltage VIM greater than or equal specification value of VTHHDmax (≥ 13,0 V)
Test failed (examples)	Voltage VIM less than specification value of VTHHDmax (< 13,0 V)
Results	VIM (VSM = 20 V): <value> VIM (VSM = 30 V): <value>

5.2.10 Low-side peak current capability at Master C/Q port

Table 18 defines the test conditions for this test case.

Table 18 – Low-side peak current capability at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0010
Name	TCM_PHYL_INTF_IQPKLM
Purpose (short)	Test of low-side peak current driver capability
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6
Configuration / setup	The output level at the Master C/Q output is measured.
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Peak current driver capability of the Master port low-side driver (wake-up request). Measurement of the voltage between negative supply L- and C/Q output. The driver shall drive a defined resistive load to a voltage level less than the input low threshold level.
Precondition	Master set to SIO mode
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply an equivalent resistive load Rload between C/Q and L+: Rload = (VSM-VTHLDmin) / IQPKMmin; *VSM = 20 V: Rload = 12 V / 0,5 A = 24 Ohm (47 Ohm shunted by 51 Ohm)* *VSM = 30 V: Rload = 22 V / 0,5 A = 44 Ohm (82 Ohm shunted by 100 Ohm)* c) Set Master to IO-Link-Mode (generate WURQ) d) Measure voltage VIM between negative supply L- and C/Q at TWU_{min} = 75 µs after voltage has dropped below the 8 V threshold d) Check whether VIM is less than the minimum limit of VTHLD (< 8 V) e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The output level shall be within specified limits.
Test passed	Voltage VIM less than or equal specification value of $VTHLD_{min}$ (≤ 8,0 V)
Test failed (examples)	Voltage VIM greater than specification value of $VTHLD_{min}$ (> 8,0 V)
Results	VIM (VSM = 20 V): <value> VIM (VSM = 30 V): <value>

5.2.11 Permissible voltage range at Master C/Q port

Table 19 defines the test conditions for this test case.

Table 19 – Permissible voltage range at Master C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0299
Name	TCM_PHYL_INTF_VOLTRANGECQ
Purpose (short)	Test of permissible voltage range at Master C/Q port
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.2, Table 5, VIL and VIH
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The receiver behaviour at signal voltages close to the supply voltages is tested. Measurement of the voltage at the C/Q terminal with reference to the positive supply L+ and negative supply L- with voltages applied to C/Q via a series resistance.
Precondition	Master set to SIO mode – digital input
Procedure	a) Apply maximum supply voltage (VSM = 30 V) to Master b) Apply voltage of 0V between C/Q and L+ via a series resistance of 1 Ohm for at least 1 min c) Apply voltage of 0V between C/Q and L- via a series resistance of 1 Ohm for at least 1 min d) Attach a Device conform to [9] and perform communication
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check communication
Test passed	Communication established
Test failed (examples)	Communication not established
Results	Communication established : <yes/no> <passed/failed>

5.3 Static parameters of the Device interface

5.3.1 Power supply current consumption of the Device

Table 20 defines the test conditions for this test case.

Table 20 – Power supply current consumption of the Device

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0011
Name	TCD_PHYL_INTF_ISD
Purpose (short)	Test of static power supply current consumption
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6
Configuration / setup	The supply current at the Device C/Q L+ terminal is measured.
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Static worst case current consumption of the Device (only applicable to Devices without auxiliary power supply).
Precondition	Device is set to Device specific mode with maximum current consumption. Device is set to SDCI Mode (cyclic operation with MinCycleTime)
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to the Device b) Set Device to SIO mode c) Measure current at L+ terminal ISDSIOmax d) Check whether ISDSIOmax is lower than the limit of 200 mA e) Set Device to SDCI mode (OPERATE mode with MinCycleTime) f) Measure current at L+ terminal ISDIOLmax g) Check whether ISDIOLmax is lower than the limit of 200 mA h) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The current shall not exceed the limits specified in [9] for the Master
Test passed	Current ISDSIOmax and ISDIOLmax ≤ specified value (200 mA)
Test failed (examples)	Current ISDSIOmax and ISDIOLmax ≥ specified value (200 mA)
Results	ISDSIOmax (VSD = 18 V): <value> ISDSIOmax (VSD = 30 V): <value> ISDIOLmax (VSD = 18 V): <value> ISDIOLmax (VSD = 30 V): <value>

5.3.2 Power-on behavior of the Device

Table 21 defines the test conditions for this test case.

Table 21 – Power-on behavior of the Device

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0012
Name	TCD_PHYL_INTF_ISIRD
Purpose (short)	Test of power-on current consumption and behavior
Equipment under test (EUT)	Device and Legacy-Device (see B.3)
Test case version	1.1
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.3, Table 6 and 5.4.1, Table 10
Configuration / setup	The Device is powered by a supply defined by the Master parameter ISIRM.
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Device behavior at power-on is verified with worst-case power supply according to Master specification ISIRM (only applicable to Devices without auxiliary power supply).
Precondition	Device is powered off and attached to a current supply, which simulates the minimum requirements for a Master port (see A.1.2.2).
Procedure	a) Turn on power supply (VSD = 18 V) with attached Device b) Monitor current at L+ terminal ISDmax c) Check whether ISDmax (50 ms) is lower than the limit of 200 mA after 50 ms d) Check whether Device is functional according to the Device's specific default power-on operation after 300 ms e) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The Device shall start-up into its default power-on operation.
Test passed	Current ISDmax (50 ms) is ≤ specified value for ISM (200 mA) and Device is in power-on default operation
Test failed (examples)	Current ISDmax (50 ms) is > specified value for ISM (200 mA) or Device is not in power-on default operation (see B.3)
Results	ISDmax(50 ms) (VSD = 18 V): <value> Power-On default operation (VSD = 18 V): <pass/fail> ISDmax(50 ms) (VSD = 30 V): <value> Power-On default operation (VSD = 30 V): <pass/fail>

5.3.3 High-side residual voltage at Device C/Q port

Table 22 defines the test conditions for this test case. This test case is only applicable for Devices with SIO mode or Devices where the output driver can be stimulated as if in SIO mode (e.g. via ASICs).

Table 22 – High-side residual voltage at Device C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0013
Name	TCD_PHYL_INTF_VRESHIGH
Purpose (short)	Test of static high-side driver capability
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.4, Table 7
Configuration / setup	The output level at the Device C/Q output is measured.

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Driver capability of the Device high-side driver (only applicable for Devices with SIO-Mode or Devices where the output driver, e.g. ASIC, can be stimulated to SIO-Mode). Measurement of the voltage drop between positive supply L+ and C/Q output.
Precondition	Device is set to SIO mode; C/Q output is high.
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Device b) Apply minimum DC driver load (current sink 50 mA) to C/Q c) Measure voltage VRQHD between positive supply L+ and C/Q d) Check whether VRQHD is lower than the limit of 3 V e) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	The output level shall be within specified limits.
Test passed	Voltage VRQHD ≤ specified value (3,0 V)
Test failed (examples)	Voltage VRQHD > specified value (3,0 V)
Results	VRQHD (VSD = 18 V): <value> VRQHD (VSD = 30 V): <value>

5.3.4 Low-side residual voltage at Device C/Q port

Table 23 defines the test conditions for this test case. This test case is only applicable for Devices with SIO mode or Devices where the output driver can be stimulated as if in SIO mode (e.g. via ASICs).

Table 23 – Low-side residual voltage at Device C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0014
Name	TCD_PHYL_INTF_VRESLOW
Purpose (short)	Test of static low-side driver capability
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.4, Table 7
Configuration / setup	The output level at the Device C/Q output is measured.
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Driver capability of the Device low-side driver (only applicable for Devices with SIO-Mode or Devices where the output driver, e.g. ASIC, can be stimulated to SIO-Mode). Measurement of the voltage drop between C/Q output and negative supply L-.
Precondition	Device set to SIO-Mode; C/Q output is low.
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Device b) Apply minimum DC driver load (current source 50 mA) to C/Q c) Measure voltage VRQLD between negative supply L- and C/Q d) Check whether VRQLD is lower than the limit of 3 V e) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The output level shall be within specified limits.
Test passed	Voltage VRQLD ≤ specified value (3,0 V)
Test failed (examples)	Voltage VRQLD > specified value (3,0 V)
Results	VRQLD (VSD = 18 V): <value> VRQLD (VSD = 30 V): <value>

5.3.5 Pull-down or residual current at C/Q port

Table 24 defines the test conditions for this test case.

Table 24 – Pull-down or residual current at C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0015
Name	TCD_PHYL_INTF_IQQD
Purpose (short)	Test of static residual current
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.4, Table 7
Configuration / setup	Current measurements at C/Q terminal in receive mode or the output driver being disabled.
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The current flowing into C/Q is measured with the C/Q output being in receive mode or the output driver being disabled.
Precondition	Device C/Q port is set to a receive mode or inactive mode
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Device b) Apply test voltage to C/Q of input threshold high voltage (VTHHD = 13 V) c) Measure current flowing at C/Q port IQQD d) Check whether IQQD is lower than the limit of 15 mA e) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The residual current shall be within specified limits.
Test passed	Current IQQD ≤ specified value (15 mA)
Test failed (examples)	Current IQQD > specified value (15 mA)
Results	IQQD (VSD = 18 V): <value> IQQD (VSD = 30 V): <value>

5.3.6 High-level input threshold voltage at Device C/Q port

Table 25 defines the test conditions for this test case.

Table 25 – High-level input threshold voltage at Device C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0016
Name	TCD_PHYL_INTF_VTHHD
Purpose (short)	Test of statical input high-level threshold at C/Q
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.2, Table 5
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Measurement of the threshold voltage for high-level at the C/Q terminal. The digital input signal for C/Q input is monitored. The test input signal / indicator transition shall be ‘low’→’high. This test is only applicable for Devices with physical layer test mode.
Precondition	Device set to PL test mode – digital input
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Device b) Sweep voltage VID at C/Q from 5 V to 15 V c) Monitor test input signal / indicator derived from input signal at C/Q d) Measure VID for transition of test signal ‘low’→’high’ e) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	Voltage VID within specification value of VTHHD (10,5 to 13,0 V)
Test failed (examples)	Voltage VID outside specification value of VTHHD (10,5 to 13,0 V)
Results	VID@VTHHD (VSD = 18 V): <value>, <pass/fail> VID@VTHHD (VSD = 30 V): <value>, <pass/fail>

507 ### 5.3.7 Low-level input threshold voltage at Device C/Q port

508 Table 26 defines the test conditions for this test case.

509 **Table 26 – Low-level input threshold voltage at Device C/Q port**

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0017
Name	TCD_PHYL_INTF_VTHLD
Purpose (short)	Test of statical input low-level threshold at C/Q
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.2, Table 5
Configuration / setup	-

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TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Measurement of the threshold voltage for low-level at the C/Q terminal. The test input signal / indicator for C/Q input is monitored. The input signal transition shall be 'high'→'low'. This test is only applicable for Devices with physical layer test mode.
Precondition	Device set to PL test mode – digital input
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Device b) Sweep voltage VID at C/Q from 15 V to 5 V c) Monitor test input signal / indicator derived from input signal at C/Q d) Measure VID for transition of digital input signal 'high'→'low' e) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-

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TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	Voltage VID within specification value of VTHLD (8,0 to 11,5 V)
Test failed (examples)	Voltage VID outside specification value of VTHLD (8,0 to 11,5 V)
Results	VID@VTHLD (VSD = 18 V): <value> VID@VTHLD (VSD = 30 V): <value>

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5.3.8 Input hysteresis voltage at Device C/Q port

Table 27 defines the test conditions for this test case.

Table 27 – Input hysteresis voltage at Device C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0018
Name	TCD_PHYL_INTF_VHYSD
Purpose (short)	Calculation of input hysteresis at C/Q
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.2, Table 5
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Calculation of the hysteresis voltage at the C/Q terminal via the values of TCD_PHYL_INTF_VTHHD and TCD_PHYL_INTF_VTHLD. This test is only applicable for Devices with physical layer test mode.
Precondition	a) Test TCD_PHYL_INTF_VTHHD (SDCI_TC_0016) passed b) Test TCD_PHYL_INTF_VTHLD (SDCI_TC_0017) passed
Procedure	-
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	VHYSD = value(TCD_PHYL_INTF_VTHHD) - value(TCD_PHYL_INTF_VTHLD)
Test passed	Voltage VHYSD is greater than or equal 0 V
Test failed (examples)	Voltage VHYSD is less than 0 V
Results	VHYSD (VSD = 18 V): <value> VHYSD (VSD = 30 V): <value>

5.3.9 High-side DC driver limit at Device C/Q port

Table 28 defines the test conditions for this test case. This test case is only applicable for Devices with SIO mode or Devices where the output driver can be stimulated as if in SIO mode (e.g. via ASICs).

Table 28 – High-side DC driver limit at Device C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0019
Name	TCD_PHYL_INTF_IQHD
Purpose (short)	Test of statical high-side driver capability limit
Equipment under test (EUT)	Device and Legacy-Device with SIO mode
Test case version	1.1
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.4, Table 7
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Driver capability limit of the Device high-side driver. Measurement of the current flowing out of the C/Q output. The output current shall not statically flow. This test is only applicable for Devices with SIO-Mode or Devices where the output driver, e.g. ASIC, can be stimulated to SIO-Mode).
Precondition	a) Device set to SIO mode b) C/Q output is high
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Device b) Apply maximum DC driver load (current sink > 500 mA) to C/Q c) Measure current IQHD at C/Q output d) Check if IQHD is exceeding the specified limit e) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	Current IQHD is less than or equal the driver limit (DC current ≤ 500 mA)
Test failed (examples)	Current IQHD is greater than driver limit (DC current > 501 mA)
Results	IQHD (VSD = 18 V): <passed/failed> IQHD (VSD = 30 V): <passed/failed>

5.3.10 Low-side DC driver limit at Device C/Q port

Table 29 defines the test conditions for this test case. This test case is only applicable for Devices with SIO mode or Devices where the output driver can be stimulated as if in SIO mode (e.g. via ASICs).

Table 29 – Low-side DC driver limit at Device C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0020
Name	TCD_PHYL_INTF_IQLD
Purpose (short)	Test of statical low-side driver capability limit
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.4, Table 7
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Driver capability limit of the Device low-side driver. The output current at the Device C/Q port is measured. The specified output current limit shall not be exceeded. This test is only applicable for Devices with SIO-Mode or Devices where the output driver, e.g. ASIC, can be stimulated to SIO-Mode).
Precondition	a) Device set to SIO mode b) C/Q output is low
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Device b) Apply maximum DC driver load (current source > 500 mA) to C/Q c) Measure current IQLD at C/Q output d) Check if IQLD is exceeding the specified limit e) Repeat test with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Current IQLD is less than or equal to the driver limit (DC current ≤ 500 mA)
Test failed (examples)	Current IQLD is greater than the driver limit (DC current > 500 mA)
Results	IQLD (VSD = 18 V): <passed/failed> IQLD (VSD = 30 V): <passed/failed>

5.3.11 Permissible voltage range at Device C/Q port

Table 30 defines the test conditions for this test case.

Table 30 – Permissible voltage range at Device C/Q port

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0300
Name	TCD_PHYL_INTF_VOLTRANGECQ
Purpose (short)	Test of permissible voltage range at Device C/Q port
Equipment under test (EUT)	Device and Legacy Device
Test case version	1.0
Category / type	Device Physical Layer; test to pass (positive testing)
Specification (clause)	[9], see 5.3.2.2, Table 5, VIL and VIH
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The receiver behavior at signal voltages exceeding the supply voltages is tested. Measurement of the voltage at the C/Q terminal with reference to the positive supply L+ and negative supply L- with voltages applied via a series resistance above or below the supply voltages.
Precondition	a) Device is in SDCI mode b) Disconnect C/Q from Master port c) Device is waiting for reception of SDCI messages (C/Q in receive state)
Procedure	a) Apply maximum supply voltage (VSD = 30 V) to Device b) Apply voltage of +1V between C/Q and L+ via a series resistance of 1 Ohm for at least 1 min c) Apply voltage of -1V between C/Q and L- via a series resistance of 1 Ohm for at least 1 min d) Attach a Master conform to [9] and perform communication
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check communication
Test passed	Communication established
Test failed (examples)	Communication not established
Results	Communication established : <yes/no> <passed/failed>

5.4 Wake-Up generation of the Master interface

5.4.1 Wake-Up current pulse high

Table 31 defines the test conditions for this test case.

Table 31 – Wake-Up current pulse high

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0021
Name	TCM_PHYL_INTF_IQWUH
Purpose (short)	Driver capability of the wake-up pulse – high-side driver
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.3, Table 8
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Master shall drive the resistive load above the threshold high level of a receiver. Measure pulse voltage at Master C/Q port with Master configured for SDCI. The pulse voltage is measured with a resistive load applied between C/Q and L-.
Precondition	Master configured to SDCI mode
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply resistive load Rload between C/Q and L-: Rload = $VTHHM_{max}$ / $IQPKHM_{min}$ *≈ 26 Ohm (51 Ohm shunted by 51 Ohm)* c) Trigger on wake-up request d) Measure voltage at C/Q port during wake-up request d) Check if VIM is exceeding $VTHHM_{max}$ e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	Level at C/Q during wake-up request greater than or equal $VTHHM_{max}$
Test failed (examples)	Level at C/Q during wake-up request less than $VTHHM_{max}$
Results	VIM@WURQ (VSM = 18 V): <value> VIM@WURQ (VSM = 30 V): <value>

5.4.2 Wake-Up pulse duration high

Table 32 defines the test conditions for this test case.

Table 32 – Wake-Up pulse duration high

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0022
Name	TCM_PHYL_INTF_TWUH
Purpose (short)	Wake-Up pulse duration (high pulse)
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.3 Table 8
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Master shall drive the resistive load below the threshold low level of a receiver. Measure the wake-up pulse duration at Master C/Q port with the Master configured to SDCI. The pulse time is measured with a resistive load applied between C/Q and L-. The pulse time is measured at the extreme position of the thresholds.
Precondition	Master configured to SDCI mode
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply resistive load Rload between C/Q and L-: Rload = $VTHHM_{max}$ / $IQPKHM_{min}$ ≈ *26 Ohm (51 Ohm shunted by 51 Ohm)* c) Trigger on wake-up request d) Measure pulse duration TWUH of wake-up request at C/Q port - $TWUH_{min}$: start @ VIM=$VTHHM_{max}$, stop @ VIM=$VTHLM_{max}$ - $TWUH_{max}$: start @ VIM=$VTHHM_{min}$, stop @ VIM=$VTHLM_{min}$ d) Check if $TWUH_{min/max}$ is within specified limits e) Repeat test with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Pulse duration of wake-up request within specified value range (≥ 75 µs, ≤ 85 µs)
Test failed (examples)	Pulse duration of wake-up request outside specified value range (< 75 µs, > 85 µs)
Results	TWUH@WURQ (VSM = 20 V): <value min/max> TWUH@WURQ (VSM = 30 V): <value min/max>

5.4.3 Wake-Up current pulse low

Table 33defines the test conditions for this test case.

Table 33 – Wake-Up current pulse low

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0023
Name	TCM_PHYL_INTF_IQWUL
Purpose (short)	Drive capability of the wake-up pulse – low-side driver
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.3 Table 8
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Master shall drive the resistive load below the threshold low level of a receiver. Measure pulse voltage at Master C/Q port with Master configured to SDCI. The pulse voltage is measured with a resistive load applied between C/Q and L+.
Precondition	Master configured to SDCI mode
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply resistive load Rload between C/Q and L+: Rload = (VSM - $VTHLM_{min}$) / $IQPKLM_{min}$≈ *24 Ohm (47 Ohm shunted by 51 Ohm)* c) Trigger on wake-up request d) Measure voltage at C/Q port during wake-up request d) Check if VIM is below $VTHLM_{min}$ e) Repeat test with maximum supply voltage (VSM = 30 V) to Master: Rload ≈ *44 Ohm (82 Ohm shunted by 100 Ohm)*
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Level at C/Q during wake-up request less than or equal $VTHLM_{min}$
Test failed (examples)	Level at C/Q during wake-up request greater than $VTHLM_{min}$
Results	VIM@WURQ (VSM = 20 V): <value> VIM@WURQ (VSM = 30 V): <value>

5.4.4 Wake-Up pulse duration low

Table 34 defines the test conditions for this test case.

Table 34 – Wake-Up pulse duration low

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0024
Name	TCM_PHYL_INTF_TWUL
Purpose (short)	Wake-Up pulse duration (low pulse)
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.3, Table 8
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Master shall drive the resistive load below the threshold low level of a receiver. Measure the wake-up pulse duration at the Master C/Q port with the Master configured to SDCI. The pulse time is measured with a resistive load applied between C/Q and L+. The pulse time is measured at extreme position of the thresholds.
Precondition	Master configured to SDCI mode
Procedure	a) Apply minimum supply voltage (VSM = 20 V) to Master b) Apply resistive load Rload between C/Q and L+: Rload = (VSM-$VTHLM_{min}$) / $IQPKLM_{min}$ ≈ *24 Ohm (47 Ohm shunted by 51 Ohm)* c) Trigger on wake-up request d) Measure pulse duration TWUL of wake-up request at C/Q port - $TWUL_{min}$: start @ VIM=$VTHLM_{min}$, stop @ VIM=$VTHHM_{min}$ - $TWUL_{max}$: start @ VIM=$VTHLM_{max}$, stop @ VIM=$VTHHM_{max}$ d) Check if $TWUL_{min/max}$ is within specified limits e) Repeat test with maximum supply voltage (VSM = 30 V), Rload ≈ *44 Ohm (82 Ohm shunted by 100 Ohm)*
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	Pulse duration of wake-up request within specified value range (≥ 75 µs, ≤ 85 µs)
Test failed (examples)	Pulse duration of wake-up request outside specified value range (< 75 µs, > 85 µs)
Results	TWUL@WURQ (VSM = 20 V): <value min/max> TWUL@WURQ (VSM = 30 V): <value min/max>

5.5 Wake-Up detection of the Device interface

5.5.1 Wake-Up pulse detection high

Table 35 defines the test conditions for this test case.

Table 35 – Wake-Up pulse detection high

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0025
Name	TCD_PHYL_INTF_TWUH
Purpose (short)	Wake-Up pulse detection capability (high pulse)
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.3, Table 8
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	A wake-up pulse is applied at the Device C/Q port with timing at specified limits. The wake-up request is indicated via a test signal / indicator. The Device reaction is evaluated. This test is only applicable for Devices with physical layer test mode.
Precondition	Device in SIO-mode or after power-on (no communication). C/Q level is brought to low-signal.
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Master b) Apply current pulse with IQWU = $IQPKH_{min}$ (current source) and of TWU_{min} (75 µs) to C/Q. c) Monitor test signal / indicator at Device d) Check if test signal / indicator indicate a wake-up request e) Repeat test with TWU_{max} (85 µs) f) Repeat test ($TWU_{min/max}$) with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Test signal / indicator indicate a received wake-up request
Test failed (examples)	Test signal / indicator do not indicate a received wake-up request
Results	WURQ (VSD = 18 V): <passed/failed> WURQ (VSD = 30 V): <passed/failed>

583 5.5.2 Wake-Up pulse detection low

584 Table 36 defines the test conditions for this test case.

585 **Table 36 – Wake-Up pulse detection low**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0026
Name	TCD_PHYL_INTF_TWUL
Purpose (short)	Wake-Up pulse detection capability (low pulse)
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.3, Table 8
Configuration / setup	-

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	A wake-up pulse is applied at the Device C/Q port with timing at specified limits. The wake-up request is inidicated via a test signal / indicator. The Device reaction is evaluated. This test is only applicable for Devices with SIO-mode and with physical layer test mode.
Precondition	Device in SIO-mode or after power-on (no communication). C/Q level is brought to high-signal.
Procedure	a) Apply minimum supply voltage (VSD = 18 V) to Master b) Apply current pulse with IQWU = $IQPKL_{min}$ (current sink) and of TWU_{min} (75 µs) to C/Q. c) Monitor test signal / indicator at Device d) Check if test signal / indicator indicate a wake-up request e) Repeat test with TWU_{max} (85 µs) f) Repeat test ($TWU_{min/max}$) with maximum supply voltage (VSD = 30 V)
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Test signal / indicator indicate a received wake-up request
Test failed (examples)	Test signal / indicator do not indicate a received wake-up request
Results	WURQ (VSD = 18 V): <passed/failed> WURQ (VSD = 30 V): <passed/failed>

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5.5.3 Wake-Up receive enable delay (C/Q high)

Table 37 defines the test conditions for this test case.

Table 37 – Wake-Up receive enable delay (C/Q high)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0027
Name	TCD_PHYL_INTF_TRENHIGH
Purpose (short)	Detect Receive Enable Delay after Wake-up Request
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.3, Table 8
Configuration / setup	See A.1.2.10 and Figure A.10

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Device shall release the high-side output driver after successful reception of a wake-up request. Measure wake-up receive enable delay of the Device with high signal at C/Q. The delay time is measured with a resistive voltage divider applied between L+ to C/Q and C/Q to L-. This test is only applicable for Devices with SIO mode support or for Devices with physical layer test mode.
Precondition	Device configured to SIO mode
Procedure	a) Apply resistive voltage divider to C/Q ($V_{static} < VTHL_{min}$, *R = 390 Ohm*) b) Apply supply voltage (VSD = 24 V) to Device c) Stimulate Device for SIO mode output signal = high e) Apply wake-up request pulse (negative pulse) d) Measure time TREN between start of wake-up request and level of C/Q = V_{static} e) Check if $TREN_{max}$ is within specified limits
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Delay time TREN within specified value range (≤ 500 µs)
Test failed (examples)	Delay time TREN outside specified value range (> 500 µs)
Results	TREN @ C/Q=high: <value>

5.5.4 Wake-Up receive enable delay (C/Q low)

Table 38 defines the test conditions for this test case.

Table 38 – Wake-Up receive enable delay (C/Q low)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0028
Name	TCD_PHYL_INTF_TRENLOW
Purpose (short)	Detect Receive Enable Delay after Wake-up Request
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.3, Table 8
Configuration / setup	See A.1.2.11 and Figure A.11

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Device shall release the output driver after successful reception of a wake-up request. Measure wake-up receive enable delay of the Device with low signal at C/Q. The delay time is measured with a resistive voltage divider applied between L+ to C/Q and C/Q to L-. The test is only applicable for Devices with SIO mode support and with push-pull output or for Devices with physical layer test mode.
Precondition	Device configured to SIO mode
Procedure	a) Apply resistive voltage divider to C/Q (V_{static} >$VTHH_{max}$, *R = 470 Ohm*) b) Apply supply voltage (VSD = 24 V) to Device c) Stimulate Device for SIO mode output signal = low e) Apply wake-up request pulse (positive pulse) d) Measure time TREN between start of wake-up request and level of C/Q = V_{static} e) Check if $TREN_{max}$ is within specified limits (500 µs)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Delay time TREN within specification (<=500 µs)
Test failed (examples)	Delay time TREN outside specification (>500 µs)
Results	TREN @ C/Q=low: <value>

5.5.5 SDCI readiness delay

Table 39 defines the test conditions for this test case.

Table 39 – SDCI readiness delay

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0029
Name	TCD_PHYL_INTF_TRDL
Purpose (short)	Test SDCI Receive Enable Delay after Power-On
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 5.4.1, Table 9
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Device shall be able to be set to the SDCI mode after the SDCI readiness delay. Measure SDCI readiness delay of the Device after a power-on situation.
Precondition	Master and Device system
Procedure	a) Apply supply voltage (VSD = 24 V) to Device b) Apply a wake-up sequence with a delay of $TRDL_{max}$ after VSD has reached VSD_{min} c) Check if the SDCI mode was entered within the first wake-up sequence
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	SDCI mode was entered
Test failed (examples)	SDCI mode was not entered
Results	SDCI mode @ TRDL: <passed/failed>

5.5.6 Time to return to SIO after failed wake-up

Table 40 defines the test conditions for this test case.

Table 40 – Time to return to SIO after failed wake-up

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0301
Name	TCD_PHYL_INTF_TDELAYTOSIO
Purpose (short)	Check if time T_{DSIO} is within permitted range
Equipment under test (EUT)	Device and Legacy-Device (with SIO-support)
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.2, Table 40
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The delay time T_{DSIO} from an unsuccessful Wake-Up to the return of the Device to the SIO-mode is tested.
Precondition	Master and Device system in SIO-Mode Device with SIO-support stimulated to deliver a ‘H’-level at C/Q
Procedure	a) Apply single WURQ to Device b) Monitor signal at C/Q c) Measure time T_{DSIO} from WURQ to transition to stable ’H’-level at C/Q d) Repeat steps a) to c) 5 times
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The time T_{DSIO} at all 6 measurements shall be within specified limits. Evaluate minimum and maximum values from all measured times T_{DSIO}
Test passed	SIO delay: 60 ms ≤ T_{DSIO} ≤ 300 ms
Test failed (examples)	SIO delay: T_{DSIO} < 60 ms or T_{DSIO} > 300 ms
Results	T_{DSIO} : <passed/failed> $T_{DSIOmin}$: <value> $T_{DSIOmax}$: <value>

5.5.7 Time to Fallback after Master command

Table 41 defines the test conditions for this test case.

Table 41 – Time to Fallback after Master command

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0302
Name	TCD_PHYL_INTF_TTOFALLBACK
Purpose (short)	Check if time T_{FBD} is within permitted range
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.3, Table 41
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The time T_{FBD} from a confirmed MasterCommand "Fallback" to the return of the Device to the SIO-mode is tested.
Precondition	Master and Device system in SIO-Mode Device with SIO-support stimulated to deliver a ‘H’-level at C/Q
Procedure	a) Set Device to SDCI OPERATE mode b) Set Device to SIO mode (apply "Fallback" Master command) c) Monitor level at C/Q d) Measurement of time T_{FBD} from end of the first Device reply message to a Master write message with MasterCommand "Fallback" and the transition to stable ’H’-level at C/Q e) Repeat steps b) to d) with Device set to SDCI PREOPERATE mode (SDCI V1.1 only)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The time T_{FBD} for all measurements shall be within specified limits.
Test passed	Fallback delay @ OPERATE 3 MasterCycleTime $\leq T_{FBD} \leq$ 500 ms, and (if applicable) Fallback delay @ PREOPERATE 3 Tinitcyc $\leq T_{FBD} \leq$ 500 ms
Test failed (examples)	Fallback delay @ OPERATE T_{FBD} < 3 MasterCycleTime or T_{FBD} > 500 ms and (if applicable) Fallback delay @ PREOPERATE T_{FBD} < 3 Tinitcyc or T_{FBD} > 500 ms
Results	Fallback delay @ OPERATE: T_{FBD} < value> <passed/failed> Fallback delay @ PREOPERATE: T_{FBD} < value> <passed/failed>

5.6 Dynamic parameters of the Master and Device interface

5.6.1 Bit eye-diagram with maximum load (Master)

Table 42 defines the test conditions for this test case.

Table 42 – Bit eye-diagram with maximum load (Master)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0030
Name	TCM_PHYL_INTF_BITEYEMAXLOAD
Purpose (short)	Eye-diagram of ‘low’ and ‘high’ bits
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master physical layer test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.2, Figure 18
Configuration / setup	See A.1.2.13 and Figure A.13
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The waveform shall meet the requirements of the eye diagram under maximum line load conditions. Test waveform for bits at the C/Q terminal on the receiver side with a maximum permissible line load applied.
Precondition	Master and Device system
Procedure	a) Attach line simulation (l = 20 m) with maximum load values (C_{max} = 3 nF, R_{max} = 6 Ohm (loop)) b) Attach test Device with COM2 capability and CQD = 10 nF c) Apply minimum supply voltage (VSM = 20 V) d) Set Master to SDCI mode e) Check bit waveform on the receiver side f) Repeat with maximum supply voltage (VSM = 30 V) g) Repeat steps c) to f) with a test Device with COM3 capability and CQD = 1 nF
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	Bit waveforms meet requirements of the eye-diagram
Test failed (examples)	Bit waveforms do not meet requirements of the eye-diagram
Results	Bit eye-diagram @ maximum load (VSM = 20 V): <passed/failed> Bit eye-diagram @ maximum load (VSM = 30 V): <passed/failed>

5.6.2 Bit eye-diagram with maximum load (Device)

Table 42 defines the test conditions for this test case.

Table 43 – Bit eye-diagram with maximum load (Device)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0294
Name	TCD_PHYL_INTF_BITEYEMAXLOAD
Purpose (short)	Eye-diagram of ‘low’ and ‘high’ bits
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device physical layer test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.2, Figure 18
Configuration / setup	See A.1.2.13 and Figure A.13
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The waveform shall meet the requirements of the eye diagram under maximum line load conditions. Test waveform for bits at the C/Q terminal on the receiver side with a maximum permissible line load applied.
Precondition	Master and Device system
Procedure	a) Attach line simulation (l = 20 m) with maximum load values (C_{max} = 3 nF, R_{max} = 6 Ohm (loop)) b) Attache test Master with CQD = 1 nF c) Apply minimum supply voltage (VSM = 20 V) c) Set Master to SDCI mode d) Check bit waveform on the receiver side e) Repeat with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	Bit waveforms meet requirements of the eye-diagram
Test failed (examples)	Bit waveforms do not meet requirements of the eye-diagram
Results	Bit eye-diagram @ maximum load (VSM = 20 V): <passed/failed> Bit eye-diagram @ maximum load (VSM = 30 V): <passed/failed>

5.6.3 Bit eye-diagram with minimum load (Master)

Table 44 defines the test conditions for this test case.

Table 44 – Bit eye-diagram with minimum load (Master)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0031
Name	TCM_PHYL_INTF_BITEYEMINLOAD
Purpose (short)	Eye-diagram of ‘low’ and ‘high’ bits
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master physical layer test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.2, Figure 18
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The waveform shall meet the requirements of the eye-diagram under minimum line load conditions. Test waveform for bits at the C/Q terminal on the receiver side with an applied minimum line load.
Precondition	Master and Device system
Procedure	a) Attach line simulation (l = 0,5 m) with minimum load values (C_{max} < 50 pF, R_{max} = 100 mOhm (loop)) b) Attach test Device with CQD < 500 pF c) Apply minimum supply voltage (VSM = 20 V) d) Set Master to SDCI mode e) Check bit waveforms on the receiver side f) Repeat with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Bit waveforms meet requirements of the eye-diagram
Test failed (examples)	Bit waveforms do not meet requirements of the eye-diagram
Results	Bit eye-diagram @ minimum load (VSM = 20 V): <passed/failed> Bit eye-diagram @ minimum load (VSM = 30 V): <passed/failed>

5.6.4 Bit eye-diagram with minimum load (Device)

Table 44 defines the test conditions for this test case.

Table 45 – Bit eye-diagram with minimum load (Device)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0295
Name	TCD_PHYL_INTF_BITEYEMINLOAD
Purpose (short)	Eye-diagram of ‘low’ and ‘high’ bits
Equipment under test (EUT)	Device and Legacy Device
Test case version	1.0
Category / type	Device physical layer test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.2, Figure 18
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The waveform shall meet the requirements of the eye-diagram under minimum line load conditions. Test waveform for bits at the C/Q terminal on the receiver side with an applied minimum line load.
Precondition	Master and Device system
Procedure	a) Attach line simulation (l = 0,5 m) with minimum load values (C_{max} < 50 pF, R_{max} = 100 mOhm (loop)) b) Attach test Master with CQD < 500 pF c) Apply minimum supply voltage (VSM = 20 V) d) Set Master to SDCI mode e) Check bit waveforms on the receiver side f) Repeat with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	-
Test passed	Bit waveforms meet requirements of the eye-diagram
Test failed (examples)	Bit waveforms do not meet requirements of the eye-diagram
Results	Bit eye-diagram @ minimum load (VSM = 20 V): <passed/failed> Bit eye-diagram @ minimum load (VSM = 30 V): <passed/failed>

654 **5.6.5 UART frame eye-diagram with maximum load (Master)**

655 Table 46 defines the test conditions for this test case.

656 **Table 46 – UART frame eye-diagram with maximum load (Master)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0032
Name	TCM_PHYL_INTF_UARTEYEMAXLOAD
Purpose (short)	Eye-diagram of the UART frame
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.1
Category / type	Master physical layer test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.2, Figure 19
Configuration / setup	See A.1.2.13 and Figure A.13

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The waveform shall meet the requirements of the eye-diagram under maximum line load conditions. Test waveform for UART frame at the C/Q terminal on the receiver side with an applied maximum permissible line load.
Precondition	Master and Device system
Procedure	a) Attach line simulation (l = 20 m) with maximum load values (C_{max} = 3 nF, R_{max} = 6 Ohm (loop)) b) Attach test Device with COM2 capability and CQD = 10 nF c) Apply minimum supply voltage (VSM = 20 V) d) Set Master to SDCI mode e) Check UART frame waveform on the receiver side f) Repeat with maximum supply voltage (VSM = 30 V) g) Repeat steps c) to f) with a test Device with COM3 capability and CQD = 1 nF
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Bit waveforms meet requirements of the eye-diagram
Test failed (examples)	Bit waveforms do not meet requirements of the eye-diagram
Results	UART frame eye-diagram @ maximum load (VSM = 20 V): <passed/failed> UART frame eye-diagram @ maximum load (VSM = 30 V): <passed/failed>

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5.6.6 UART frame eye-diagram with maximum load (Device)

Table 46 defines the test conditions for this test case.

Table 47 – UART frame eye-diagram with maximum load (device)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0296
Name	TCD_PHYL_INTF_UARTEYEMAXLOAD
Purpose (short)	Eye-diagram of the UART frame
Equipment under test (EUT)	Device and Legacy Device
Test case version	1.1
Category / type	Device physical layer test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.2, Figure 19
Configuration / setup	See A.1.2.13 and Figure A.13

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The waveform shall meet the requirements of the eye-diagram under maximum line load conditions. Test waveform for UART frame at the C/Q terminal on the receiver side with an applied maximum permissible line load.
Precondition	Master and Device system
Procedure	a) Attach line simulation (l = 20 m) with maximum load values (C_{max} = 3 nF, R_{max} = 6 Ohm (loop)) b) Attach test Master with CQD = 1 nF c) Apply minimum supply voltage (VSM = 20 V) d) Set Master to SDCI mode e) Check UART frame waveform on the receiver side f) Repeat with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Bit waveforms meet requirements of the eye-diagram
Test failed (examples)	Bit waveforms do not meet requirements of the eye-diagram
Results	UART frame eye-diagram @ maximum load (VSM = 20 V): <passed/failed> UART frame eye-diagram @ maximum load (VSM = 30 V): <passed/failed>

668 ### 5.6.7 UART frame eye-diagram with minimum load (Master)

669 Table 48 defines the test conditions for this test case.

670 **Table 48 – UART frame eye-diagram with minimum load (Master)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0033
Name	TCM_PHYL_INTF_UARTEYEMINLOAD
Purpose (short)	Eye-diagram of UART frame
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master physical layer test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.2, Figure 19
Configuration / setup	-

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The waveform shall meet the requirements of the eye-diagram under minimum line load conditions. Test waveform for UART frame at the C/Q terminal on the receiver side with an applied minimum line load.
Precondition	Master and Device system
Procedure	a) Attach line simulation (l = 0,5 m) with minimum load values (C_{max} < 50 pF, R_{max} = 100 mOhm (loop)) b) Attach test Device with CQD < 500 pF c) Apply minimum supply voltage (VSM = 20 V) d) Set Master to SDCI mode e) Check UART frame waveform on the receiver side f) Repeat with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Bit waveforms meet requirements of the eye-diagram
Test failed (examples)	Bit waveforms do not meet requirements of the eye-diagram
Results	UART frame eye-diagram @ minimum load (VSM = 20 V): <passed/failed> UART frame eye-diagram @ minimum load (VSM = 30 V): <passed/failed>

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5.6.8 UART frame eye-diagram with minimum load (Device)

Table 48 defines the test conditions for this test case.

Table 49 – UART frame eye-diagram with minimum load (Device)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0297
Name	TCD_PHYL_INTF_UARTEYEMINLOAD
Purpose (short)	Eye-diagram of UART frame
Equipment under test (EUT)	Device and Legacy Device
Test case version	1.0
Category / type	Device physical layer test; test to pass (positive testing)
Specification (clause)	[9], see 5.3.3.2, Figure 19
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The waveform shall meet the requirements of the eye-diagram under minimum line load conditions. Test waveform for UART frame at the C/Q terminal on the receiver side with an applied minimum line load.
Precondition	Master and Device system
Procedure	a) Attach line simulation (l = 0,5 m) with minimum load values (C_{max} < 50 pF, R_{max} = 100 mOhm (loop)) b) Attach test Master with CQD < 500 pF c) Apply minimum supply voltage (VSM = 20 V) d) Set Master to SDCI mode e) Check UART frame waveform on the receiver side f) Repeat with maximum supply voltage (VSM = 30 V)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	-
Test passed	Bit waveforms meet requirements of the eye-diagram
Test failed (examples)	Bit waveforms do not meet requirements of the eye-diagram
Results	UART frame eye-diagram @ minimum load (VSM = 20 V): <passed/failed> UART frame eye-diagram @ minimum load (VSM = 30 V): <passed/failed>

5.6.9 UART frame transmission delay of Master (ports)

Table 50 defines the test conditions for this test case.

Table 50 – UART frame transmission delay of Master (ports)

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0303
Name	TCM_PHYL_INTF_UARTTRANSDELAY
Purpose (short)	Check whether UART frame transmission delay is within permitted range
Equipment under test (EUT)	Master and Legacy Master
Test case version	1.0
Category / type	Master physical layer test; test to pass (positive testing)
Specification (clause)	[9], see A.3.3, equation (A.3)
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The delay time between two consecutive UART frames of a Master message is measured.
Precondition	Master and Device system Device supplied by Master, supply voltage VSM = 24 V Oscilloscope or other UART frame analyzing tool connected to L- and C/Q
Procedure	a) Set Master to SDCI mode b) Record minimum 7 Master messages in STARTUP State c) Record minimum 7 Master messages in PREOPERATE State (SDCI V1.1 or higher only) d) Record minimum 7 Master messages in OPERATE State
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Calculate time tFRAME between the rising edges of start bits of consecutive UART frames for all recorded Master messages. Calculate UART frame transmission delay t1 for all evaluated UART frames with: t1 = (tFRAME – 11 TBIT) / TBIT Evaluate minimum and maximum values from all calculated delays t1
Test passed	All values t1: 0 ≤ t1 ≤ 1 TBIT
Test failed (examples)	Any value t1: t1 > 1 TBIT
Results	t1: <passed/failed> t1min : <minimum value of t1> t1max : <maximum value of t1>

5.6.10 UART frame transmission delay of Device

Table 51 defines the test conditions for this test case.

Table 51 – UART frame transmission delay of Device

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0304
Name	TCD_PHYL_INTF_UARTTRANSDELAY
Purpose (short)	Check whether UART frame transmission delay is within permitted range
Equipment under test (EUT)	Device and Legacy Device
Test case version	1.0
Category / type	Device physical layer test; test to pass (positive testing)
Specification (clause)	[9], see A.3.4, equation (A.4)
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The delay time between two consecutive UART frames of a Device reply message is measured.
Precondition	Master and Device system Device supplied by Master, supply voltage VSM = 24 V Oscilloscope or other UART frame analyzing tool attached between L- and C/Q
Procedure	a) Set Master to SDCI mode b) Record minimum 7 Device reply messages (> 1 UART frame) in STARTUP State c) Record minimum 7 Device reply messages (> 1 UART frame) in PREOPERATE State (Device with SDCI V1.1 or higher only) d) Record minimum 7 Device reply messages (> 1 UART frame) in OPERATE State
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Calculate time tFRAME between the rising edges of start bits of consecutive UART frames for all recorded Device reply messages. Calculate UART frame transmission delay t2 for all evaluated UART frames with: t2 = (tFRAME – 11 TBIT) / TBIT Evaluate minimum and maximum values from all calculated delays t2
Test passed	All values t2: 0 ≤ t2 ≤ 3 TBIT
Test failed (examples)	Any value t2: t2 > 3 TBIT
Results	t2: <passed/failed> t2min : <minimum value of t2> t2max : <maximum value of t2>

5.6.11 Response time of Device

Table 52 defines the test conditions for this test case.

Table 52 – Response time of Device

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0305
Name	TCD_PHYL_INTF_RESPONSETIME
Purpose (short)	Check whether Device response time is within permitted range
Equipment under test (EUT)	Device and Legacy Device
Test case version	1.0
Category / type	Device physical layer test; test to pass (positive testing)
Specification (clause)	[9], see A.3.5, equation (A.5)
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The delay time between Master messages to Device reply message (end of last UART frame to begin of first UART frame) is measured.
Precondition	Master and Device system Device supplied by Master, supply voltage VSM = 24 V Oscilloscope or other UART frame analyzing tool attached between L- and C/Q
Procedure	a) Set Master to SDCI mode b) Record minimum 7 M-sequences with Master read messages in STARTUP State c) Record minimum 2 M-sequences with Master write messages in STARTUP State d) Record minimum 7 M-sequences with Master read messages in PREOPERATE State (Device with SDCI V1.1 or higher only) e) Record minimum 7 M-sequences with Master write messages in PREOPERATE State (Device with SDCI V1.1 or higher only) f) Record minimum 7 M-sequences with Master read messages in OPERATE State g) Record minimum 7 M-sequences with Master write messages in OPERATE State
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Calculate time tDELAY between the rising edges of the start bit of the last UART frame of the Master message to the start bit of the first UART frame of the Device reply message for all recorded M-sequences. Calculate response time of the Device tA for all evaluated M-sequences with: t_A = (tDELAY – 11 TBIT) / TBIT Evaluate minimum and maximum values from all calculated delays tA
Test passed	All values tA: 1 ≤ tA ≤ 10 TBIT
Test failed (examples)	Any value tA: tA > 10 TBIT
Results	tA: <passed/failed> tAmin : <minimum value of tA > tAmax: <maximum value of tA >

5.7 Test report template for PL tests

Table 53 shows the template for the test report of the Physical Layer tests.

Table 53 – Template for the test report of the Physical Layer tests

TEST CASE ID	TEST results	Passed Y/N	Statement/ Exception
SDCI_TC_0001	ISM capability (VSM = 20 V): <pass/fail> ISM capability (VSM = 30 V): <pass/fail>		
SDCI_TC_0002	ISM capability (VSM = 20 V): <pass/fail> ISM capability (VSM = 30 V): <pass/fail>		
SDCI_TC_0003	ILLM (VIM = 5 V, VSM = 20 V): <value> ILLM (VIM = 15 V, VSM = 20 V): <value> ILLM (VIM = VSM = 20 V): <value> ILLM (VSM = 30 V): <value> ILLM (VIM = 15 V, VSM = 30 V): <value> ILLM (VIM = VSM = 30 V): <value>		
SDCI_TC_0004	VRQHM (VSM = 20 V): <value> VRQHM (VSM = 30 V): <value>		
SDCI_TC_0005	VRQLM (VSM = 20 V): <value> VRQLM (VSM = 30 V): <value>		
SDCI_TC_0006	VIM@VTHHM (VSM = 20 V): <value> VIM@VTHHM (VSM = 30 V): <value>		
SDCI_TC_0007	VIM@VTHLM (VSM = 20 V): <value> VIM@VTHLM (VSM = 30 V): <value>		
SDCI_TC_0008	VHYSM (VSM = 20 V): <value> VHYSM (VSM = 30 V): <value>		
SDCI_TC_0009	VIM (VSM = 20 V): <value> VIM (VSM = 30 V): <value>		
SDCI_TC_0010	VIM (VSM = 20 V): <value> VIM (VSM = 30 V): <value>		
SDCI_TC_0011	ISDSIOmax (VSD = 18 V): <value> ISDSIOmax (VSD = 30 V): <value> ISDIOLmax (VSD = 18 V): <value> ISDIOLmax (VSD = 30 V): <value>		
SDCI_TC_0299	VIHM: <value> <passed/failed> VILM: <value> <passed/failed>		
SDCI_TC_0012	ISDmax(50 ms) (VSD = 18 V): <value> Power-On default operation (VSD = 18 V): <pass/fail> ISDmax(50 ms) (VSD = 30 V): <value> Power-On default operation (VSD = 30 V): <pass/fail>		
SDCI_TC_0013	VRQHD (VSD = 18 V): <value> VRQHD (VSD = 30 V): <value>		
SDCI_TC_0014	VRQLD (VSD = 18 V): <value> VRQLD (VSD = 30 V): <value>		
SDCI_TC_0015	IQQD (VSD = 18 V): <value> IQQD (VSD = 30 V): <value>		
SDCI_TC_0016	VID@VTHHD (VSD = 18 V): <value> VID@VTHHD (VSD = 30 V): <value>		
SDCI_TC_0017	VID@VTHLD (VSD = 18 V): <value> VID@VTHLD (VSD = 30 V): <value>		
SDCI_TC_0018	VHYSD (VSD = 18 V): <value> VHYSD (VSD = 30 V): <value>		
SDCI_TC_0019	IQHD (VSD = 18 V): <passed/failed> IQHD (VSD = 30 V): <passed/failed>		
SDCI_TC_0020	IQLD (VSD = 18 V): <passed/failed> IQLD (VSD = 30 V): <passed/failed>		
SDCI_TC_0300	VIHD: <value> <passed/failed> VILD: <value> <passed/failed>		

TEST CASE ID	TEST results	Passed Y/N	Statement/ Exception
SDCI_TC_0021	VIM@WURQ (VSM = 18 V): <value> VIM@WURQ (VSM = 30 V): <value>		
SDCI_TC_0022	TWUH@WURQ (VSM = 20 V): <value min/max> TWUH@WURQ (VSM = 30 V): <value min/max>		
SDCI_TC_0023	VIM@WURQ (VSM = 20 V): <value> VIM@WURQ (VSM = 30 V): <value>		
SDCI_TC_0024	TWUL@WURQ (VSM = 20 V): <value min/max> TWUL@WURQ (VSM = 30 V): <value min/max>		
SDCI_TC_0025	WURQ (VSD = 18 V): <passed/failed> WURQ (VSD = 30 V): <passed/failed>		
SDCI_TC_0026	WURQ (VSD = 18 V): <passed/failed> WURQ (VSD = 30 V): <passed/failed>		
SDCI_TC_0027	TREN@C/Q=high: <value>		
SDCI_TC_0028	TREN@C/Q=low: <value>		
SDCI_TC_0029	SDCI mode@TRDL: <passed/failed>		
SDCI_TC_0301	TDSIO : <passed/failed> TDSIOmin: <value> TDSIOmax: <value>		
SDCI_TC_0302	Fallback delay@OPERATE:TFBD < value> <passed/failed> Fallback delay@PREOPERATE:TFBD < value> <passed/failed>		
SDCI_TC_0030	Bit eye-diagram max load (VSM=20 V): <passed/failed> Bit eye-diagram max load (VSM=30 V): <passed/failed>		
SDCI_TC_0294	Bit eye-diagram max load (VSM=20 V): <passed/failed> Bit eye-diagram max load (VSM=30 V): <passed/failed>		
SDCI_TC_0031	Bit eye-diagram min load (VSM=20 V): <passed/failed> Bit eye-diagram min load (VSM=30 V): <passed/failed>		
SDCI_TC_0295	Bit eye-diagram min load (VSM=20 V): <passed/failed> Bit eye-diagram min load (VSM=30 V): <passed/failed>		
SDCI_TC_0032	UART frame eye-dia. max load (VSM=20 V): <passed/failed> UART frame eye-dia. max load (VSM=30 V): <passed/failed>		
SDCI_TC_0296	UART frame eye-dia. max load (VSM=20 V): <passed/failed> UART frame eye-dia. max load (VSM=30 V): <passed/failed>		
SDCI_TC_0033	UART frame eye-dia. min load (VSM=20 V): <passed/failed> UART frame eye-dia. min load (VSM=30 V): <passed/failed>		
SDCI_TC_0297	UART frame eye-dia. min load (VSM=20 V): <passed/failed> UART frame eye-dia. min load (VSM=30 V): <passed/failed>		
SDCI_TC_0303	t1: <passed/failed> t1min : <minimum value of t1> t1max : <maximum value of t1>		
SDCI_TC_0304	t2: <passed/failed> t2min : <minimum value of t2> t2max: <maximum value of t2>		
SDCI_TC_0305	tA: <passed/failed> tAmin: <minimum value of tA > tAmax: <maximum value of tA >		

6 Device protocol test cases

6.1 General

The protocol tests can be performed almost automatically with the help of a Device-Tester as defined in A.2.2. The test sequences are described in 4.4 together with a list of the relevant test cases for Legacy-Devices in Table 4, a list of the relevant test cases for Devices without ISDU support in Table 5, and a list of the relevant test cases for Devices with ISDU support in Table 6. Supplementary requirements for Legacy-Devices beyond the definitions in [13] are listed in Annex B.

6.2 STARTUP

6.2.1 STARTUP cycle time

Table 54 defines the test conditions for this test case.

Table 54 – STARTUP cycle time

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0034
Name	TCD_DLPC_STUP_CYCTIME
Purpose (short)	Test STARTUP cycle time
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.5, 9.3.3.2, and A.2.6
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Device shall work in state STARTUP with any cycle time greater equal 100 TBIT
Precondition	Wake-up and ComRequest are performed, Device is in SDCI mode
Procedure	The Master reads the communication parameter (Direct Parameter 0x02 to 0x06) at different cycle times
Input parameter	Cycle times: a) 100 TBIT b) 10000 TBIT c) 10 s
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check the Device response
Test passed	The Device shall respond to any read request with valid (constant) data
Test failed (examples)	-
Results	Cycle Time variation in STARTUP: <pass/fail>

6.2.2 From STARTUP to OPERATE

Table 55 defines the test conditions for this test case.

Table 55 – From STARTUP to OPERATE

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0035
Name	TCD_DLPC_STUP_STUPOPER1
Purpose (short)	Test state transition STARTUP to OPERATE
Equipment under test (EUT)	Device and Legacy-Device, except Devices with zero length process data
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 7.2.3.5, 9.3.3.2
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Device shall change from STARTUP to OPERATE when it receives a Master command 0x99. This transition is used by Legacy Masters.
Precondition	Wake-up and read the communication parameter (Direct Parameter 0x02 to 0x06)
Procedure	a) Master sends MasterCycleTime b) Master sends OPERATE command c) Master sends ISDU idle command, using the M-sequence TYPE for OPERATE
Input parameter	MasterCycleTime a) MinCycleTime of the Device b) 0xBF (132,8 ms)
Post condition	
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check the Device response
Test passed	The Device responds to any request
Test failed (examples)	-
Results	Transition from STARTUP directly to OPERATE: <pass/fail>

6.2.3 Master start-up with overwrite of the RID (compatible)

Table 56 defines the test conditions for this test case.

Table 56 – Master start-up with overwrite of the RID (compatible)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0306
Name	TCD_DLPC_CHCK_OVERRIDOK
Purpose (short)	Check Device start-up behavior with overwrite of the Device RID (compatible)
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], 10.6.3
Configuration / setup	-

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Device start-up behavior with overwrite of the RevisionID (compatible). This test supposes the active switching to protocol revision 1.0. The Master overwrites the RID and the Device accepts the requested protocol version. The configured Device identification is equal to the Device identification and the RevisionID is 0x10.
Precondition	a) Master is in STARTUP mode. b) Master is configured to the Device under test and RevisionID 0x10 c) Protocol revision of the Device is V1.1 (0x11)
Procedure	a) Master establishes communication with the Device b) Master detects the wrong "RevisionID" c) Master overwrites the RevisionID with the requested legacy RevisionID d) Master writes the Master-Command 0x96 e) Device accepts the written RID f) Master reads communication parameters again g) Master turns the "modified" Device into the OPERATE mode
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check if the read RID matches the written RID 0x10
Test passed	The Device provides the requested RID 0x10
Test failed (examples)	The Device provides the RID 0x11
Results	Active switching to legacy protocol revision accepted: <pass/fail>

6.2.4 Illegal STARTUP to OPERATE

Table 57 defines the test conditions for this test case.

Table 57 – Illegal STARTUP to OPERATE

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0036
Name	TCD_DLPC_STUP_STUPOPER2
Purpose (short)	Test illegal state transition STARTUP to OPERATE
Equipment under test (EUT)	Device and Legacy-Device, except Devices with zero length process data
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 7.2.3.5, 9.3.3.2
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Device shall not change from STARTUP to OPERATE unless it receives a Master command 0x99.
Precondition	Wake-up and read the communication parameter (Direct Parameter 0x02 to 0x06)
Procedure	a) Master sends MasterCycleTime b) Master sends ISDU idle command, using the M-sequence TYPE for OPERATE
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check the Device response
Test passed	No Device response
Test failed (examples)	Any Device response
Results	Device does not leave STARTUP: <pass/fail>

6.2.5 From OPERATE to STARTUP via Master command

Table 58 defines the test conditions for this test case.

Table 58 – From OPERATE to STARTUP via Master command

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0037
Name	TCD_DLPC_OPER_OPERSTUP1
Purpose (short)	Test correct state transition from OPERATE to STARTUP
Equipment under test (EUT)	Device and Legacy-Device, except Devices with zero length process data
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 7.2.3.5, 9.3.3.2
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the correct state transition from OPERATE to STARTUP via Master command
Precondition	Device is in OPERATE state
Procedure	a) Master sends Master command 0x97 "DeviceStartup" b) Master sends ISDU idle command, using the M-sequence TYPE for OPERATE
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check the Device response
Test passed	-
Test failed (examples)	The Device responds to ISDU idle command
Results	Transition from OPERATE state to STARTUP state: <pass/fail>

6.2.6 From OPERATE to STARTUP via ISDU idle command

Table 59 defines the test conditions for this test case.

Table 59 – From OPERATE to STARTUP via ISDU idle command

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0038
Name	TCD_DLPC_OPER_OPERSTAR2
Purpose (short)	Test state transition OPERATE to STARTUP
Equipment under test (EUT)	Device and Legacy-Device, except Devices with zero length process data
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 7.2.3.5, 9.3.3.2
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test state transition OPERATE to STARTUP
Precondition	Device is in OPERATE state
Procedure	a) Master sends ISDU idle command, using M-sequence TYPE_0 b) Master sends ISDU idle command, using M-sequence TYPE_0 c) Master sends ISDU idle command, using the M-sequence TYPE for OPERATE
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check the Device response
Test passed	The Device responds to ISDU idle command b), but not to a) and c).
Test failed (examples)	-
Results	Illegal M-sequence in OPERATE state: <pass/fail>

6.3 PREOPERATE

6.3.1 From STARTUP to PREOPERATE Read

Table 60 defines the test conditions for this test case.

Table 60 – From STARTUP to PREOPERATE Read

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0039
Name	TCD_DLPC_PROP_READDPP1
Purpose (short)	Set Device from STARTUP into PREOPERATE and read Direct Parameter page 1.
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device PREOPERATE, test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34, and Annex A.2, Table A.7
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Set Device from STARTUP into PREOPERATE via Master command 0x9A and read Direct Parameter page 1. Device activates on-request data, service and event handler and returns DL_Mode.ind (PREOPERATE). Device reply message to Master read message to be checked.
Precondition	a) Initialize an SDCI communication (WURQ) b) Communication initialization between Master and Device is successful (both in STARTUP state) c) Save M-sequenceCapability, PDIn and PDOut for later comparison
Procedure	a) Master sends PREOPERATE command 0x9A. b) Positive response from Device c) Master and Device changed to PREOPERATE state. d) Master read message -> Read DirectParameterPage 1
Input parameter	M-sequenceCapability, PDIn and PDOut
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether the 0x9A command results in a positive response of the Device b) Calculate with saved settings on PDIn, PDOut, and M-sequenceCapability the expected M-sequenceTYPE c) Check whether Device response (read DirectParameterPage 1) used the expected M-sequenceTYPE (Device reply message to Master read message). d) Check whether the Device reply message has been received with the expected amount of on-request data octets. e) Check whether no process data has been transmitted.
Test passed	Device reply message has been received with the expected amount of on-request data octets.
Test failed (examples)	a) PREOPERATE command results in a negative response, or b) No or wrong response from the Device, or c) Unexpected M-sequenceTYPE used by the Device
Results	Read of Direct Parameter page 1 in PREOPERATE state: <pass/fail>

6.3.2 From STARTUP to PREOPERATE Read Param+Event

Table 61 defines the test conditions for this test case.

Table 61 – From STARTUP to PREOPERATE Read Param+Event

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0292
Name	TCD_DLPC_PROP_READDPPEP
Purpose (short)	Test Device support of 1_2, 1_V, or 2_V M-sequence types, Direct Parameter or Event page
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see Annex A.2
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	If the Device supports M-sequence types 1_2, 1_V, or 2_V with more than 1 On-request Data octets, all octets shall be valid in case of read accesses to Direct Parameter or Event page.
Precondition	Device is in PREOPERATE state
Procedure	a) Device-Tester reads Direct Parameter page 1 (Index = 0x00, Subindex = 0x02) b) Device is prompted to generate an Event c) Device-Tester reads the Event buffer
Input parameter	a) Content of the Direct Parameter page 1 acquired from IODD b) Valid EventCodes from the Device
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check the content of all transmitted octets against predefined parameters from IODD b) Check the content of all transmitted octets against the Event.
Test passed	All octets contain valid data
Test failed (examples)	Only the first octet is valid
Results	Read predefined parameters: <pass/fail> Read Event buffer: <pass/fail>

774 6.3.3 From STARTUP to PREOPERATE Write

775 Table 62 defines the test conditions for this test case.

776 **Table 62 – From STARTUP to PREOPERATE Write**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0040
Name	TCD_DLPC_PROP_WRITEDPP1
Purpose (short)	Set Device from STARTUP into PREOPERATE and write Direct Parameter page 1.
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device PREOPERATE, test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34, and Annex A.2, Table A.7
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Set Device from STARTUP into PREOPERATE state via Master command 0x9A and read Direct Parameter page 1. The Master writes Direct Parameter page 1. Device reply message to Master read message to be checked. NOTE The number of octets to write depends on the used M-sequenceTYPE. The Direct Parameter page 1 will not be completely written, but a write request with a valid M-sequenceTYPE length will be accepted.
Precondition	a) Initialize an SDCI communication (WURQ) b) Communication initialization between Master and Device has been successful (both in STARTUP state) c) Save M-sequenceCapability, PDIn and PDOut for later comparison
Procedure	a) Master sends PREOPERATE command 0x9A. b) Positive response from Device c) Master and Device changed to PREOPERATE d) Read Direct Parameter page 1 (one M-sequence) e) Save the Device's response on-request data f) Master builds a write message with the saved on-request data ("mirror") g) Master writes Direct Parameter page 1 (one message) in correct length h) Receive Device response
Input parameter	M-sequenceCapability, PDIn and PDOut
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether the Master command 0x9A results in a positive response of the Device b) Calculate with saved settings on PDIn, PDOut, and M-sequenceCapability the expected M-sequenceTYPE c) Check whether the Device response (write Direct Parameter page 1) used the expected M-sequenceTYPE (Device reply message to Master write message) d) Check whether no process data has been transmitted
Test passed	Direct Parameter page 1 write command has been accepted
Test failed (examples)	a) PREOPERATE command results in a negative response b) No or wrong response from the Device c) Unexpected M-sequenceTYPE used by the Device
Results	Write of Direct Parameter page 1 in PREOPERATE state: <pass/fail>.

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6.3.4 From STARTUP to PREOPERATE short message

Table 63 defines the test conditions for this test case.

Table 63 – From STARTUP to PREOPERATE short message

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0041
Name	TCD_DLPC_PROP_SHORTMESSAGE
Purpose (short)	Test behavior to truncated M-sequence request.
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device PREOPERATE protocol test
Specification (clause)	[9], see 7.3.2.5, Figure 34, and Annex A.2, Table A.7
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Set Device into PREOPERATE. To emulate message disturbances, caused for example by electromagnetic interference, the Device-Tester sends one octet less than required. The Device shall not respond to this truncated M-sequence request and respond to the following request without error.
Precondition	Master and Device in PREOPERATE
Procedure	a) Master writes to parameter "VendorID" in Direct Parameter page 1 (address 0x07/0x08) with one octet less than the normal request length b) Master writes to parameter "VendorID" in Direct Parameter page 1 (address 0x07/0x08) after the shortest possible time (MinCycleTime, see Table A.9 and B.1.4)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check responses on the two requests
Test passed	a) No response on the first request b) Response on the second request
Test failed (examples)	a) Response on the first request b) No response to the second request
Results	First response: <pass/fail> Second response: <pass/fail>

6.3.5 From STARTUP to PREOPERATE collision

Table 64 defines the test conditions for this test case.

Table 64 – From STARTUP to PREOPERATE collision

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0042
Name	TCD_DLPC_PROP_WRITECOLL
Purpose (short)	Set Device from STARTUP into PREOPERATE and cause a collision while writing.
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device PREOPERATE, test to fail (negative testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34, and Annex A.2, Table A.7
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Set Device from STARTUP into PREOPERATE state via Master command 0x9A and read Direct Parameter page 1. The Master writes Direct Parameter page 1 within one M-sequence and "parameter length overrun", i.e. one octet more than specified. Check whether there is a collision while sending the last (exceeding) octet. It is also a test purpose to send a correct M-sequence after the minimum cycle time of PREOPERATE and check the response.
Precondition	Establish an SDCI communication
Procedure	a) Master sends PREOPERATE command 0x9A. b) Positive response from Device c) Master and Device switched to PREOPERATE. d) Read Direct Parameter page 1 (one M-sequence) e) Master prepares a write message with the saved on-request data (one octet more than specified for the Master write message length). It is important, that the checksum after the specified M-sequence length is correct and the exceeding octet will be added after the checksum. f) Write Direct Parameter page 1 with extended length g) A collision shall be detected h) Master prepares a write message with the saved on-request data in correct length i) Master writes Direct Parameter page 1 (one M-sequence) in correct length and with the minimum cycle time of PREOPERATE j) Receive Device response
Input parameter	Read and saved on-request data (mirror)
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether the 0x9A command results in a positive response of the Device b) Check whether a collision (write Direct Parameter page 1 with one octet more than specified) will be detected. c) Check whether the Device response (write Direct Parameter page 1 with correct length) results in a specified Device reply message
Test passed	Device works properly after the detected collision.
Test failed (examples)	a) PREOPERATE command results in a negative response b) No collision detection c) Unexpected M-sequence TYPE used by the Device d) No Device reply message upon the correct Master message
Results	Collision detection in PREOPERATE state: <pass/fail>

6.3.6 From PREOPERATE to STARTUP via simulated reset

Table 65 defines the test conditions for this test case.

Table 65 – From PREOPERATE to STARTUP via simulated reset

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0043
Name	TCD_DLPC_PROP_SIMRESET
Purpose (short)	Set Device from PREOPERATE back to STARTUP state via simulation of a reset
Equipment under test (EUT)	Device and Legacy-Device without TYPE_0 in PREOPERATE state
Test case version	1.1
Category / type	Device protocol test - PREOPERATE, positive testing
Specification (clause)	[9], see 7.3.2.5, Figure 34 (T12), and Annex A, Table A.7
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master and Device are in PREOPERATE state. The Master sends a TYPE_0 message (simulation of a Master reset – FHInfo_ILLEGAL_FRAMETYPE). The Device shall switch in STARTUP state (deactivate on-request data, service and event handler) and shall send a TYPE_0 response.
Precondition	a) Establish an SDCI communication (WURQ) b) Communication between Master and Device successful (both in STARTUP state) c) Save M-sequenceCapability, PDIn, and PDOut for later comparison d) Master sends PREOPERATE command 0x9A e) Master and Device in PREOPERATE
Procedure	a) Master sends TYPE_0 read request to get MinCycleTime. b) Device does not respond c) Master sends TYPE_0 read request to get MinCycleTime again d) Device changes state to STARTUP e) Device responds with "MinCycleTime" message
Input parameter	M-sequenceCapability, PDIn, and PDOut
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check whether the Master TYPE_0 request results in a response message of TYPE_0 from the Device with "MinCycleTime"
Test passed	Received "MinCycleTime" with TYPE_0 message
Test failed (examples)	a) Wrong M-sequence TYPE from Device b) No or wrong response from Device
Results	Received "MinCycleTime" within TYPE_0 Device message: <pass/fail>

6.3.7 From PREOPERATE to PREOPERATE with M-sequence fault

Table 66 defines the test conditions for this test case.

Table 66 – From PREOPERATE to PREOPERATE with M-sequence fault

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0044
Name	TCD_DLPC_PROP_FRAMEFAULT
Purpose (short)	Force Device into STARTUP by sending the OPERATE M-sequence type
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device PREOPERATE, test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34 (T12), and Annex A, Table A.7
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Device shall not support another different M-sequence type while in PREOPERATE state. The Device shall switch to STARTUP when detecting an illegal M-sequence type. In case of equal M-sequence types for PREOPERATE and OPERATE, the test case causes no error.
Precondition	Device in PREOPERATE
Procedure	a) Invoke first Read on parameter "MinCycleTime" with the OPERATE M-sequence type b) Invoke second Read on parameter "MinCycleTime" with the PREOPERATE M-sequence type c) Invoke third Read on parameter "MinCycleTime" with the STARTUP M-sequence type
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check the responses to the three Reads with appropriate M-sequence types.
Test passed	a) PREOPERATE not equal to OPERATE M-sequence type: - First and second Read shall not be responded by the Device - Third Read shall provide correct data b) PREOPERATE equal to OPERATE M-sequence type: - All Read requests shall be responded by the Device
Test failed (examples)	-
Results	PREOPERATE not equal to OPERATE M-sequence type: <pass/fail> PREOPERATE equal to OPERATE M-sequence type: <pass/fail>

809 ## 6.4 OPERATE

810 ### 6.4.1 From PREOPERATE to OPERATE Read

811 Table 67 defines the test conditions for this test case.

812 **Table 67 – From PREOPERATE to OPERATE Read**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0045
Name	TCD_DLPC_OPER_READ
Purpose (short)	Turn Master and Device into OPERATE state via Master command 0x99
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device OPERATE, test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34, and Annex A.2, Table A.8
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Master command 0x99 will be sent by the Master and both (Device and Master) switch into OPERATE state.
Precondition	a) Establish an SDCI communication (WURQ) b) Communication between Master and Device successful (both in STARTUP) c) Save M-sequenceCapability, PDIn, and PDOut for later comparison d) Master sends PREOPERATE command 0x9A e) Master and Device in PREOPERATE state f) Read Direct Parameter page 1 and save it in a variable for further use
Procedure	a) Master sends OPERATE command 0x99 followed by 0x98. b) Positive response from Device c) Master and Device changed to OPERATE state. d) Read Direct Parameter page 1
Input parameter	M-sequenceCapability, PDIn, and PDOut
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether the 0x99 command results in a positive response of the Device b) Calculate with saved settings PDIn, PDOut, and M-sequenceCapability the specified M-sequenceTYPE c) Check whether the Device response (read Direct Parameter page 1) used the expected M-sequenceTYPE (Device reply message to Master read message) d) Check whether the Direct Parameter page 1 was received completely (use variable from "input parameters" for comparison) e) Check whether process data was transmitted
Test passed	Direct Parameter page 1 received
Test failed (examples)	a) OPERATE command results in a negative response b) No or wrong response from the Device c) Device did not use the expected M-sequence TYPE
Results	Direct Parameter page 1 received in OPERATE state: <pass/fail>

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817 ### 6.4.2 From PREOPERATE to OPERATE Write

818 Table 68 defines the test conditions for this test case.

819 **Table 68 – From PREOPERATE to OPERATE Write**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0046
Name	TCD_DLPC_OPER_WRITE
Purpose (short)	Set Device from PREOPERATE into OPERATE write
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device OPERATE, test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34, and Annex A.2, Table A.8
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The command 0x9A will be sent by the Master and both (Device and Master) change into the OPERATE state. Master writes Direct Parameter page 1. Device reply message to Master write message to be checked. NOTE The number of octets to write depends on the used M-sequenceTYPE. The Direct Parameter page 1 will not be completely written, but a write request with a valid M-sequenceTYPE length will be accepted.
Precondition	a) Save M-sequenceCapability, PDIn, and PDOut for later comparison b) Master and Device in PREOPERATE state
Procedure	a) Master sends OPERATE command 0x99 b) Positive response from Device c) Master and Device changed to OPERATE. d) Read Direct Parameter page 1 (one M-sequence) e) Save the on-request data of the Device's response ("mirror") f) Master prepares a write message with the saved on-request data g) Master writes Direct Parameter page 1 (one M-sequence) within correct length h) Receive Device response
Input parameter	M-sequenceCapability, PDIn, and PDOut
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether the 0x99 command results in a positive response of the Device b) Calculate with saved PDIn, PDOut, and M-sequenceCapability settings the specified M-sequenceTYPE c) Check whether the Device response (write Direct Parameter page 1) used the expected M-sequenceTYPE (Device reply message to Master write message) d) Check whether process data has been transmitted
Test passed	Direct Parameter page 1 write command was accepted
Test failed (examples)	a) OPERATE command results in a negative response b) No or wrong response from the Device c) Device did not use the expected M-sequence TYPE
Results	Direct Parameter page 1 write command accepted in OPERATE state: <pass/fail>

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6.4.3 From PREOPERATE to OPERATE negative Write

Table 69 defines the test conditions for this test case.

Table 69 – From PREOPERATE to OPERATE negative Write

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0047
Name	TCD_DLPC_OPER_NEGWRITE
Purpose (short)	Set Device from PREOPERATE into OPERATE with a negative write response
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device OPERATE, test to fail (negative testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34, and Annex A.2, Table A.8
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Set Device from STARTUP into OPERATE state via Master command 0x99. The Master writes Direct Parameter page 1 with one M-sequence and "parameter length underrun", i.e. one octet less than specified. Check whether the Device does not respond to this incomplete M-sequence. It is also a test purpose to send a correct M-sequence after the minimum cycle time of OPERATE and check the response.
Precondition	Master and Device in PREOPERATE state
Procedure	a) Master sends OPERATE command 0x99. b) Positive response from Device c) Master and Device changed to OPERATE. d) Read Direct Parameter page 1 (one M-sequence) e) Save the on-request data of the Device response f) Master builds a write message with the saved on-request data (one octet less than specified for the Master write message). g) Master writes Direct Parameter page 1 (one M-sequence) within reduced length h) Device does not respond i) Master prepares a write message with the saved on-request data in correct length j) Master writes Direct Parameter page 1 (one M-sequence) in correct length after the minimum cycle time of OPERATE k) Receive Device response
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether the 0x99 command results in a positive response of the Device b) Check whether Device response (write Direct Parameter page 1 with one octet less than expected) results in no response c) Check whether Device response (write Direct Parameter page 1 within correct length) results in an expected Device reply message
Test passed	Device works properly after using the incomplete M-sequence TYPE
Test failed (examples)	a) OPERATE command results in a negative response b) Device responds to message with incomplete M-sequence c) Device did not use the expected M-sequence TYPE d) No Device response to the complete M-sequence
Results	Direct Parameter page 1 write command only accepted with specified length in OPERATE state: <pass/fail>

6.4.4 From PREOPERATE to OPERATE collision

Table 70 defines the test conditions for this test case.

Table 70 – From PREOPERATE to OPERATE collision

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0048
Name	TCD_DLPC_OPER_WRITECOLL
Purpose (short)	Set Device from STARTUP into OPERATE and cause a collision while writing.
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device OPERATE, test to fail (negative testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34, and Annex A.2, Table A.8
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Set Device from STARTUP into OPERATE state via Master command 0x99. The Master writes Direct Parameter page 1 within one M-sequence and "parameter length overrun", .i.e. one octet more than specified. Check whether there is a collision while sending the last (exceeding) octet. It is also a test purpose to send a correct M-sequence after the minimum cycle time of OPERATE and to check the response.
Precondition	Master and Device in PREOPERATE state
Procedure	a) Master sends OPERATE command 0x99. b) Positive response from Device c) Master and Device changed to OPERATE. d) Read Direct Parameter page 1 (one M-sequence) e) Master prepares a write message with the saved on-request data (one octet more than specified for the Master write message). It is important, that the checksum after the specified M-sequence length is correct and the exceeding octet will be added after the checksum. f) Write Direct Parameter page 1 in extended length g) A collision shall be detected. h) Master prepares a write message with the saved on-request data in correct length i) Master writes Direct Parameter page 1 (one M-sequence) in correct length after the minimum cycle time of the OPERATE state j) Receive Device response
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether the 0x99 command results in a positive response of the Device b) Check whether a collision (write Direct Parameter page 1 with one octet more than specified) will be detected. c) Check whether the Device (write Direct Parameter page 1 with correct length) responds with an expected reply message
Test passed	Device works properly after the detected collision.
Test failed (examples)	a) OPERATE command results in a negative response b) No collision detected or wrong response from the Device c) Device does not use the expected M-sequenceTYPE d) No Device response to the complete (correct) M-sequence
Results	Collision detection in OPERATE state: <pass/fail>

6.4.5 From OPERATE to STARTUP via simulated reset

Table 71 defines the test conditions for this test case.

Table 71 – From OPERATE to STARTUP via simulated reset

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0049
Name	TCD_DLPC_OPER_SIMRESET
Purpose (short)	Set Device from OPERATE back to STARTUP state via a simulated reset
Equipment under test (EUT)	Device and Legacy-Device without TYPE_0 in OPERATE state
Test case version	1.1
Category / type	Device OPERATE, test to pass (positive testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34 (T11), and Annex A, Table A.8
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master and Device are in OPERATE state. The Master sends a TYPE_0 message (simulation of a Master reset). The Device shall switch into the STARTUP state (de-activate on-request data, service and event handler) and shall send a TYPE_0 re-sponse.
Precondition	a) Master and Device in PREOPERATE state b) Master sends OPERATE command 0x99 c) Master and Device in OPERATE state
Procedure	a) Master sends TYPE_0 read request for the MinCycleTime parameter. b) Device does not respond c) Master sends TYPE_0 read request for the MinCycleTime parameter again d) Device changes state to STARTUP e) Response from Device with the MinCycleTime parameter value
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check whether the Master TYPE_0 request results in a Device TYPE_0 response message with the MinCycleTime parameter value
Test passed	Received the MinCycleTime parameter value via TYPE_0 message
Test failed (examples)	a) Device used wrong M-sequence TYPE b) No or wrong response from Device
Results	Received MinCycleTime parameter value within TYPE_0 message: <pass/fail>

6.4.6 From OPERATE to OPERATE with wrong M-sequence TYPE

Table 72 defines the test conditions for this test case.

This test case is currently not in use.

Table 72 – From OPERATE to OPERATE with wrong M-sequence TYPE

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0051
Name	TCD_DLPC_OPER_WRONGFRAMETYPE
Purpose (short)	Device receives in OPERATE an unexpected M-sequenceTYPE (same category)
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device OPERATE, test to fail (negative testing)
Specification (clause)	[9], see 7.3.2.5, Figure 34 (T12), and Annex A, Table A.7
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master and Device are in OPERATE state. The Master sends a message with another M-sequence TYPE then expected by the Device (same category TYPE_x, but not the expected TYPE). Device does not respond.
Precondition	Master and Device in OPERATE state
Procedure	a) Master calculates an unexpected M-sequenceTYPE (same category, but not the expected TYPE) via the saved M-sequenceCapability, PDIn, and PDOut. b) Master reads Direct Parameter page 1 with the unexpected M-sequence TYPE c) Device does not respond d) Master reads Direct Parameter page 1 correctly e) Device responds correctly
Input parameter	M-sequenceCapability, PDIn, and PDOut
Post condition	
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether the faulty Master request does not result in a Device response b) Check whether the correct Master request results in a Device correct response
Test passed	No response received upon an unexpected M-sequenceTYPE
Test failed (examples)	a) Device responds to an unexpected M-sequenceTYPE b) Device does not respond to a valid read request c) Device does not respond in the expected M-sequenceTYPE
Results	Device stays in OPERATE after unexpected M-sequenceTYPE: <pass/fail>

6.5 ISDU (Indexed Service Data Unit)

6.5.1 Prearrangement measures and configuration

A precondition for the ISDU test cases is the possibility of write operations. The only possible writeable Index usable by all Device vendors is the "Application Specific Tag" parameter (Index = 0x0018). However, this parameter is optional.

Therefore, the vendor shall provide the necessary Index information for ISDU write/read operations (Config 1, 2, 3, and 7 within the IODD) of the Device:

- Config1: An 8 bit readable and writeable SDCI Index of the Device
- Config2: A 16 bit readable and writeable SDCI Index in case 16 bit Indices are supported by the Device. If a particular 16 bit Index is not supported, a 16 bit Index shall be provided which is not used by the Device. With this Index the test system will check the 16-bit capabilities (coping with the 16 bit ISDU addressing scheme) of the Device. The ISDU responses shall be correct and shall contain the appropriate ErrorCodes.
- Config3: An 8 bit readable SDCI Index of the Device providing more than 12 octets data for ISDU read operations with an "ExtLength" octet in an ISDU read response
- Config4 (List of Block Parameters): A list of Block Parameter Indices which are accessed via block parameterization (ListOfBlockParameters() As UInt16())
- Config5 (AlternativeValueOfFirstBlockPar): The alternative value for the first Block Parameter defines a second valid and useful entry which can be used during the Block Parameter tests. The value is provided as Octet string and shall match the length of the variable.
- Config6 (IllegalValueOfFirstBlockPar): The illegal value for the first Block Parameter defines an entry which can be used during the Block Parameter tests for the test of ErrorCodes. The value is provided as Octet string and shall match the length of the variable.
- Config7 (IndexToGenerateEvent): This Index is a highly recommended parameter which can be used to stimulate up to two specific incidents within the Device. The incidents are associated with pairs of values. One value is used to stimulate an "appeared" event; the second value is used to stimulate the corresponding "disappeared" event. The data type of the parameter is UintegerT, bitLength = 8 (octet).

6.5.2 Availability of ISDU via M-sequence Capability

Table 73 defines the test conditions for this test case.

Table 73 – Availability of ISDU via M-sequence Capability

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0052
Name	TCD_DLPC_ISDU_AVAILFSEQCAP
Purpose (short)	Availability of ISDU via M-sequence Capability in Direct Parameter Page 1
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see Annex B.1.5, Table B.5
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master reads the Device's M-sequence Capability via Direct Parameter Page 1 and checks whether the ISDU data channel is supported.
Precondition	a) Establish an SDCI communication (WURQ) b) Establish communication into PREOPERATE or OPERATE respectively. For a Legacy-Device establish communication only into OPERATE.
Procedure	a) Read M-sequence Capability (Direct Parameter page 1, address 0x03) b) Check Bit 0 of the parameter M-sequenceCapability
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Received M-sequence Capability b) Bit 0 = 1 (ISDU communication channel is supported)
Test passed	Bit 0 = 1 (ISDU communication channel is supported)
Test failed (examples)	a) No response from the Device b) Bit 0 = 0 (ISDU communication channel is NOT supported)
Results	Availability of the ISDU service is indicated correctly: <pass/fail>

6.5.3 "Idle/Busy" check

Table 74 defines the test conditions for this test case.

Table 74 – "Idle/Busy" check

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0053
Name	TCD_DLIC_ISDU_IDLEBUSYCHECK
Purpose (short)	Device response “Busy” received upon an "Idle" request of the Master
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see 7.3.6.2, Table 50, and Annex A.5, Table A.12, Table A.14
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether the Device response “Busy” was received after an "Idle" request of the Master. Response length is 1 octet.
Precondition	Master in PREOPERATE or OPERATE respectively. In case of a Legacy-Device in OPERATE only.
Procedure	Master sends "keep alive" message "Idle" (0x00)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Read 0x11 (FlowCtrl) b) Read 0x12 to 0x1F
Test passed	a) ISDU response 0x00 ("No service") received from Device b) No communication error
Test failed (examples)	a) No response from the Device or other than 0x00 received from Device b) Communication error
Results	ISDU service is available: <pass/fail>

6.5.4 Read 8 bit Index

Table 75 defines the test conditions for this test case.

Table 75 – Read 8 bit Index

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0054
Name	TCD_DLIC_ISDU_READINDEX8
Purpose (short)	Check Device response to an ISDU read request with 8 bit Index
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see 7.3.6.4, Figure 48, and Annex A.2, Table A.10
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends ISDU read request for VendorName (0x10, mandatory). Device responds with expected VendorName.
Precondition	a) Master in PREOPERATE or OPERATE respectively b) Read "VendorName" parameter and write it to a variable for comparison/ evaluation
Procedure	a) Master: Sends ISDU Read request *Segment 1:* 0x93 (Service: Read request – 0b1001 / Length:0b0011) *Segment 2:* 0x10 (Address of "VendorName") *Segment 3:* 0x83 (Checksum) b) Receive Read response "busy" (0x01) until Device is ready c) Check and save Read response ("VendorName") d) Save service, length, data and checksum in variables and save ISDU Read response frames count
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether the ServiceCode of the positive ReadResponse = 0b1101 b) Compare Length variable with the actual received Frame count c) Data ("VendorName") with "VendorName" saved in precondition shall be identical d) Calculate checksum and compare with saved checksum
Test passed	a) "VendorName" received is complete as expected. b) Service, Length and Checksum are correct.
Test failed (examples)	No, negative or wrong response from the Device
Results	"VendorName" read correctly from Device: <pass/fail>

6.5.5 Read 8 bit Index with ExtLength

Table 76 defines the test conditions for this test case.

Table 76 – Read 8 bit Index with ExtLength

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0055
Name	TCD_DLIC_ISDU_READ8EXTLENGTH
Purpose (short)	Read request with 8 bit Index and read response with ExtLength
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see 7.3.6.4, Annex A.5.6, and Annex B, Table B.9
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends ISDU read request using "Config3". Device responds according "Config3" (ISDU response with ExtLength octet possible).
Precondition	a) Device in PREOPERATE or OPERATE respectively b) Master in PREOPERATE or OPERATE respectively
Procedure	a) Master: Sends ISDU Read request *Segment 1:* 0x93 (Service: Read request – 0b1001 / Length:0b0011) *Segment 2:* 0xnn (Address according Config3) *Segment 3:* 0xnn (actual Checksum) b) Receive Read response "busy" (0x01) until Device is ready c) Check and save Read response (according Config3) d) Save service, length, data and checksum in variables and save ISDU Read response frames count
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Service shall be positive Read response 0b1101. b) Length = 0b0001? c) Compare ExtLength variable with Frame count d) Read response contains no Process Data e) Calculate checksum and compare with saved checksum
Test passed	a) Response correct according Config3. b) Service, Length, ExtLength and Checksum are correct.
Test failed (examples)	No, negative or wrong response from the Device
Results	Config3 read correctly from Device: <pass/fail>

6.5.6 Write 8 bit Index

Table 77 defines the test conditions for this test case.

Table 77 – Write 8 bit Index

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0056
Name	TCD_DLIC_ISDU_WRITE8
Purpose (short)	Check whether a write request with 8 bit Index is possible
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.1
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see 7.3.6.4
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends ISDU write request according Config1. Check whether the Write request has been successful.
Precondition	a) Device in PREOPERATE or OPERATE respectively b) Master in PREOPERATE or OPERATE respectively c) Read data according Config1 and write it to a Config1 variable for comparison and length
Procedure	a) Master: Sends ISDU Write request *Segment 1:* 0x93 (Service: Write request + possible Length from precondition) *Segment 2:* 0xnn (Address according Config1) *Segment 3:* 0x01 (data 1) *Segment …* *Segment m:* 0x01 (data n - possible Length received in precondition) *Segment n:* Checksum b) Receive Write response "busy" (0x01) until Device is ready c) Receive Write response d) Read Config1
Input parameter	Config1 according to 6.5.1
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether the Write response is positive with expected length 0x52 (Service: 0b0101, Length: 0b0010). b) Compare the Config1 variable from precondition with the Config1 content. It shall be different as the content now shall be identical with the Write request data.
Test passed	a) Positive write response; Config1 contents as expected. b) Response "Index not available"
Test failed (examples)	a) Negative write response from Device b) Octets of Config1 not written
Results	"Config1" changed after Write request: <pass/fail>.

6.5.7 Read 8 bit Index reserved

Table 78 defines the test conditions for this test case.

Table 78 – Read 8 bit Index reserved

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0057
Name	TCD_DLIC_ISDU_READ8RESERVED
Purpose (short)	Check Device response “Index not available” upon Read to 8 bit reserved Index
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device ISDU, test o fail (negative testing)
Specification (clause)	[9], see 7.3.6, and Annex C, Table C.1 and C.2
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master sends ISDU read request for Index = 0xFF (reserved) and receives “Index not available” (ErrorCode = 0x80, AdditionalCode = 0x11)
Precondition	a) Device in PREOPERATE or OPERATE respectively b) Master in PREOPERATE or OPERATE respectively
Procedure	a) Master: Sends ISDU Read request *Segment 1:* 0x93 (Service: Read request: 0b1001 / Length:0b0011) *Segment 2:* 0xFF (reserved Index) *Segment 3:* 0x6C (Checksum) b) Receive Read response "busy" (0x01) until Device is ready c) Receive Read response and check whether it contains a negative read response with ErrorCode and AdditionalCode
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether the Read response is negative (Service: 0b1100, Length: 0b0100) b) Compare ErrorCode with 0x80 c) Compare AdditionalCode with 0x11 “Index not available”.
Test passed	All comparisons and checks valid
Test failed (examples)	Positive response from Device or wrong ErrorCode or AdditionalCode
Results	Negative read response received upon reserved 8 bit Index: <pass/fail>**.**

6.5.8 Read 8 bit Index with unavailable Subindex

Table 79 defines the test conditions for this test case.

Table 79 – Read 8 bit Index with unavailable Subindex

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0058
Name	TCD_DLIC_ISDU_READ8NOSUBINDEX
Purpose (short)	Check 8 bit read response when Subindex not available
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device protocol test - ISDU, test to fail (negative testing)
Specification (clause)	[9], see 7.3.6, and Annex C, Table C.1
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master sends ISDU read request for VendorName (Index = 0x10, mandatory, StringT) and a Subindex = 0x02. This results in a negative read response, “Subindex not available” (ErrorCode = 0x80 / AdditionalCode = 0x12)
Precondition	a) Device in PREOPERATE or OPERATE respectively b) Master in PREOPERATE or OPERATE respectively
Procedure	a) Master: Sends ISDU Read request *Segment 1:* 0xA4 (Service: Read request: 0b1010 / Length:0b0100) *Segment 2:* 0x10 (VendorName, mandatory, StringT) *Segment 3:* 0x02 (Subindex) *Segment 4:* 0xB6 (Checksum) b) Receive Read response "busy" (0x01) until Device is ready c) Receive Read response and check whether it contains a negative read response with ErrorCode and AdditionalCode
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether the Read response is negative (Service: 0b1100, Length: 0b0100) b) Compare ErrorCode with 0x80 c) Compare AdditionalCode with 0x12 “Subindex not available”.
Test passed	All comparisons and checks valid
Test failed (examples)	Positive response from Device or wrong ErrorCode or AdditionalCode
Results	Negative read response received upon unavailable Subindex: <pass/fail>.

6.5.9 Read 16 bit Index

Table 80 defines the test conditions for this test case.

Table 80 – Read 16 bit Index

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0059
Name	TCD_DLIC_ISDU_READ16
Purpose (short)	Check Read response with 16 bit Index using Config2.
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see 7.3.6.4, Figure 48, and Annex A.2, Table A.10
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends ISDU read request using Config2. Device responds according Config2.
Precondition	a) Master in PREOPERATE or OPERATE respectively b) Read Config2 contents and write it to the Config2 variable for comparison / test evaluation
Procedure	a) Master: Sends ISDU Read request *Segment 1:* 0x93 (Service: Read request: 0b1001 / Length:0b0011) *Segment 2:* 0xnn (Index in Config2, part1) *Segment 3:* 0xnn (Index in Config2, part2) *Segment 4:* 0xzz (Checksum) b) Receive Read response "busy" (0x01) until Device is ready c) Check and save Read response d) Save service, length, data and checksum in variables and save ISDU Read response
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response
Test passed	a) Config2 received is complete as expected or response Index not available. b) Service, Length and Checksum are correct.
Test failed (examples)	Any other negative response or no response
Results	Config2 read correctly from Device: <pass/fail>

6.5.10 Write 16 bit Index

Table 81 defines the test conditions for this test case.

Table 81 – Write 16 bit Index

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0060
Name	TCD_DLIC_ISDU_WRITE16
Purpose (short)	Check whether a 16 bit Write request is possible
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.1
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see 7.3.6.4
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master sends 16 bit ISDU Write request using Config2. Check whether the Write request was successful.
Precondition	a) Device in PREOPERATE or OPERATE respectively b) Master in PREOPERATE or OPERATE respectively c) Read Config2 and write it to the Config2 variable for comparison and length
Procedure	a) Master: Sends 16 bit ISDU Write request using Config2. b) Receive response "busy" (0x01) until Device is ready c) Receive Write response d) Read Config2
Input parameter	Config2 according to 6.5.1
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response
Test passed	a) Positive Write response; Config2 contents as expected. b) Response "Index not available"
Test failed (examples)	a) Negative write response from Device b) Octets of Config2 not written
Results	"Config2" changed after Write request: <pass/fail>.

6.5.11 Read 16 bit Index reserved

Table 82 defines the test conditions for this test case.

Table 82 – Read 16 bit Index reserved

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0061
Name	TCD_DLIC_ISDU_READ16RESERVED
Purpose (short)	Check Device response “Index not available” upon Read to 16 bit reserved Index
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device ISDU, negative testing for Devices with 16 bit indices
Specification (clause)	[9], see 7.3.6, and Annex C, Table C.1
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends ISDU read request for Index = 0x7F32 (reserved) and receives a negative response with “Index not available” (ErrorCode = 0x80, AdditionalCode = 0x11).
Precondition	a) Device in PREOPERATE or OPERATE respectively b) Master in PREOPERATE or OPERATE respectively
Procedure	a) Master: Sends ISDU Read request *Segment 1:* 0xB4 (Service: Read request 16 bit: 0b1011 / Length: 0b0100) *Segment 2:* 0x7F (reserved Index, part 1) *Segment 3:* 0x32 (reserved Index, part 2) *Segment 4:* 0xzz (Checksum) b) Receive Read response "busy" (0x01) until Device is ready c) Receive Read response and check whether it contains a negative read response with ErrorCode and AdditionalCode
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether the Read response is negative (Service: 0b1100, Length: 0b0100) b) Compare ErrorCode with 0x80 c) Compare AdditionalCode with 0x11 “Index not available”.
Test passed	All comparisons and checks are valid
Test failed (examples)	Positive response from Device or wrong ErrorCode or AdditionalCode
Results	Negative read response received upon reserved 16 bit Index: <pass/fail>.

953 ### 6.5.12 Read 16 bit Index with unavailable Subindex

954 Table 83 defines the test conditions for this test case.

955 **Table 83 – Read 16 bit Index with unavailable Subindex**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0062
Name	TCD_DLIC_ISDU_READ16NOSUBINDEX
Purpose (short)	Check 16 bit read response when Subindex not available
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device ISDU, test to fail (negative testing)
Specification (clause)	[9], see 7.3.6, and Annex C, Table C.1
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends ISDU read request for Config2 and a Subindex = 0x02 (not specified). This results in a negative read response, “Subindex not available” (ErrorCode = 0x80 / AdditionalCode = 0x12).
Precondition	a) Device in PREOPERATE or OPERATE respectively b) Master in PREOPERATE or OPERATE respectively
Procedure	a) Master: Sends ISDU Read request *Segment 1:* 0xA4 (Service: Read request: 0b1010 / Length:0b0100) *Segment 2:* 0xnn (Index in Config2, part1) *Segment 3:* 0xnn (Index in Config2, part2) *Segment 4:* 0xzz (Checksum) b) Receive Read response "busy" (0x01) until Device is ready c) Receive Read response and check whether it contains a negative read response with ErrorCode and AdditionalCode
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether the Read response is negative (Service: 0b1100, Length: 0b0100) b) Compare ErrorCode with 0x80 c) Compare AdditionalCode with 0x12 “Subindex not available”.
Test passed	All comparisons and checks valid
Test failed (examples)	Positive response from Device or wrong ErrorCode or AdditionalCode
Results	Negative read response received upon unavailable Subindex: <pass/fail>.

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6.5.13 Write 8 bit Index with data length overrun

Table 84 defines the test conditions for this test case.

Table 84 – Write 8 bit Index with data length overrun

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0063
Name	TCD_DLIC_ISDU_WRITE8LENOVERRUN
Purpose (short)	Check response of 8 bit Write request with 70 octets when 64 are permitted
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device ISDU, test to fail (negative testing)
Specification (clause)	[9], see 7.3.6, and Annex C, Table C.1
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master sends Write request with 70 octets for Config1 (maximum of 64 octets). Write Request with ExtLength. Check whether the Write request was denied.
Precondition	a) Device in PREOPERATE state b) Master in PREOPERATE state c) Read Config1 and write it to the Config1 variable for comparison
Procedure	a) Master: Sends Write request *Segment 1:* 0x11 (Service: Write request: 0b0001 / Length:0b0001) *Segment 2:* 0x4A (ExtLength = 74) *Segment 3:* 0xnn (Index in Config1) *Segment 4:* 0x01 (data 1) ………. *Segment 73:* 0x01 (data 70) *Segment 74:* 0xzz (Checksum) b) Receive Write response "busy" (0x01) until Device is ready c) Receive Write response and check whether it contains a negative read response with ErrorCode and AdditionalCode d) Read Config1 and compare it with the Config1 variable (saved while in PREOPERATE state)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether the Write request results in a negative response b) Check whether ErrorCode = 0x80 and AdditionalCode = 0x33 “Parameter length overrun” c) Compare Config1 contents: stored and read back data shall be identical
Test passed	Negative write response, Config1 contents as expected.
Test failed (examples)	a) Positive Write response from Device b) Octets have been written
Results	Negative read response received upon length overrun: <pass/fail>.

6.5.14 Write 8 bit Index with wrong Length value

Table 84 defines the test conditions for this test case.

Table 85 – Write 8 bit Index with wrong Length value

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0064
Name	TCD_DLIC_ISDU_WRITE8WRONGLEN
Purpose (short)	Check response of 8 bit Write request with one octet less then expected
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device ISDU, test to fail (negative testing)
Specification (clause)	[9], see 7.3.6, and Annex C, Table C.1
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master sends Write request with one octet less than the m expected octets for Config1. Check whether the Write request was denied.
Precondition	a) Device in PREOPERATE state b) Master in PREOPERATE state c) Read Config1 and write it to the Config1 variable for comparison
Procedure	a) Master prepares a Write message with the saved on-request data (one octet less than the m expected octets from Config1). b) Master: Sends Write request *Segment 1:* 0x11 (Service: Write request: 0b0001 / Length:0b0001) *Segment 2:* 0xnn (Index in Config1) *Segment 3:* 0x01 (data 1) ………. *Segment n-1:* 0x01 (data m-1) *Segment n:* 0xzz (Checksum) c) Receive response "busy" (0x01) until Device is ready d) Receive Write response e) Read Config1 and compare it with the Config1 variable (saved while in PREOPERATE state)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Optional: Check whether the Write request results in a response "busy" b) Check negative response whether ErrorCode = 0x80 and AdditionalCode = 0x34 “Parameter length underrun” c) Compare Config1 contents: stored and read back data shall be identical
Test passed	Negative write response, Config1 contents as expected.
Test failed (examples)	a) Positive Write response from Device b) Octets have been written
Results	Negative read response received upon length underrun: <pass/fail>.

6.5.15 Read 8 bit Index with wrong Checksum value

Table 84 defines the test conditions for this test case.

Table 86 – Read 8 bit Index with wrong Checksum value

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0065
Name	TCD_DLIC_ISDU_WRITE8WRONGCHECKSUM
Purpose (short)	Check Device response “Device application Error” – on read
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device ISDU, test to fail (negative testing)
Specification (clause)	[9], see 7.3.6, Annex A.5, Table A.12, and Table A.14
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends 8 bit Read request with a wrong Checksum value. The Read request for the VendorName (0x10) shall be used. The correct Checksum value is 0x8B, the value in use is 0xFF. A negative Read response is expected.
Precondition	a) Device in PREOPERATE state or OPERATE respectively b) Master in PREOPERATE state or OPERATE respectively
Procedure	a) Master: Sends ISDU Read request *Segment 1:* 0x93 (Service: Read request: 0b1001 / Length:0b0011) *Segment 2:* 0x10 (VendorName, mandatory, StringT) *Segment 3:* 0xFF (Checksum) b) Receive response "busy" (0x01) until Device is ready c) Receive Read response
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check whether the Read response returns "no service"
Test passed	Checks are valid
Test failed (examples)	Positive response from Device or ErrorCode with AdditionalCode
Results	Read response "no service" received upon wrong Checksum value: <pass/fail>.

6.5.16 Write 8 bit Index on read only Index

Table 87 defines the test conditions for this test case.

Table 87 – Write 8 bit Index on read only Index

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0066
Name	TCD_DLIC_ISDU_WRITE8ROINDEX
Purpose (short)	Check response of 8 bit Write request on read only Index
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only)
Test case version	1.0
Category / type	Device ISDU, test to fail (negative testing)
Specification (clause)	[9], see 7.3.6, and Annex C, Table C.1
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends 8 bit Write request on read only index "VendorName". A negative Write response is expected with ErrorCode = 0x80 and AdditionalCode = 0x23.
Precondition	a) Device in PREOPERATE or OPERATE respectively b) Master in PREOPERATE or OPERATE respectively
Procedure	a) Master: Sends ISDU Write request *Segment 1:* 0x17 (Service: Write request: 0b0001/Length: 0b0111) *Segment 2:* 0x10 ("VendorName") *Segment 3:* 0x01 (data 1) *Segment 4:* 0x02 (data 2) *Segment 5:* 0x03 (data 3) *Segment 6:* 0x04 (data 4) *Segment 7:* 0xzz (Checksum) b) Receive response "busy" (0x01) until Device is ready c) Receive negative Write response with ErrorCode and AdditionalCode.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether the Write response is negative b) Compare ErrorCode with 0x80 c) Compare AdditionalCode with 0x23 “Access denied”
Test passed	All comparisons and checks are valid
Test failed (examples)	Positive response from Device or wrong ErrorCode
Results	Negative Write response received upon read only Index: <pass/fail>.

988 ### 6.5.17 Read 8 bit Index with request abort

989 Table 88 defines the test conditions for this test case.

990 **Table 88 – Read 8 bit Index with request abort**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0067
Name	TCD_DLIC_ISDU_ABORTREADREQ
Purpose (short)	Check response of 8 bit Read request with abort
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only, see B.4)
Test case version	1.1
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see 7.3.6.4, Figure 50 (T9; for Devices with more than two octets On-request Data within one message: T10 or T11), and Annex A.2, Table A.10
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master sends and aborts an 8 bit Read request for "VendorName" (0x10 – mandatory). Device switches to Idle mode.
Precondition	Master in PREOPERATE or OPERATE respectively
Procedure	ISDU request: *Segment 1:* 0x93 (Service: Read request: 0b1001/Length: 0b0011) *Segment 2:* 0x10 ("VendorName") *Segment 3:* Checksum a) Master sends first ISDU segment in first message b) Master sends abort (R, FlowCTRL = ABORT = 0x1F, ISDU) in next message c) Maximum one response BUSY permitted d) Next response: "No Service"
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Device sends no reception of the 8 bit Read request b) Read response of the Device is 0x00 = “No Service”
Test passed	“No Service” received (see B.4)
Test failed (examples)	Wrong Device response to the incomplete ISDU
Results	Device works properly after the aborted Read request: <pass/fail>.

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6.5.18 Read 8 bit Index with response abort

Table 89 defines the test conditions for this test case.

Table 89 – Read 8 bit Index with response abort

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0068
Name	TCD_DLIC_ISDU_ABORTREADRESP
Purpose (short)	Check reaction of 8 bit Read response with abort
Equipment under test (EUT)	Device and Legacy-Device (the latter one in OPERATE only, see B.4)
Test case version	1.1
Category / type	Device ISDU, test to pass (positive testing)
Specification (clause)	[9], see 7.3.6.4, Figure 50 (T11), and Annex A.2, Table A.10
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master sends Read request for VendorName (0x0010 – mandatory) and receives from the Device the expected "VendorName". Master aborts reading the complete "VendorName".
Precondition	Master in PREOPERATE or OPERATE respectively
Procedure	a) Master: Sends ISDU Read request to Index 0x0010 (16) b) Master receives response "BUSY" (0x01) until Device is ready c) Master receives the first message of the Read response ("VendorName") d) Master sends FlowCtrl = ABORT (Table 50 in [9]) e) Master starts reading with "Idle" (0x00) f) Master receives Read response 0x00 = "No service"
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Device tries to send the complete "VendorName" as ISDU Read response. b) Read response after Master ABORT is 0x00 = “No Service”
Test passed	“No Service” received (see B.4)
Test failed (examples)	Wrong Device reply message to the incomplete Read response
Results	Device works properly after the aborted Read response: <pass/fail>.

6.6 Events

6.6.1 General

Any of the Device applications can generate predefined "status" information when SDCI operations fail, or "technology specific" information (diagnosis) as a result from technology specific diagnostic methods. This information can be communicated via SDCI Event to upper level systems of different capability. Thus the following tests can only verify the conformity to the SDCI standard [9] and the legacy specification [13] in terms of Event handling mechanisms.

The cause for an Event of a Device is determined vendor specific. Thus the test cases will not require specific Events to occur, but any Event. It is the Device designer's and tester's responsibility to provide a possibility to stimulate at least one kind of Event for test purposes. This stimulation, for example, can be an auxilliary mechanism on a Device prototype for the purpose of testing that will be removed in series production. Devices, for example, which monitor their power supply level, can raise an Event whenever the power supply is above a certain limit.

For Devices according [9] not supporting Events and the corresponding description within the IODD, except for the internal Event "DS_UPLOAD_REQ", it is not required to implement an Event test interface and to describe it within the IODD. In this case, the Event test cases can be skipped.

For Devices supporting only one Event A (error or warning appears/disappears), the Event test cases for two Events A/B can be skipped.

NOTE Event A is considered to be a placeholder for an Event with a certain error code and Event B is considered to be a placeholder for an Event with a different error code.

For Legacy-Devices (or variants of those) according [13] without any test interface and stimulation of incidents/Events, the Event test cases can be skipped.

6.6.2 Single Event while in OPERATE state

Table 90 defines the test conditions for this test case.

Table 90 – Single Event while in OPERATE state

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0069
Name	TCD_DLIC_EVNT_OPERSINGLEEVENT
Purpose (short)	Test of single Event processing while in OPERATE state.
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.2
Category / type	Event test, test to pass (positive testing)
Specification (clause)	[9], see 7.3.8.2
Configuration / setup	Device-Tester shall service event flag as specified. User shall invoke Event via stimulation of Device (e.g. short circuit, over voltage).
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check if event flag and event buffer is serviced as specified: - Event Flag is raised once an event occurred - StatusCode Type 2 is set respectively - Event page is frozen while event is pending - Event is cleared as specified - Event Type & Code match
Precondition	a) Device is in OPERATE state. b) EUT is free of Events; no incidents in application, no Events in communication c) Events A and B defined by manufacturer
Procedure	a1) Device-Tester to read StatusCode. Save value in tester variable "SCa”. a2) Insert step if Legacy-Device: Device-Tester to write "0xFF" to StatusCode. b) Invoke an event A (Vendor to define how this can be achieved). c) Device-Tester to read StatusCode. Save value in tester variable "SCc”. d) Invoke an event B (Vendor to define how this can be achieved). e) Device-Tester to read StatusCode. Save value in tester variable "SCe”. f) Device-Tester to read EventQualifier. g) Device-Tester to read EventCode. h) Device-Tester to write "0xFF" to StatusCode.
Input parameter	Event A and B
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Result of procedure step b): Event Flag is set b) Result of procedure step c): Content of "SCa" and "SCc" are different; "SCc" indicates the event. c) Result of procedure step e): "SCc" and "SCe" contain the same value; - Event Type & Code are as specified - Check if Eventcode text matches the event described in user manual. d) Result of procedure step h): Event Flag is reset
Test passed	Evaluation steps a) through d) ok.
Test failed (examples)	a) No Event Flag set b) Content of "SCa" and "SCc" are not different c) No event indicated in evaluation step b) d) Event Type & Code are not as specified e) Eventcode does not match description in user manual f) Event Flag is not reset.
Results	a) Event Flag set: <pass/fail> b) Content of "SCa" and "SCc" are different: <pass/fail> c) Content of "SCa": <pass/fail> d) Event Type & Code: <pass/fail> e) Eventcode matches user manual: <pass/fail> f) Event Flag is reset: <pass/fail>

6.6.3 Single Event while in PREOPERATE state

Table 91 defines the test conditions for this test case.

Table 91 – Single Event while in PREOPERATE

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0070
Name	TCD_DLIC_EVNT_PROPSINGLEEVENT
Purpose (short)	Test of single Event processing while in PREOPERATE state.
Equipment under test (EUT)	Device
Test case version	1.2
Category / type	Event test, test to pass (positive testing)
Specification (clause)	[9], see 7.3.8.2
Configuration / setup	Device-Tester shall service event flag as specified. User shall invoke Event via stimulation of Device (e.g. short circuit, over voltage).

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check if event flag and event buffer is serviced as specified: - Event flag is raised once event has occurred - StatusCode Type 2 is set respectively - Event page is frozen while event is pending - Event is cleared as specified
Precondition	a) Device is in PREOPERATE state. b) EUT is free of Events; no incidents in application, no Events in communication c) Events A and B defined by manufacturer
Procedure	a1) Device-Tester to read StatusCode. Save value in tester variable "SCa". a2) Insert step if Legacy-Device: Device-Tester to write "0xFF" to StatusCode. b) Invoke an event A (Vendor to define how this can be achieved). c) Device-Tester to read StatusCode. Save value in tester variable "SCc". d) Invoke an event B (Vendor to define how this can be achieved). e) Device-Tester to read StatusCode. Save value in tester variable "SCe". f) Device-Tester to read EventQualifier. g) Device-Tester to read EventCode. h) Device-Tester to write "0xFF" to StatusCode.
Input parameter	Event A and B
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Result of procedure step b): Event Flag is set b) Result of procedure step c): Content of "SCa" and "SCc" are different; "SCc" indicates the event. c) Result of procedure step e): "SCc" and "SCe" contain the same value; - Event Type & Code are as specified - Check if Eventcode text matches the event described in user manual. d) Result of procedure step h): Event Flag is reset
Test passed	Evaluation steps a) through d) ok.
Test failed (examples)	a) No Event Flag set b) Content of "SCa" and "SCc" are not different c) No event indicated in evaluation step b) d) Event Type & Code are not as specified e) Eventcode does not match description in user manual f) Event Flag is not reset.
Results	a) Event Flag set: <pass/fail> b) Content of "SCa" and "SCc" are different: <pass/fail> c) Content of "SCa": <pass/fail> d) Event Type & Code: <pass/fail> e) Eventcode matches user manual: <pass/fail> f) Event Flag is reset: <pass/fail>

6.6.4 Event clearance in OPERATE state

Table 92 defines the test conditions for this test case.

Table 92 – Event clearance in OPERATE state

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0071
Name	TCD_DLIC_EVNT_OPEREVENTCLEAR
Purpose (short)	Test of Event clearance while in OPERATE state.
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Event test, test to pass (positive testing)
Specification (clause)	[9], see 7.3.8.2
Configuration / setup	Device-Tester shall service Event Flag as specified. User shall invoke Event via stimulation of Device (e.g. short circuit, over voltage).
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check if event flag is serviced as specified, i.e. Event is cleared with any value written back into the StatusCode (Line 1505 & 1513, V1.09)
Precondition	a) Device is in OPERATE. b) EUT is free of Events; no incidents in application, no Events in communication c) Event A defined by manufacturer
Procedure	a) Stimulation of Event A. b) Device-Tester to write StatusCode "0x00". c) Stimulation of Event A. d) Device-Tester to write StatusCode "0xAA". e) Stimulation of Event A. f) Device-Tester to read StatusCode. Save value in tester variable "SCf". g) Device-Tester to write StatusCode with value of tester variable "SCf".
Input parameter	Event A
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Result of procedure step b): Event Flag is reset b) Result of procedure step d): Event Flag is reset c) Result of procedure step g): Event Flag is reset
Test passed	Evaluation steps a) through c) ok.
Test failed (examples)	Event Flag not reset in any of the evaluation steps.
Results	a) Event Flag in procedure step b: <pass/fail> b) Event Flag in procedure step d: <pass/fail> c) Event Flag in procedure step g: <pass/fail>

6.6.5 Event handling while communication interruption

Table 93 defines the test conditions for this test case.

Table 93 – Event handling while communication interruption

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0072
Name	TCD_DLIC_EVNT_OPERCOMMINTERRUPT
Purpose (short)	Test of Event handling while communication is interrupted.
Equipment under test (EUT)	Device
Test case version	1.2
Category / type	Event test, test to pass (positive testing)
Specification (clause)	[9], see 10.9.2
Configuration / setup	Device-Tester shall service Event Flag as specified. User shall invoke Event via stimulation of Device (e.g. short circuit, over voltage).

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check if Event is handled as specified once communication is cancelled or interrupted.
Precondition	a) Device is in OPERATE state. b) EUT is free of Events; no incidents in application, no Events in communication c) Stimulation of Event A defined by manufacturer
Procedure	a) Stimulation of Event A (error). Example: primary voltage supply over-run. This cause for the Event A shall not be cleared, thus the error appeared but did not yet disappear. b) Device-Tester to read StatusCode. Save value in tester variable "SCb". c) Device-Tester to read the indicated EventQualifier ("Event appears"). Save value in tester variable "SCc". d) Device-Tester to read the indicated EventCode. Save value in tester variable "SCd". e) Device-Tester to stop communication with Device f) Pause of 15 sec g) Device-Tester to wake-up Device to OPERATE state h) Read out and acknowledge events until expected event occurred
Input parameter	Error Event A
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Result of procedure step g): Event Flag is set because the error cause from step a) was not cleared before communication was lost. The timeout for the Device-Tester shall be 2 min. b) Result of procedure step h): Value read corresponds to tester variable "SCb", "SCc", and "SCd".
Test passed	Evaluation steps a) through b) ok.
Test failed (examples)	No correspondence between any of the values read and tester variables "SCb", "SCc", and "SCd".
Results	a) Event Flag in procedure step g: <pass/fail> b) Read value in step h: <pass/fail>

6.6.6 Event handling while power supply interruption

Table 94 defines the test conditions for this test case.

Table 94 – Event handling while power supply interruption

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0073
Name	TCD_DLIC_EVNT_OPERPOWERINTERRUPT
Purpose (short)	Test of Event handling while power supply is interrupted.
Equipment under test (EUT)	Device
Test case version	1.2
Category / type	Event test, test to pass (positive testing)
Specification (clause)	[9], see 7.3.8.2
Configuration / setup	Device-Tester shall service Event Flag as specified. User shall invoke Event via stimulation of Device (e.g. short circuit, overvoltage).
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check if Event modes are handled as specified when power supply of the Device is interrupted.
Precondition	a) Device is in OPERATE. b) EUT is free of Events; no incidents in application, no Events in communication c) Stimulation of Event A defined by manufacturer
Procedure	a) Stimulation of Event A (error). Example: primary voltage supply over-run. This cause for the Event A shall not be cleared, thus the error appeared but did not yet disappear. b) Device-Tester to read StatusCode. Save value in tester variable "SCb”. c) Device-Tester to read the indicated EventQualifier ("Event appears"). Save value in tester variable "SCc”. d) Device-Tester to read the indicated EventCode. Save value in tester variable "SCd”. e) Power-down of the Device (disconnect from Device-Tester) f) Pause of 15 sec g) Re-connect Device h) Device-Tester to wake-up Device to OPERATE state i) Read out and acknowledge events until expected event occurred
Input parameter	Event A
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Result of procedure step h): Event Flag is set because the error cause from step a) was not cleared before communication was lost. The timeout for the Device-Tester shall be 2 min. b) Result of procedure step i): Either no value or value read corresponds to tester variable "SCb", "SCc", and "SCd".
Test passed	After power-up the Device may report an Event with status "Event appears" by its own (if incidents are stored) or nothing.
Test failed (examples)	If after power-up the Device reports an Event with status "Event disappears" by its own.
Results	a) Event Flag in procedure step h: <pass/fail> b) Read value in step i: <pass/fail>

6.6.7 Event appears/disappears

Table 95 defines the test conditions for this test case.

Table 95 – Event appears/disappears

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0074
Name	TCD_DLIC_EVNT_OPERAPPEARDISAPPEAR
Purpose (short)	Test of Event handling with Errors appearing and disappearing.
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Event test, test to pass (positive testing)
Specification (clause)	[9], see 7.3.8.2
Configuration / setup	Device-Tester shall service Event Flag as specified. User shall invoke Event via stimulation of Device (e.g. short circuit, over voltage).

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check if Event modes are handled as specified in Figure 11. (Line 2810, V1.09)
Precondition	a) Device is in OPERATE state. b) EUT is free of Events; no incidents in application, no Events in communication c) Stimulation of Event A defined by manufacturer
Procedure	a) Stimulation of Error A. Error shall stay applied to the Device. b) Device-Tester to read StatusCode c) Device-Tester to read EventQualifier. Save value in tester variable "SCc". d) Device-Tester to read EventCode. Save value in tester variable "SCd". e) Device-Tester to write StatusCode "0xFF". f) User to release Error from Device. g) Device-Tester to read StatusCode. h) Device-Tester to read EventQualifier. Save value in tester variable "SCh". i) Device-Tester to read EventCode. Save value in tester variable "SCi". j) Device-Tester to write StatusCode "0xFF".
Input parameter	Error A
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Result of procedure step a): Event Flag is set b) Result of procedure step c): Value read shows mode = "Event appeared" c) Result of procedure step e): Event Flag is reset d) Result of procedure step f): Event Flag is set e) Result of procedure step h): Value read shows mode = "Event disappeared" f) Result of procedure step i): Value of "SCi" = value of "SCd" (EventCodes). g) Result of procedure step j): Event Flag is reset
Test passed	Evaluation steps a) through g) ok.
Test failed (examples)	a) Event Flags are not set correctly b) Event modes are indicated incorrectly c) EventCodes are different
Results	a) Event Flag in procedure step a: <pass/fail> b) Value in procedure step c: <pass/fail> c) Event Flag in procedure step e: <pass/fail> d) Event Flag in procedure step f: <pass/fail> e) Value in procedure step h: <pass/fail> f) EventCodes in procedure step i: <pass/fail> g) Event Flag in procedure step j: <pass/fail>

Figure 11 shows the relationship of an Error and the Event Flag and its appearance and disappearance.

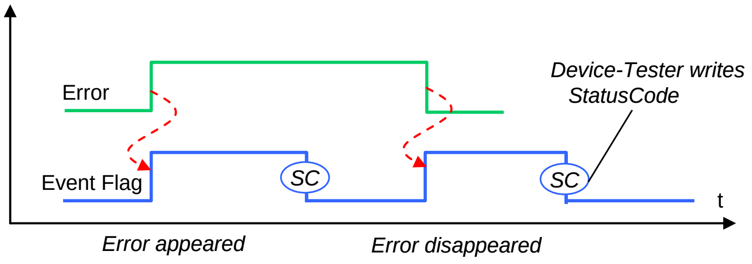

Figure 11 – Relationship of an Error and the Event Flag

1074 ### 6.6.8 Multi Event handling

1075 Table 96 defines the test conditions for this test case.

1076 **Table 96 – Multi Event handling**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0075
Name	TCD_DLIC_EVNT_OPERMULTEVENT
Purpose (short)	Test of Event handling with multiple Errors/Events.
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Event test, test to pass (positive testing)
Specification (clause)	[9], see 7.3.8.2
Configuration / setup	Device-Tester shall service Event Flag as specified. User shall invoke Events via stimulation of Device (e.g. short circuit, over voltage).

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check if Event modes are handled as specified in Figure 12. See (Line 2810, V1.09)
Precondition	a) Device is in OPERATE state. b) EUT is free of Events; no incidents in application, no Events in communication c) Stimulation of Event A and B defined by manufacturer
Procedure	a) Stimulation of Error A. Error shall stay applied to Device. b) Device-Tester to read StatusCode c) Device-Tester to read EventQualifier. Save value in tester variable "SCc". d) Device-Tester to read EventCode. Save value in tester variable "SCd". e) Device-Tester to write Status Code "0xFF". f) Stimulation of Error B. Error shall stay applied to Device. h) Device-Tester to read StatusCode g) Stop simulation of Error A i) Device-Tester to read EventQualifier. Save value in tester variable "SCi". j) Device-Tester to read EventCode. Save value in tester variable "SCj". k) Device-Tester to write Status Code "0xFF". l) Device-Tester to read StatusCode m) Stop simulation of Error B n) Device-Tester to read EventQualifier. Save value in tester variable "SCm". o) Device-Tester to read EventCode. Save value in tester variable "SCn". p) Device-Tester to write StatusCode "0xFF". q) Device-Tester to read StatusCode r) Device-Tester to read EventQualifier. Save value in tester variable "SCq". s) Device-Tester to read EventCode. Save value in tester variable "SCr". t) Device-Tester to write StatusCode "0xFF".
Input parameter	Error/Event A and B
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Result of procedure step c): Value read shows mode = "Event A appeared" b) Result of procedure step i): Value read shows mode = "Event B appeared" c) Result of procedure step n): Value read shows mode = "Event A disappeared" d) Result of procedure step r): Value read shows mode = "Event B disappeared"
Test passed	Evaluation steps a) through d) ok.
Test failed (examples)	a) Event Flags are not set correctly b) Event modes are indicated incorrectly c) EventCodes are different
Results	a) Value in procedure step c): <pass/fail> b) Value in procedure step i): <pass/fail> f) Value in procedure step n): <pass/fail> g) Value in procedure step r): <pass/fail>

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Figure 12 shows the correlation of two Errors and the Event Flag and its appearance and disappearance.

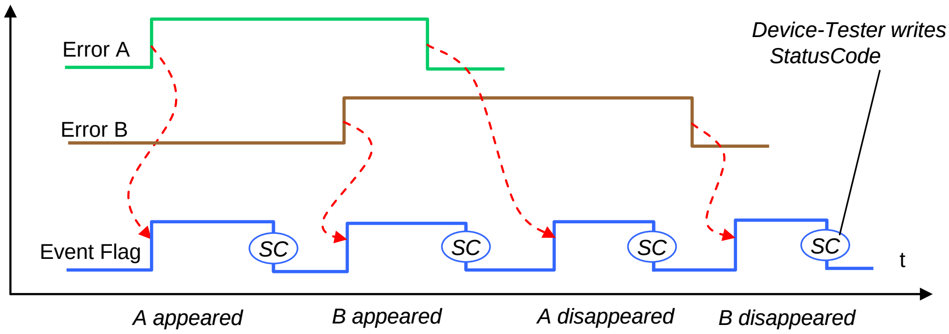

Figure 12 – Correlation of two Errors and the Event Flag

1086 ### 6.6.9 Short time Events

1087 Table 97 defines the test conditions for this test case.

1088 **Table 97 – Short time Events**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0076
Name	TCD_DLIC_EVNT_OPERSHORTEVENT
Purpose (short)	Test of the Event handling of short time errors.
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Event test, test to pass (positive testing)
Specification (clause)	[9], see 7.3.8.2
Configuration / setup	Device-Tester shall service Event flag as specified. Person in charge of the test to stimulate an Event (e.g. short circuit, over voltage).
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of the Event handling of short time errors according Figure 13. "Short time error" means that the cause of the error is no more existent, when the acknowledgement from the Master occurred (Write access to StatusCode (SC)). The Device shall send "Error disappeared" in this case after the acknowledgement.
Precondition	a) Device is in OPERATE state. b) EUT is free of Events; no incidents in application, no Events in communication c) Stimulation of short time Event A defined by manufacturer
Procedure	a) Stimulation of a short time error A. Duration of the error as short as possible. b) Person in charge of the test shall confirm the end of the error cause to the Device-Tester (Figure 13). c) Device-Tester to write StatusCode "0xFF". d) Device-Tester to start timer (measurement) when Event Flag is set. e) Device-Tester to write StatusCode "0xFF" once 100 ms time elapsed and Event Flag still is set.
Input parameter	Short time Error A
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Result of procedure step a): Event Flag is set b) Result of procedure step c): - Event Flag still is set and then reset or - Event Flag remains set c) Result of procedure step e): Event Flag still is set and then reset
Test passed	Evaluation steps a) through c) ok.
Test failed (examples)	Event Flags are not set correctly
Results	Event has been latched: <pass/fail>

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Figure 13 shows the timings of a short time error and the Event flag.

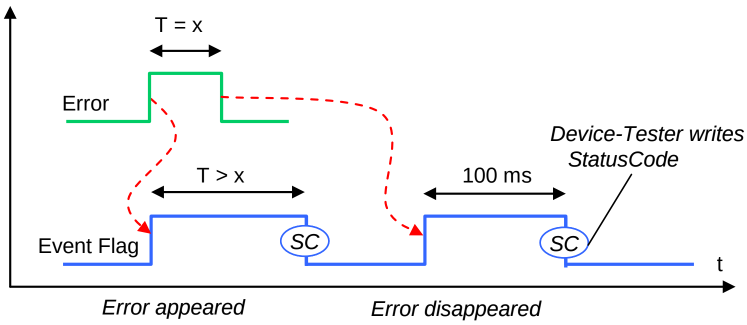

Figure 13 – Timings of a short time error and the Event flag

6.7 Data Storage (DS)

6.7.1 General

6.7.1.1 Checks on Data Storage Index

Checks on different states/values shall be performed according to the notes in the "Evaluation" and "Results" field of the test cases:

- State_Property
  - value of 'State of Data Storage'
  - value of 'DS_UPLOAD_FLAG'
- Data_Storage_Size
  - shall be larger or equal to actual memory size for the current 'Index_List' and current object values, as described in "Structure of the stored DS data objects"
  - check after Upload
- Parameter_checksum
  - After modification of parameters listed for data storage this value shall be changed
  - Check after parameter modification

These states are specified in [9], 10.4.2 (Data Storage state machine), and B.2.3 (Data Storage Index).

"Parameter set 1" and "Parameter set 2" are used as placeholders for two parameter sets that fulfil the following conditions:

- "Parameter set 1" and "Parameter set 2" contain parameters listed for data storage
- "Parameter set 1" and "Parameter set 2" are different in parameters listed for data storage
- "Parameter set 1" and the parameter set of the Device after factory reset are different

6.7.1.2 Generation of "DS_UPLOAD_REQ"

It would be possible to test the generation of "DS_UPLOAD_REQ" in separate testcases. But these tests are already executed within the test cases for Upload and Download.

6.7.1.3 Different Upload test cases

Upload is tested in different states of the Device.

6.7.1.4 Different Download test cases

Download is only checked with "DS_UPLOAD_REQ" flag = false.

6.7.2 Upload without DS_UPLOAD_FLAG notification

Table 98 defines the test conditions for this test case.

1128 **Table 98 – Upload without DS_UPLOAD_FLAG notification**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0077
Name	TCD_APPS_DSUP_NOFLAG
Purpose (short)	Test of explicit upload without DS_UPLOAD_FLAG notification
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.4.2, Table B.11, Figure 95
Configuration / setup	-

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test covers upload of data storage contents (parameter set) without DS_UPLOAD_FLAG notification
Precondition	a) Device in PREOPERATE or OPERATE mode b) Device DS activated c) DS_UPLOAD_FLAG is not set d) Device parameterized (manufacturer to define parameter set)
Procedure	Execute upload completely as defined in Master DS state machine: a) Switch Master DS from deactivated to activated state. b) Stimulate upload using DS_Commands "DS_UploadStart" and "DS_UploadEnd"
Input parameter	Parameter set (manufacturer to define parameter set)
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check whether parameter set is read without errors through Data Storage Index. Upon each of the following actions: a) After call of the DS_UploadStart command b) After reading/uploading the parameters c) After call of the DS_UploadEnd command check the following: d) State of Data Storage is correct e) DS_UPLOAD_FLAG is not set f) Parameter_checksum does not change
Test passed	If all three checks during the three actions described in evaluation are positive
Test failed (examples)	If one check during the actions described in Evaluation is negative
Results	a) Result of evaluation action a) and check d): <state> <pass/fail> b) Result of evaluation action a) and check e): <flag> <pass/fail> c) Result of evaluation action a) and check f): <checksum> <pass/fail> d) Result of evaluation action b) and check d): <state> <pass/fail> e) Result of evaluation action b) and check e): <flag> <pass/fail> f) Result of evaluation action b) and check f): <checksum> <pass/fail> g) Result of evaluation action c) and check d): <state> <pass/fail> h) Result of evaluation action c) and check e): <flag> <pass/fail> i) Result of evaluation action c) and check f): <checksum> <pass/fail>

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6.7.3 Upload via ParamDownloadStore

Table 99 defines the test conditions for this test case.

Table 99 – Upload via ParamDownloadStore

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0078
Name	TCD_APPS_DSUP_VIADOWNLOADSTORE
Purpose (short)	Test of explicit upload via SystemCommand "ParamDownloadStore"
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.4.2, Tables B.8, B.11, D.2, Figure 95
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test covers parameterization (parameter set 2) of a Device and upload of this set into the Master DS per SystemCommand "ParamDownloadStore". Manufacturer is responsible for the definition of two possible "parameter sets".
Precondition	a) Device in PREOPERATE or OPERATE mode b) Device DS activated c) Parameter set 1 stored within Device (manufacturer to define parameter set 1) d) DS_UPLOAD_FLAG is not set d) Test preparation e.g. using DS_Command "DS_UploadStart", upload of parameter set 1" using the Index List (upload), followed by a "DS_UploadEnd"
Procedure	a) Call SystemCommand "ParamDownloadStart" if Device supports Block Parameterization b) Write different parameter set 2 into the Device (manufacturer to define parameter set 2) c) Call SystemCommand "ParamDownloadStore" (causes the Event DS_UPLOAD_REQ) d) Wait for event DS_UPLOAD_REQ e) Execute Upload (Data Storage) completely as defined in the Master state machine (switch Master DS from deactivated to activated)
Input parameter	Parameter set 1 and parameter set 2 (defined by manufacturer)
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check whether parameter set 2 is read without errors through Parameter_checksum. Upon each of the following actions: a) After call of the DS_UploadStart command b) After reading/uploading the parameters c) After call of the DS_UploadEnd command check the following: d) State of Data Storage is 0b00 (Inactive) e) DS_UPLOAD_FLAG is not set f) Parameter_checksum has changed to that of parameter set 2
Test passed	If all three checks during the three actions described in evaluation are positive.
Test failed (examples)	If one check during the actions described in Evaluation is negative.
Results	a) Result of evaluation action a) and check d): <state> <pass/fail> b) Result of evaluation action a) and check e): <flag> <pass/fail> c) Result of evaluation action a) and check f): <checksum> <pass/fail> d) Result of evaluation action b) and check d): <state> <pass/fail> e) Result of evaluation action b) and check e): <flag> <pass/fail> f) Result of evaluation action b) and check f): <checksum> <pass/fail> g) Result of evaluation action c) and check d): <state> <pass/fail> h) Result of evaluation action c) and check e): <flag> <pass/fail> i) Result of evaluation action c) and check f): <checksum> <pass/fail>

1141 6.7.4 Upload via ParamDownloadStore without write calls

1142 Table 100 defines the test conditions for this test case.

1143 **Table 100 – Upload via ParamDownloadStore without write calls**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0079
Name	TCD_APPS_DSUP_VIADOWNLOADSTORENOWRITE
Purpose (short)	Test of explicit upload via "ParamDownloadStore" without write calls
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.4.2, Table B.11, Table D.2, Figure 95
Configuration / setup	-

1144

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test covers parameterization (parameter set 2) of a Device and upload of this set into the Master DS per SystemCommand "ParamDownloadStore". Manufacturer is responsible for the definition of two possible "parameter sets".
Precondition	a) Device in PREOPERATE or OPERATE mode b) Device DS activated c) Parameter set 1 stored within Device (manufacturer to define parameter set 1) d) DS_UPLOAD_FLAG is not set d) Test preparation e.g. using DS_Command "DS_UploadStart", upload of parameter set 1" using the Index List (upload), followed by a "DS_UploadEnd"
Procedure	a) Write different parameter set 2 into the Device (manufacturer to define parameter set 2) b) Wait 1 s for event DS_UPLOAD_REQ c) Call SystemCommand "ParamDownloadStart" via ISDU (w/o writing parameters), if Device supports Block Parameterization d) Initiate upload via SystemCommand "ParamDownloadStore" e) Wait for event DS_UPLOAD_REQ e) Execute upload (Data Storage) completely as defined in the Master state machine (switch Master DS from deactivated to activated)
Input parameter	Parameter set 1 and 2 (manufacturer to define possible parameter sets)
Post condition	-

1145

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether parameter set 2 is written without errors b) Check whether Event DS_UPLOAD_REQ was not raised after changing parameters (parameter set 2) c) Check whether Event DS_UPLOAD_REQ was raised by the Device after SystemCommand "ParamDownloadStore" d) Check whether parameter set 2 is read without errors through Parameter_checksum Upon each of the following actions: e) After call of the DS_UploadStart command f) After reading/uploading the parameters g) After call of the DS_UploadEnd command check via Data Storage Index the following: h) State of Data Storage is correct i) DS_UPLOAD_FLAG is not set j) Parameter_checksum has changed only after 'Write parameter set 2'
Test passed	If all three checks during the three actions described in evaluation are positive.
Test failed (examples)	If one check during the actions described in Evaluation is negative.
Results	a) Result of evaluation action a): <checksum> <pass/fail> b) Result of evaluation action b): <flag> <pass/fail> c) Result of evaluation action c): <flag> <pass/fail> d) Result of evaluation action d): <checksum> <pass/fail> e) Result of evaluation action e) and check h): <state> <pass/fail> f) Result of evaluation action e) and check i): <flag> <pass/fail> g) Result of evaluation action e) and check j): <checksum> <pass/fail> h) Result of evaluation action f) and check h): <state> <pass/fail>

TEST CASE RESULTS	CHECK / REACTION	
	i) Result of evaluation action f) and check i): <flag> j) Result of evaluation action f) and check j): <checksum> k) Result of evaluation action g) and check h): <state> l) Result of evaluation action g) and check i): <flag> m) Result of evaluation action g) and check j): <checksum>	<pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail>

1148 6.7.5 Upload via local parameter modification

1149 Table 101 defines the test conditions for this test case.

1150 **Table 101 – Upload via local parameter modification**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0080
Name	TCD_APPS_DSUP_VIALOCALCHANGE
Purpose (short)	Test of implicit upload after local parameter modification
Equipment under test (EUT)	Device (only if local parameterization such as teach-in or panel is supported)
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.4.2, Table B.11, Table D.2, Figure 95
Configuration / setup	-

1151

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test covers local parameter changes of a Device and implicit upload of the parameter set into the Master DS. Manufacturer is responsible for the definition of two possible "parameter sets".
Precondition	a) Device in PREOPERATE or OPERATE mode b) Device DS activated c) Parameter set 1 stored within Device (manufacturer to define parameter set 1) d) DS_UPLOAD_FLAG is not set d) Test preparation e.g. using DS_Command "DS_UploadStart", upload of parameter set 1" using the Index List (upload), followed by a "DS_UploadEnd"
Procedure	Only if Device supports local parameter changes: a) Change parameter value(s) locally in the Device, e.g. via local menu or teach-in b) Wait for event DS_UPLOAD_REQ c) Execute upload (Data Storage) completely as defined in the Master state machine (switch Master DS from deactivated to activated)
Input parameter	Parameter set 1 (manufacturer to define the possible parameter set)
Post condition	-

1152

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Event DS_UPLOAD_REQ was raised automatically by the Device after local parameter modification b) Check whether parameter set 2 is read without errors through Parameter_checksum Upon each of the following actions: c) After call of the DS_UploadStart command d) After reading/uploading the parameters e) After call of the DS_UploadEnd command check via Data Storage Index the following: f) State of Data Storage is correct g) DS_UPLOAD_FLAG is not set h) Parameter_checksum has changed only after 'local change of parameter values'
Test passed	If all three checks during the three actions described in evaluation are positive.
Test failed (examples)	If one check during the actions described in Evaluation is negative.
Results	a) Result of evaluation action a): <flag> <pass/fail> b) Result of evaluation action b): <checksum> <pass/fail> c) Result of evaluation action c) and check f): <state> <pass/fail> d) Result of evaluation action c) and check g): <flag> <pass/fail> e) Result of evaluation action c) and check h): <checksum> <pass/fail> f) Result of evaluation action d) and check f): <state> <pass/fail> g) Result of evaluation action d) and check g): <flag> <pass/fail> h) Result of evaluation action d) and check h): <checksum> <pass/fail> i) Result of evaluation action e) and check f): <state> <pass/fail> j) Result of evaluation action e) and check g): <flag> <pass/fail> k) Result of evaluation action e) and check h): <checksum> <pass/fail>

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1154 ### 6.7.6 Call ParamBreak in different states of Upload

1155 Table 102 defines the test conditions for this test case.

1156 **Table 102 – Call ParamBreak in different states of Upload**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0081
Name	TCD_APPS_DSUP_PARABREAKABORT
Purpose (short)	Test of Upload abort via SystemCommand "ParamBreak" in different states
Equipment under test (EUT)	Device with supported Block Parameterization
Test case version	1.3
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.4.2, Table B.11, Table D.2, Figure 95
Configuration / setup	

1157

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test covers Upload aborts via SystemCommand "ParamBreak" in different states. Manufacturer is responsible for the definition of two possible "parameter sets".
Precondition	a) Device in PREOPERATE or OPERATE mode b) Device DS activated c) Parameter set 1 stored within Device (manufacturer to define parameter set 1) d) DS_UPLOAD_FLAG is not set d) Test preparation e.g. using DS_Command "DS_UploadStart", upload of parameter set 1" using the Index List (upload), followed by a "DS_UploadEnd"
Procedure	a) Call SystemCommand "ParamDownloadStart" b) Write different parameter set 2 into the Device (manufacturer to define parameter set 2) c) Call SystemCommand "ParamDownloadStore" (causes event DS_UPLOAD_REQ) d) Wait for event DS_UPLOAD_REQ e) Start Upload via SystemCommand "ParamUploadStart" f) Call SystemCommand "ParamBreak" directly after "ParamUploadStart" g) Start Upload via SystemCommand "ParamUploadStart" h) Transmit first Block Parameter object of Config4 i) Call SystemCommand "ParamBreak" j) Start Upload via SystemCommand "ParamUploadStart" k) Transmit all Block Parameter objects of Config4 l) Call SystemCommand "ParamBreak" m) Execute upload (Data Storage) completely as defined in the Master state machine (switch Master DS from deactivated to activated)
Input parameter	Parameter set 1 and 2
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Event DS_UPLOAD_REQ was raised automatically by the Device b) Check whether parameter set 2 is read without errors through Parameter_checksum Upon each of the following actions: c) After call of each SystemCommand "ParamUploadStart" (3x) d) After call of each SystemCommand "ParamBreak" (3x) check via Data Storage Index the following: e) State of Data Storage is 0b00 (inactive) f) DS_UPLOAD_FLAG is is set g) Parameter_checksum has changed only after 'write parameter set 2' h) Check whether the Upload has been completed without errors
Test passed	If all three checks during the two actions described in evaluation are positive.
Test failed (examples)	If one check during the actions described in Evaluation is negative.
Results	a) Result of evaluation action a): <flag> <pass/fail> b) Result of evaluation action b): <checksum> <pass/fail> c) Result of evaluation action c) and check e): <state> <pass/fail> d) Result of evaluation action c) and check f): <flag> <pass/fail> e) Result of evaluation action c) and check g): <checksum> <pass/fail> g) Result of evaluation action d) and check e): <state> <pass/fail> h) Result of evaluation action d) and check f): <flag> <pass/fail>

TEST CASE RESULTS	CHECK / REACTION
	i) Result of evaluation action d) and check g): <checksum> <pass/fail> j) Result of evaluation action h): <pass/fail>

6.7.7 Download after modification of parameters

Table 103 defines the test conditions for this test case.

Table 103 – Download after modification of parameters

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0082
Name	TCD_APPS_DSDN_PARAMODIFICATION
Purpose (short)	Test Download after modification of parameters
Equipment under test (EUT)	Device with supported Block Parameterization
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.4.2, Table B.11, Table D.2, Figure 95
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	After changing parameters in Device without storing them in DS, download a different parameter set into the Device.
Precondition	a) Device in PREOPERATE or OPERATE mode b) Device DS activated c) Parameter set 1 stored within Device (manufacturer to define parameter set 1) d) DS_UPLOAD_FLAG is not set d) Test preparation e.g. using DS_Command "DS_UploadStart", upload of parameter set 1" using the Index List (upload), followed by a "DS_UploadEnd"
Procedure	a) Call SystemCommand "ParamDownloadStart" via ISDU b) Write different parameter set 2 into the Device (manufacturer to define parameter set 2) c) Call SystemCommand "ParamDownloadEnd" d) Execute Download (restore) of parameter set 1 completely as defined in the Master state machine only if the DS_UPLOAD_FLAG is not set (switch Master DS from deactivated to activated)
Input parameter	Parameter set 1 and 2
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether Event DS_UPLOAD_REQ was not raised by the Device Upon each of the following actions: b) After call of SystemCommand "ParamDownloadStart" c) After call of SystemCommand "ParamDownloadEnd" d) After execution of the complete Download check via Data Storage Index the following: e) State of Data Storage is 0b00 (inactive) f) DS_UPLOAD_FLAG is not set g) Parameter_checksum has changed only after 'write parameter set 2' h) Check whether the Download has been completed without errors
Test passed	If all three checks during the three actions described in evaluation are positive.
Test failed (examples)	If one check during the actions described in Evaluation is negative.
Results	a) Result of evaluation action a): <flag> <pass/fail> b) Result of evaluation action b) and check e): <state> <pass/fail> c) Result of evaluation action b) and check f): <flag> <pass/fail> d) Result of evaluation action b) and check g): <checksum> <pass/fail> e) Result of evaluation action c) and check e): <state> <pass/fail> f) Result of evaluation action c) and check f): <flag> <pass/fail> g) Result of evaluation action c) and check g): <checksum> <pass/fail> h) Result of evaluation action d) and check e): <state> <pass/fail> i) Result of evaluation action d) and check f): <flag> <pass/fail> j) Result of evaluation action d) and check g): <checksum> <pass/fail> k) Result of evaluation action h): <pass/fail>

6.7.8 Download into the Device after reset

Table 104 defines the test conditions for this test case.

Table 104 – Download into the Device after reset

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0083
Name	TCD_APPS_DSDN_FACTORYRESET
Purpose (short)	Test of Download into the Device after reset to factory settings
Equipment under test (EUT)	Device (only if reset to factory settings is supported)
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.4.2, 10.6.4, Table B.11, Table D.2, Figure 95
Configuration / setup	-
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of Download of the stored parameter set into the Device after reset to factory settings. Manufacturer to provide parameter set 1 different to factory settings.
Precondition	a) Device in PREOPERATE or OPERATE mode b) Device DS activated c) Parameter set 1 stored within Device (manufacturer to define parameter set 1) d) DS_UPLOAD_FLAG is not set d) Test preparation e.g. using DS_Command "DS_UploadStart", upload of parameter set 1" using the Index List (upload), followed by a "DS_UploadEnd"
Procedure	a) Call SystemCommand "Restore factory settings" via ISDU b) Execute Download (restore) of parameter set 1 completely as defined in the Master state machine only if the DS_UPLOAD_FLAG is not set (switch Master DS from deactivated to activated)
Input parameter	Parameter set 1
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) After "Restore factory settings" check whether Event DS_UPLOAD_REQ was not raised by the Device. Upon each of the following actions: b) After "Restore factory settings" check via Data Storage Index the following: c) State of Data Storage is correct d) DS_UPLOAD_FLAG is not set e) Parameter_checksum has changed f) Check whether the Download has been completed without errors
Test passed	If all three checks during the action described in evaluation are positive.
Test failed (examples)	If one check during the actions described in Evaluation is negative.
Results	a) Result of evaluation action a): <flag> <pass/fail> b) Result of evaluation action b) and check c): <state> <pass/fail> c) Result of evaluation action b) and check d): <flag> <pass/fail> d) Result of evaluation action b) and check e): <checksum> <pass/fail> e) Result of evaluation action f): <pass/fail>

1174 ### 6.7.9 Call ParamBreak in different states of Download

1175 Table 104 defines the test conditions for this test case.

1176 **Table 105 – Call ParamBreak in different states of Download**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0084
Name	TCD_APPS_DSDN_PARABREAKABORT
Purpose (short)	Test of Download abort via SystemCommand "ParamBreak" in different states
Equipment under test (EUT)	Device with supported Block Parameterization
Test case version	1.2
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.4.2, Table B.11, Table D.2, Figure 95
Configuration / setup	-

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test covers Download aborts via SystemCommand "ParamBreak" in different states. Manufacturer is responsible for the definition of two possible "parameter sets".
Precondition	a) Device in PREOPERATE or OPERATE mode b) Device DS activated c) Parameter set 1 stored within Device (manufacturer to define parameter set 1) d) DS_UPLOAD_FLAG is not set e) Test preparation e.g. using DS_Command "DS_UploadStart", upload of parameter set 1" using the Index List (upload), followed by a "DS_UploadEnd"
Procedure	a) Start Download via SystemCommand "ParamDownloadStart" b) Call SystemCommand "ParamBreak" directly after "ParamDownloadStart" c) Start Download via SystemCommand "ParamDownloadStart" d) Transmit first Block Parameter object of Config4 with data of parameter set 2 e) Call SystemCommand "ParamBreak" f) Start Download via SystemCommand "ParamDownloadStart" g) Transmit all Block Parameter objects of Config4 with data of parameter set 2 h) Call SystemCommand "ParamBreak" i) Execute Download of parameter set 2 completely as defined in the Master state machine only if the DS_UPLOAD_FLAG is not set in the Device (switch Master DS from deactivated to activated)
Input parameter	Parameter set 1 and 2
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	Upon each of the following actions: a) After call of each SystemCommand "ParamBreak" (3x) check via Data Storage Index the following: b) State of Data Storage is 0b00 (inactive) c) DS_UPLOAD_FLAG is not set d) Parameter_checksum has changed e) Check whether the Download has been completed without errors
Test passed	If all checks during the actions described in evaluation are positive.
Test failed (examples)	If one check during the actions described in Evaluation is negative.
Results	a) Result of evaluation action a) and check b): <state> <pass/fail> b) Result of evaluation action a) and check c): <flag> <pass/fail> c) Result of evaluation action a) and check d): <checksum> <pass/fail> d) Result of evaluation action e): <pass/fail>

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6.8 Operation with a legacy Master ("Master 1.0")

6.8.1 General

Designers of Devices according to [9] ("Device 1.1") should be aware of the possibility that such a Device in the field can be connected to a Master ("Master 1.0") designed according to a previous specification [13]. Therefore, the conformity class requirements and the associated test cases are specified within the following clauses. It should be noted that the IODD of such a Device plays an important role in establishing the right behavior in respect to Process Data exchange and cycle times (interleave mode). The compatibility rules for IODDs are defined in [3].

6.8.2 Conformity classes

6.8.2.1 Master conformity

The "Masters 1.0" in the field are supposed to be conform with [13]. By design according to [9], the "Masters 1.1" shall be compatible to any legacy "Device 1.0". Therefore, no special compatibility rules are required for Masters and no conformity classes.

6.8.2.2 "Device 1.1" without backward compatibility

The Device requires features that only a Master provides, which is designed according to [9] or a later version. Thus, usually it can deny SDCI communication with a "Master 1.0". Example is a Device with large Process Data (PD). If this Device would be used with a "Master 1.0" and an M-sequence TYPE_1, the Process Data cycle could last much longer than with a "Master 1.1". The manufacturer or vendor of a Device shall document the behavior of the Device in case it will be connected to a "Master 1.0" (see B.5 also).

6.8.2.3 "Device 1.1" compatible with a "Master 1.0"

There exist two main possibilities to design a "Device 1.1" compatible to a "Master 1.0".

- The "Device 1.1" can be adjusted to a behavior according to [13] through setting of a specific parameter using ISDU services ("Device 1.0"). In this case no new test cases are required due to an SDCI communication compatible to [13].
- The "Device 1.1" will automatically detect connection to a "Master 1.0" and switch to an SDCI communication compatible to [13]. For this case, the restrictions for the "Master 1.0" and the "Device 1.1" are defined in the following.

The compatibility restrictions or constraints for a "Master 1.0" being able to support automatic SDCI communication version detection are:

- As defined in the state machines of [9], the "Device 1.1" will send the protocol version 1.1 (or a later one) via parameter 0x04 (RevisionID) to the "Master 1.0" during the startup phase. The "Master 1.0" shall ignore this version number. If the "Master 1.0" insists in protocol version 1.0, the "Device 1.1" cannot be used with this Master.
- During reading of the parameters 0x02 to 0x06 (Direct Parameter page 1) in the STARTUP phase, the "Device 1.1" cannot detect the Master version. For this reason, some of the reserved bits in the parameter 0x03 (M-sequence Capability) in [13] are set in the "Device 1.1". The "Master 1.0" shall ignore these bits. Otherwise, the "Device 1.1" cannot be used with this "Master 1.0".

1223 ### 6.8.3 From STARTUP to OPERATE (V1.0)

1224 Table 106 defines the test conditions for this test case.

1225 **Table 106 – From STARTUP to OPERATE (V1.0)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0085
Name	TCD_DLIC_COMP_STARTUP
Purpose (short)	Establish a connection from Wakeup to OPERATE in V1.0 way of SDCI protocol
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[13],
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Establish a connection from Wakeup to OPERATE in V1.0 way of SDCI protocol. The Device-Tester initiates a Wakeup request, reads out the parameter 0x02 – 0x06 (Direct Parameter page 1) and then tries to turn the Device in OPERATE mode. After this, the Device shall be able to exchange Process Data and accept ISDU services. This test shall ensure that a V1.1 Device can be accessed from a V1.0 Master.
Precondition	-
Procedure	a) Master initiates a Wakeup (with reading of parameter 0x02) b) After the transmission rate detection the Master reads parameter 0x03 – 0x06 c) After reading the parameter it will write the MasterCycleTime d) Master sends MasterCommand 0x99 (OPERATE) e) Master switches to target M-sequence type and exchanges Process Data f) Master initiates an ISDU Read or Write to test the Device capability
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check if Device responds with the correct values during STARTUP b) Check if the Device responds with the correct M-sequence type after OPERATE c) Check if the ISDU Read or Write is responded
Test passed	a) If Device exchanges Process Data after STARTUP b) If ISDU is working
Test failed (examples)	a) MasterCommand 0x99 (OPERATE) results in a negative response or b) Device does not use the target M-sequence type c) Device does not respond to ISDU Read or Write
Results	Exchange of PD: <yes/no> <pass/fail> ISDU is working: <yes/no> <pass/fail>

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1230 ### 6.8.4 From STARTUP to OPERATE – interleave (V1.0)

1231 Table 107 defines the test conditions for this test case.

1232 **Table 107 – From STARTUP to OPERATE - interleave (V1.0)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0086
Name	TCD_DLIC_COMP_TYPE1INTERLEAVE
Purpose (short)	Interleave test
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[13],
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Interleave test. In V1.1 the SDCI protocol defines new M-sequence types for large Process Data transfers (more than 2 octets). In Version V1.0, SDCI communication uses the TYPE_1_x M-sequences with interleaving of Process Data and ISDU data. A compatible Device shall be able to switch to the interleave mode (TYPE_1_x) during communication with the Device-Tester .
Precondition	Device supports more than 2 octets of Process Data
Procedure	a) Master initiates a Wakeup request (with reading of parameter 0x02) b) After detection of the transmission rate the Master reads parameter 0x03 – 0x06 c) After reading the parameter it will write the MasterCycleTime to 0x01 d) Master sends MasterCommand 0x99 (OPERATE) e) Master switches to M-sequence TYPE_1_1/2 and exchanges Process Data f) Master initiates a ISDU Read or Write to ensure an answer of the Device
Input parameter	"PD size" taken from the IODD.
Post condition	-

1234

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check if Device responds with the correct values during STARTUP b) Check if the Device responds with the correct M-sequence type after OPERATE c) Check if the ISDU Read or Write is responded
Test passed	a) If Device exchanges Process Data in interleave mode after STARTUP b) If ISDU is working
Test failed (examples)	a) MasterCommand 0x99 (OPERATE) results in a negative response or b) Device does not use the target M-sequence type c) Device does not respond to ISDU Read or Write
Results	Exchange of PD in interleave mode: <yes/no> <pass/fail> ISDU is working: <yes/no> <pass/fail>

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1237 ### 6.8.5 Events – PDInvalid / PDValid (V1.0)

1238 Table 108 defines the test conditions for this test case.

1239 **Table 108 – Events – PDInvalid / PDValid (V1.0)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0087
Name	TCD_DLIC_COMP_PDINVALIDEVENT
Purpose (short)	Send Event for PDVALID/INVALID
Equipment under test (EUT)	Device and Legacy-Device NOTE For Devices without PDInvalid Flag support, this test case can be skipped. No test interface required. For Legacy-Devices without test interface and without means to address the PDInvalid Flag, this test case can be skipped.
Test case version	1.1
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[13],
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Send Event for PDVALID/INVALID. This test to ensure that a Device can indicate the validity of the Process Data inputs GOOD or BAD via an Event in a V1.0 SDCI communication (In V1.0, the Master does not interpret the bit in the Process Data).
Precondition	The communication is established
Procedure	a) Stimulate an error in the Device, which leads to a Process Data failure b) The Device shall send this status change via an Event
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check if the Device sent an Event with PDValid/Invalid to the Master.
Test passed	Device-Tester received an Event for the validity change of Process Data (GOOD and BAD).
Test failed (examples)	Device did not send an Event.
Results	Device sent "GOOD/BAD" Event: <yes/no> <pass/fail>

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6.9 Direct Parameter page 1

6.9.1 MasterCycleTime

Table 109 defines the test conditions for this test case.

Table 109 – MasterCycleTime

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0089
Name	TCD_DLPC_STDP_MASTERCYCLETIME
Purpose (short)	Test for correct value of MasterCycleTime
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.3
Configuration / setup	Device-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the correct value of MasterCycleTime. The value shall match the value provided by the Master (Maximum is 134 ms, see B.6).
Precondition	Device is in SIO mode
Procedure	a) Set Device to SDCI communication mode b) Monitor MasterCycleTime written to the Device at startup c) Read via the Master the MasterCycleTime on Direct Parameter page 1 (address 0x01) d) Compare value of MasterCycleTime with written value at startup
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check valid MasterCycleTime (Maximum is 134 ms)
Test passed	Value of MasterCycleTime is equal to value written at startup.
Test failed (examples)	Value of MasterCycleTime is not equal to value written at startup.
Results	MasterCycleTime: <value> <passed/failed>

1252 ### 6.9.2 MinCycleTime

1253 Table 110 defines the test conditions for this test case.

1254 **Table 110 – MinCycleTime**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0090
Name	TCD_DLPC_STDP_MINCYCLETIME
Purpose (short)	Test for correct setting of MinCycleTime
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.4, Figure B.2, Table B.3
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the MinCycleTime. The value shall match the Device specific default settings as defined in IODD or shall be valid (Maximum is 132,8 ms, see B.7).
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read via Device-Tester the MinCycleTime on Direct Parameter page 1 (Index 0, Subindex 3 redirected to 0x02) b) Check value of MinCycleTime parameter c) Check if Time Base contains a valid value
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check value of MinCycleTime (Maximum is 132,8 ms, see B.7) and Time Base.
Test passed	MinCycleTime is equal to 0x00 or MinCycleTime is equal to specified value and Time Base is less than 3.
Test failed (examples)	MinCycleTime is not equal to 0x00 and MinCycleTime is not equal to specified value and Time Base is equal to value 3.
Results	MinCycleTime: <value> <passed/failed> Time Base: <value> <passed/failed>

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6.9.3 M-sequenceCapability

Table 111 defines the test conditions for this test case.

Table 111 – M-sequenceCapability

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0091
Name	TCD_DLPC_STDP_FSEQCAPABILITY
Purpose (short)	Test for correct M-sequence type entries
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.5, Figure B.3
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the parameter M-sequenceCapability. The values shall match the Device specific default settings as defined in the IODD.
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read with the Device-Tester the M-sequenceCapability on Direct Parameter page 1 (Index 0, Subindex 4 redirected to 0x03) b) Check if ISDU value matches specified value (Bit 0) c) Check if OPERATE M-sequence type matches specified value (Bit 1-3) d) Check if PREOPERATE M-sequence type matches specified value (Bit 4,5) e) Check if Bit 6,7 match the default value
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check validity of M-sequenceCapability bit combinations
Test passed	a) ISDU bit matches specified value b) OPERATE M-sequence type matches specified value c) PREOPERATE M-sequence type matches specified value d) Bit 6,7 are equal to value "0"
Test failed (examples)	Any of the bit combinations do not match specified values or bit 6,7 are not "0"
Results	M-sequenceCapability: <value> <passed/failed>

6.9.4 RevisionID

Table 112 defines the test conditions for this test case.

Table 112 – RevisionID

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0092
Name	TCD_DLPC_STDP_REVISIONID
Purpose (short)	Test for correct default protocol revision
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.6, Figure B.4
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the protocol revision. The value shall match the Revision defined by the vendor as the default value.
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read via the Device-Tester the RevisionID on Direct Parameter page1 (Index 0, Subindex 5 redirected to 0x04) b) Check if RevisionID matches the vendor assigned default value
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check validity of the parameter RevisionID
Test passed	Revision ID matches the vendor assigned default value
Test failed (examples)	Revision ID does not match the assigned default value
Results	RevisionID: <value> <passed/failed>

6.9.5 ProcessDataIn

Table 113 defines the test conditions for this test case.

Table 113 – ProcessDataIn

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0093
Name	TCD_DLPC_STDP_PDIN
Purpose (short)	Test for correct default ProcessDataInput value
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.7, Figure B.5
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the values of ProcessDataInput. The value shall match the specified default value according to the IODD.
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read via the Device-Tester the parameter ProcessDataIn on Direct Parameter page 1 (Index 0, Subindex 6 redirected to 0x05) b) Check if Process Data length matches the specified values (Bit 0-4,7) c) Check if SIO bit matches the specified value (Bit 6) d) Check if Bit 5 has default value
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check validity of the parameter ProcessDataInput.
Test passed	a) Process Data length and SIO bit match specified values and b) Process Data length unit is a valid value and c) Bit 5 is "0".
Test failed (examples)	a) Process Data length or SIO bit do not match specified values or b) Process Data length unit is not a valid value or c) Bit 5 is not "0".
Results	ProcessDataIn: <value> <passed/failed>

6.9.6 ProcessDataOut

Table 114 defines the test conditions for this test case.

Table 114 – ProcessDataOut

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0094
Name	TCD_DLPC_STDP_PDOUT
Purpose (short)	Test for correct default ProcessDataOutput value
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.8, Figure B.5
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the values of Process Data Output. The value shall match the specified default value according to the IODD.
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read via the Device-Tester the parameter ProcessDataOut on Direct Parameter page 1 (Index 0, Subindex 7 redirected to 0x06) b) Check if Process Data length matches the specified value (Bit 0-4,7) c) Check if Bits 5,6 have default value
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check validity of the parameter ProcessDataOutput.
Test passed	a) Process Data length match specified values and b) Process Data length unit is a valid value and c) Bit 5 and 6 are "0".
Test failed (examples)	a) Process Data length do not match specified values or b) Process Data length unit is not a valid value or c) Bit 5 or 6 are not "0".
Results	ProcessDataOut: <value> <passed/failed>

6.9.7 VendorID

Table 115 defines the test conditions for this test case.

Table 115 – VendorID

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0095
Name	TCD_DLPC_STDP_VENDORID
Purpose (short)	Test for correct VendorID
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.9
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the VendorID. The value shall match the unique ID assigned to the vendor.
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read via the Device-Tester VendorID1 and VendorID2 on Direct Parameter page 1 (Index 0, Subindex 8 and Subindex 9 redirected to 0x07, 0x08) b) Check if it matches the assigned value
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check validity of the parameter VendorID.
Test passed	VendorID matches the assigned value
Test failed (examples)	VendorID does not match the assigned value
Results	VendorID: <value> <passed/failed>

6.9.8 DeviceID

Table 116 defines the test conditions for this test case.

Table 116 – DeviceID

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0096
Name	TCD_DLPC_STDP_DEVICEID
Purpose (short)	Test for correct default DeviceID
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.10
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the DeviceID. The value shall match the ID assigned by the vendor for the specific Device function as the default value.
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read via the Device-Tester DeviceID1, DeviceID2 and DeviceID3 on Direct Parameter page 1 (Index 0 Subindex 10, Subindex 11, Subindex 12 redirected to 0x09, 0x0A, 0x0B) b) Check if DeviceID matches the vendor assigned value according to the IODD
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check validity of the parameter DeviceID.
Test passed	DeviceID matches the vendor assigned default value and IODD DeviceID
Test failed (examples)	DeviceID is 0x00, 0x00, 0x00 or does not match the assigned value
Results	DeviceID: <value> <passed/failed>

1301 ### 6.9.9 FunctionID

1302 Table 117 defines the test conditions for this test case.

1303 **Table 117 – FunctionID**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0097
Name	TCD_DLPC_STDP_FUNCTIONID
Purpose (short)	Test for correct FunctionID
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.11
Configuration / setup	Device-Tester

1304

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the FunctionID. The FunctionID is not used and shall contain the default value.
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read via the Device-Tester FunctionID1 and FunctionID2 on Direct Parameter page 1 (Index 0 Subindex 13, Subindex 14 redirected to 0x0C, 0x0D) b) Check if FunctionID matches the default value
Input parameter	-
Post condition	-

1305

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check validity of the parameter FunctionID.
Test passed	FunctionID is 0x00, 0x00
Test failed (examples)	FunctionID is not 0x00, 0x00
Results	FunctionID: <value> <passed/failed>

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6.9.10 Reserved parameter – Read

Table 118 defines the test conditions for this test case.

Table 118 – Reserved parameter - Read

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0100
Name	TCD_DLPC_STDP_READRESPAR
Purpose (short)	Test reserved Direct Parameter read result
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.1
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the read result of a read access to a reserved Direct Parameter.
Precondition	Device is in SDCI communication mode (Scan mode).
Procedure	a) Read via the Device-Tester reserved parameters on Direct Parameter page 1 (Address 0x0E) b) Check if result matches specification
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check validity of a Read access to reserved Direct Parameter.
Test passed	Read Result is 0x00
Test failed (examples)	Read Result is not 0x00
Results	Read Reserved Parameter: <value> <passed/failed>

6.9.11 Reserved parameter – Write

Table 119 defines the test conditions for this test case.

Table 119 – Reserved parameter - Write

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0101
Name	TCD_DLPC_STDP_WRITERESPAR
Purpose (short)	Test reserved Direct Parameter write behavior
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.0
Category / type	Device Direct Parameter; test to pass (positive testing)
Specification (clause)	[9], see B.1.1
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the Device behavior and read result after write access to a reserved Direct Parameter
Precondition	Device is in SDCI communication mode
Procedure	Write values 0x00 to 0xFF via the Device-Tester to reserved parameters on Direct Parameter page 1 (Address 0x0E)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check validity of a Write access to reserved Direct Parameter.
Test passed	If no communication errors occurred
Test failed (examples)	If communication errors or Events occurred
Results	Communication errors: <no/yes> <passed/failed>

6.10 Predefined Device parameters

6.10.1 General rules

Predefined parameters shall be tested in any case. The following rules apply:

a) They shall be tested as specified within the test cases, if they are defined within the IODD.

b) They shall *not* be tested as specified within the test cases, if they are *not* defined within the IODD.

c) All optional test cases for Predefined Parameters shall be handled according to rule b)

6.10.2 System command – reserved commands

Table 120 defines the test conditions for this test case.

Table 120 – System command – reserved commands

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0104
Name	TCD_DLIC_DEFP_SYSCMDRES
Purpose (short)	Test of SystemCommand reserved value implementation (via ISDU)
Equipment under test (EUT)	Device and Legacy-Device (see B.8)
Test case version	1.0
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see B.2.2, and Annex C.2.1, Table C.1
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The test verifies the correct response values upon usage of reserved and unused SystemCommands.
Precondition	Device is in SDCI communication mode (Scan mode) and SystemCommand is implemented.
Procedure	Write subsequently all values to SystemCommand, which are marked as reserved or marked as unused.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check every response on Write access.
Test passed	Every Write request is followed by a negative response: FUNC_NOTAVAIL (0x8035). If the error response does not match this expectation, the Device tester shall raise a warning and display the response value. For Legacy-Devices see B.8.
Test failed (examples)	Wrong or no response.
Results	Write response (reserved SC): <value> <pass/fail>

6.10.3 System command – implemented commands

Table 121 defines the test conditions for this test case.

Table 121 – System command – implemented commands

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0105
Name	TCD_DLIC_DEFP_SYSCMDIMP
Purpose (short)	Test of SystemCommand implemented value behavior (via ISDU)
Equipment under test (EUT)	Device and Legacy-Device (see B.9)
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.2
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The test verifies, that implemented SystemCommands are responded correctly.
Precondition	Device is in SDCI communication mode (Scan mode) and SystemCommand is implemented.
Procedure	Write subsequently all values to System Command, which are marked as implemented.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check every response on Write access.
Test passed	Every Write request is followed by a positive response received within 5 s (ISDU). See B.9.
Test failed (examples)	Error responses such as "Index not available", "Access denied", or "Write length error" are not permitted.
Results	Write response (implemented SC): <value> <pass/fail> Response time: <value> <pass/fail>

6.10.4 Data Storage Index – complete parameter

Table 122 defines the test conditions for this test case.

Table 122 – Data Storage Index – complete parameter

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0107
Name	TCD_DLIC_DEFP_DSINDEX
Purpose (short)	Test of parameter Data Storage Index (mandatory if DS is supported)
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.3, Table B.9
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The test verifies the implementation of parameter Data Storage Index.
Precondition	Device is in SDCI communication mode (Scan mode) and Data Storage Index is implemented.
Procedure	Read parameter Data Storage Index (Index 0x03)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check for response on Read access b) Check for parameter length c) Calculate <index entries> = (parameter length – 12)/3
Test passed	a) No negative response and b) Evaluation <index entries> has a positive integer value in the range ≥ 0 and ≤ 70
Test failed (examples)	a) Negative response, or b) Evaluation <index entries> outside the permitted range
Results	Data Storage Index, length: <index entries> <pass/fail>

6.10.5 Data Storage Index – record items

Table 123 defines the test conditions for this test case.

Table 123 – DataStorageIndex – record items

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0108
Name	TCD_DLIC_DEFP_DSRECORD
Purpose (short)	Test of parameter Data Storage Index record items
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.3, Table B.9
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The test verifies the correct structure of parameter and record items of the Data Storage Index.
Precondition	Device is in SDCI communication mode (Scan mode) and Data Storage Index is implemented.
Procedure	Read subsequently Subindex 1 to 5 of Data Storage Index (Index 0x03)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check for response on Read access b) Check for record item length c) Check value of record item
Test passed	No negative response on record item Read access and a) Subindex 1 has a length of 1 octet and value is within range ≥ 0 to ≤ 5 b) Subindex 2 has a length of 1 octet and value of bit 0 and bit 3 - 6 is "0" c) Subindex 3 has a length of 4 octets and value is within range 0 to 2048 d) Subindex 4 has a length of 4 octets e) Subindex 5 has a length of ≥ 2 octets in increments of 3 (2,5,8,11,14, until 212)
Test failed (examples)	Record items are deviating in length or value range
Results	Data Storage Index, Subindex 1: <length, value> <pass/fail> Data Storage Index, Subindex 2: <length, value> <pass/fail> Data Storage Index, Subindex 3: <length, value> <pass/fail> Data Storage Index, Subindex 4: <length> <pass/fail> Data Storage Index, Subindex 5: <length> <pass/fail>

6.10.6 Device Access Locks – valid

Table 124 defines the test conditions for this test case.

Table 124 – Device Access Locks – valid

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0109
Name	TCD_DLIC_DEFP_ACCESSLOCKSVAL
Purpose (short)	Test of Device Access Locks with valid values
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.4, Table B.11
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The test verifies that all implemented values for Device Access Locks are stored and responded correctly.
Precondition	Device is in SDCI communication mode (Scan mode) and Device Access Locks are implemented
Procedure	a) Write value to Device Access Locks with "1" at every bit position marked as implemented and "0" at the remaining bits. b) Read value Device Access Locks c) Write value 0x0000 to Device Access Locks d) Read value Device Access Locks
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check for response on Read and Write access. b) Compare response value from step b) with written value from step a) c) Compare response value from step d) with written value from step c)
Test passed	a) No negative response on Read or Write access and b) Comparison of evaluation step a) and b) show matching values
Test failed (examples)	No matching values.
Results	Device Access Locks implemented: <written/read values> <pass/fail> Device Access Locks 0x0000: <written/read values> <pass/fail>

6.10.7 Device Access Locks – invalid

Table 125 defines the test conditions for this test case.

Table 125 – Device Access Locks – invalid

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0110
Name	TCD_DLIC_DEFP_ACCESSLOCKSINVAL
Purpose (short)	Test of Device Access Locks with invalid values
Equipment under test (EUT)	Device
Test case version	1.0
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.4, Table B.11
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The test verifies that all reserved or unused values for Device Access Locks are responded correctly.
Precondition	Device is in SDCI communication mode (Scan mode) and Device Access Locks are implemented.
Procedure	a) Write to Device Access Locks subsequently the value "1" at a single bit position, which is marked as reserved and a value "0" at the remaining bit positions b) Read value Device Access Locks c) Repeat with next bit position
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response from step a) b) Check response value from step b)
Test passed	Each write request in step a) is responded by a negative response PAR_VALOUTOFRNG (0x8030) and each result returned in step b) shows the value 0x0000
Test failed (examples)	a) No negative response b) Returned value in step b) is ≠ 0x0000
Results	Device Access Locks reserved: <written/read values> <pass/fail> Device Access Locks 0x0000: <written/read values> <pass/fail>

6.10.8 Profile Characteristic

Table 126 defines the test conditions for this test case.

Table 126 – Profile Characteristic

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0111
Name	TCD_DLIC_DEFP_PROFILCHARAC
Purpose (short)	Test of parameter Profile Characteristics
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.5
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test for implementation of parameter Profile Characteristics
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Profile Characteristics marked as implemented within the IODD.
Procedure	Read parameter Profile Characteristics (Index 0x000D)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response on read access
Test passed	No negative response
Test failed (examples)	No response
Results	Profile Characteristics: <response> <pass/fail>

6.10.9 PD Input Descriptor

Table 127 defines the test conditions for this test case.

Table 127 – PD Input Descriptor

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0112
Name	TCD_DLIC_DEFP_PDINDESC
Purpose (short)	Test of parameter PD Input Descriptor
Equipment under test (EUT)	Device
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.5
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test for implementation of parameter PD Input Descriptor
Precondition	Device is in SDCI communication mode (Scan mode) and parameter PD Input Descriptor marked as implemented within the IODD.
Procedure	Read parameter PD Input Descriptor (Index 0x000E)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response on Read access
Test passed	No negative response
Test failed (examples)	No response
Results	PD Input Descriptor: <response> <pass/fail>

6.10.10 PD Output Descriptor

Table 128 defines the test conditions for this test case.

Table 128 – PD Output Descriptor

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0113
Name	TCD_DLIC_DEFP_PDOUTDESC
Purpose (short)	Test of parameter PD Output Descriptor
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.5
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test for implementation of parameter PD Output Descriptor
Precondition	Device is in SDCI communication mode (Scan mode) and parameter PD Output Descriptor marked as implemented within the IODD.
Procedure	Read parameter PD Output Descriptor (Index 0x000F)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response on Read access
Test passed	No negative Response
Test failed (examples)	No response
Results	PD Output Descriptor: <response> <pass/fail>

6.10.11 Vendor Name

Table 129 defines the test conditions for this test case.

Table 129 – Vendor Name

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0114
Name	TCD_DLIC_DEFP_VENDORNAM
Purpose (short)	Test of parameter Vendor Name (mandatory with ISDU)
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.6
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the correct contents and coding of parameter Vendor Name
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Vendor Name marked as implemented within the IODD.
Procedure	Read parameter Vendor Name (Index 0x0010)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on read access b) Check coding of parameter c) Check parameter length d) Check contents of parameter
Test passed	a) No negative response and b) Parameter is coded in UTF8 and c) Parameter length is ≤ 64 octets and d) Contents matches registered vendor for VendorID (VID)
Test failed (examples)	Any of the evaluation steps fails
Results	Vendor Name response: <negative/positive> <pass/fail> Vendor Name UTF8 coding: <yes/no> <pass/fail> Vendor Name length: <value> <pass/fail> Vendor Name registration: <ok/not ok> <pass/fail>

6.10.12 Vendor Text

Table 130 defines the test conditions for this test case.

Table 130 – Vendor Text

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0115
Name	TCD_DLIC_DEFP_VENDORTEXT
Purpose (short)	Test of parameter Vendor Text
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.7
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the correct contents and coding of parameter Vendor Text
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Vendor Text marked as implemented within the IODD.
Procedure	Read parameter Vendor Text (Index 0x0011)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Read access b) Check coding of parameter c) Check parameter length d) Check contents of parameter
Test passed	a) No negative response and b) Parameter is coded in UTF8 and c) Parameter length is ≤ 64 octets and d) Contents matches vendor / Device specific information
Test failed (examples)	Any of the evaluation steps fails
Results	Vendor Text response: <negative/positive> <pass/fail> Vendor Text UTF8 coding: <yes/no> <pass/fail> Vendor Text length: <value> <pass/fail> Vendor Text adequate: <ok/not ok> <pass/fail>

6.10.13 Product Name

Table 131 defines the test conditions for this test case.

Table 131 – Product Name

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0116
Name	TCD_DLIC_DEFP_PRODUCTNAM
Purpose (short)	Test of parameter Product Name (mandatory with ISDU)
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.8
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the correct contents and coding of parameter Product Name (ISDU support)
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Product Name marked as implemented within the IODD.
Procedure	Read parameter Product Name (Index 0x0012)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Read access b) Check coding of parameter c) Check parameter length d) Check contents of parameter
Test passed	a) No negative response and b) Parameter is coded in UTF8 and c) Parameter length is ≤ 64 octets and d) Contents matches vendor / Device specific information
Test failed (examples)	Any of the evaluation steps fails
Results	Product Name response: <negative/positive> <pass/fail> Product Name UTF8 coding: <yes/no> <pass/fail> Product Name length: <value> <pass/fail> Product Name adequate: <ok/not ok> <pass/fail>

6.10.14 Product ID

Table 132 defines the test conditions for this test case.

Table 132 – Product ID

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0117
Name	TCD_DLIC_DEFP_PRODUCTID
Purpose (short)	Test of parameter Product ID
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.9
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the correct contents and coding of parameter Product ID.
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Product ID marked as implemented within the IODD.
Procedure	Read parameter Product ID (Index 0x0013)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on Read access b) Check coding of parameter c) Check parameter length d) Check contents of parameter
Test passed	a) No negative response and b) Parameter is coded in UTF8 and c) Parameter length is ≤ 64 octets and d) Contents matches vendor / Device specific information
Test failed (examples)	Any of the evaluation steps fails
Results	Product ID response: <negative/positive> <pass/fail> Product ID UTF8 coding: <yes/no> <pass/fail> Product ID length: <value> <pass/fail> Product ID adequate: <ok/not ok> <pass/fail>

6.10.15 Product Text

Table 133 defines the test conditions for this test case.

Table 133 – Product Text

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0118
Name	TCD_DLIC_DEFP_PRODUCTTEXT
Purpose (short)	Test of parameter Product Text
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.10
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the correct contents and coding of parameter Product Text
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Product Text marked as implemented within the IODD.
Procedure	Read parameter Product Text (Index 0x0014)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Read access b) Check coding of parameter c) Check parameter length d) Check contents of parameter
Test passed	a) No negative response and b) Parameter is coded in UTF8 and c) Parameter length is ≤ 64 octets and d) Contents matches vendor / Device specific information
Test failed (examples)	Any of the evaluation steps fails
Results	Product Text response: <negative/positive> <pass/fail> Product Text UTF8 coding: <yes/no> <pass/fail> Product Text length: <value> <pass/fail> Product Text adequate: <ok/not ok> <pass/fail>

1431 ### 6.10.16 Serial Number

1432 Table 134 defines the test conditions for this test case.

1433 **Table 134 – SerialNumber**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0119
Name	TCD_DLIC_DEFP_SERNUM
Purpose (short)	Test of parameter Serial Number
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.11
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the correct contents and coding of parameter Serial Number
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Serial Number marked as implemented within the IODD.
Procedure	Read parameter Serial Number (Index 0x0015)
Input parameter	Serial Number of the EUT provided by the manufacturer
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on Read access b) Check coding of parameter c) Check parameter length d) Check contents of parameter
Test passed	a) No negative response and b) Parameter is coded in UTF8 and c) Parameter length is ≤ 16 octets and d) Contents matches vendor / Device specific information
Test failed (examples)	Any of the evaluation steps fails
Results	Serial Number response: <negative/positive> <pass/fail> Serial Number UTF8 coding: <yes/no> <pass/fail> Serial Number length: <value> <pass/fail> Serial Number adequate: <ok/not ok> <pass/fail>

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6.10.17 Hardware Revision

Table 135 defines the test conditions for this test case.

Table 135 – HardwareRevision

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0120
Name	TCD_DLIC_DEFP_HARDREV
Purpose (short)	Test of parameter Hardware Revision
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.12
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the correct contents and coding of parameter Hardware Revision
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Hardware Revision marked as implemented within the IODD.
Procedure	Read parameter Hardware Revision (Index 0x0016)
Input parameter	Hardware Revision of the EUT provided by the manufacturer
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Read access b) Check coding of parameter c) Check parameter length d) Check contents of parameter
Test passed	a) No negative response and b) Parameter is coded in UTF8 and c) Parameter length is ≤ 64 octets and d) Contents matches vendor / Device specific information
Test failed (examples)	Any of the evaluation steps fails
Results	Hardware Revision response: <negative/positive> <pass/fail> Hardware Revision UTF8 coding: <yes/no> <pass/fail> Hardware Revision length: <value> <pass/fail> Hardware Revision adequate: <ok/not ok> <pass/fail>

6.10.18 Firmware Revision

Table 136 defines the test conditions for this test case.

Table 136 – Firmware Revision

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0121
Name	TCD_DLIC_DEFP_FIRMREV
Purpose (short)	Test of parameter Firmware Revision
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.13
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the correct contents and coding of parameter Firmware Revision
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Firmware Revision marked as implemented within the IODD.
Procedure	Read parameter Firmware Revision (Index 0x0017)
Input parameter	Firmware Revision of the EUT provided by the manufacturer
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on Read access b) Check coding of parameter c) Check parameter length d) Check contents of parameter
Test passed	a) No negative response and b) Parameter is coded in UTF8 and c) Parameter length is ≤ 64 octets and d) Contents matches vendor / Device specific information
Test failed (examples)	Any of the evaluation steps fails
Results	Firmware Revision response: <negative/positive> <pass/fail> Firmware Revision UTF8 coding: <yes/no> <pass/fail> Firmware Revision length: <value> <pass/fail> Firmware Revision adequate: <ok/not ok> <pass/fail>

6.10.19 Application Specific Tag – valid

Table 137 defines the test conditions for this test case.

Table 137 – Application Specific Tag – valid

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0122
Name	TCD_DLIC_DEFP_TAGVALID
Purpose (short)	Test of parameter Application Specific Tag – valid strings
Equipment under test (EUT)	Device and Legacy-Device (see B.10)
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.14
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the correct behavior for write and read access to parameter Application Specific Tag
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Application Specific Tag marked as implemented within the IODD.
Procedure	a) Write a random text string with length <specified fixed length> to parameter Application Specific Tag (Index 0x0018) b) Read parameter Application Specific Tag (Index 0x0018) c) Power cycle the Device (switch off and on) d) Read parameter Application Specific Tag (Index 0x0018)
Input parameter	Random text string with <specified fixed length>: manufacturer dependent (minimum 16 octets, maximum 32 octets). See B.10 for Legacy Devices.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Read and Write access b) Compare contents and length of reading in step b) to written string in step a). c) Compare contents and length of reading in step b) and step d)
Test passed	a) No negative response and b) Comparisons in evaluation b) and c) are correct in string length (see and c) Comparisons in evaluation b) and c) are correct in contents.
Test failed (examples)	Negative response or comparison fails
Results	Application Specific Tag string length: <ok/not ok> <pass/fail> Application Specific Tag content: <ok/not ok> <pass/fail>

6.10.20 Application Specific Tag – invalid

Table 138 defines the test conditions for this test case.

Table 138 – Application Specific Tag – invalid

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0123
Name	TCD_DLIC_DEFP_TAGINVALID
Purpose (short)	Test of parameter Application Specific Tag – invalid string length
Equipment under test (EUT)	Device and Legacy-Device (see B.10)
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.14
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test the correct behavior for Write and Read access with invalid string length to parameter Application Specific Tag.
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Application Specific Tag marked as implemented within the IODD.
Procedure	a) Read parameter Application Specific Tag (Index 0x0018) b) Write a random string with length <specified fixed length+1> to parameter Application Specific Tag (Index 0x0018) c) Read parameter Application Specific Tag (Index 0x0018)
Input parameter	Random text string with <specified fixed length>: manufacturer dependent (minimum 16 octets, maximum 32 octets). See B.10 for Legacy Devices.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Read access b) Check response on Write access c) Compare contents and length of reading in step c) and step a)
Test passed	a) No negative response on read access and b) Negative response VAL_LENOVRRUN (0x8033) upon Write access in step b) and c) Comparison in evaluation c) shows maching values. Legacy-Devices may respond with any other ErrorCode 0x80xy instead of 0x8033.
Test failed (examples)	No response
Results	Application Specific Tag negative response: <yes/no> <pass/fail> Application Specific Tag content matches: <yes/no> <pass/fail>

6.10.21 Error Count

Table 139 defines the test conditions for this test case.

Table 139 – Error Count

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0124
Name	TCD_DLIC_DEFP_ERRCOUNT
Purpose (short)	Test of parameter Error Count
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.15
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the correct contents and coding of parameter Error Count
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Error Count marked as implemented within the IODD.
Procedure	a) Read parameter Error Count (Index 0x0020) b) Stimulate error within Device technology specific application (registered for Error Count) c) Read parameter Error Count (Index 0x0020) d) Power cycle the Device (switch off and on) e) Read parameter Error Count (Index 0x0020)
Input parameter	Manufacturer defined stimulance of an error
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on read access b) Check parameter length c) Compare values from step a) and step c) d) Check value of step e)
Test passed	a) No negative response and b) Parameter length is 2 octets and c) Evaluation c) shows an increment of 1 and d) Evaluation d) returns the value '0x0000'
Test failed (examples)	Any of the evaluation a) through d) fails
Results	ErrorCount: <length> <pass/fail> ErrorCount: <increment> <pass/fail> ErrorCount: <value> <pass/fail>

6.10.22 Device Status

Table 140 defines the test conditions for this test case.

Table 140 – DeviceStatus

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0128
Name	TCD_DLIC_DEFP_DEVSTAT
Purpose (short)	Test of parameter Device Status
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.16
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the correct contents and coding of parameter Device Status
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Device Status marked as implemented within the IODD.
Procedure	Read parameter Device Status (Index 0x0024)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on Read access b) Check parameter length c) Check parameter value
Test passed	a) No negative response and b) Parameter length is 1 octet and c) Value is ≥ 0 and ≤4
Test failed (examples)	No response
Results	Device Status response: <negative/positive> <pass/fail> Device Status length: <value> <pass/fail> Device Status: <value> <pass/fail>

6.10.23 Detailed Device Status – complete object

Table 141 defines the test conditions for this test case.

Table 141 – Detailed Device Status – complete object

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0129
Name	TCD_DLIC_DEFP_DETAILDEVSTAT
Purpose (short)	Test of complete parameter Detailed Device Status
Equipment under test (EUT)	Device
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.17 and [12]
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of the correct length of parameter Detailed Device Status
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Detailed Device Status marked as implemented within the IODD.
Procedure	Read parameter Detailed Device Status (Index 0x0025)
Input parameter	<record item count>
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on read access b) Check parameter length c) Calculate <record item count> = parameter length / 3
Test passed	a) No negative response and b) Parameter length is ≤ 64*3 octets and c) <record item count> is a positive integer value with 1 ≤ value ≤ 64
Test failed (examples)	No response
Results	Detailed Device Status response: <negative/positive> <pass/fail> Detailed Device Status length: <value> <pass/fail> Detailed Device Status: <value> <pass/fail>

6.10.24 Detailed Device Status – Event inactive

Table 142 defines the test conditions for this test case.

Table 142 – Detailed Device Status – Event inactive

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0130
Name	TCD_DLIC_DEFP_DETAILDEVSTATINACTIVE
Purpose (short)	Test of record contents in parameter Detailed Device Status without active Events
Equipment under test (EUT)	Device
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.17
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of the correct contents of the record in parameter Detailed Device Status and that the values are initialized.
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Detailed Device Status marked as implemented within the IODD and no Events are active.
Procedure	a) Read the record in parameter Detailed Device Status b) Parse result from beginning to end in steps of 3 octets and store values
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check the values at each step from procedure b)
Test passed	The value at each step is "0x000000"
Test failed (examples)	No response or value is not "0x000000"
Results	Detailed Device Status Event inactive: <pass/fail>

6.10.25 Detailed Device Status – Event active

Table 143 defines the test conditions for this test case.

Table 143 – Detailed Device Status – Event active

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0131
Name	TCD_DLIC_DEFP_DETAILDEVSTATACTIVE
Purpose (short)	Test of record contents in parameter Detailed Device Status with active event
Equipment under test (EUT)	Device
Test case version	1.2
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.17
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of the correct entry of active Events into parameter Detailed Device Status
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Detailed Device Status is marked as implemented within the IODD.
Procedure	a) Stimulate an incident in Device's technology specific application causing an Event (error or warning) b) Read the record in parameter Detailed Device Status c) Parse result from beginning to end in steps of 3 octets and store value d) Power cycle the device (switch off and on) e) Read the record in parameter Detailed Device Status f) Parse result from beginning to end in steps of 3 octets and store value
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check the value at each step of procedure c) b) Check the value at each step of procedure f)
Test passed	a) Evaluation a) gives exactly one value different from "0x000000" and b) the value matches the transferred Event in EventCode and EventQualifier and c) each value from evaluation b) is "0x000000"
Test failed (examples)	Incorrect values or no response
Results	Detailed Device Status Event active: <pass/fail>

6.10.26 Process Data Input

Table 144 defines the test conditions for this test case.

Table 144 – Process Data Input

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0132
Name	TCD_DLIC_DEFP_PDIN
Purpose (short)	Test of parameter Process Data Input
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.18
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test the correct contents and coding of parameter Process Data Input
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Process Data Input marked as implemented within the IODD.
Procedure	Read parameter Process Data Input (Index 0x0028)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on Read access b) Check parameter length c) Check parameter contents
Test passed	a) No negative response and b) Parameter length matches parameter Process Data In (Direct Parameter page1, address 0x05) and c) Not used bits are "0".
Test failed (examples)	No response
Results	Process Data Input response: <negative/positive> <pass/fail> Process Data Input length: <value> <pass/fail> Process Data Input not used bits = "0": <yes/no> <pass/fail>

1508 ### 6.10.27 Process Data Output

1509 Table 145 defines the test conditions for this test case.

1510 **Table 145 – Process Data Output**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0133
Name	TCD_DLIC_DEFP_PDOUT
Purpose (short)	Test of parameter Process Data Output
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.19
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of the correct contents and coding of parameter Process Data Output
Precondition	Device is in SDCI communication mode (Scan mode) and parameter Process Data Output marked as implemented within the IODD.
Procedure	Read parameter Process Data Output (Index 0x0029)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Read access b) Check parameter length c) Check parameter contents
Test passed	a) No negative response and b) Parameter length matches parameter Process Data In (Direct Parameter page1, address 0x06) and c) Not used bits are "0".
Test failed (examples)	No response
Results	Process Data Output response: <negative/positive> <pass/fail> Process Data Output length: <value> <pass/fail> Process Data Output not used bits = "0": <yes/no> <pass/fail>

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6.10.28 Offset Time – valid

Table 146 defines the test conditions for this test case.

Table 146 – Offset Time – valid

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0134
Name	TCD_DLIC_DEFP_OFFTIMEVALID
Purpose (short)	Test of Offset Time with valid values
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.20, Table B.11
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The test verifies whether the value range for Offset Time is correct.
Precondition	Device is in SDCI communication mode (Scan mode) with maximum MasterCycleTime and parameter Offset Time marked as implemented within the IODD.
Procedure	a) Write value to Offset Time with "0" for time base and for multiplier (Index 0x0030) b) Read value Offset Time c) Repeat step a) and step b) with multiplier = "63" d) Repeat step a) to step c) with time base = "1" and time base = "2"
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Read and Write access b) Compare response value of step b) with written value of step a)
Test passed	a) No negative response on Read or Write access and b) Comparison of evaluation b) shows matching values
Test failed (examples)	No response
Results	For each of the 3 settings: OffsetTime valid response: <negative/positive> <pass/fail> OffsetTime valid matching values: <yes/no> <pass/fail>

6.10.29 Offset Time – invalid

Table 147 defines the test conditions for this test case.

Table 147 – Offset Time – invalid

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0135
Name	TCD_DLIC_DEFP_OFFTIMEINVALID
Purpose (short)	Test of Offset Time with invalid values
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.20, Table B.11, and Annex C.2.9
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The test verifies whether the reserved value range for Offset Time is correct.
Precondition	Device is in SDCI communication mode (Scan mode) with maximum MasterCycleTime and parameter Offset Time marked as implemented within the IODD.
Procedure	a) Read value Offset Time (Index 0x0030) b) Write value to Offset Time with "3" for the time base and "0" for multiplier c) Read value Offset Time d) Repeat step a) to step c) with multiplier = "63"
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check for response on Read and Write access b) Compare response value from step c) with written value from step a)
Test passed	a) No negative response on Read access and b) Negative response PAR_VALOUTOFRNG (0x8030) on Write access and c) Comparison of evaluation b) shows matching values
Test failed (examples)	No response
Results	For each of the 2 settings: OffsetTime valid Read response: <negative/positive> <pass/fail> OffsetTime valid Write response: <ErrorType> <pass/fail> OffsetTime valid matching values: <yes/no> <pass/fail>

6.10.30 Profile Parameter – Read access

Table 148 defines the test conditions for this test case.

Table 148 – Profile Parameter – Read access

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0136
Name	TCD_DLIC_DEFP_PROFILEPARREAD
Purpose (short)	Test of implemented Profile Parameter Read access (Device supports profile)
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.21
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test of Read access of parameters defined as Profile specific
Precondition	Device is in SDCI communication mode (Scan mode), parameter Profile marked as implemented within the IODD, and Device supports profile.
Procedure	Read Profile parameters from index 0x0031 to 0x003F
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check each response on Read access
Test passed	a) No negative response on Profile parameters marked as implemented and b) Negative response IDX_NOTAVAIL (0x8011) on parameters not used within a specific profile or not implemented
Test failed (examples)	No response
Results	For each Read access: Profile Parameter response: <negative/positive> <pass/fail> Profile Parameter not used/implemented response: <ErrorType> <pass/fail>

6.10.31 Profile Parameter – Write access

Table 149 defines the test conditions for this test case.

Table 149 – Profile Parameter – Write access

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0137
Name	TCD_DLIC_DEFP_PROFILEPARWRITE
Purpose (short)	Test of implemented Profile Parameter Write access (Device supports profile)
Equipment under test (EUT)	Device
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2.21
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of Write access to parameters defined Profile specific
Precondition	Device is in SDCI communication mode (Scan mode), parameter Profile marked as implemented within the IODD, and Device supports profile.
Procedure	a) Write Profile Parameters from index 0x0031 to 0x003F with <values>, if marked as implemented, and b) With value "0x0000", if marked as not implemented
Input parameter	<values>: randomly chosen valid values
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check each response on Write access
Test passed	a) No negative response on Profile Parameters marked as implemented and b) Negative response IDX_NOTAVAIL (0x8011) on parameters not used within a specific profile or not implemented
Test failed (examples)	No response
Results	For each Write access: Profile Parameter used response: <negative/positive> <pass/fail> Profile Parameter not used/implemented response: <ErrorType> <pass/fail>

6.10.32 Write access – Read only

Table 150 defines the test conditions for this test case.

Table 150 – Write access – Read only

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0140
Name	TCD_DLIC_DEFP_WRITETOREADONLY
Purpose (short)	Test of Write access to Read only parameter
Equipment under test (EUT)	Device and Legacy-Device
Test case version	1.3
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2 and Annex C.2.8
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test that Write access to a Read only standard parameter shows the correct response behavior
Precondition	Device is in SDCI communication mode, standard parameters are referenced within the IODD.
Procedure	Write Request with <value> and with the specified parameter length to all standard parameters that are marked Read Only. Prior to the Write Request, a Read Request shall provide the parameter length to be used.
Input parameter	<value>: any
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check for negative response
Test passed	Negative Response is IDX_NOT_WRITEABLE (0x8023)
Test failed (examples)	No response
Results	Upon all Write accesses to Read Only parameters: Parameter Read Only response: <ErrorType> <pass/fail>

6.10.33 Write access – invalid short Length

Table 151 defines the test conditions for this test case.

Table 151 – Write access – invalid short Length

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0141
Name	TCD_DLIC_DEFP_WRITETOOSHORT
Purpose (short)	Test of Write access with invalid length (too short) to writable parameter
Equipment under test (EUT)	Device and Legacy-Device (see B.11)
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2 and Annex C.2.13
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test that Write access to a writable standard parameter with a too short parameter length shows the correct response behavior
Precondition	Device is in SDCI communication mode. Writeable standard parameters are referenced within the IODD, not of data type StringT, and their length is > 1 octet.
Procedure	Write Request to all appropriate standard parameters, while using a parameter length shorter than the specified <value>.
Input parameter	<value>: any
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check for negative response
Test passed	Negative Response is VAL_LENUNDRUN (0x8034). If the error response does not match this expectation, the Device tester shall raise a warning and display the response value. For Legacy-Devices see B.11.
Test failed (examples)	No response
Results	Upon all Write accesses with too short length to writable parameters: Parameter Write response: <ErrorType> <pass/fail>

6.10.34 Write access – invalid long Length

Table 152 defines the test conditions for this test case.

Table 152 – Write access – invalid long Length

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0142
Name	TCD_DLIC_DEFP_WRITETOOLONG
Purpose (short)	Test of Write access with invalid length (too long) to writable parameter
Equipment under test (EUT)	Device and Legacy-Device (see B.11)
Test case version	1.1
Category / type	Device application test; test to pass (positive testing)
Specification (clause)	[9], see Annex B.2, and Annex C.2.8
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test that Write access to a writable standard parameter with a too long parameter length shows the correct response behavior
Precondition	Device is in SDCI communication mode. Writeable standard parameters are referenced within the IODD.
Procedure	Write Request to all appropriate standard parameters, while using a parameter length longer than the specified <value>.
Input parameter	<value>: any
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check for negative response
Test passed	Negative response is VAL_LENOVRRUN (0x8033). If the error response does not match this expectation, the Device-Tester shall raise a warning and display the response value. For Legacy-Devices see B.11.
Test failed (examples)	No response
Results	Upon all Write accesses with too long length to writeable parameters: Parameter Write response: <ErrorType> <pass/fail>

6.11 Block parameter

6.11.1 General

The manufacturer/vendor of a Device shall provide information about a possible Block Parameter set enabling the performance of the following tests. This Block Parameter set shall comply with the requirements of the test cases 6.11.2 through 6.11.6.

6.11.2 Block parameter – Download

Table 153 defines the test conditions for this test case.

Table 153 – Block parameter – Download

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0143
Name	TCD_DSBP_APPL_BPDOWNLOAD
Purpose (short)	Test of Block Parameter download
Equipment under test (EUT)	Device with option Block Parameter
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.3.5 and 10.6.14
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of Block Parameter download
Precondition	Device in PREOPERATE or OPERATE mode
Procedure	a) Write SystemCommand (0x0002): 0x03 (ParamDownloadStart) b) Write Block Parameters listed by the manufacturer c) Write SystemCommand (0x0002): 0x04 (ParamDownloadEnd)
Input parameter	The manufacturer shall specify a set of parameters that are combined to a Block
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Write "ParamDownloadStart" b) Check response while Writing Block parameters c) Check response on Write "ParamDownloadEnd"
Test passed	There is no negative response during any Write request
Test failed (examples)	No response
Results	Write "ParamDownloadStart" response: <negative/positive> <pass/fail> Write Block parameter response: <negative/positive> <pass/fail> Write "ParamDownloadEnd" response: <negative/positive> <pass/fail>

6.11.3 Block parameter – Break by command

Table 154 defines the test conditions for this test case.

Table 154 – Block parameter – Break by command

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0144
Name	TCD_DSBP_APPL_BPBREAKCMD
Purpose (short)	Test break of Block Parameter transfer per command
Equipment under test (EUT)	Device with option Block Parameter
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.3.5 and 10.6.14
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test, that a Device discards any change of parameters when it receives a System-Command "ParamDownloadBreak"
Precondition	Device in PREOPERATE or OPERATE mode
Procedure	a) Read one Parameter listed by the vendor and buffer the <value1> b) Write SystemCommand "ParamDownloadStart" c) Write parameter listed by the vendor, <value2> ≠ <value1> of step a) d) Write SystemCommand "ParamDownloadBreak" e) Read Parameter written in step c) and verify with the value of step a) f) Write SystemCommand "ParamDownloadEnd" g) Read Parameter written in step c) and verify with the value of step a)
Input parameter	The vendor shall specify a set of parameters that are combined to a Block
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on Write "ParamDownloadStart" b) Check response on Write "ParamDownloadBreak" c) Parameter value of step a) matches the parameter value of step e) d) Check response on Write "ParamDownloadEnd" e) Parameter value of step a) matches the parameter value of step g)
Test passed	a) There is no negative response during any Write request except in step f) b) Positive evaluations c) and e)
Test failed (examples)	No response or evaluations negative
Results	Write "ParamDownloadBreak" response: <negative/positive> <pass/fail> Evaluation c): <negative/positive> <pass/fail> Write "ParamDownloadEnd" response: <ErrorType> <pass/fail> Evaluation e): <negative/positive> <pass/fail>

6.11.4 Block parameter – Break by reset

Table 155 defines the test conditions for this test case.

Table 155 – Block parameter – Break by reset

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0145
Name	TCD_DSBP_APPL_BPBREAKRESET
Purpose (short)	Test break of Block Parameter transfer per reset
Equipment under test (EUT)	Device with option Block Parameter
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.3.5 and 10.6.14
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test, that a Device discards any change of parameters if a reset occurs during parametrization
Precondition	Device in PREOPERATE or OPERATE mode
Procedure	a) Read one Parameter listed by the vendor and store the <value1> b) Write SystemCommand "ParamDownloadStart" c) Write parameter listed by the vendor, <value2> ≠ <value1> of step a) d) Reset the Device either - using power cycle off/on reset or - using SystemCommand "DeviceReset" or - using MasterCommand "Fallback" e) Set Device to PREOPERATE or OPERATE mode f) Read Parameter written in step c) and verify with the value of a) g) Write SystemCommand "ParamDownloadEnd" h) Read Parameter written in c) and verify with value of a)
Input parameter	The vendor shall specify a set of parameters combined to a block
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on Write "ParamDownloadStart" b) Check Device behavior after reset c) Parameter value of step a) matches the parameter value of step e) d) Check response on Write "ParamDownloadEnd" e) Parameter value of step a) matches the parameter value of step g)
Test passed	a) There is no negative response during any write request except in step g) b) Positive evaluations c) and e)
Test failed (examples)	No response or evaluations negative
Results	Write "ParamDownloadStart" response: <negative/positive> <pass/fail> Device reset: <ok/not ok> <pass/fail> Evaluation c): <negative/positive> <pass/fail> Write "ParamDownloadEnd" response: <ErrorType> <pass/fail> Evaluation e): <negative/positive> <pass/fail>

6.11.5 Block parameter – Break by double download

Table 156 defines the test conditions for this test case.

Table 156 – Block parameter – Break by double download

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0147
Name	TCD_DSBP_APPL_BPBREAK2DOWNLOADS
Purpose (short)	Test break of Block Parameter transfer by double SystemCommand "ParamDownloadStart"
Equipment under test (EUT)	Device with option Block Parameter
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.3.5 and 10.6.14
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test, that a Device discards any change of parameters if it occurs outside the Block Parameter transfer
Precondition	Device in PREOPERATE or OPERATE mode
Procedure	a) Read one parameter listed by the vendor and store the <value1> b) Write SystemCommand "ParamDownloadStart" c) Write parameter listed by the vendor, <value2> ≠ <value1> of step a) d) Write SystemCommand "ParamDownloadStart" e) Write all parameters listed by the vendor, except those used in a) f) Write SystemCommand "ParamDownloadEnd" g) Read parameters written in c) and verify with value of a)
Input parameter	The vendor shall specify a set of parameters that are combined to a block
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check response on first Write "ParamDownloadStart" b) Check response on second Write "ParamDownloadStart" c) Check Device behavior after writing different Block Parameter sequence d) Check response on Write "ParamDownloadEnd" e) Parameter value of step a) shall not match the parameter values of step g)
Test passed	a) There is no negative response during any write request b) Positive evaluation e)
Test failed (examples)	No response or evaluations negative
Results	Write "ParamDownloadStart" first response: <negative/positive> <pass/fail> Write "ParamDownloadStart" second response: <negative/positive> <pass/fail> Device behavior on different Block: <ok/not ok> <pass/fail> Write "ParamDownloadEnd" response: <negative/positive > <pass/fail> Evaluation e): <negative/positive> <pass/fail>

6.11.6 Block parameter – local locking

Table 157 defines the test conditions for this test case.

Table 157 – Block parameter – local locking

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0148
Name	TCD_DSBP_APPL_BPBREAKLOCALLOCK
Purpose (short)	Test locking of local parametrization during Block Parameter transfer
Equipment under test (EUT)	Device with option Block Parameter and local parameterization capability (on-board)
Test case version	1.0
Category / type	Device protocol test; test to pass (positive testing)
Specification (clause)	[9], see 10.3.5 and 10.6.14
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test, that local access is locked during Block parametrization
Precondition	Device in PREOPERATE or OPERATE mode
Procedure	a) Read one parameter listed by the vendor and store the <value1> b) Read a parameter which can be changed by local parameterization (on-board) c) Write SystemCommand "ParamDownloadStart" d) Write parameter listed by the vendor, <value2> ≠ <value1> of step a) e) Try to change parameter of step b) via local parameterization (on-board) f) Write SystemCommand "ParamDownloadEnd" g) Read parameter written in d) and verify with value of a) h) Read parameter changed in e) and verify with value of b)
Input parameter	The vendor shall specify a set of parameters that are combined to a block
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check response on Write "ParamDownloadStart" b) Check Device behavior when using local parameterization features c) Check response on Write "ParamDownloadEnd" d) Parameter value of step a) shall not match the parameter values of step g) e) Parameter value of step b) shall match the parameter values of step h)
Test passed	a) There is no negative response during any write request b) Positive evaluation d) c) Positive evaluation e) d) Positive acknowledge on local parameterization (none or negative are acceptable)
Test failed (examples)	No response or evaluations negative
Results	Write "ParamDownloadStart" response: <negative/positive> <pass/fail> Device behavior on local parameterization: <acknowledge> <pass/fail> Write "ParamDownloadEnd" response: <negative/positive > <pass/fail> Evaluation d): <negative/positive> <pass/fail> Evaluation e): <negative/positive> <pass/fail>

6.12 Test report summary of the Device protocol tests

The template is defined by the Device-Tester. The test report shall present at least the results of the test cases for the Device protocol tests.

7 IODD test

7.1 General

The IODD test focuses on three major issues. The first issue is the test of a Device's IODD file with the help of a so-called IODD checker tool. This specification defines the parsers such an IODD checker tool shall use for IODD schema consistency checks. It defines also a set of business rules for the IODD check.

The second issue is the test, whether the parameters defined in the IODD are accessible within the Device (parameter verification test).

The third issue focuses on the IODD interpreter tool. This test shall ensure, that the "Port and Device Configuration Tool" of the Master is able to provide all the IODD definitions in the correct manner.

7.2 Schema test via an IODD checker tool

The organization referenced in Annex D makes available an IODD checker tool ("Checker") for free download from its web server. It is mandatory for each and every IODD associated with a Device to pass the test with this Checker. The Device's manufacturer declaration shall state the successful result of the test.

The requirements for the Checker consist of two main parts.

Within the first part the Checker uses the following parsers or their later versions or alternatives where applicable to test the schema consistency of a particular IODD:

- XmlReader class of Microsoft .NET Framework Version 2.0 with schema validation switched on, i.e. *Settings.ValidationType* set to *ValidationType.Schema*.

  Microsoft .NET Framework Version 2.0 Redistributable Package,
  date published: 22-Jan-2006,
  http://www.microsoft.com/downloads/details.aspx?familyid=0856EACB-4362-4B0D-8EDD-AAB15C5E04F5&displaylang=en

  Microsoft .NET Framework 2.0 Service Pack 2
  date published: 16-Jan-2009,
  http://www.microsoft.com/downloads/details.aspx?FamilyID=5b2c0358-915b-4eb5-9b1d-10e506da9d0f&displaylang=en
- Xerces-C++ Version 3.1.1,
  http://xerces.apache.org/xerces-c/

Within the second part the Checker uses the following business rule set in Table 158. An "x" in column "M" indicates relevance for the main IODD and in column "L" relevance for the language file. An "x" in column "W" indicates that this business rule check creates a warning, and an "x" in column "V" indicates validity of the check for legacy Devices (V1.0).

Table 158 – Checker business rule set for IODDs

IODD_TC No	Rule name (TCDD_...)	Reference	Definition	M	L	W	V
0001	Encoding	[3], 5	Encoding shall be UTF-8	x	x		x
0002	NameSpace	[3], 5	http://www.w3.org/2001/XMLSchema-instance with the prefix “xsi” http://www.io-link.com/IODD/2010/10 with the prefix “iodd”	x	x		
0003	Additional-NameSpaces	[3], 5	No additional name spaces shall be included	x	x		x
0004	SchemaLocation	[3], 5	http://www.io-link.com/IODD/2010/10	x	x		
0005	SchemaMainIODD	[3], 5	IODD1.1.xsd	x			
0006	SchemaLanguage-	[3], 5	IODD-Primitives1.1.xsd		x		

IODD_TC No	Rule name (TCDD_...)	Reference	Definition	M	L	W	V
	File						
0007	FileNameConven-tion_IODD_Special Characters	[3], 5	Special characters are permitted in vendor name and device name part of filename: _, #, -	x	x		x
0008	FileNameConven-tion_IODD_VendorNamePart	[3], 5	All files of the set of files belonging to a specif-ic IODD shall have the same <vendor name> part in their file names.	x	x		x
0009	FileNameConven-tion_MainIODD	[3], 5.1	<vendor name>-<device name>-<date of file creation>-IODD<schema version>.xml; IODD shall be done with upper case letters	x			x
0010	FileNameConven-tion_LanguageFile	[3], 5.2	<vendor name>-<device name>-<date of file creation>-IODD<schema version>-<language>.xml; IODD shall be done with up-per case letter		x		x
0011	LanguagePart_-LanguageFile-Name_ISO	[3], 5.2	The “language” part follows ISO 639-1:2002.		x	x	x
0012	LanguagePart_-LanguageFile-Name_2Letters	[3], 5.2	The “language” part consists of two letters		x		x
0013	LanguagePart_-LanguageFile-Name_Unique	[3], 5.2	There shall be no additional language file for languages already covered in the main IODD file		x		x
0014	LanguagePart_-LanguageFile-Name_Inside	[3], 5.2	The language part of the language file name shall be the same as the definition inside the language file		x		x
0015	LanguageStandard-Definitions	[3], 5.2	If an IODD contains a language, which is not existing for IODD-StandardDefinitions or IODD-StandardUnitDefinitions, the checker will show a warning	x	x	x	
0016	VendorLogo	[3], 5.3	160 x 90 pixel, landscape format	x			x
0017	DeviceIcon	[3], 5.3	48 x 48 pixel	x			x
0018	DevicePicture	[3], 5.3	Min. 160 x 160 pixel, max. 320 x 320, square	x			x
0019	ConnectionSymbol	[3], 5.3	Min. 160 x 160 pixel, max. 320 x 320, square	x			
0020	ImageFilesExist	[3], 5.3	If the attributes are used, the referenced image files shall be present	x			x
0021	ImageFile-NameConvention	[3], 5	All files of the set of files belonging to a specif-ic IODD shall have the same <vendor name> part in their file names	x			x
0022	Date_IODD_-FileName	[3], 7.3.1	The date information in the IODD file name shall correspond to the releaseDate attribute in the DocumentInfo element	x			x
0023	Date_Language_-FileName	[3], 7.3.1	The date information in the language file name shall correspond to the releaseDate attribute in the DocumentInfo element, if the DocumentInfo element exists		x		x
0024	ProfileHeader	[3], 7.3.2	It shall correspond exactly to the given values in the specification	x			x
0025	Stamp	[3], 7.3.4	If no errors are detected during the checking process, the crc attribute is set to a CRC value calculated across the file contents. Otherwise, the crc attribute is set to an invalid value.	x	x		x
0026	Comments_InOr-After_Stamp	[3], 7.3.4	Comments shall not be included in or after the Stamp element.	x	x		x
0027	ProductId	[3], 7.4.1	ProductID in IODD corresponds to the ISDU standard parameter. If ProductID is not imple-mented in the Device, multiple device variants	x			x

IODD_TC No	Rule name (TCDD_...)	Reference	Definition	M	L	W	V
			are not allowed.				
0028	ProductId_Length	[3], 7.4.1	The maximum length of ProductId shall not exceed 64 octets UTF-8 coded.	x			x
0029	Declarations_Data-types	[3], 7.5.2	There shall be no unreferenced data type elements.	x			x
0030	DatatypeId	[3], 7.5.2	For data types in the DatatypeCollection, the attribute id shall be specified.	x			x
0031	NoDatatypeId	[3], 7.5.2	For Datatypes outside the DatatypeCollection, the attribute id shall not be specified	x			x
0032	StdVariableRef	[3], 7.5.4.1	Since direct parameters are mandatory, the variables V_DirectParameters_1 and V_DirectParameters_2 shall always be referenced. All standard ISDU variables marked with the attribute mandatory="true" in the IODD-StandardDefinitions shall be referenced, if the Device supports ISDU access.	x			x
0033	StdVariableRef_-Reserved_Ids	[3], 7.5.4.1 [9], B.2.1	The ids of optional variables in StdDefinitions1.1.xml shall not be used for user specific variables, even if they are not referenced in the IODD.	x			x
0034	StdVariableRef_-DefaultValue	[3], 7.5.4.1	@defaultValue shall not be specified for references to V_ProcessDataInput or V_Process-DataOutput	x			x
0035	FixedLength-Restriction	[3], 7.5.4.1	If referenced variable is of type OctetString or String, it shall be less or equal its fixedLength attribute. If referenced variable is of type Array, it shall be less or equal to its count attribute.	x			x
0036	V_Application-SpecificTag	[9], B.2.14	If fixedLengthRestriction is used, it shall be equal or greater than 16.	x			x
0037	StdSingleValueRef	[3], 7.5.4.1 [3], 8.1	Check if StdSingleValue exists as SingleValue in StdDefinitions1.1.xml.	x			x
0038	StdValueRangeRef	[3], 7.5.4.1 [3], 8.1	Check if StdValueRange exists as ValueRange in StdDefinitions1.1.xml.	x			x
0039	StdVariableRef_-SingleValue	[3], 7.5.4.1 [3], 8.1	Check against overlapping with StdSingleValue and StdValueRange (even if they are optional and not referenced), other SingleValue or ValueRange.	x			x
0040	StdVariableRef_-ValueRange	[3], 7.5.4.1 [3], 8.1	Check against overlapping with StdSingleValue and StdValueRange (even if they are optional and not referenced), other SingleValue or ValueRange.	x			x
0041	StdRecordItemRef	[3], 7.5.4.1	Check if referenced RecordItem exists in StdDefinitions1.1.xml.	x			x
0042	DirectParameter-Overlay_Subindex-AccessSupported	[3], 7.3.3.2 [9], B.1.1	Statement subindexAccessSupported="false" shall not be used. Index 1 can only be accessed octet by octet.	x			
0043	DirectParameter-Overlay_Datatype	[3], 7.5.4.2	The data type shall be a record.	x			
0044	DirectParameter-Overlay_Usage	[3], 7.5.4.2	Recommendation: Use DirectParameterOverlay only for Devices not supporting ISDU access (checker shall generate a warning)	x		x	
0045	VariableIndex	[9] B.2.1	Preferred and extended Index for Device or vendor specific variables are 64 to 254 and 256 to 16383. Indices 2 to 63, 255, 16384 to 65535 shall not be used as Device or vendor specific variable.	x			x

IODD_TC No	Rule name (TCDD_...)	Reference	Definition	M	L	W	V
0046	VariableIndex_-Profiles	[9] B.2.1	Indices 49 to 63 and 16384 to 20479 are reserved for profiles. Since the checker is not designed to perform profile specific checks, a warning is given and the vendor is responsible to use these Indices only according to profile definitions.	x		x	x
0047	RecordItemInfo	[3], 7.5.4.3	RecordItem shall exist.	x			x
0048	RecordItemInfo_-NoRecord	[3], 7.5.4.3	Only applicable if the variable is of type record.	x			x
0049	DefaultValue	[3], 7.5.4.1, 7.5.4.3	The default value shall match the given datatype.	x			x
0050	DefaultValue_String	[3], 7.5.4.1, 7.5.4.3	Check whether used letters are valid in respect to given encoding.	x			x
0051	ProcessData_-Condition	[3], 7.5.5	If ProcessData occur more than once, the individual ProcessData elements can be distinguished by to the Condition element.	x			x
0052	ProcessData_-BitLength	[3], 7.5.5	The attribute 'bitLength' shall represent the underlying ProcesssDataIn (-Out) datatype in a bit by bit manner. For record data types this bitLength shall equal the bitLength attribute of the record.	x			x
0053	ProcessData_Id	[3], 7.5.5	The attribute "id" shall be unique within the elements ProcessData, ProcessDataIn, and ProcessDataOut.	x			x
0054	ProcessData_-Condition_Variable	[3], 7.5.5	There shall only be exactly one variable used for the switching of process data. The referenced variable shall contain a default value. The process data length (of ProcessDataIn and ProcessDataOut respectively) shall be the same for all ProcessData.	x			x
0055	ProcessData_-Condition_Datatype	[3], 7.5.5	Conditions shall only be of datatype IntegerT, UIntegerT and BooleanT.	x			x
0056	StdErrorTypeRef	[3], 7.5.6	Check whether referenced ErrorType exists in StdDefinitions1.1.xml.	x			
0057	StdEventRef	[3], 7.5.7	Check whether referenced Event exists in StdDefinitions1.1.xml.	x			
0058	EventCode	[9], D.2	Vendor or device specific codes are: 0x1800-0x18FF and 0x8CA0-0x8DFF.	x			
0059	ProfileEventCode	[9], D.2	The codes reserved for profiles are: 0xB000-0xBFFF.	x		x	
0060	ProcessDataInfo	[3], 7.5.8.1	Check whether displayFormat and Datatype are matching.	x			
0061	MenuLevel	[3], 7.5.8.2	At most three menu levels below the role assignment are acceptable.	x			x
0062	NotUsedMenus	[3], 7.5.8.3	There shall be no unreferenced Menu elements	x			
0063	MenuName	[3], 7.5.8.3	In underlying menus, a menu name shall be given by the IODD.	x			x
0064	Gradient_Offset	[3], 7.5.8.4	When applying gradient and/or offset to convert the Variable or RecordItem value into the displayed value, the value will be implicitely converted to a floating point value. Consequently, the only allowed displayFormat for such values shall be "Dec".	x			x
0065	Record-ItemRef_Array	[3], 7.5.8.4	Single array members can't be referenced by RecordItemRef. If there is a need to access a single member, a record shall be defined instead of an array.	x			x
0066	UnitCode	[3], 7.5.8.4	Unit code to which the indicated variable refers. See IODD-StandardUnitDefinitions1.1.xml	x			x

IODD_TC No	Rule name (TCDD_...)	Reference	Definition	M	L	W	V
			for valid unit codes.				
0067	Menu_AccessRight Restriction	[3], 7.5.8.4	The accessright of the referenced element shall include the accessrights given by accessRightRestriction.	x			x
0068	ButtonValue	[3], 7.5.8.4	The value of the 'buttonValue' attribute shall be defined as a 'SingleValue' of the Variable/-RecordItem	x			x
0069	ButtonReference	[3], 7.5.8.4	A variable referenced as "Button" shall have accessRights "wo", shall only be displayed as a button, and shall not be used as a condition variable to switch menus or processdata.	x			x
0070	RecordItemRef	[3], 7.5.8.5	The variable referenced by variableId shall be of type record. If referenced as "Button", the referenced variable shall support subindex access. The subindex shall be defined in the referenced record.	x			x
0071	Record-ItemRef_Button	[3], 7.5.8.5	If referenced as "Button", the referenced variable shall support subindex access.	x			x
0072	Button_NoDisplay-Format	[3], 7.5.8.5	If in menu subelement 'Button' exists for VariableRef or RecordItemRef, displayFormat shall not be defined.	x			
0073	MenuRef_Circular-References	[3], 7.5.8.6	Circular references shall be avoided.	x			x
0074	MenuCondition	[3], 7.5.8.6	Conditions shall only be of datatype IntegerT, UIntegerT, and BooleanT.	x			x
0075	MenuCondition_-ProcessData-Condition	[3], 7.5.8.6	If there is more than one ProcessData element selected by conditions, and the variable V_ProcessDataIn or V_ProcessDataOut is referenced in a menu, one of the following shall hold: a) The type of reference (VariableRef/-RecordItemRef) and the gradient, offset, unitCode and displayFormat match each of the ProcessData elements. b) The menu is conditioned in the same way as one of the ProcessData elements, and the type of reference (VariableRef / RecordItemRef) and the gradient, offset, unitCode and displayFormat match this particular ProcessData element ("conditioned in the same way" means that this menu or one of the parent menus has the same condition: same variable, same subindex, same value).	x			x
0076	MinCycleTime	[3], 7.6 [9], B.1.4	The minimum cycle time of the slave; specified in units of 1 µs. For example 2300 represents 2,3 ms. For the allowed values, refer to chapter 'Min Cycle Time' in [9].	x			x
0077	PrimaryLanguage	[3], 7.7.1	The primary language shall be English (the attribute xml:lang shall have the value "en").	x			x
0078	TextRedefine	[3], 7.7.1	Language dependent text overriding a standard text. Only applicable for texts describing the octets of DirectParameter page 2. It shall be one of STD_TI_DeviceSpecific_1 to STD_TI_-DeviceSpecific_16.	x			
0079	NotUsedTexts	[3], 7.7.1	Shall be referenced by other elements via their textId attribute (there shall be no unreferenced Text elements)	x	x		x
0080	NotTranslatedTexts	[3], 7.7.1	Check whether texts are not translated.	x	x	x	x
0081	Unique_Device-VariantNameText	[3], 7.7.1	Texts referenced by DeviceVariantCollection/DeviceVariant/Name/textId shall be unique for each language.	x	x		

IODD_TC No	Rule name (TCDD_...)	Reference	Definition	M	L	W	V
0082	Unique_Variable-NameText	[3], 7.7.1	Texts referenced by StandardVariables, DirectParameterOverlay or Variables shall be unique for each language.	x	x		
0083	Overlaping_Single-Value_ValueRange	[3], 7.5.3.1.1	SingleValues and ValueRanges shall not overlap	x			x
0084	Arrays	[9], E.3	UIntegerT and IntegerT with a length of ≥ 58 bit and < 64 bit are not permitted.	x			x
0085	Record_Subindices	[9], E.3	The Subindices within the IODD shall be listed in ascending order from 1 to n describing an octet sequence. Gaps within the list of Subindices are allowed.	x			x
0086	Alignment_Data-types	[9], E.3	The following data types shall always be aligned with octet boundaries: Float32T, StringT, OctetStringT, TimeT, and TimeSpanT.	x			x
0087	Alignment_-Integer58	[9], E.3	UIntegerT and IntegerT with a length of ≥ 58 bit shall always be aligned with one side of an octet boundary.	x			x
0088	Alignment_-Integer10	[9], E.3	It is highly recommended for UIntegerT and IntegerT with a length of ≥ 8 bit to align always with one side of an octet boundary.	x		x	x
0089	Alignment_-Integer6	[9], E.3	It is highly recommended for UIntegerT and IntegerT with a length of < 8 bit not to cross octet boundaries.	x		x	x
0090	RecordItems_-AccessRight-Restriction	[9], E.3	The accessright of the RecordItem shall include the accessrights of the variable.	x			x
0091	ProcessData_-AccessRight-Restriction	[9], E.3	The attribute "‘accessRightRestriction" is only applicable for service parameter, not for process data.	x			x
0092	BitOffset	[9], E.3	RecordItem shall not overlap	x			x
0093	Connection_MinDef	[3], 7.6	Connection: L+, L- and C/Q shall be defined with OtherConnectionT/Wires.	x			
0094	MaxLength_-Variables	[9], 4.4	The length of a variable shall not exeed 238 octets.	x			x
0095	MaxLength_-ProcessData	[9], 4.4	The length of a ProcessDataIn/Out shall not exeed 32 octets.	x			X
0096	Exclud-edFromDataStorage	[3], 7.5.4.1	This check shall only be used for variables with accessRights = "rw"	x			
0097	ModifiesOther-Variables	[3], 7.5.4.2	This check shall only be used for variables with accessRight = "rw" or "wo"	x			
0098	Dynamic	[3], 7.5.4.2	This check shall only be used for variables with accessRights = "rw" or "ro"	x			x

7.3 Parameter verification test

7.3.1 IODD identification

Table 159 defines the test conditions for this test case.

Table 159 – IODD identification

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0149
Name	TCD_IODD_PARV_IDENT
Purpose (short)	Verification that Device under test is related to the associated IODD
Equipment under test (EUT)	Device and Legacy-Device and associated IODD
Test case version	1.0
Category / type	IODD parameter verification test; test to pass (positive testing)
Specification (clause)	[3] 5.2 and 5.2.1; [9] B.1.9, B.1.10 and B.2.9
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Verify that Device is related to the associated IODD. The Device-Tester reads dedicated IODD parameters from the Device. Therefore read the VendorID, DeviceID and ProductID and check if IODD describes this specific Device. For further tests only the read DeviceID and the ProductID shall match the IODD entries.
Precondition	Device is in SDCI communication mode
Procedure	Read VendorID, DeviceID, ProductID from Device
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check if IDs match the entries in the IODDs Device identity b) Check if ProductID is listed in the DeviceVariantCollection of the IODD
Test passed	All IDs from Device found in IODD
Test failed (examples)	Any of the ID from Device not found in IODD (not matching)
Results	VendorID: <value> <pass/fail> DeviceID: <value> <pass/fail> ProductID: <value> <pass/fail> ProductID listed in DeviceVariantCollection: <yes/no> <pass/fail>

7.3.2 IODD communication profile verification

Table 160 defines the test conditions for this test case.

Table 160 – IODD communication profile verification

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0150
Name	TCD_IODD_PARV_COMPROFILE
Purpose (short)	Verification of Device network communication profile
Equipment under test (EUT)	Device and Legacy-Device and associated IODD
Test case version	1.0
Category / type	IODD parameter verification test; test to pass (positive testing)
Specification (clause)	[3] 5.4; [9] B.1.4, B.1.6, B.1.7 and B.1.8
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Device-Tester reads dedicated IODD parameters from the Device Test if the IODD network communication profile corresponds to the entries in the Direct Parameter page 1 of the Device. The properties MinCycleTime (address 0x02), RevisionID (address 0x04) and ProcessDataIn/SIO supported (address 0x05, bit 6) of the IODD commNetworkProfile are tested.
Precondition	Device is in SDCI communication mode, matching VendorID and ProductID
Procedure	Read Direct Parameter page 1 (Index 0)
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check if values (address 0x02, address 0x04, address 0x05, bit 6) correspond to entries in IODD commNetworkProfile (MinCycleTime, RevisionID, SIO supported)
Test passed	Values are matching
Test failed (examples)	Values are not matching
Results	MinCycleTime: <value> <pass/fail> RevisionID: <value> <pass/fail> SIO supported: <yes/no> <pass/fail>

7.3.3 IODD parameter read verification

Table 161 defines the test conditions for this test case.

Table 161 – IODD parameter read verification

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0151
Name	TCD_IODD_PARV_READVERIFY
Purpose (short)	Test access rights, structure and data content of Read parameters
Equipment under test (EUT)	Device and Legacy-Device and associated IODD
Test case version	1.0
Category / type	IODD parameter verification test; test to pass (positive testing)
Specification (clause)	[3] 5.3.2.1, 5.3.2.3; [9] Table C.1, C.2.2 to C.2.19, E.2.2 to E.2.9, E.3.2, E.3.3
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Device-Tester reads dedicated IODD parameters from the Device. Verify that all parameters in the IODD with Read access can be read from the Device, have a correct structure and valid data content. The length of the read parameter is used to test the structure. The lengths of parameters depend on their data. The validity of the data content is only checked for parameter that can have invalid data content (“0x00” in the middle of a string).
Precondition	Device is in SDCI communication mode, matching VendorID and ProductID
Procedure	Read all parameter with read access according to the IODD (parameter by parameter) and evaluate
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	For each read out parameter: a) Check for ErrorType according Table C.1 in [9] b) Check if length corresponds to IODD entry c) Check if data content is valid (no "0x00" in the middle of a string)
Test passed	Successful evaluation
Test failed (examples)	Any ErrorType out of C.2.3 to C.2.8 (see [9]) is indicated; invalid data content or read length is not as described in the IODD
Results	For each and every parameter with Read access in the IODD: Parameter Read access: <ok/not ok> <pass/fail> Parameter length match: <yes/no> <pass/fail> Parameter string without "0x00": <yes/no> <pass/fail>

7.3.4 IODD parameter write verification

Table 162 defines the test conditions for this test case.

Table 162 – IODD parameter write verification

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0152
Name	TCD_IODD_PARV_WRITEVERIFY
Purpose (short)	Test verifies index space and value ranges defined within the Device's IODD
Equipment under test (EUT)	Device and Legacy-Device and associated IODD
Test case version	1.0
Category / type	IODD parameter verification test; test to pass (positive testing)
Specification (clause)	[3] 5.3.2.1, 5.3.2.3; [9] Table C.1, E.2.2 to E.2.9, E.3.2, E.3.3
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Device-Tester writes dedicated IODD parameters to the Device. Verify that all parameters in the IODD can be accessed within their value ranges. Test for semantics (device specific technology) is not included. The individual rules for applicable values to be written are defined depending on the data types (for example string, integer, enum), see section "Input parameter".
Precondition	Device is in SDCI communication mode, matching VendorID and ProductID
Procedure	a) Identify parameter with Write access in the associated IODD. b) Identify a valid <value> for the Write access (see field "Input parameter"). c) Write parameter according to IODD including Subindices.
Input parameter	For each and every <value> to be written the following rules for the data types shall apply: - String: filled with blanks - INT, UINT, FLOAT: maximum value of the permitted range minus one unit - BOOL: true - Time: 2011-04-18T12:00:00 - Timespan: P1S - Enum (single value): first single value
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	For each written parameter: Check for ErrorType according Table C.1
Test passed	If Write access without error. Device may enter undefined technology states, but it shall continue to communicate.
Test failed (examples)	ErrorType C.2.3 occurred (0x8011 = IDX_NOTAVAIL)
Results	For each and every parameter with Write access in the IODD: Parameter Write access: <OK/ErrorType> <pass/fail>

7.3.5 IODD reset to factory settings verification

Table 163 defines the test conditions for this test case.

Table 163 – IODD reset to factory settings verification

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0155
Name	TCD_IODD_PARV_FACTORYSETTINGS
Purpose (short)	Test parameters after SystemCommand "Restore factory settings" (Option)
Equipment under test (EUT)	Device and Legacy-Device and associated IODD (see B.12)
Test case version	1.0
Category / type	IODD parameter verification test; test to pass (positive testing)
Specification (clause)	[3] 5.3.2.1, 5.3.2.3; [9] 10.6.4, B.2.2,Table C.1
Configuration / setup	Device-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Device-Tester tests if parameters are set to default values via the System-Command "Restore factory settings". Non-dynamic parameters are set to default values if applicable. Only parameters are read out and tested, - if they do not own the attribute "dynamic", - if they show access rights "Read/Write", - if they provide a default value. For Legacy-Devices see B.12.
Precondition	Device is in SDCI communication mode, matching VendorID and ProductID
Procedure	a) Write SystemCommand 0x82 ("Restore factory settings") into Index 0x0002 b) Identify non-dynamic parameter with Read access and default value from IODD c) Read identified parameter
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	For each read parameter: a) Check for ErrorType according Table C.1 b) Check whether read value matches default value in the IODD If the response does not match the expectation, the Device tester shall raise a warning and display the response value. User manual of the Device shall explain the deviation. For Legacy-Devices see B.12.
Test passed	a) If no errors occur b) If evaluation b) is successful
Test failed (examples)	a) Errors occur b) If evaluation b) is not successful
Results	For each and every non-dynamic parameter with Read access in the IODD: Parameter Read access: <no error/ErrorType> <pass/fail> Default value: <value> <pass/fail>

1688 ### 7.3.6 IODD parameter access lock verification

1689 Table 164 defines the test conditions for this test case.

1690 **Table 164 – IODD parameter access lock verification**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0156
Name	TCD_IODD_PARV_ACCESSLOCK
Purpose (short)	Test IODD parameter access locking function (Option)
Equipment under test (EUT)	Device and associated IODD
Test case version	1.0
Category / type	IODD parameter verification test; test to pass (negative testing)
Specification (clause)	[3] 5.3.2.3; [9] B.2.4, C.2.3 to C.2.8
Configuration / setup	Device-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Device-Tester tests if parameters are locked by the "Device Access Lock" parameter. The access to write values is locked if this feature is implemented. (Version 1.1).
Precondition	Connection established, vendor and product ID of Device and IODD are equal
Procedure	a) Write the value "0x01" to Index 0x000C, Subindex 0x00 ("Device Access Locks – parameter access locked") b) Identify parameter with Write access within the IODD c) Write <value> to the identified parameter
Input parameter	<value> to be defined by manufacturer
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	For each written parameter: a) Check for ErrorType according Table C.1
Test passed	If an ErrorType out of C.2.3 to C.2.8 is indicated at each attempt to write
Test failed (examples)	No error was indicated and Write access was possible
Results	For each and every parameter with Write access in the IODD: Parameter Write access: <no error/ErrorType> <pass/fail>

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7.3.7 IODD parameter Index/Subindex consistency

Table 165 defines the test conditions for this test case.

Table 165 – IODD parameter Index/Subindex consistency

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0157
Name	TCD_IODD_PARV_INDEXCONSISTENT
Purpose (short)	Test the consistency between Indices and Subindices for IODD parameters
Equipment under test (EUT)	Device and Legacy-Device and associated IODD
Test case version	1.0
Category / type	IODD parameter verification test; test to pass (positive testing)
Specification (clause)	[3] 5.3.2.1, 5.3.5.3; [9] A.5.4, E.3.2, E.3.3
Configuration / setup	Device-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Device-Tester tests if reading or writing parameters with Subindex access has the same results for access via Index and Subindex. This test is only for non-dynamic parameters with complex data type and “subindexAccessSupported = true” within the IODD.
Precondition	Connection established, vendor and product ID of Device and IODD are equal
Procedure	a) Identify parameter from IODD (see "Purpose") b) Identify a valid <value1> to write c) Write <value1> into parameter d) Read parameter (Index, Subindex "0x00") e) Read <value2> of particular Subindex of Index f) Write <value2> into Subindex of the same parameter g) Read parameter (Index, Subindex "0x00") h) Read <value3> particular Subindex of Index
Input parameter	<value1> to be defined by manufacturer
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether <value2> fits into <value1> b) Check whether <value2> matches <value3>
Test passed	If evaluations are positive
Test failed (examples)	If evaluations are negative
Results	For each and every parameter with Subindex access in the IODD: Parameter consistency: <value2/value1> <pass/fail> Parameter consistency: <value2/value3> <pass/fail>

7.4 Fictive IODD

The Master-Tester ("Golden Device") shall provide a so-called Fictive IODD with critical constellations of parameters, which are supported by the "Golden Device". The IODD interpreter tools associated or related to a particular Master can be tested with the help of this IODD. Clause 4.5 describes how these tests can be performed.

8 Master protocol tests

8.1 General

The protocol tests can be performed almost automatically with the help of a Master-Tester ("Golden Device") as defined in A.4. The test sequences are described in 4.5 together with a list of the relevant test cases for Legacy-Master in Table 7 and a list of the relevant test cases for Master in Table 8. Supplementary requirements for Legacy-Masters beyond the definitions in [13] are listed in Annex B.

8.2 Timings

8.2.1 Delay times after WURQ and Master messages (TDMT)

Table 166 defines the test conditions for this test case.

Table 166 – Delay times after WURQ and Master messages (TDMT)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0158
Name	TCM_ PHYL_TIME_TDMT
Purpose (short)	Check delay times after WURQ and Master messages
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.2, Table 34
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Measuring the delays between WURQ and first request (230,4 kbit/s) or between the requests in the individual transmission rates respectively.
Precondition	Master is in SDCI communication mode (Scan mode)
Procedure	a) Detect end of Wake-up b) Measure time to the start bit of the first request c) Detect transmission rate d) Check if TDMT is within the tolerance of 27 to 37 TBIT of the subsequent transmission rate e) Measure and evaluate times between stop bit and start bit of the next request
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Measure TDMT and check tolerances
Test passed	TDMT within tolerance
Test failed (examples)	TDMT out of tolerance
Results	TDMT (230,4 kbit/s): <value> <pass/fail> TDMT (38,4 kbit/s): <value> <pass/fail> TDMT (4,8 kbit/s): <value> <pass/fail>

8.2.2 Delay time between three WURQs (TDWU)

Table 167 defines the test conditions for this test case.

Table 167 – Delay time between three WURQs (TDWU)

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0159
Name	TCM_ PHYL_TIME_TDWU
Purpose (short)	Check whether delay time between wake-up retries is within tolerance
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.2, Table 34
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Measuring the times between the three Wake-up retries. Master-Tester ("Device") shall detect the beginning of all Wake-up requests and measure the time in between. It shall not react to the requests.
Precondition	Master is in SDCI communication mode (Scan mode)
Procedure	a) Detect start of first Wake-up b) Measure time to second Wake-up c) Check if TDWU is within the tolerance of 30 to 50 ms d) Measure and evaluate time between second and third Wake-up
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Measure TDWU
Test passed	Times within tolerance
Test failed (examples)	Times out of tolerance
Results	TDWU (interval between first and second): <value> <pass/fail> TDWU (interval between second and third): <value> <pass/fail>

1732 ### 8.2.3 Number of WURQs

1733 Table 168 defines the test conditions for this test case.

1734 **Table 168 – Number of WURQs**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0160
Name	TCM_ PHYL_TIME_NUMOFWURQS
Purpose (short)	Check number of Wake-up retries
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.2, Table 34
Configuration / setup	Master-Tester ("Device")

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The number of WURQs during one Wake-up sequence is counted. The number of retries shall be exactly 2 (total number 3). Master-Tester ("Device") shall detect the start of the first WURQ and then start time measurement. Another 2 WURQs shall follow within the next 100 ms. No further requests except these 3 WURQs shall follow within 500 ms after start of the first WURQ.
Precondition	Master is in SDCI communication mode (Scan mode)
Procedure	a) Detect start of first Wake-up b) Measure time until third detected Wake-up (shall be ≤ 100 ms) c) Time (after these 3 WURQs) until a new WURQ shall be minimum 500 ms.
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	Measure between two subsequent WakeUp request cycles
Test passed	a) Number of WURQ retries during one Wake-up sequence = 2 within ≤ 100 ms and b) No retries between 100 ms and 500 ms
Test failed (examples)	a) Number of WURQ retries during one Wake-up sequence ≠ 2, or b) Retries between 100 ms and 500 ms
Results	Number of WURQs: <value> <pass/fail> Retries between 100 ms and 500 ms: <value> <pass/fail>

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8.2.4 Delay time between WURQ retry sequences (TSD)

Table 169 defines the test conditions for this test case.

Table 169 – Delay time between WURQ retry sequences (TSD)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0161
Name	TCM_ PHYL_TIME_TSD
Purpose (short)	Check time between two WURQs is between 0.5 s and 1 s.
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.2, Table 34
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The time between the start of two Wake-up sequences is measured. Master-Tester ("Device") shall detect the start of the first WURQ and start time measurement. 2 more WURQs shall follow within the next 100 ms. No further requests except these 3 WURQs shall follow within 500 ms after start of the first WURQ. 1 s after the first WURQ at the latest the Master shall start a new Wake-up sequence. Master-Tester ("Device") shall check these times.
Precondition	Master is in SDCI communication mode (Scan mode)
Procedure	a) Detect start of first Wake-up b) Measure time until third detected Wake-up (shall be ≤ 100 ms) c) No further WURQ shall follow within the first 500 ms after start of the first WURQ. d) Master-Tester ("Device") shall detect a new WURQ within 1 s after the first WURQ at the latest.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Measure TSD
Test passed	0,5 s ≤ TSD ≤ 1 s
Test failed (examples)	TSD > 1 s
Results	TSD: <value> <pass/fail>

1746 **8.2.5 Delay time between two Master messages at STARTUP (TINITCYC)**

1747 Table 170 defines the test conditions for this test case.

1748 **Table 170 – Delay time between two Master messages at STARTUP (TINITCYC)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0162
Name	TCM_ PHYL_TIME_TINITCYC
Purpose (short)	At STARTUP the time between two beginning messages shall be ≥ 100 TBIT
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.3.3, A.2.6
Configuration / setup	Master-Tester ("Device")

1749

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	During the start-up phase the time between the start of two Master messages is measured. This is repeated for all transmission rates supported by the Master. Master-Tester ("Device") detects the start of each Master message and measures the time in between. These times shall be ≥ 100 TBIT of the transmission rate. This test is repeated for all supported transmission rates.
Precondition	Master is in SDCI communication mode (Scan mode)
Procedure	a) Master start-up b) Master-Tester ("Device") detects the starting time of the Master message and measures the time between the individual messages. It responds to the requests as specified. c) Master-Tester ("Device") checks whether the time between two messages is ≥ 100 TBIT of the transmission rate in use. d) This process is repeated for all transmission rates.
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	Measure TINITCYC for all detected messages
Test passed	TINITCYC is always ≥ 100 TBIT of the transmission rate in use
Test failed (examples)	TINITCYC is at least < 100 TBIT of the transmission rate in use
Results	Minimum TINITCYC: <value> <pass/fail> Average TINITCYC: <value> <pass/fail> Maximum TINITCYC: <value> <pass/fail>

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8.2.6 Adjustment of the MasterCycleTime

Table 171 defines the test conditions for this test case.

Table 171 – Adjustment of the MasterCycleTime

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0163
Name	TCM_ PHYL_TIME_MASTERCYCLETIME
Purpose (short)	The Master shall adapt correctly to a too short MinCycleTime of the Device
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] B.1.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master-Tester ("Device") shall suggest the M-sequence type for a too small MinCycleTime value. The Master shall not accept this time and shall write back a sensible MasterCycle time. The same applies if the MinCycleTime value is "0". At each M-sequence type the Master-Tester ("Device") starts with the MinCycleTime value "0" and with times below the time that can be reached by the Master. The Master shall correct these times by writing back a possible MasterCycleTime value.
Precondition	Master is in SDCI communication mode (Scan mode)
Procedure	a) Master-Tester ("Device") is configured with an unrealistic MinCycleTime. b) Master writes back a correct MasterCycleTime value.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check MasterCycleTime against limits
Test passed	Master writes back valid times
Test failed (examples)	Master does not write back valid times.
Results	MasterCycleTime: <value> <pass/fail>

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8.2.7 Written MasterCycleTime corresponds to real cycle time

1761 Table 172 defines the test conditions for this test case.

1762 **Table 172 – Written MasterCycleTime corresponds to real cycle time**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0164
Name	TCM_ PHYL_TIME_MASTERCYCLETIMEREAL
Purpose (short)	Written MasterCycleTime matches real cycle time
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.3.3
Configuration / setup	Master-Tester ("Device")

1763

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Master shall read the MinCycleTime value from Master-Tester ("Device") and shall write back its MasterCycleTime value. This time shall be checked by the Master-Tester ("Device"). To do so, Master-Tester ("Device") shall start several times with different MinCycleTimes and shall then check them. Master-Tester ("Device") receives different values in the Direct Parameter page 1 for the MinCycleTime and carries out a start-up to OPERATE mode. In this state the MasterCycleTime is checked.
Precondition	Master in OPERATE mode
Procedure	a) MinCycleTime = "0" in Master-Tester ("Device") b) Connection start-up to OPERATE c) Master-Tester ("Device") measures the time between the start bit of the Master message and that of the subsequent message. d) The measured time shall vary only within the MasterCycleTime tolerance (0 % and a maximum of +10 %). e) This test is repeated with different transmission rates and MinCycleTimes.
Input parameter	-
Post condition	-

1764

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Measure cycle times and test against tolerance limits 0 % and +10 %
Test passed	Within tolerance limits
Test failed (examples)	Outside time tolerance limits
Results	Minimum cycle time: <value> <pass/fail> Average cycle time: <value> <pass/fail> Maximum cycle time: <value> <pass/fail>

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8.2.8 Master tolerates different Device response times

Table 173 defines the test conditions for this test case.

Table 173 – Master tolerates different Device response times

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0165
Name	TCM_ PHYL_TIME_DEVRESPTIMES
Purpose (short)	Master tolerates different Device response times
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.3.5
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master-Tester ("Device") shall answer with different response times after receiving the Master message. The Master shall be able to handle this jitter. Master-Tester ("Device") responds with different response times between 1 and 10 TBIT.
Precondition	Master in OPERATE mode
Procedure	a) Master-Tester ("Device") responds after 1 TBIT b) Master-Tester ("Device") responds after 5 TBIT c) Master-Tester ("Device") responds after 10 TBIT
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check cyclic communication
Test passed	No aborts or repeated messages
Test failed (examples)	Abort or repeated messages
Results	Master reaction abort: <yes/no> <pass/fail> Master reaction retry: <yes/no> <pass/fail>

1774 ### 8.2.9 Master tolerates different UART frame delay times (T2)

1775 Table 174 defines the test conditions for this test case.

1776 **Table 174 – Master tolerates different UART frame delay times (T2)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0166
Name	TCM_ PHYL_TIME_UARTT2
Purpose (short)	Master tolerates different UART frame delay times (T2) of the Device.
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.3.4
Configuration / setup	Master-Tester ("Device")

1777

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master-Tester ("Device") shall respond with different delays between the octets. The Master shall be able to handle this variation. Master-Tester ("Device") responds with different delays between 0 and 3 TBIT.
Precondition	Master in OpERATE mode
Procedure	a) Master-Tester ("Device") responds with 0 TBIT b) Master-Tester ("Device") responds with 1 TBIT c) Master-Tester ("Device") responds with 2 TBIT d) Master-Tester ("Device") responds with 3 TBIT.
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check cyclic communication
Test passed	No aborts or repeated messages
Test failed (examples)	Abort or repeated messages
Results	Master reaction abort: <yes/no> <pass/fail> Master reaction retry: <yes/no> <pass/fail>

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8.2.10 Master sends UART frames within tolerated times (T1)

Table 175 defines the test conditions for this test case.

Table 175 – Master sends UART frames within tolerated times (T1)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0167
Name	TCM_ PHYL_TIME_UARTT1
Purpose (short)	Master sends UART frames within tolerated times (T1)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.3.3
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Measuring the delays between the UART octets. Master-Tester ("Device") shall measure the delays between the end of the stop bit and the beginning of the start bit of the next octet.
Precondition	Master in OPERATE mode
Procedure	a) Measure the delays between the end of the stop bit and the beginning of the start bit of the next octet b) Check if T1 is within the tolerance of 0 to 1 TBIT
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Measure and check timing
Test passed	Times within tolerance
Test failed (examples)	Times out of tolerance
Results	T1: <value> <pass/fail>

8.3 Process Data (PD)

8.3.1 Master uses TYPE_2_1 for 8 bit PD input

Table 176 defines the test conditions for this test case.

Table 176 – Master uses TYPE_2_1 for 8 bit PD input

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0168
Name	TCM_ DLPD_CYCC_TYPE21BIT8IN
Purpose (short)	Master uses M-sequence TYPE_2_1 for 8 bit Process Data input
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.6
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Process data input length = 8 bits; Output length = 0 bit. Based on this information the Master shall select M-sequence TYPE_2_1. Parameterize Master to Process Data length input = 8 bits and output = 0 bit. Set Process Data length input = 8 bits and output = 0 bit in the Direct Parameter page 1 of Master-Tester ("Device").
Precondition	Master port inactive.
Procedure	a) Master switches port to STARTUP b) Master switches ports to OPERATE to Process Data exchange.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check correct M-sequence TYPE_2_1
Test passed	Master communicates with correct M-sequence TYPE and message (Checksum etc.)
Test failed (examples)	Master communicates with wrong M-sequence TYPE or message error
Results	M-sequence type: <TYPE_x_y> <pass/fail> Message: <value/checksum> <pass/fail>

8.3.2 Master uses TYPE_2_2 for 16 bit PD input

Table 177 defines the test conditions for this test case.

Table 177 – Master uses TYPE_2_2 for 16 bit PD input

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0169
Name	TCM_ DLPD_CYCC_TYPE22BIT16IN
Purpose (short)	Master uses M-sequence TYPE_2_2 for 16 bit Process Data input
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.6
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Process data input length = 16 bit; output length = 0 bit. Based on this information the Master shall select M-sequence TYPE_2_2. Parameterize Master to Process Data length input = 8 bits and output = 0 bit. Set Process Data length input = 16 bits and output = 0 bit in the Direct Parameter page 1 of the Master-Tester ("Device").
Precondition	Master port inactive.
Procedure	a) Master switches port to STARTUP b) Master switches ports to OPERATE to Process Data exchange.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check correct M-sequence TYPE_2_2
Test passed	Master communicates with correct M-sequence TYPE and message (Checksum etc.)
Test failed (examples)	Master communicates with wrong M-sequence TYPE or message error
Results	M-sequence type: <TYPE_x_y> <pass/fail> Message: <value/checksum> <pass/fail>

8.3.3 Master uses TYPE_2_3 for 8 bit PD output

Table 178 defines the test conditions for this test case.

Table 178 – Master uses TYPE_2_3 for 8 bit PD output

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0170
Name	TCM_ DLPD_CYCC_TYPE23BIT8OUT
Purpose (short)	Master uses M-sequence TYPE_2_3 for 8 bit Process Data output
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.6
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Process data input length = 0 bit; output length = 8 bit. Based on this information the Master shall select M-sequence TYPE_2_3. Parameterize Master to Process Data length input = 0 bit and output = 8 bit. Set Process Data length input = 0 bit and output = 8 bit in the Direct Parameter page 1 of Master-Tester ("Device").
Precondition	Master port inactive.
Procedure	a) Master switches port to STARTUP b) Master switches ports to OPERATE to process data exchange.
Input parameter	
Post condition	
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check correct M-sequence TYPE_2_3
Test passed	Master communicates with correct M-sequence TYPE and message (check sum etc.)
Test failed (examples)	Master communicates with wrong M-sequence TYPE or message error
Results	M-sequence type: <TYPE_x_y> <pass/fail> Message: <value/checksum> <pass/fail>

8.3.4 Master uses TYPE_2_4 for 16 bit PD output

Table 179 defines the test conditions for this test case.

Table 179 – Master uses TYPE_2_4 for 16 bit PD output

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0171
Name	TCM_ DLPD_CYCC_TYPE24BIT16OUT
Purpose (short)	Master uses M-sequence TYPE_2_4 for 16 bit Process Data output
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test , test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.6
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Process data input length = 0 bit; output length = 16 bit. Based on this information the Master shall select M-sequence TYPE_2_4. Parameterize Master to Process Data length input = 0 bit and output = 16 bit. Set Process Data length input = 0 bit and output = 16 bit in the Direct Parameter page 1 of the Master-Tester ("Device").
Precondition	Master port inactive.
Procedure	a) Master switches port to STARTUP b) Master switches ports to OPERATE to process data exchange.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check correct M-sequence TYPE_2_4
Test passed	Master communicates with correct M-sequence TYPE and message (Checksum etc.)
Test failed (examples)	Master communicates with wrong M-sequence TYPE or message error
Results	M-sequence type: <TYPE_x_y> <pass/fail> Message: <value/checksum> <pass/fail>

8.3.5 Master uses TYPE_2_5 for 8/8 bit PD in/output

Table 180 defines the test conditions for this test case.

Table 180 – Master uses TYPE_2_5 for 8/8 bit PD in/output

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0172
Name	TCM_ DLPD_CYCC_TYPE25BIT8INBIT8OUT
Purpose (short)	Master uses M-sequence TYPE_2_5 for 8/8 bit Process Data in/output
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.6
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Process data input length = 8 bit; output length = 8 bit. Based on this information the Master shall select M-sequence TYPE_2_5. Parameterize Master to Process Data length input = 8 bit and output = 8 bit. Set Process Data length input = 8 bit and output = 8 bit in the Direct Parameter page 1 of the Master-Tester ("Device").
Precondition	Master port inactive.
Procedure	a) Master switches port to STARTUP b) Master switches ports to OPERATE to process data exchange.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check correct M-sequence TYPE_2_5
Test passed	Master communicates with correct M-sequence TYPE and message (Checksum etc.)
Test failed (examples)	Master communicates with wrong M-sequence TYPE or message error
Results	M-sequence type: <TYPE_x_y> <pass/fail> Message: <value/checksum> <pass/fail>

8.3.6 Master uses TYPE_2_6 for 16/16 bit PD in/output

Table 180 defines the test conditions for this test case.

Table 181 – Master uses TYPE_2_6 for 16/16 bit PD in/output

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0298
Name	TCM_ DLPD_CYCC_TYPE26BIT16INBIT16OUT
Purpose (short)	Master uses M-sequence TYPE_2_6 for 16/16 bit Process Data in/output
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.6
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Process data input length = 16 bit; output length = 16 bit. Based on this information the Master shall select M-sequence TYPE_2_6. Parameterize Master to Process Data length input = 16 bit and output = 16 bit. Set Process Data length input = 16 bit and output = 16 bit in the Direct Parameter page 1 of the Master-Tester ("Device").
Precondition	Master port inactive.
Procedure	a) Master switches port to STARTUP b) Master switches ports to OPERATE to process data exchange.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check correct M-sequence TYPE_2_6
Test passed	Master communicates with correct M-sequence TYPE and message (Checksum etc.)
Test failed (examples)	Master communicates with wrong M-sequence TYPE or message error
Results	M-sequence type: <TYPE_x_y> <pass/fail> Message: <value/checksum> <pass/fail>

8.3.7 Master uses TYPE_1 for 256 bit PD input

Table 182 defines the test conditions for this test case.

Table 182 – Master uses TYPE_1 for 256 bit PD input

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0173
Name	TCM_ DLPD_CYCC_TYPE1BIT256IN
Purpose (short)	Master uses M-sequence TYPE_1 for 256 bit Process Data input
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.6
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Process data input length = 256 bit; output length = 0 bit. Based on this information the Master shall select M-sequence TYPE_1. Parameterize Master to Process Data length input = 256 bit and output = 0 bit. Set Process Data length input = 256 bit and output = 0 bit in the Direct Parameter page 1 of the Master-Tester ("Device").
Precondition	Master port inactive.
Procedure	a) Master switches port to STARTUP b) Master switches ports to OPERATE to process data exchange.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check correct M-sequence TYPE_1
Test passed	Master communicates with correct M-sequence TYPE and message (Checksum etc.)
Test failed (examples)	Master communicates with wrong M-sequence TYPE or message error
Results	M-sequence type: <TYPE_x_y> <pass/fail> Message: <value/checksum> <pass/fail>

8.3.8 Master behavior in case of no Device response

Table 183 defines the test conditions for this test case.

Table 183 – Master behavior in case of no Device response

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0174
Name	TCM_ DLPD_CYCC_WATCHDOG
Purpose (short)	Master behavior in case of no Device response
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.3.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	In case of no Device response the Master shall wait until a watchdog time expires and then repeat the last message. After a second repetition the Master shall establish a new connection.
Precondition	Master and Master-Tester ("Device") are in OPERATE mode and in Process Data exchange.
Procedure	Master-Tester ("Device") does not reply to Master messages
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Repetition of messages: after 2 repetitions connection is re-established.
Test passed	After a certain time the Master carries out a re-start.
Test failed (examples)	Master shows no reaction
Results	Watchdog time: <value> <pass/fail> Repetitions: <value> <pass/fail> New connection: <pass/fail>

1846 ### 8.3.9 Master behavior to wrong checksum in Device response

1847 Table 184 defines the test conditions for this test case.

1848 **Table 184 – Master behavior to wrong checksum in Device response**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0175
Name	TCM_ DLPD_CYCC_CHECKSUMWRONG
Purpose (short)	Master behavior to wrong checksum in Device response
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.2.2.1
Configuration / setup	Master-Tester ("Device")

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	In case of a wrong checksum value in the "Device" response the Master shall repeat the last message. After a second repetition the Master shall establish a new connection.
Precondition	Master and Master-Tester ("Device") are in OPERATE mode and in Process Data exchange.
Procedure	Master-Tester ("Device") sends single messages with wrong Checksum.
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	Message repetition and watchdog
Test passed	After a certain time the Master has carried out a re-start and the Process Data did not pass.
Test failed (examples)	No reaction of the Master or process data passed.
Results	Checksum: <value> <pass/fail> Repetitions: <value> <pass/fail> New connection: <yes/no> <pass/fail>

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8.3.10 Master reads mirrored in/out PD from Device

Table 185 defines the test conditions for this test case.

Table 185 – Master reads mirrored in/out PD from Device

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0176
Name	TCM_ DLPD_CYCC_MIRROREDPD
Purpose (short)	Master reads mirrored input/output Process Data from Device
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.5.4.2; [9] 7.3.3.2
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master-Tester ("Device") mirrors its Process Data such that the Master can check the consistency.
Precondition	a) Master-Tester ("Device") Process Data length in = 16 octets; out = 16 octets b) Master and Master-Tester ("Device") are in OPERATE mode and in Process Data exchange.
Procedure	a) Master-Tester ("Device") mirrors its input Process Data to the output Process Data. b) Master transmits different Process Data values and checks the received data after 50 times the cycle time.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Transmitted and received data shall match.
Test passed	All transmitted process data correspond to the received data.
Test failed (examples)	Inconsistency between transmitted and received process data
Results	Sent and received PD match: <pass/fail>

8.3.11 Master propagates "PD invalid" indication in a correct manner

Table 186 defines the test conditions for this test case.

Table 186 – Master propagates "PD invalid" indication in a correct manner

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0177
Name	TCM_ DLPD_CYCC_PDINVALID
Purpose (short)	Master propagates "PD invalid" indication in a correct manner
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2, Table 48; [9] A.6.2
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test PDValid – PDInvalid transition
Precondition	a) Master in SDCI communication mode. b) Master-Tester ("Device") is in OPERATE mode and provides valid Process Data (PDValid).
Procedure	a) Master-Tester ("Device") is prompted to set the Process Data to "PDInvalid". b) It sets bit 6 of the Checksum / status octet (CKS) to 1. c) The Device-Tester performs the "PDInvalid" handling. For example it marks the PDs at the upper level system "invalid".
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Process Data status shall signalise transition invalid (system-specific).
Test passed	Master defines the Process Data in the upper level system invalid
Test failed (examples)	Master defines the Process Data in the upper level system as valid
Results	"PDInvalid" = 1 propagated to higher level system: <pass/fail>

8.3.12 Master propagates "PD valid" indication in a correct manner

Table 187 defines the test conditions for this test case.

Table 187 – Master propagates "PD valid" indication in a correct manner

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0178
Name	TCM_ DLPD_CYCC_PDVALID
Purpose (short)	Master propagates "PDValid" indication in a correct manner
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2, Table 48; [9] A.6.2
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test if PDInvalid – PDValid transition was handled correctly.
Precondition	a) Master in SDCI communication mode. b) Master-Tester ("Device") is in OPERATE mode and provides invalid Process Data (PDInvalid).
Procedure	a) Master-Tester ("Device") is prompted to set the Process Data to valid. b) It sets bit 6 of the Checksum / status octet (CKS) to "0". c) The Device-Tester performs the "PDInvalid" handling. For example it marks the PDs at the upper level system "valid".
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Process Data status shall signalise transition valid / invalid (system-specific).
Test passed	Master defines the Process Data in the upper level system invalid
Test failed (examples)	PDs remain system-specific invalid or
Results	"PDInvalid" = "0" propagated to higher level system: <pass/fail>

8.4 On-request Data (OD)

8.4.1 Master uses TYPE_2_V for several PD in/out and 1 octet OD

Table 188 defines the test conditions for this test case.

Table 188 – Master uses TYPE_2_V for several PD in/out and 1 octet OD

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0179
Name	TCM_DLOD_CYCC_TYPE2VPDXOD1
Purpose (short)	Check whether Master uses TYPE_2_V for several in/output PD and 1 octet OD
Equipment under test (EUT)	Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.4, B.1.5
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check whether Master uses TYPE_2_V for several in/output Process Data and 1 octet OD. The Master receives the information about the target M-sequence type via address 0x03 (M-sequenceCapability), 0x05 (ProcessDataIn), and 0x06 (ProcessDataOut) out of the Direct Parameter page 1.
Precondition	a) In OPERATE mode the M-sequence type in M-sequenceCapability is set to the value 4. b) The process data width PDin is 0 to 32 octets (and 3 to 32 octets as they do not contain the M-sequence TYPE_2_x). c) The process data width PDout is 0 to 32 octets (and 3 to 32 octets as they do not contain the M-sequence TYPE_2_x). d) Master is in STARTUP mode.
Procedure	a) The Master writes the value 0xBF into Index 24 ("ApplicationSpecificTag") of the Master-Tester. b) The Master reads the value 0xBF from Index 24 of the Master-Tester. c) After each successful test cycle the Master is reset to STARTUP mode and another PD combination is set in the Master-Tester for checking the M-sequence type selection. d) Prior to a new test the Master-Tester sets the content of Index 24 to "0". e) The successful test cycles are indicated as follows: Number of Process Data in / number of Process Data out (PDin / PDout) f) The following 4 PD combinations are tested: 1/3, 3/1, 32/32, 6/0, and 0/20. g) Each octet of the Process Data carries the content 0x5A. h) In OPERATE mode TYPE_0 is excluded in M-sequenceCapability (values in M-sequence Capability < 0x01).
Input parameter	5 PDin/PDout combinations: 1/3, 3/1, 32/32, 6/0, and 0/20 with "0x01" to "0x20" de-pending on the length of PDin or PDout. OD with "0xBF".
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) For each combination of PDin and PDout it is checked whether the correct M-sequence type (correct detection of the PD width) is set in M-sequenceCapability and if the Process Data are correctly shown in the target system. b) The M-sequence type can be traced on the Line-Monitor or determined via the Checksum/ M-sequence type (CKT) octet in the Master message.
Test passed	If the following three conditions are met: a) The Process Data entered per M-sequence are at the target system of the Master or in the Master-Tester. b) The value 0xBF is written into Index 24 of the Master-Tester. c) The Master succeeded to read back the value 0xBF.
Test failed (examples)	If one of the three conditions is not fulfilled.
Results	M-sequence type (1/3): <TYPE> <pass/fail> M-sequence type (3/1): <TYPE> <pass/fail> M-sequence type (32/32): <TYPE> <pass/fail> M-sequence type (6/0): <TYPE> <pass/fail> M-sequence type (0/20): <TYPE> <pass/fail>

8.4.2 Master uses TYPE_2_V for several PD in/out and 2 octets OD

Table 189 defines the test conditions for this test case.

Table 189 – Master uses TYPE_2_V for several PD in/out and 2 octets OD

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0180
Name	TCM_DLOD_CYCC_TYPE2VPDXOD2
Purpose (short)	Check whether Master uses TYPE_2_V for several in/output PD and 2 octets OD
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.4, B.1.5
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check whether Master uses TYPE_2_V for several in/output PD and 2 octets OD. The Master receives the information about the target M-sequence type via address 0x03 (M-sequenceCapability), 0x05 (ProcessDataIn), and 0x06 (ProcessDataOut) out of the Direct Parameter page 1.
Precondition	a) In OPERATE mode the M-sequence type in M-sequenceCapability is set to the value 5. b) The process data width PDin is 0 to 32 octets. c) The process data width PDout is 0 to 32 octets. d) Master is in STARTUP mode.
Procedure	a) The Master writes the values 0xAA and 0xBF into Index 24 ("ApplicationSpecificTag") of the Master-Tester. b) The Master reads the values 0xAA and 0xBF from Index 24 of the Master-Tester. c) After each successful test cycle the Master is reset to STARTUP mode and another PD combination is set in the Master-Tester for checking the M-sequence type selection. d) Prior to a new test the Master-Tester sets the content of Index 24 to "0". e) The successful test cycles are indicated as follows: Number of Process Data in / number of Process Data out (PDin / PDout) f) The following 4 PD combinations are tested: 1/1, 32/32, 6/0, and 0/20. g) Each octet of the Process Data carries the content 0x5A. h) In OPERATE mode TYPE_0 is excluded in M-sequenceCapability (values in M-sequence Capability < 0x01).
Input parameter	4 PDin/PDout combinations: 1/1, 32/32, 6/0, and 0/20 with "0x5A". OD with "0xAA, 0xBF".
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) For each combination of PDin and PDout it is checked whether the correct M-sequence type (correct detection of the PD width) is set in M-sequenceCapability and if the Process Data are correctly shown in the target system. b) The M-sequence type can be traced on the Line-Monitor or determined via the Checksum/ M-sequence type (CKT) octet in the Master message.
Test passed	If the following three conditions are met: a) The Process Data entered per M-sequence are at the target system of the Master or in the Master-Tester. b) The values 0xAA and 0xBF are written into Index 24 in the Master-Tester. c) The Master succeeded to read back the values 0xAA and 0xBF.
Test failed (examples)	If one of the three conditions is not fulfilled.
Results	M-sequence TYPE (1/1): <TYPE> <pass/fail> M-sequence TYPE (32/32): <TYPE> <pass/fail> M-sequence TYPE (6/0): <TYPE> <pass/fail> M-sequence TYPE (0/20): <TYPE> <pass/fail>

8.4.3 Master uses TYPE_2_V for several PD in/out and 8 octets OD

Table 190 defines the test conditions for this test case.

Table 190 – Master uses TYPE_2_V for several PD in/out and 8 octets OD

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0181
Name	TCM_DLOD_CYCC_TYPE2VPDXOD8
Purpose (short)	Check whether Master uses TYPE_2_V for several in/out PD and 8 octets OD
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.4, B.1.5
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check whether Master uses TYPE_2_V for several in/output PD and 8 octets OD. The Master receives the information about the target M-sequence type via address 0x03 (M-sequenceCapability), 0x05 (ProcessDataIn), and 0x06 (ProcessDataOut) out of the Direct Parameter page 1.
Precondition	a) In OPERATE mode the M-sequence type in M-sequenceCapability is set to the value 6. b) The process data width PDin is 0 to 32 octets. c) The process data width PDout is 0 to 32 octets. d) Master is in STARTUP mode.
Procedure	a) The Master writes the values 0xAA, 0xBF, 0x77, 0x40, 0x55, 0xCD, 0x33, 0xE4 into Index 24 ("ApplicationSpecificTag") of the Master-Tester. b) The Master reads the values 0xAA, 0xBF, 0x77, 0x40, 0x55, 0xCD, 0x33, 0xE4 from Index 24 of the Master-Tester. c) After each successful test cycle the Master is reset to STARTUP mode and another PD combination is set in the Master-Tester for checking the M-sequence type selection. d) Prior to a new test the Master-Tester sets the content of Index 24 to "0". e) The successful test cycles are indicated as follows: Number of Process Data in / number of Process Data out (PDin / PDout) f) The following 4 PD combinations are tested: 1/1, 32/32, 6/0, and 0/20. g) Each octet of the Process Data carries the content 0x5A. h) In OPERATE mode TYPE_0 is excluded in M-sequenceCapability (values in M-sequence Capability < 0x01).
Input parameter	4 PDin/PDout combinations: 1/1, 32/32, 6/0, and 0/20 with "0x5A". OD with "0xAA, 0xBF, 0x77, 0x40, 0x55, 0xCD, 0x33, 0xE4".
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) For each combination of PDin and PDout it is checked whether the correct M-sequence type (correct detection of the PD width) is set in M-sequenceCapability and if the Process Data are correctly shown in the target system. b) The M-sequence type can be traced on the Line-Monitor or determined via the Checksum/ M-sequence type (CKT) octet in the Master message.
Test passed	If the following two conditions are met: a) The Process Data entered per M-sequence are at the target system of the Master or in the Master-Tester. b) The values 0xAA, 0xBF, 0x77, 0x40, 0x55, 0xCD, 0x33, 0xE4 are written into Index 24 in the Master-Tester.
Test failed (examples)	If one of the two conditions is not fulfilled.
Results	M-sequence TYPE (1/1): <TYPE> <pass/fail> M-sequence TYPE (32/32): <TYPE> <pass/fail> M-sequence TYPE (6/0): <TYPE> <pass/fail> M-sequence TYPE (0/20): <TYPE> <pass/fail>

1896 8.4.4 Master uses TYPE_2_V for several PD in/out and 32 octets OD

1897 Table 191 defines the test conditions for this test case.

1898 **Table 191 – Master uses TYPE_2_V for several PD in/out and 32 octets OD**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0182
Name	TCM_DLOD_CYCC_TYPE2VPDXOD32
Purpose (short)	Check whether Master uses TYPE_2_V for several in/out PD and 32 octets OD
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.5, A.2.4, B.1.5
Configuration / setup	Master-Tester, Line-Monitor (optionally)

1899

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether Master uses TYPE_2_V for several in/out PD and 32 octets OD. The Master receives the information about the target M-sequence type via address 0x03 (M-sequenceCapability), 0x05 (ProcessDataIn), and 0x06 (ProcessDataOut) out of the Direct Parameter page 1.
Precondition	a) In OPERATE mode the M-sequence type in M-sequenceCapability is set to the value 7. b) The process data width PDin is 0 to 32 octets. c) The process data width PDout is 0 to 32 octets. d) Master is in STARTUP mode.
Procedure	a) The Master writes the text "Hello World, this is Master Test“ into Index 24 ("ApplicationSpecificTag") of the Master-Tester. b) The Master reads the text "Hello World, this is Master Test“ from Index 24 of the Master-Tester. c) After each successful test cycle the Master is reset to STARTUP mode and another PD combination is set in the Master-Tester for checking the M-sequence type selection. d) Prior to a new test the Master-Tester sets the content of Index 24 to "0". e) The successful test cycles are indicated as follows: Number of Process Data in / number of Process Data out (PDin / PDout) f) The following 4 PD combinations are tested: 1/1, 32/32, 6/0, and 0/20. g) Each octet of the Process Data carries the content 0x5A. h) In OPERATE mode TYPE_0 is excluded in M-sequenceCapability (values in M-sequence Capability < 0x01).
Input parameter	4 PDin/PDout combinations: 1/1, 32/32, 6/0, and 0/20 with "0x5A". OD with "Hello World, this is Master Test“.
Post condition	-

1900

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) For each combination of PDin and PDout it is checked whether the correct M-sequence type (correct detection of the PD width) is set in M-sequenceCapability and if the Process Data are correctly shown in the target system. b) The M-sequence type can be traced on the Line-Monitor or determined via the Checksum/ M-sequence type (CKT) octet in the Master message.
Test passed	If the following three conditions are met: a) The Process Data entered per M-sequence are at the target system of the Master or in the Master-Tester. b) The text "Hello World, this is Master Test" is written into Index 24 in the Master-Tester. c) The Master succeeded to read back the text "Hello World, this is Master Test".
Test failed (examples)	If one of the three conditions is not fulfilled.
Results	M-sequence TYPE (1/1): <TYPE> <pass/fail> M-sequence TYPE (32/32): <TYPE> <pass/fail> M-sequence TYPE (6/0): <TYPE> <pass/fail> M-sequence TYPE (0/20): <TYPE> <pass/fail>

1901

8.5 STARTUP

8.5.1 Master reads communication parameters (Direct Parameter)

Table 192 defines the test conditions for this test case.

Table 192 – Master reads communication parameters (Direct Parameter)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0183
Name	TCM_DLST_CHCK_COMPARAM
Purpose (short)	Check whether Master starts communication correctly at all communication modes and reads communication parameters 0x02 to 0x06
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.2
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.3.3, Figures 66, 67, 76, 77
Configuration / setup	Master-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Checking of the correct startup for legacy Master (V1.0) and Master (≥ V1.1). Master reads communication parameters 0x02 to 0x06 (Direct Parameter page 1).
Precondition	a) Master is in SIO mode. b) Master-Tester is in SIO mode.
Procedure	a) Set Master-Tester to communication mode COM1 b) Set Master to SDCI mode c) The Master reads the communication parameters 0x02 to 0x06 from the Direct Parameter page 1 d) Record first 6 Master messages at the selected communication mode e) Repeat at communication mode COM2 and COM3
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Evaluate number of Master read messages required for each parameter b) Evaluate sequence of Master read messages
Test passed	For all 3 communication modes COM1, COM2, and COM3: a) No communication retries b) Master read messages accessed parameters 0x02 to 0x06 in ascending order c) One or two Master read messages to parameter 0x02 at startup permitted d) Only one single Master read message to each parameter 0x03 to 0x06
Test failed (examples)	Any of case a) to e) in "test passed" failed at any communication mode
Results	No communication retries: <pass/fail> Master read message sequence: <pass/fail> Number of read access to 0x02: <value> <pass/fail> Number of read access to 0x03 to 0x06 <pass/fail> Communication modes COM1, COM2, COM3: <pass/fail> NOTE In this test case, a Master reading 0x02 only once is tolerated; however, the Master-Tester shall display and/or print out a warning.

8.5.2 Master adjusts to protocol V1.1 (Direct Parameter)

Table 193 defines the test conditions for this test case.

Table 193 – Master adjusts to protocol V1.1 (Direct Parameter)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0184
Name	TCM_DLST_CHCK_VIDDID
Purpose (short)	Check whether Master adjusts to protocol V1.1 and reads VendorID and DeviceID
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.2.3.3, Figures 66, 67, 78
Configuration / setup	Master-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master adjusts to protocol V1.1 and reads VendorID and DeviceID. Check for the right decision in respect to the protocol version.
Precondition	a) Master is in STARTUP mode. b) Master-Tester is in STARTUP mode. c) Protocol revision of the Device is > V1.0 (e.g. 0x11)
Procedure	The Master checks the protocol revision and carries out another startup according to protocol V1.1.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check startup for V1.1, which is defined as follows: a) Write MasterCommand 0x95 b) Read VendorID c) Read DeviceID
Test passed	If the Master identified the protocol version > V1.0 and writes the MasterCommand 0x95. Master reads VendorID and DeviceID.
Test failed (examples)	If the Master did not write the MasterCommand 0x95.
Results	MasterCommand 0x95: <yes/no> <pass/fail> Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail>

8.5.3 Master adjusts to protocol V1.0 (Direct Parameter)

Table 194 defines the test conditions for this test case.

Table 194 – Master adjusts to protocol V1.0 (Direct Parameter)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0185
Name	TCM_DLST_CHCK_V10VIDDID
Purpose (short)	Check whether Master adjusts to protocol V1.0 and reads VendorID and DeviceID
Equipment under test (EUT)	Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.2.3.3, Figures 66, 67, 78
Configuration / setup	Master-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether Master adjusts to protocol V1.0 and reads VendorID and DeviceID. Check for the right decision in respect to the protocol version.
Precondition	a) Master is in STARTUP mode. b) Master-Tester is in STARTUP mode. c) Protocol revision of the Device is V1.0 (0x10)
Procedure	The Master checks the protocol revision and carries out the startup according to protocol V1.0.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check startup for V1.0, which is defined as follows: a) Read VendorID b) Read DeviceID
Test passed	If the Master identified the protocol version V1.0 and reads VendorID and DeviceID.
Test failed (examples)	If the Master did not recognize the correct protocol version and did not read the VendorID and DeviceID.
Results	Master identified protocol version: <yes/no> <pass/fail> Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail>

8.5.4 Master start-up with non configured VID and DID

Table 195 defines the test conditions for this test case.

Table 195 – Master start-up with non configured VID and DID

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0186
Name	TCM_DLST_CHCK_NONCONFVIDDID
Purpose (short)	Check whether Master performs start-up with non configured VID and DID
Equipment under test (EUT)	Master
Test case version	1.2
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.2.3.3, Figures 66, 67, 78
Configuration / setup	Master-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check the Master behavior with not configured VendorID and DeviceID (VendorID = 0x00, 0x00; DeviceID = 0x00, 0x00, 0x00)
Precondition	a) Master is in STARTUP mode. b) Master-Tester is in STARTUP mode. c) Protocol revision of the Device is > V1.0 (e.g. 0x11). d) Target Mode = AUTOCOM e) Inspection Level = NOCHECK f) Compatibility check (Revision check) successfully completed g) The Process Data width is not changed.
Procedure	The Master establishes communication with the Device and turns it into the PRE-OPERATE mode.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check startup for V1.1, which is defined as follows: a) Read VendorID b) Read DeviceID c) Write MasterCommand 0x9A
Test passed	If the Master reads VendorID and DeviceID and writes the MasterCommand 0x9A.
Test failed (examples)	If the Master does not write the MasterCommand 0x9A.
Results	Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail> MasterCommand 0x95: <yes/no> <pass/fail>

8.5.5 Master start-up with configured VID and DID

Table 196 defines the test conditions for this test case.

Table 196 – Master start-up with configured VID and DID

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0187
Name	TCM_DLST_CHCK_CONFVIDDID
Purpose (short)	Check Master start-up behavior with configured VendorID and DeviceID
Equipment under test (EUT)	Master
Test case version	1.2
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.2.3.3, Figures 66, 67, 78
Configuration / setup	Master-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master start-up behavior with configured VendorID and DeviceID (VendorID ≠ 0x00, 0x00; DeviceID ≠ 0x00, 0x00, 0x00).
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (VID selected randomly). c) Master-Tester is in STARTUP mode. d) Master-Tester has the VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (DID is selected randomly) e) Protocol revision of the Device is ≥ V1.1 (e.g. 0x11). f) Target Mode = CFGCOM g) Inspection Level = TYPECOMP h) Compatibility check (Revision check) successfully completed i) The command 0x95 is written successfully. j) The Process Data width is not changed.
Procedure	The Master establishes communication with the Device and turns it into the PRE-OPERATE mode.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check startup for V1.1, which is defined as follows: a) Read VendorID b) Read DeviceID c) Write MasterCommand 0x9A
Test passed	If the Master writes the MasterCommand 0x9A after checking.
Test failed (examples)	If the Master does not write the MasterCommand 0x9A.
Results	Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail> MasterCommand 0x95: <yes/no> <pass/fail>

1938 ### 8.5.6 Master start-up with overwrite of the DID (compatible)

1939 Table 197 defines the test conditions for this test case.

1940 **Table 197 – Master start-up with overwrite of the DID (compatible)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0188
Name	TCM_DLST_CHCK_OVERDIDOK
Purpose (short)	Check Master start-up behavior with overwrite of the DeviceID (compatible)
Equipment under test (EUT)	Master
Test case version	1.3
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.3.3, Figure 78
Configuration / setup	Master-Tester

1941

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master start-up behavior with overwrite of the DeviceID (compatible). The configured VendorID is ≠ 0x00, 0x00 and the DeviceID is ≠ 0x00, 0x00, 0x00.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (VID selected randomly). c) Master-Tester is in STARTUP mode. d) Master-Tester has the VendorID 0x02, 0xA4 and DeviceID 0x00, 0xA4, 0x39 (DID is selected randomly) e) Protocol revision of the Device is ≥ V1.1 (e.g. 0x11). f) Target Mode = CFGCOM g) Inspection Level = TYPECOMP h) Compatibility check (Revision check) successfully completed i) The MasterCommand 0x95 (MasterIdent) is written successfully. j) The Process Data width is not changed.
Procedure	The Master establishes communication with the "Device" (Master-Tester), detects the wrong "Device", overwrites the DeviceID with the requested DeviceID, reads communication parameters again, and turns the "Device" into the PREOPERATE mode. NOTE The Master-Tester shall tolerate Masters reading communication parameter 0x02 (Direct Parameter page 1) twice.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2 Master-Tester: VendorID 0x02, 0xA4; DeviceID 0x00, 0xA4, 0x39
Post condition	-

1942

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Read VendorID b) Read DeviceID c) Write Revision with "0x11" (V1.1) d) Write configured DeviceID e) Write MasterCommand 0x96 (announces new read of communication parameters) f) Read communication parameters 0x02 to 0x06 (Direct Parameter page 1) g) Read again VendorID h) Read again DeviceID i) Write MasterCommand 0x9A
Test passed	Check startup with configured DeviceID for V1.1, which is defined as follows: a) After checking, the Master overwrites the DeviceID with the configured values b) Master sends MasterCommand 0x96 to announce new readout of communication parameters and VID and DID c) Master writes MasterCommand 0x9A d) Test-Master/Device has the DeviceID 0x00, 0x2B, 0xD2 (Master sends no error message as the reread DeviceID matches the configured values).
Test failed (examples)	If the Master does not write the Master Command 0x9A or the Test-Master/Device does not have the DeviceID 0x00, 0x2B, 0xD2
Results	Master writes Revision 0x11: <yes/no> <pass/fail> MasterCommand 0x96: <yes/no> <pass/fail> Master reads VendorID: <value> <pass/fail>

TEST CASE RESULTS	CHECK / REACTION	
	Master reads DeviceID: <value>	<pass/fail>
	MasterCommand 0x9A: <yes/no>	<pass/fail>

1945 ### 8.5.7 Master start-up with overwrite of the DID (incompatible)

1946 Table 198 defines the test conditions for this test case.

1947 **Table 198 – Master start-up with overwrite of the DID (incompatible)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0189
Name	TCM_DLST_CHCK_OVERDIDNOK
Purpose (short)	Check Master start-up behavior with overwrite of the DeviceID (incompatible)
Equipment under test (EUT)	Master
Test case version	1.3
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.3.3, Figure 78
Configuration / setup	Master-Tester: Fault indication propagation to the upper level system defined for example by a corresponding "upper level integration system" such as [17].

1948

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master start-up behavior with overwrite of the DeviceID. This test case supposes an incompatible DeviceID that causes the Master-Tester to initiate a corresponding Event. The configured VendorID is ≠ 0x00, 0x00 and the DeviceID is ≠ 0x00, 0x00, 0x00.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (VID selected randomly). c) Master-Tester is in STARTUP mode. d) Master-Tester has the VendorID 0x02, 0xA4 and DeviceID 0x00, 0xA4, 0x39 (DID is selected randomly) e) Protocol revision of the Device is V1.1 (0x11). f) Target Mode = CFGCOM g) Inspection Level = TYPECOMP h) Compatibility check (Revision check) successfully completed i) The MasterCommand 0x95 (MasterIdent) is written successfully. j) The Process Data width is not changed.
Procedure	The Master starts communication with the "Device" (Master-Tester), detects the wrong "Device", overwrites the DeviceID with the requested DeviceID, reads communication parameters again, and turns the "Device" into the PREOPERATE mode. NOTE The Master-Tester shall tolerate Masters reading communication parameter 0x02 (Direct Parameter page 1) twice.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2 Master-Tester: VendorID 0x02, 0xA4; DeviceID 0x00, 0xA4, 0x39
Post condition	-

1949

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Read VendorID b) Read DeviceID c) Write Revision with "0x11" (V1.1) d) Write configured DeviceID e) Write MasterCommand 0x96 (announces new read of communication parameters) g) Read communication parameters 0x02 to 0x06 (Direct Parameter page 1) h) Read again VendorID i) Read again DeviceID j) Write MasterCommand 0x9A k) Master indicates an Event
Test passed	a) If the Master indicates a corresponding fault indication to the upper level system (optional) b) If the Master sent the MasterCommand 0x9A and thereafter no MasterCommand 0x99
Test failed (examples)	a) If the Master does not indicate a fault indication. b) If the Master sent the MasterCommand 0x9A and thereafter a MasterCommand 0x99
Results	Master writes Revision 0x11: <yes/no> <pass/fail> Master writes configured DeviceID: <yes/no> <pass/fail> MasterCommand 0x96: <yes/no> <pass/fail> Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail>

TEST CASE RESULTS	CHECK / REACTION	
	MasterCommand 0x9A: <yes/no> Master indicates Event: <EventCode>	<pass/fail> <pass/fail>

1952
8.5.8 Master start-up with overwrite of the RID (incompatible)

1953 Table 199 defines the test conditions for this test case.

1954 **Table 199 – Master start-up with overwrite of the RID (incompatible)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0190
Name	TCM_DLST_CHCK_OVERRIDNOK
Purpose (short)	Check Master start-up behavior with overwrite of the RevisionID (incompatible)
Equipment under test (EUT)	Master
Test case version	1.3
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.3.3, Figure 78
Configuration / setup	Master-Tester ("Device"): Fault indication propagation to the upper level system defined for example by a corresponding "upper level integration system" such as [17].

1955

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master start-up behavior with overwrite of the RevisionID (RID). This test case supposes an incompatible RevisionID (>V1.1). The Master overwrites the RID, the "Device" (Master-Tester) in turn restores the original RID that causes the Master-Tester to initiate a corresponding Event. The configured VendorID is ≠ 0x00, 0x00 and the DeviceID is ≠ 0x00, 0x00, 0x00.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (VID selected randomly). c) Master-Tester is in STARTUP mode. d) Master-Tester has the VendorID 0x02, 0xA4 and DeviceID 0x00, 0xA4, 0x39 (DID is selected randomly) e) Protocol revision of the Device is V1.2 (0x12). f) Target Mode = CFGCOM g) Inspection Level = TYPECOMP h) Compatibility check (Revision check) successfully completed i) The MasterCommand 0x95 (MasterIdent) is written successfully. j) The Process Data width is not changed.
Procedure	The Master starts communication with the "Device", detects the "wrong" RevisionID and overwrites the RevisionID with the requested RevisionID. The "Device" restores the original RevisionID. The Master reads communication parameters again. NOTE The Master-Tester shall tolerate Masters reading communication parameter 0x02 (Direct Parameter page 1) twice.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2 Master-Tester: VendorID 0x02, 0xA4; DeviceID 0x00, 0xA4, 0x39; RevisionID: 0x12
Post condition	-

1956

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Read VendorID and DeviceID b) Write Revision with "0x11" (V1.1) c) Write configured DeviceID d) Write MasterCommand 0x96 (announces new read of communication parameters) e) Read communication parameters 0x02 to 0x06 (Direct Parameter page 1) f) Read again VendorID g) Read again DeviceID h) Master indicates an Event
Test passed	a) If the revision 0x12 is restored in the Device (address 0x04 in Direct Parameter page 1) after the actions and the Master did not send the command 0x9A. b) If the Master indicates a corresponding fault to the upper level system (optional).
Test failed (examples)	If the Master does not indicate a system-specific fault or turns into PREOPERATE mode.
Results	Master writes Revision 0x11: <yes/no> <pass/fail> Master writes configured DeviceID: <yes/no> <pass/fail> MasterCommand 0x96: <yes/no> <pass/fail> Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail> MasterCommand 0x9A: <yes/no> <pass/fail>

TEST CASE RESULTS	CHECK / REACTION	
	Master-Tester ("Device") RevisionID: <value>	<pass/fail>
	Master indicates Event: <EventCode>	<pass/fail>

8.5.9 Master start-up with non configured VID and DID (V1.0)

Table 200 defines the test conditions for this test case.

Table 200 – Master start-up with non configured VID and DID (V1.0)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0192
Name	TCM_DLST_CHCK_VIDDIDNONCONFIG
Purpose (short)	Check Master start-up behavior with non configured VID and DID (V1.0)
Equipment under test (EUT)	Master
Test case version	1.3
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.2.1; [9] 9.2.3.2, 9.3.3, Figure 78
Configuration / setup	Master-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check Master start-up behavior with non configured VID and DID for a legacy "Device" (V1.0). The Master shall write the MasterCycleTime and turn the "Device" from PREOPERATE to OPERATE mode. The configured VendorID is = 0x00, 0x00 and the DeviceID is = 0x00, 0x00, 0x00.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x00, 0x00 and DeviceID 0x00, 0x00, 0x00. c) Master-Tester is in STARTUP mode. d) Master-Tester has the VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (DID is selected randomly) e) Protocol revision of the Device is V1.0 (0x10) f) Target Mode = AUTOCOM g) Inspection Level = NOCHECK h) Compatibility check (Revision check) successfully completed
Procedure	The Master establishes communication with the "Device" (Master-Tester), writes the MasterCycleTime (address 0x01 in Direct Parameter page 1), and sends the MasterCommand 0x99 (OPERATE).
Input parameter	Master: VendorID: 0x00, 0x00; DeviceID 0x00, 0x00, 0x00 Master-Tester: VendorID 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; RevisionID: 0x10
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Read VendorID b) Read DeviceID c) Write MasterCycleTime (address 0x01 in Direct Parameter page 1) d) Write MasterCommand 0x99 (turn "Device" into OPERATE mode)
Test passed	If the Master writes the MasterCycleTime (address 0x01) and successfully sent the MasterCommand 0x99.
Test failed (examples)	If the Master does not write the MasterCycleTime (address 0x01) or does not send the MasterCommand 0x99.
Results	Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail> MasterCycleTime written: <yes/no> <pass/fail> MasterCommand 0x99: <yes/no> <pass/fail>

8.5.10 Master start-up with configured VID and DID (Device V1.0)

Table 201 defines the test conditions for this test case.

Table 201 – Master start-up with configured VID and DID (V1.0)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0193
Name	TCM_DLST_CHCK_VIDDIDCONFIG
Purpose (short)	Check Master start-up behavior with configured VID and DID (Device V1.0)
Equipment under test (EUT)	Master
Test case version	1.3
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.2.1; [9] 9.2.3.2, 9.3.3, Figure 78
Configuration / setup	Master-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master start-up behavior with configured VID and DID for a legacy "Device" (V1.0). The Master shall write the MasterCycleTime only if the configured values match the values in the "Device". Then, the Master shall turn the "Device" from PREOPERATE to OPERATE mode. The configured VendorID is ≠ 0x00, 0x00 and the DeviceID is ≠ 0x00, 0x00, 0x00.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2. c) Master-Tester is in STARTUP mode. d) Master-Tester has the VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (DID is selected randomly) e) Protocol revision of the Device is V1.0 (0x10). f) Target Mode = CFGCOM g) Inspection Level = TYPECOMP h) Compatibility check (Revision check) successfully completed
Procedure	The Master establishes communication with the "Device" (Master-Tester) and writes the MasterCycleTime (address 0x01 in Direct Parameter page 1) only, if the configured values match the values in the "Device". The Master sends the MasterCommand 0x99 to turn the "Device" into the OPERATE mode.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2 Master-Tester: VendorID 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; RevisionID: 0x10
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Read VendorID b) Read DeviceID c) Write MasterCycleTime (address 0x01 in Direct Parameter page 1) d) Write MasterCommand 0x99 (turn "Device" into OPERATE mode)
Test passed	If the Master writes the MasterCycleTime (address 0x01) and successfully sent the MasterCommand 0x99.
Test failed (examples)	If the Master does not write the MasterCycleTime (address 0x01) or does not send the MasterCommand 0x99.
Results	Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail> MasterCycleTime written: <yes/no> <pass/fail> MasterCommand 0x99: <yes/no> <pass/fail>

8.5.11 Master start-up with wrong DID (Device V1.0)

Table 202 defines the test conditions for this test case.

Table 202 – Master start-up with wrong DID (V1.0)

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0194
Name	TCM_DLST_CHCK_DIDWRONG
Purpose (short)	Check Master start-up behavior with wrong DID (Device V1.0)
Equipment under test (EUT)	Master
Test case version	1.3
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.2.1; [9] 9.2.3.2, 9.3.3, Figure 78
Configuration / setup	Master-Tester: Fault indication propagation to the upper level system defined for example by a corresponding "upper level integration system" such as [17].
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check Master start-up behavior with wrong configured DID for a legacy "Device" (V1.0). The Master shall indicate a corresponding Event to the upper level system. The configured VendorID is ≠ 0x00, 0x00 and the DeviceID is ≠ 0x00, 0x00, 0x00.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2. c) Master-Tester is in STARTUP mode. d) Master-Tester has a deviating DeviceID e) Protocol revision of the "Device" is V1.0 (0x10). f) Target Mode = CFGCOM g) Inspection Level = TYPECOMP h) Compatibility check (Revision check) successfully completed i) Device is actuator.
Procedure	The Master establishes communication with the "Device" (Master-Tester), recognizes a deviating DeviceID, and indicates a corresponding fault to the upper level system.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2 Master-Tester: Deviating DeviceID; RevisionID: 0x10
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Read VendorID b) Read DeviceID c) Master indicates a fault The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	If Master indicates a system specific fault information.
Test failed (examples)	Master indicates no system specific fault information or sends MasterCommand 98.
Results	Master reads VendorID: <value> <pass/fail> Master reads DeviceID: <value> <pass/fail> Master indicates Event: <EventCode> <pass/fail>

1980 **8.5.12 Master start-up with overwrite of the RID (compatible)**

1981 Table 203 defines the test conditions for this test case.

1982 **Table 203 – Master start-up with overwrite of the RID (compatible)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0307
Name	TCM_DLST_CHCK_OVERRIDOK
Purpose (short)	Check Master start-up behavior with overwrite of the Device RID (compatible)
Equipment under test (EUT)	Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 10.6.3
Configuration / setup	Master-Tester

1983

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master start-up behavior with overwrite of the RevisionID (compatible). This test supposes the active switching to protocol revision 1.0. The master overwrites the RID and the Device accepts the requested protocol version. The configured VendorID is ≠ 0x00, 0x00 and the DeviceID is ≠ 0x00, 0x00, 0x00 and RevisionID is ≠ 0x00
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 and RevisionID 0x10 c) Protocol revision of the device is V1.1 (0x11) d) Inspection Level = TYPECOMP e) Target Mode = CFGCOM f) Compatibility check (Revision check) successfully completed g) The MasterCommand 0x95 (MasterIdent) is written successfully.
Procedure	a) Master establishes communication with the "Device" (Master-Tester) b) Master detects the wrong "RevisionID" c) Master overwrites the RevisionID with the requested legacy RevisionID d) "Device" accepts the written RID e) Master reads communication parameters again f) Master turns the "Device" into the OPERATE mode NOTE The Master-Tester shall tolerate Masters reading communication parameter 0x02 (Direct Parameter page 1) twice.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2, RevisionID 0x10 Master-Tester: VendorID 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2, RevisionID 0x11
Post condition	-

1984

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Write VendorID, DeviceID, RevisionID with 0x10 subsequently b) Write MasterCommand 0x96 (announces new read of communication parameters) c) Read communication parameters 0x02 to 0x06 (Direct Parameter page 1) d) Read again VendorID, DeviceID, RevisionID subsequently e) Write MasterCommand 0x99
Test passed	Check startup with configured DeviceID for V1.0, which is defined as follows: a) After checking, the Master overwrites the Vendor-, Device-, and RevisionID with the configured values b) Master sends MasterCommand 0x96 to announce new readout of communication parameters and VID, DID and RID c) Master writes MasterCommand 0x99 d) Test-Master/Device has the RevisionID 0x10, (Master sends no error message as the reread RevisionID matches the configured values)
Test failed (examples)	If the Master writes the Master Command 0x9A or the "Device" (Master-Tester) does not have the RevisionID 0x10
Results	Master writes RevisionID 0x11: <yes/no> <pass/fail> MasterCommand 0x96: <yes/no> <pass/fail> Master reads RevisionID: <value> <pass/fail>

1985

1986 ### 8.5.13 Master start-up with wrong SerialNumber (Device V1.0)

1987 Table 204 defines the test conditions for this test case.

1988 **Table 204 – Master start-up with wrong SerialNumber (V1.0)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0195
Name	TCM_DLST_CHCK_SNWRONG
Purpose (short)	Check Master start-up behavior with wrong SerialNumber (Device V1.0)
Equipment under test (EUT)	Master
Test case version	1.3
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.2.1; [9] 9.2.3.2, 9.2.3.4, 9.3.3, Figure 78
Configuration / setup	Master-Tester ("Device"): Fault indication propagation to the upper level system defined for example by a correponding "upper level integration system" such as [17].

1989

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master start-up behavior with wrong SerialNumber (Device V1.0). After the transition to the OPERATE mode (MasterCommand 0x99) the Master detects a wrong or not matching SerialNumber. The Master shall indicate a corresponding fault to the upper level system.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2. c) Master is configured to SerialNumber "0123456789FEDCBA" (selected randomly). d) Master-Tester is in STARTUP mode. e) Master-Tester has the VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (DID is selected randomly) f) Master-Tester has the SerialNumber "0123456789ABCDEF" (selected randomly) g) Protocol revision of the "Device" is V1.0 (0x10). h) Target Mode = CFGCOM i) Inspection Level = IDENTICAL j) Compatibility check (Revision check) successfully completed k) Transition to OPERATE mode was successful.
Procedure	The Master establishes communication with the "Device" (Master-Tester), detects a deviating SerialNumber in OPERATE mode, indicates a corresponding fault to the upper level system, and stops communicating with the "Device".
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; SerialNumber: 0123456789FEDCBA Master-Tester: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; SerialNumber: e.g. 0123456789ABCDEF (Master tester is free to choose any number); RevisionID: 0x10
Post condition	-

1990

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Write MasterCommand 0x99 (turn "Device" into OPERATE mode) b) Read SerialNumber c) Master indicates fault to upper level sytem The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	If the Master indicates a system-specific fault to the upper level system.
Test failed (examples)	If the Master sends the MasterCommand 0x99 again or does not indicate a system-specific fault to the upper level system.
Results	Master writes MasterCommand 0x99: <yes/no> <pass/fail> Master reads SerialNumber: <value> <pass/fail> Master indicates Event: <EventCode> <pass/fail>

1991

1992

1993 ### 8.5.14 Master start-up with correct SerialNumber (Device V1.0)

1994 Table 205 defines the test conditions for this test case.

1995 **Table 205 – Master start-up with correct SerialNumber (V1.0)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0196
Name	TCM_DLST_CHCK_SNRIGHT
Purpose (short)	Check Master start-up behavior with correct SerialNumber (Device V1.0)
Equipment under test (EUT)	Master
Test case version	1.3
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.2.1; [9] 9.2.3.2, 9.2.3.4, 9.3.3, Figure 72
Configuration / setup	Master-Tester ("Device")

1996

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master start-up behavior with correct SerialNumber (Device V1.0). After the transition to the OPERATE mode (MasterCommand 0x99) the Master detects a matching SerialNumber. The Master shall write the MasterCycleTime and the MasterCommand 0x99 again.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2. c) Master is configured to SerialNumber "0123456789ABCDEF". d) Master-Tester is in STARTUP mode. e) Master-Tester has the VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (DID is selected randomly) f) Master-Tester has the SerialNumber "0123456789ABCDEF" (selected randomly) g) Protocol revision of the "Device" is V1.0 (0x10) h)Target Mode = CFGCOM i) Inspection Level = IDENTICAL j) Compatibility check (Revision check) successfully completed k) Transition to OPERATE mode was successful.
Procedure	The Master establishes communication with the "Device" (Master-Tester), detects a matching SerialNumber in OPERATE mode. The Master writes the MasterCycleTime and the MasterCommand 0x99 again.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; SerialNumber: 0123456789 ABCDEF Master-Tester: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; SerialNumber: e.g. 0123456789ABCDEF (Master tester is free to choose any number); RevisionID: 0x10
Post condition	-

1997

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Master writes MasterCommand 0x99 (turn "Device" into OPERATE mode) b) Read SerialNumber c) Master writes MasterCycleTime (address 0x01 in Direct Parameter page 1) d) Master writes MasterCommand 0x99
Test passed	If the Master after writing the first MasterCommand 0x99 reads the SerialNumber and then writes the MasterCycleTime and the MasterCommand 0x99 again.
Test failed (examples)	If the Master does not read the SerialNumber, or does not write the MasterCycleTime again, or does not send the MasterCommand 0x99 again.
Results	Master writes MasterCommand 0x99: <yes/no> <pass/fail> Master reads SerialNumber: <value> <pass/fail> Master writes MasterCycleTime: <yes/no> <pass/fail> Master writes MasterCommand 0x99: <yes/no> <pass/fail>

1998

1999

8.6 PREOPERATE

8.6.1 Master PREOPERATE with correct SerialNumber

Table 206 defines the test conditions for this test case.

Table 206 – Master PREOPERATE with correct SerialNumber

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0198
Name	TCM_DLOD_PREP_SNCORRECT
Purpose (short)	Check Master PREOPERATE behavior with correct SerialNumber
Equipment under test (EUT)	Master
Test case version	1.2
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check Master PREOPERATE behavior with correct SerialNumber. The Master writes the command 0x9A and turns into the PREOPERATE mode. The Master then reads the SerialNumber of the "Device". If it matches the configured SerialNumber the Master can start the Data Storage mechanism.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2. c) Master is configured to SerialNumber 0x02, 0x66, 0x64, 0xAF, 0xBD (selected randomly) d) Master-Tester is in STARTUP mode. e) Master-Tester has VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (selected randomly). f) Master-Tester has SerialNumber 0x02, 0x66, 0x64, 0xAF, 0xBD (selected randomly). g) Protocol revision of the "Device" is V1.1 (0x11). h)Target Mode = CFGCOM i) Inspection Level = IDENTICAL j) Compatibility check (Revision check) successfully completed
Procedure	The Master establishes communication with the "Device" (Master-Tester) and detects a matching SerialNumber in PREOPERATE mode.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; SerialNumber: 0x02, 0x66, 0x64, 0xAF, 0xBD Master-Tester: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; SerialNumber: 0x02, 0x66, 0x64, 0xAF, 0xBD; RevisionID: 0x11
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Master writes MasterCommand 0x9A (turn "Device" into PREOPERATE mode) b) Read SerialNumber
Test passed	If the Master reads the SerialNumber after the first MasterCommand 0x9A.
Test failed (examples)	If the Master does not write the MasterCommand 0x9A or does not read the SerialNumber.
Results	Master writes MasterCommand 0x9A: <yes/no> <pass/fail> Master reads SerialNumber: <value> <pass/fail>

8.6.2 Master PREOPERATE without configured SerialNumber

Table 207 defines the test conditions for this test case.

Table 207 – Master PREOPERATE without configured SerialNumber

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0199 (PreOperate_2)
Name	TCM_DLOD_PREP_SNNONCONFIG
Purpose (short)	Check Master PREOPERATE behavior without configured SerialNumber
Equipment under test (EUT)	Master
Test case version	1.2
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check Master PREOPERATE behavior without configured SerialNumber. The Master writes the MasterCommand 0x9A and turns into PREOPERATE mode. The Master then reads the SerialNumber of the "Device". The following comparison has no effect. The Master can start the Data Storage mechanism.
Precondition	a) Master is in STARTUP mode. b) Master is configured to VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2. c) Master is configured to no SerialNumber d) Master-Tester is in STARTUP mode. e) Master-Tester has VendorID 0x02, 0xA4 and DeviceID 0x00, 0x2B, 0xD2 (selected randomly). f) Protocol revision of the "Device" is V1.1 (0x11). g) Target Mode = CFGCOM h) Inspection Level = IDENTICAL i) Compatibility check (Revision check) successfully completed
Procedure	The Master establishes communication with the "Device" (Master-Tester) and turns the "Device" into the PREOPERATE mode.
Input parameter	Master: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; SerialNumber: none Master-Tester: VendorID: 0x02, 0xA4; DeviceID 0x00, 0x2B, 0xD2; RevisionID: 0x11
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Master writes MasterCommand 0x9A (turn "Device" into PREOPERATE mode).
Test passed	If the Master writes the MasterCommand 0x9A.
Test failed (examples)	If the Master does not write the MasterCommand 0x9A.
Results	Master writes MasterCommand 0x9A: <yes/no> <pass/fail>

2015 ### 8.6.3 Master PREOPERATE Write with configured S/N and Upload

2016 Table 208 defines the test conditions for this optional test case, which is also covered by
2017 TC_0202 through TC_0209.

2018 **Table 208 – Master PREOPERATE Write with configured S/N and Upload**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0200
Name	TCM_DLOD_PREP_SNCONFIGWRITEUPLOAD
Purpose (short)	Check Master PREOPERATE behavior with configured SerialNumber and Upload
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.2.3.4, 9.3.3, 11.2.2.6, 11.3.3
Configuration / setup	Master-Tester ("Device"), Line-Monitor (optionally)

2019

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check Master PREOPERATE behavior with configured SerialNumber and Upload. The Master writes the MasterCommand 0x9A and turns into the PREOPERATE mode. The Master then reads the SerialNumber out of the "Device". If it matches the configured Serial-Number the Master can start the Data Storage upload mechanism. After successful completion of the Data Storage upload, the Master application writes a defined string of 32 octets into Index 24 ("ApplicationSpecificTag"). The Master then writes the MasterCycleTime into address 0x01 (Direct Parameter page 1) and the MasterCommand 0x99.
Precondition	a) Data Storage upload / download to be activated in the Master. b) Successful write of the MasterCommand 0x9A and completed Data Storage.
Procedure	a) The Master or the layer above (upper level system / gateway) writes the following contents into Index 24 via a Write request: "Check application specific tag!!" b) The Master then writes the MasterCycleTime again and turns into the OPERATE mode with MasterCommand 0x99.
Input parameter	Text string: "Check application specific tag!!" (32 octets)
Post condition	-

2020

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Writing into Index 24 can be traced with the help of a Line-Monitor. b) Index 24 holds the following content: "Check application specific tag!!" c) Master writes MasterCommand 0x99. d) Master and "Device" in OPERATE mode.
Test passed	a) If Index 24 of the Master-Tester ("Device") holds: "Check application specific tag!!" b) Master wrote MasterCommand 0x99.
Test failed (examples)	a) If content of Index 24 of the Master-Tester deviates from: "Check application specific tag!!" b) Master did not write MasterCommand 0x99.
Results	Index 24 holds defined text string: <yes/no> <pass/fail> Master writes MasterCommand 0x99: <yes/no> <pass/fail>

2021
2022

8.6.4 Master PREOPERATE Read with configured S/N and Upload

Table 209 defines the test conditions for this optional test case, which is also covered by TC_0202 through TC_0209.

Table 209 – Master PREOPERATE Read with configured S/N and Upload

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0201
Name	TCM_DLOD_PREP_SNCONFIGREADUPLOAD
Purpose (short)	Check Master PREOPERATE Write behavior with configured S/N and Upload
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 9.2.3.2, 9.2.3.4, 9.3.3, 11.2.2.6, 11.3.3
Configuration / setup	Master-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Check Master PREOPERATE behavior with configured SerialNumber (S/N) and Upload. The Master writes the MasterCommand 0x9A and turns into the PREOPERATE mode. The Master then reads the SerialNumber out of the "Device". If it matches the configured SerialNumber the Master can start the Data Storage upload mechanism. After successful completition of the Data Storage upload, the Master application reads a defined string of 32 octets out of Index 24 ("ApplicationSpecificTag"). The Master then writes the MasterCycleTime into address 0x01 (Direct Parameter page 1) and the MasterCommand 0x99.
Precondition	a) Successful write of the MasterCommand 0x9A and completed Data Storage. b) Establish communication and wait until OD request data communication is available
Procedure	a) The Master or the layer above (upper level system / gateway) reads the following contents out of Index 24 via a Read request: "Check application specific tag!!" b) The Master then writes the MasterCycleTime again and turns into the OPERATE mode with MasterCommand 0x99.
Input parameter	Text string: "Check application specific tag!!" (32 octets)
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Reading out of Index 24 can be traced with the help of a Line-Monitor. b) Upper level system shows the following content: "Check application specific tag!!" c) Master writes MasterCommand 0x99. d) Master and "Device" in OPERATE mode.
Test passed	a) If upper level system shows: "Check application specific tag!!" b) Master wrote MasterCommand 0x99.
Test failed (examples)	a) If upper level system does not show: "Check application specific tag!!" b) Master did not write MasterCommand 0x99.
Results	Upper level system shows defined text string: <yes/no> <pass/fail> Master writes MasterCommand 0x99: <yes/no> <pass/fail>

8.6.5 Master PREOPERATE uses TYPE_0 to read Index 24 (1OD)

Table 210 defines the test conditions for this test case.

Table 210 – Master PREOPERATE uses TYPE_0 to read Index 24 (1OD)

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0202
Name	TCM_DLOD_PREP_TYPE0READOD1
Purpose (short)	Master to use TYPE_0 to read Index 24 in PREOPERATE mode (1OD)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.2.2, A.5.2, Table A.13, B.2.1
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master to use TYPE_0 to read Index 24 in PREOPERATE mode (1OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which PREOPERATE M-sequence type can be used.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) The Index 24 contains the string 'TestFrameTypeXOD'. c) Data Storage is activated and DS_UPLOAD_REQ_FLAG is active. d) DS_IndexList contains Index 24 only. e) Master Data Storage is enabled. f) Master is in SIO mode.
Procedure	Master is switched to communication and performs Data Storage during PREOPER-ATE phase.
Input parameter	Another Index than Index 24 and content can be selected by the Master tester.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Master shall use the correct M-sequence type (TYPE_X), test via line monitor.
Test passed	If the correct M-sequence type is used (TYPE_X).
Test failed (examples)	Usage of other M-sequence types than TYPE_X.
Results	Used M-sequence type: <type> <pass/fail> Value read from Index 24: <value> <pass/fail>

8.6.6 Master PREOPERATE uses TYPE_1_2 to read Index 24 (2OD)

Table 211 defines the test conditions for this test case.

Table 211 – Master PREOPERATE uses TYPE_1_2 to read Index 24 (2OD)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0203
Name	TCM_DLOD_PREP_TYPE12READOD2
Purpose (short)	Master to use TYPE_1_2 to read Index 24 in PREOPERATE mode (2OD)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Master-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master to use TYPE_1_2 to read Index 24 in PREOPERATE mode. The Master reads from address 0x03 of the Direct Parameter page 1 the information which PREOPERATE M-sequence type can be used.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) The Index 24 contains the string 'TestFrameTypeXOD'. c) Data Storage is activated and DS_UPLOAD_REQ_FLAG is active. d) DS_IndexList contains Index 24 only. e) Master Data Storage is enabled. f) Master is in SIO mode.
Procedure	Master is switched to communication and performs Data Storage during PREOPER-ATE phase.
Input parameter	Another Index than Index 24 and content can be selected by the Master tester.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Master shall use the correct M-sequence type (TYPE_X), test via line monitor.
Test passed	If the correct M-sequence type is used (TYPE_X).
Test failed (examples)	Usage of other M-sequence types than TYPE_X.
Results	Used M-sequence type: <type> <pass/fail> Values read from Index 24: <values> <pass/fail>

8.6.7 Master PREOPERATE uses TYPE_1_V to read Index 24 (8 OD)

Table 212 defines the test conditions for this test case.

Table 212 – Master PREOPERATE uses TYPE_1_V to read Index 24 (8 OD)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0204
Name	TCM_DLOD_PREP_TYPE1VREADOD8
Purpose (short)	Master to use TYPE_1_V to read Index 24 in PREOPERATE mode (8OD)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master to use TYPE_1_V to read Index 24 in PREOPERATE mode (8OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which PREOPERATE M-sequence type can be used.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) The Index 24 contains the string 'TestFrameTypeXOD'. c) Data Storage is activated and DS_UPLOAD_REQ_FLAG is active. d) DS_IndexList contains Index 24 only. e) Master Data Storage is enabled. f) Master is in SIO mode.
Procedure	Master is switched to communication and performs Data Storage during PREOPERATE phase.
Input parameter	Another Index than Index 24 and content can be selected by the Master tester.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Master shall use the correct M-sequence type (TYPE_X), test via line monitor.
Test passed	If the correct M-sequence type is used (TYPE_X).
Test failed (examples)	Usage of other M-sequence types than TYPE_X.
Results	Used M-sequence type: <type> <pass/fail> Values read from Index 24: <values> <pass/fail>

2052 ### 8.6.8 Master PREOPERATE uses TYPE_1_V to read Index 24 (32 OD)

2053 Table 213 defines the test conditions for this test case.

2054 **Table 213 – Master PREOPERATE uses TYPE_1_V to read Index 24 (32 OD)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0205
Name	TCM_DLOD_PREP_TYPE1VREADOD32
Purpose (short)	Master to use TYPE_1_V to read Index 24 in PREOPERATE mode (32 OD)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1
Configuration / setup	Master-Tester, Line-Monitor (optionally)

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master to use TYPE_1_V to read Index 24 in PREOPERATE mode (32 OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which PREOPERATE M-sequence type can be used.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) The Index 24 contains the string 'TestFrameTypeXOD'. c) Data Storage is activated and DS_UPLOAD_REQ_FLAG is active. d) DS_IndexList contains Index 24 only. e) Master Data Storage is enabled. f) Master is in SIO mode.
Procedure	Master is switched to communication and performs Data Storage during PREOPER-ATE phase.
Input parameter	Another Index than Index 24 and content can be selected by the Master tester.
Post condition	-

2056

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Master shall use the correct M-sequence type (TYPE_X), test via line monitor.
Test passed	If the correct M-sequence type is used (TYPE_X).
Test failed (examples)	Usage of other M-sequence types than TYPE_X.
Results	Used M-sequence type: <type> <pass/fail> Text string read from Index 24: <text string> <pass/fail>

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2059 ### 8.6.9 Master PREOPERATE uses TYPE_0 to write Index 24 (1 OD)

2060 Table 214 defines the test conditions for this test case.

2061 **Table 214 – Master PREOPERATE uses TYPE_0 to write Index 24 (1 OD)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0206
Name	TCM_DLOD_PREP_TYPE0WRITEOD1
Purpose (short)	Master to use TYPE_0 to write to Index 24 in PREOPERATE mode (1 OD)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Master-Tester

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master to use TYPE_0 to write to Index 24 in PREOPERATE mode (1 OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which PREOPERATE M-sequence type can be used.
Precondition	a) A parameter set is already stored within the Master b) The Index 24 contains the string 'TestFrameTypeXOD'. c) Data Storage is activated and DS_UPLOAD_REQ_FLAG is active. d) DS_IndexList contains Index 24 only. e) Master Data Storage is enabled. f) Master is in SIO mode.
Procedure	Master is switched to communication and performs Data Storage during PREOPERATE phase.
Input parameter	Another Index than Index 24 and content can be selected by the Master tester.
Post condition	-

2063

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Master shall use the correct M-sequence type (TYPE_X), test via line monitor.
Test passed	If the correct M-sequence type is used (TYPE_X).
Test failed (examples)	Usage of other M-sequence types than TYPE_X.
Results	Used M-sequence type: <type> <pass/fail> Value in Index 24: <value> <pass/fail>

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8.6.10 Master PREOPERATE uses TYPE_1_2 to write Index 24 (2 OD)

Table 215 defines the test conditions for this test case.

Table 215 – Master PREOPERATE uses TYPE_1_2 to write Index 24 (2 OD)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0207
Name	TCM_DLOD_PREP_TYPE12WRITEOD2
Purpose (short)	Master to use TYPE_1_2 to write to Index 24 in PREOPERATE mode (2 OD)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Test-Master, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master to use TYPE_1_2 to write to Index 24 in PREOPERATE mode (2 OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which PREOPERATE M-sequence type can be used.
Precondition	a) A parameter set is already stored within the Master b) The Index 24 contains the string 'TestFrameTypeXOD'. c) Data Storage is activated and DS_UPLOAD_REQ_FLAG is active. d) DS_IndexList contains Index 24 only. e) Master Data Storage is enabled. f) Master is in SIO mode.
Procedure	Master is switched to communication and performs Data Storage during PREOPER-ATE phase.
Input parameter	Another Index than Index 24 and content can be selected by the Master tester.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Master shall use the correct M-sequence type (TYPE_X), test via line monitor.
Test passed	If the correct M-sequence type is used (TYPE_X).
Test failed (examples)	Usage of other M-sequence types than TYPE_X.
Results	Used M-sequence type: <type> <pass/fail> Values in Index 24: <values> <pass/fail>

8.6.11 Master PREOPERATE uses TYPE_1_V to write Index 24 (8 OD)

Table 216 defines the test conditions for this test case.

Table 216 – Master PREOPERATE uses TYPE_1_V to write Index 24 (8 OD)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0208
Name	TCM_DLOD_PREP_TYPE1VWRITEOD8
Purpose (short)	Master to use TYPE_1_V to write to Index 24 in PREOPERATE mode (8 OD)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master to use TYPE_1_V to write to Index 24 in PREOPERATE mode (8 OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which PREOPERATE M-sequence type can be used.
Precondition	a) A parameter set is already stored within the Master b) The Index 24 contains the string 'TestFrameTypeXOD'. c) Data Storage is activated and DS_UPLOAD_REQ_FLAG is active. d) DS_IndexList contains Index 24 only. e) Master Data Storage is enabled. f) Master is in SIO mode.
Procedure	Master is switched to communication and performs Data Storage during PREOPER-ATE phase.
Input parameter	Another Index than Index 24 and content can be selected by the Master tester.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Master shall use the correct M-sequence type (TYPE_X), test via line monitor.
Test passed	If the correct M-sequence type is used (TYPE_X).
Test failed (examples)	Usage of other M-sequence types than TYPE_X.
Results	Used M-sequence type: <type> <pass/fail> Values in Index 24: <values> <pass/fail>

8.6.12 Master PREOPERATE uses TYPE_1_V to write Index 24 (32 OD)

Table 217 defines the test conditions for this test case.

Table 217 – Master PREOPERATE TYPE_1_V to write Index 24 (32 OD)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0209
Name	TCM_DLOD_PREP_TYPE1VWRITEOD32
Purpose (short)	Master to use TYPE_1_V to write to Index 24 in PREOPERATE mode (32 OD)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master to use TYPE_1_V to write to Index 24 in PREOPERATE mode (32 OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which PREOPERATE M-sequence type can be used.
Precondition	a) A parameter set is already stored within the Master b) The Index 24 contains the string 'TestFrameTypeXOD'. c) Data Storage is activated and DS_UPLOAD_REQ_FLAG is active. d) DS_IndexList contains Index 24 only. e) Master Data Storage is enabled. f) Master is in SIO mode.
Procedure	Master is switched to communication and performs Data Storage during PREOPER-ATE phase.
Input parameter	Another Index than Index 24 and content can be selected by the Master tester.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Master shall use the correct M-sequence type (TYPE_X), test via line monitor.
Test passed	If the correct M-sequence type is used (TYPE_X).
Test failed (examples)	Usage of other M-sequence types than TYPE_X.
Results	Used M-sequence type: <type> <pass/fail> Values in Index 24: <values> <pass/fail>

8.7 OPERATE

8.7.1 Master OPERATE uses TYPE_0 to read Index 24 (1 OD)

Table 218 defines the test conditions for this test case.

Table 218 – Master OPERATE uses TYPE_0 to read Index 24 (1 OD)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0210
Name	TCM_DLOD_OPER_TYPE0READOD1
Purpose (short)	Master to use TYPE_0 to read Index 24 in OPERATE mode (1 OD)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Master-Tester, Line-Monitor (optionally)

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master to use TYPE_0 to read Index 24 in OPERATE mode (1 OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which OP-ERATE M-sequence type can be used.
Precondition	a) The parameter M-sequenceCapability contains the value "0" for the OPERATE mode. b) The On-request Data are fixed to 1 octet for reading from Index 24, which contains the value 0xBF. c) Master in STARTUP mode.
Procedure	Master is in STARTUP mode and reads the communication parameters in the Direct Parameter page 1. The address 0x03 provides information on the OPERATE M-sequence type. Master reads the Index 24 of the Master-Tester ("Device").
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Master shall be able to read the correct content (0xBF) out of Index 24 in the Master-Tester ("Device"). b) The M-sequence type can be traced via a Line-Monitor or determined via the Checksum/M-sequence type (CKT) octet in the Master message.
Test passed	a) If the correct M-sequence type is used (TYPE_0). b) The value "0xBF" is read from Index 24 of the Master-Tester ("Device").
Test failed (examples)	a) From Index 24 a value deviating from "0xBF" is read or b) The Master triggers a restart.
Results	Used M-sequence type: <type> <pass/fail> Value read from Index 24: <value> <pass/fail>

2095 ### 8.7.2 Master OPERATE uses TYPE_0 to write Index 24 (1 OD)

2096 Table 219 defines the test conditions for this test case.

2097 **Table 219 – Master OPERATE TYPE_0 to write Index 24 (1 OD)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0211
Name	TCM_DLOD_OPER_TYPE0WRITEOD1
Purpose (short)	Master to use TYPE_0 to write to Index 24 in OPERATE mode (1 OD)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Master-Tester, Line-Monitor (optionally)

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master to use TYPE_0 to write to Index 24 in OPERATE mode (1 OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which OPERATE M-sequence type can be used.
Precondition	a) The parameter M-sequenceCapability contains the value "0" for the OPERATE mode. b) The On-request Data are fixed to 1 octet for writing to Index 24. c) Master in STARTUP mode.
Procedure	Master is in STARTUP mode and reads the communication parameters in the Direct Parameter page 1. The address 0x03 provides information on the OPERATE M-sequence type. Master writes the text string "0xBF" into the Index 24 of the Master-Tester ("Device").
Input parameter	"0xBF" for Index 24
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Master-Tester ("Device") contains "0xBF" in Index 24. b) The M-sequence type can be traced via a Line-Monitor or determined via the Checksum/M-sequence type (CKT) octet in the Master message.
Test passed	a) If the correct M-sequence type is used (TYPE_0). b) Master-Tester ("Device") contains "0xBF" in Index 24.
Test failed (examples)	a) Master-Tester ("Device") contains a different value than "0xBF" in Index 24 or b) The Master triggers a restart.
Results	Used M-sequence type: <type> <pass/fail> Value in Index 24: <values> <pass/fail>

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8.7.3 Master OPERATE uses TYPE_1_2 to write Index 24 (2 OD)

Table 220 defines the test conditions for this test case.

Table 220 – Master OPERATE uses TYPE_1_2 to write Index 24 (2 OD)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0212
Name	TCM_DLOD_OPER_TYPE12WRITEOD2
Purpose (short)	Master to use TYPE_1_2 to write to Index 24 in OPERATE mode (2 OD)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] A.5.2, Table A.13, B.2.1, B.2.3
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master to use TYPE_1_2 to write to Index 24 in OPERATE mode (2 OD). The Master reads from address 0x03 of the Direct Parameter page 1 the information which OPERATE M-sequence type can be used.
Precondition	a) The parameter M-sequenceCapability contains the value "1" for the OPERATE mode. b) The On-request Data are fixed to 2 octets for writing to Index 24. c) Master in STARTUP mode.
Procedure	Master is in STARTUP mode and reads the communication parameters in the Direct Parameter page 1. The address 0x03 provides information on the OPERATE M-sequence type. Master writes the values "0xAA, 0xBF" into the Index 24 of the Master-Tester ("Device").
Input parameter	"0xAA, 0xBF" for Index 24
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Master-Tester ("Device") contains "0xAA, 0xBF" in Index 24. b) The M-sequence type can be traced via a Line-Monitor or determined via the Checksum/M-sequence type (CKT) octet in the Master message.
Test passed	a) If the correct M-sequence type is used (TYPE_1_2). b) Master-Tester ("Device") contains "0xAA, 0xBF" in Index 24.
Test failed (examples)	a) Master uses an M-sequence type different from TYPE_1_2 or b) Master-Tester ("Device") contains different values than "0xAA, 0xBF" in Index 24 or c) The Master triggers a restart.
Results	Used M-sequence type: <type> <pass/fail> Values in Index 24: <values> <pass/fail>

8.8 Fallback

8.8.1 Fallback from PREOPERATE

Table 221 defines the test conditions for this test case.

Table 221 – Fallback from PREOPERATE

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0213
Name	TCM_DLFB_PROP_OK
Purpose (short)	Test of Master Fallback from PREOPERATE mode
Equipment under test (EUT)	Master and Legacy-Master (see B.13)
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.3, 7.3.2.4, Figure 32, Table B.2
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of Master Fallback from PREOPERATE mode. The Master is in PREOPERATE communication when it sends the MasterCommand 0x5A (Fallback). Upon receipt of the valid response the Master switches its port to SIO mode "DI".
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) The Master is communicating with the Device while in PREOPERATE mode. If the Master does not support the Fallback through a command from the upper level system such as a fieldbus, the Master-Tester shall generate a warning for the person in charge of the test. See B.13.
Procedure	a) Master sends the MasterCommand 0x5A (Fallback). b) Upon receipt of a valid response message the Master port is switched to SIO mode "DI". c) The Master-Tester sets signal to logical "1" (high-level)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Upon receipt of a valid response message the Master stops its communication at the port (visible on Line-Monitor). b) After a maximum of 500 ms the digital input signal is visible at the target system (Master-Tester) of the Master (logical 1).
Test passed	a) If the Master stops its communication upon receipt of a valid response message and b) If the logical 1 signal is shown correctly on the target system (Master-Tester) within 500 ms after receipt of the valid response message.
Test failed (examples)	a) If the Master does not stop communication upon receipt of a valid response message or b) If the Master stops communication upon receipt of the valid response message and the logical 1 does not appear on the target system (Master_Tester) after 500 ms.
Results	Master stops communication: <yes/no> <pass/fail> DI signal shows logical 1: <yes/no> <pass/fail>

2117 ### 8.8.2 Fallback request from PREOPERATE fails

2118 Table 222 defines the test conditions for this test case.

2119 **Table 222 – Fallback request from PREOPERATE fails**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0214
Name	TCM_DLFB_PROP_FAILS
Purpose (short)	Test of Master when Fallback request from PREOPERATE fails
Equipment under test (EUT)	Master and Legacy-Master (see B.13)
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.3, 7.3.2.4, Figure 32, Table B.2
Configuration / setup	Master-Tester, Line-Monitor (optionally)

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TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test of Master when Fallback request from PREOPERATE fails. The Master is in PREOPERATE communication and sends the MasterCommand 0x5A (Fallback). Upon receipt of an invalid response the Master shall repeat the Fallback request (Master stays in communication mode). The Master shall start another MasterCommand after the reception of a second invalid response. Upon receipt of the valid response the Master iniates a port restart or stops communicating.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) The Master is communicating with the "Device" while in PREOPERATE mode. If the Master does not support the Fallback through a command from the upper level system such as a fieldbus, the Master-Tester shall generate a warning for the person in charge of the test. See B.13.
Procedure	a) Master sends the MasterCommand 0x5A (Fallback). b) Upon receipt of a first invalid response message the Master repeats the Master Command 0x5A and stays in communication mode c) Upon receipt of a second invalid response message the Master repeats the MasterCommand 0x5A a second time and stays in communication mode
Input parameter	-
Post condition	-

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TEST CASE RESULTS	CHECK / REACTION
Evaluation	The Line-Monitor follows the communication on the signal line of the Master-Tester. In total, three Master Fallback requests are to be traced. Upon receipt of a third valid response message the Master initiates a restart for the port or stops communicating.
Test passed	If the Master sends three MasterCommands 0x5A (Fallback). See B.13.
Test failed (examples)	a) If the Master does not send two repetitions b) If Master continues communicating without port restart
Results	Master sends three MasterCommands 0x5A (Fallback): <yes/no> <pass/fail>

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8.8.3 Fallback from OPERATE

Table 223 defines the test conditions for this test case.

Table 223 – Fallback from OPERATE

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0215
Name	TCM_DLFB_OPER_OK
Purpose (short)	Test of Master Fallback from OPERATE mode
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.3, 7.3.2.4, Figure 32, Table B.2
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of Master Fallback from OPERATE mode. The Master is in OPERATE communication when it sends the MasterCommand 0x5A (Fallback). Upon receipt of the valid response the Master switches its port to SIO mode "DI".
Precondition	The Master is communicating with the "Device" while in OPERATE mode.
Procedure	a) Master sends the MasterCommand 0x5A (Fallback). b) Upon receipt of a valid response message the Master port is switched to SIO mode "DI". c) The Master-Tester sets signal to logical "1" (high-level)
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Upon receipt of a valid response message the Master stops its communcation at the port (visible on Line-Monitor). b) After a maximum of 500 ms the digital input signal is visible at the target system (Master-Tester) of the Master (logical 1).
Test passed	a) If the Master stops its communication upon receipt of a valid response message and b) If the logical 1 signal is shown correctly on the target system (Master-Tester) within 500 ms after receipt of the valid response message.
Test failed (examples)	a) If the Master does not stop communication upon receipt of a valid response message or b) If the Master stops communication upon receipt of the valid response message and the logical 1 does not appear on the target system (Master_Tester) after 500 ms.
Results	Master stops communication: <yes/no> <pass/fail> DI signal shows logical 1: <yes/no> <pass/fail>

8.8.4 Fallback request from OPERATE fails

Table 224 defines the test conditions for this test case.

Table 224 – Fallback request from OPERATE fails

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0216
Name	TCM_DLFB_OPER_FAILS
Purpose (short)	Test of Master when Fallback request from STARTUP fails
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.3, 7.3.2.4, Figure 32, Table B.2
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of Master when Fallback request from STARTUP fails. The Master is in OPERATE communication and sends the MasterCommand 0x5A (Fallback). Upon receipt of an invalid response the Master shall repeat the Fallback request (Master stays in communication mode). The Master shall start another MasterCommand after the reception of a second invalid response. Upon receipt of the invalid response the Master iniates a port restart or stops communicating.
Precondition	The Master is communicating with the "Device" while in OPERATE mode.
Procedure	a) Master sends the MasterCommand 0x5A (Fallback). b) Upon receipt of a first invalid response message the Master repeats the Master Command 0x5A and stays in communication mode c) Upon receipt of a second invalid response message the Master repeats the MasterCommand 0x5A a second time and stays in communication mode
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The Line-Monitor follows the communication on the signal line of the Master-Tester. In total, three Master Fallback requests are to be traced. Upon receipt of a third valid response message the Master initiates a restart for the port or stops communicating.
Test passed	If the Master sends three MasterCommands 0x5A (Fallback).
Test failed (examples)	a) If the Master does not send two repetitions or b) If Master continues communicating without port restart
Results	Master sends three MasterCommands 0x5A (Fallback): <yes/no> <pass/fail>

8.9 Retry

8.9.1 Master retries after responses with wrong Checksum

Table 225 defines the test conditions for this test case.

Table 225 – Master retries after responses with wrong Checksum

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0217
Name	TCM_DLCC_RTRY_CHCKSUMWRONG
Purpose (short)	Test of Master retry behavior after response with wrong Checksum
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to fail (positive testing)
Specification (clause)	[9] 7.3.3.4, Figure 37, Table 38
Configuration / setup	Master-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test of Master retry behavior after responses with wrong Checksum. Master is in communication. The Master sends a message which is responded with the wrong checksum. The Master resends the message, again the checksum of the response is incorrect or there is no response to the message. The Master repeats the message one more time and receives a valid response from the "Device". The test shall be carried out for the STARTUP, PREOPERATE and OPERATE mode.
Precondition	Master is in communication in the STARTUP, PREOPERATE, or OPERATE mode. Legacy-Master in the STARTUP and OPERATE mode only.
Procedure	a) The Master sends a random message. b) The Master-Tester ("Device") sends response with a wrong checksum. c) The Master resends the same random message. d) The Master-Tester ("Device") responds again with the wrong checksum. e) The Master sends the same message for a third time. f) The Master-Tester ("Device") replies with the correct checksum. g) The test is carried out in STARTUP, PREOPERATE and OPERATE mode.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	The Line-Monitor follows the communication on the signal line of the Master-Tester. In total, three Master messages are to be traced.
Test passed	If the Master sends three Master messages with the same contents.
Test failed (examples)	a) If the Master does not send two repetitions or b) If the Master stops the communication.
Results	STARTUP: Number of identical Master messages: <number> <pass/fail> PREOPERATE: Number of identical Master messages: <number> <pass/fail> OPERATE: Number of identical Master messages: <number> <pass/fail>

8.9.2 Master retries after responses with wrong Checksum and restart/stop

Table 226 defines the test conditions for this test case.

Table 226 – Master retries after responses with wrong Checksum and restart/stop

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0218
Name	TCM_DLCC_RTRY_CHCKSUMWRONGRESTARTSTOP
Purpose (short)	Test of Master retry behavior after response with wrong Checksum and restart/stop
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to fail (positive testing)
Specification (clause)	[9] 7.3.3.4, Figure 37, Table 38
Configuration / setup	Master-Tester, Line-Monitor (optionally)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test of Master retry behavior after responses with wrong Checksum and restart or stop of communication. Master is in communication. The Master sends a message for the first time, which is responded with the wrong checksum. The Master resends the message, again the checksum of the response is incorrect or there is no response to the message. The Master repeats the message one more time and does not receive a valid response from the "Device". The Master thus forces the Device to a restart or a stop of communication. The test shall be carried out for the STARTUP, PREOPERATE and OPERATE mode.
Precondition	Master is in communication in the STARTUP, PREOPERATE, or OPERATE mode. Legacy-Master in the STARTUP and OPERATE mode only.
Procedure	a) The Master sends a random message. b) The Master-Tester ("Device") sends response with a wrong checksum. c) The Master resends the same random message. d) The Master-Tester ("Device") responds again with the wrong checksum. e) The Master sends the same message for a third time. f) The Master-Tester ("Device") replies again with the wrong checksum. g) The test is carried out in STARTUP, PREOPERATE and OPERATE mode.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The Line-Monitor follows the communication on the signal line of the Master-Tester. In total, three Master messages followed by a Wake-up sequence are to be traced.
Test passed	If the Master sends three Master requests with the same contents.
Test failed (examples)	a) If the Master does not send two repetitions, or b) If the Master continues communicating without port restart
Results	STARTUP: Number of Master requests: <number> <pass/fail> STARTUP: Wake-up request or stop of communication: <yes/no> <pass/fail> PREOPERATE: Number of Master requests: <number> <pass/fail> PREOPERATE: Wake-up request or stop of communication: <yes/no> <pass/fail> OPERATE: Number of Master requests: <number> <pass/fail> OPERATE: Wake-up request or stop of communication: <yes/no> <pass/fail>

8.9.3 Master retries after no responses and final correct Checksum

Table 227 defines the test conditions for this test case.

Table 227 – Master retries after no responses and final correct Checksum

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0219
Name	TCM_DLCC_RTRY_NORESPCHCKSUMRIGHT
Purpose (short)	Test Master retry behavior after no responses and final correct Checksum
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.3.4, Figure 37, Table 38
Configuration / setup	Master-Tester

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test Master retry behavior after no responses and final correct Checksum. Master in communication. The Master sends for the first time a message, which is not responded. The Master resends the message and again the checksum is incorrect or there is no response to the message. The Master repeats the request message one last time and receives a valid response from the Device. The test shall be carried out for the STARTUP, PREOPERATE and OPERATE mode.
Precondition	Master is in communication in the STARTUP, PREOPERATE, or OPERATE mode. Legacy-Master in the STARTUP and OPERATE mode only.
Procedure	a) The Master sends a random message. b) The Master-Tester ("Device") does not respond. c) The Master resends the same random message. d) The Master-Tester ("Device") does not respond. e) The Master sends the same message for a third time. f) The Master-Tester ("Device") responds with the correct checksum. g) The test is carried out in STARTUP, PREOPERATE and OPERATE mode.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	The Line-Monitor follows the communication on the signal line of the Master-Tester. In total, three Master messages to the same address are to be traced.
Test passed	If the Master sends three Master request messages with the same content.
Test failed (examples)	a) If the Master does not send two repetitions or b) If the Master stops the communication
Results	STARTUP: Number of Master requests: <number> <pass/fail> PREOPERATE: Number of Master requests: <number> <pass/fail> OPERATE: Number of Master requests: <number> <pass/fail>

2160 8.9.4 Master retries after no responses ending with restart/stop

2161 Table 228 defines the test conditions for this test case.

2162 **Table 228 – Master retries after no responses ending with restart/stop**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0220
Name	TCM_DLCC_RTRY_NORESPRESTARTSTOP
Purpose (short)	Test Master retry behavior after no responses ending with restart
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.3.4, Figure 37, Table 38, 9.3.3.2
Configuration / setup	Master-Tester

2163

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test Master retry behavior after no responses ending with restart or stop of communication. Master is in communication. The Master sends for the first time a message, which is not responded. The Master resends the message and again the checksum is incorrect or there is no response to the message. The Master repeats the request message one last time and receives no response from the "Device". The test shall be carried out for the STARTUP, PREOPERATE and OPERATE mode.
Precondition	Master is in communication in the STARTUP, PREOPERATE, or OPERATE mode. Legacy-Master in the STARTUP and OPERATE mode only.
Procedure	a) The Master sends a random message. b) The Master-Tester ("Device") does not respond. c) The Master resends the same random message. d) The Master-Tester ("Device") does not respond. e) The Master sends the same message for a third time. f) The Master-Tester ("Device") does not respond. g) The test is carried out in STARTUP, PREOPERATE and OPERATE mode.
Input parameter	-
Post condition	-

2164

TEST CASE RESULTS	CHECK / REACTION
Evaluation	The Line-Monitor follows the communication on the signal line of the Master-Tester. In total, three Master messages followed by a Wake-up sequence are to be traced.
Test passed	If the Master sends three Master requests with the same contents.
Test failed (examples)	a) If the Master does not send two repetitions, or b) If the Master continues communicating without port restart
Results	STARTUP: Number of Master requests: <number> <pass/fail> STARTUP: Wake-up request or stop of communication: <yes/no> <pass/fail> PREOPERATE: Number of Master requests: <number> <pass/fail> PREOPERATE: Wake-up request or stop of communication: <yes/no> <pass/fail> OPERATE: Number of Master requests: <number> <pass/fail> OPERATE: Wake-up request or stop of communication: <yes/no> <pass/fail>

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2167 8.9.5 Master with maximum WURQs and final success

2168 Table 229 defines the test conditions for this test case.

2169 **Table 229 – Master with maximum WURQs and final success**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0221
Name	TCM_DLCC_RTRY_MAXWURQSUCCESS
Purpose (short)	Test Master behavior with maximum WURQ sequences and final success
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.4, 7.3.2.2, Figures 28, 29, 30, 32, and 33
Configuration / setup	Master-Tester

2170

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test Master behavior with maximum WURQ sequences and final success. Master is in STARTUP mode. The Master sends for the first time a Wakeup pulse (WURQ) with subsequent communication requests; the "Device" does not respond to the subsequent communication requests. The Master resends the Wakeup pulse (WURQ) with subsequent communication requests and again there is no response from the "Device". The Master repeats for the last time the Wakeup pulse (WURQ) with subsequent communication requests. Finally, the "Device" responds to the communication requests.
Precondition	The Master is in STARTUP mode
Procedure	a) The Master sends a Wakeup pulse (WURQ) with subsequent communication requests. b) The Master-Tester does not respond. c) The Master sends a Wakeup pulse (WURQ) with subsequent communication requests. d) The Master-Tester does not respond. e) The Master sends a third time a Wakeup pulse (WURQ) with subsequent communication requests. f) The Master-Tester responds with the contents of address 0x02 ("MinCycleTime") of the Direct Parameter page 1.
Input parameter	-
Post condition	-

2171

TEST CASE RESULTS	CHECK / REACTION
Evaluation	The Line-Monitor follows the communication on the signal line of the Master-Tester. In total, three Master messages are to be traced followed by a Wake-up sequence and the startup to PREOPERATE.
Test passed	If the Master sends three Wakeup requests that finally result in a communication startup.
Test failed (examples)	a) If the Master does not send two repetitions of the Wake-up requests or b) If the Master stops the communication
Results	Number of Wake-up requests: <number> <pass/fail> Start-up to PREOPERATE: <yes/no> <pass/fail>

2172

2173

8.9.6 Master with maximum WURQs and no final success

Table 230 defines the test conditions for this test case.

Table 230 – Master with maximum WURQs and no final success

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0222
Name	TCM_DLCC_RTRY_MAXWURQNOSUCCESS
Purpose (short)	Test Master behavior with maximum WURQ sequences and no final success
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[9] 7.3.2.4, 7.3.2.2, Figures 28, 29, 30, 32, and 33
Configuration / setup	Master-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Test Master behavior with maximum WURQ sequences and no final success. Master is in STARTUP mode. The Master sends for the first time a Wakeup pulse (WURQ) with subsequent communication requests; the "Device" does not respond to the subsequent communication requests. The Master resends the Wakeup pulse (WURQ) with subsequent communication requests and again there is no response from the "Device". The Master repeats for the last time the Wakeup pulse (WURQ) with subsequent communication requests and again there is no response from the "Device". After a waiting time, the Master restarts the Wake-up requests and the "Device" responds in a correct manner.
Precondition	The Master is in STARTUP mode
Procedure	a) The Master sends a Wakeup pulse (WURQ) with subsequent communication requests. b) The Master-Tester does not respond. c) The Master sends a Wakeup pulse (WURQ) with subsequent communication requests. d) The Master-Tester does not respond. e) The Master sends a third time a Wakeup pulse (WURQ) with subsequent communication requests. f) The Master-Tester does not respond. g) The Master-Tester waits TSD – 3*TDWU. h) The Master sends a Wakeup pulse (WURQ) with subsequent communication requests. i) The Master-Tester responds with the contents of address 0x02 ("MinCycleTime") of the Direct Parameter page 1.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	The Line-Monitor follows the communication on the signal line of the Master-Tester. In total, three Master Wake-up requests are to be traced and a pause of TSD – 3*TDWU followed by another Wake-up sequence and the startup to PREOPERATE.
Test passed	If the Master sent three Wakeup requests followed by a pause TSD – 3*TDWU and another Wake-up sequence and the startup to PREOPERATE.
Test failed (examples)	a) If the Master does not send two repetitions or b) If the Master stops the communication or c) If no Wakeup request follows after a pause TSD – 3*TDWU.
Results	Number of Wake-up requests: <number> <pass/fail> Pause TSD – 3*TDWU: <ms> <pass/fail> Start-up to PREOPERATE: <yes/no> <pass/fail>

8.10 ISDU (Indexed Service Data Unit) – Application ErrorTypes

8.10.1 ISDU Write rejected with ErrorType

Table 231 defines the test conditions for this test case.

Table 231 – ISDU Write rejected with ErrorType

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0223
Name	TCM_ALIC_AERR_WRITEREJECT
Purpose (short)	ISDU Write service rejected with defined ErrorType, no details
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write service rejected with ErrorType, no details. Access to an ISDU service supported by the Master-Tester ("Device") is rejected with an application error without details. The response reports an ErrorType "0x8000" (APP_ERR).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16383 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8000)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.2 ISDU Write to unsupported Index rejected with ErrorType

Table 232 defines the test conditions for this test case.

Table 232 – ISDU Write to unsupported Index rejected with ErrorType

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0224
Name	TCM_ALIC_AERR_WRITEINDEXUNSUPPORTED
Purpose (short)	ISDU Write to unsupported Index rejected with ErrorType
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write to unsupported Index rejected with ErrorType. Access to a non supported Index in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8011" (IDX_NOTAVAIL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 254 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8011)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.3 ISDU Write to unsupported Subindex rejected with ErrorType

Table 233 defines the test conditions for this test case.

Table 233 – ISDU Write to unsupported Subindex rejected with ErrorType

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0225
Name	TCM_ALIC_AERR_WRITESUBINDEXNOTSUPPORTED
Purpose (short)	ISDU Write to unsupported Subindex (>0) rejected with ErrorType
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write to unsupported Subindex (>0) rejected with ErrorType. Access to a non supported Subindex in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8012" (SUBIDX_NOTAVAIL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 253 / 1 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8012)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.4 ISDU Write to temporarily unavailable Index rejected with ErrorType

Table 234 defines the test conditions for this test case.

Table 234 – ISDU Write to temporarily unavailable Index rejected with ErrorType

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0226
Name	TCM_ALIC_AERR_WRITETEMPUNAV
Purpose (short)	ISDU Write to temporarily unavailable Index rejected with ErrorType
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write to temporarily unavailable Index rejected with ErrorType. Access to a temporarily unavailable Index in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8020" (SERV_NOTAVAIL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 252 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8020)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

2210 ### 8.10.5 ISDU Write to temporarily unavailable Index due to local control

2211 Table 235 defines the test conditions for this test case.

2212 **Table 235 – ISDU Write to temporarily unavailable Index due to local control**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0227
Name	TCM_ALIC_AERR_WRITEINDEXTEMPANAVLC
Purpose (short)	ISDU Write to temporarily unavailable Index due to local control
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

2213

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to a temporarily unavailable Index due to local control in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8021" (SERV_NOTAVAIL_LOCCRTL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with <value> to <Index/Subindex> b) Evaluate response code (Error_Type)
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 251 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-

2214

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8021)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

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8.10.6 ISDU Write to temporarily unavailable Index due to Device control

Table 236 defines the test conditions for this test case.

Table 236 – ISDU Write to temporarily unavailable Index due to Device control

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0228
Name	TCM_ALIC_AERR_WRITEINDEXTEMPANAVDC
Purpose (short)	ISDU Write to temporarily unavailable Index due to Device control
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to temporarily unavailable Index due to Device control in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8022" (SERV_NOTAVAIL_DEVCRTL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 250 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8022)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.7 ISDU Write to read-only Index denied

Table 237 defines the test conditions for this test case.

Table 237 – ISDU Write to read-only Index denied

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0229
Name	TCM_ALIC_AERR_WRITEINDEXRO
Purpose (short)	ISDU Write to read-only Index denied
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to read-only Index in the Master-Tester ("Device") is denied with an application error. The response reports an ErrorType "0x8023" (IDX_NOT_WRITEABLE).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 249 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8023)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.8 ISDU Write with invalid Length

Table 238 defines the test conditions for this test case.

Table 238 – ISDU Write with invalid Length

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0230
Name	TCM_ALIC_AERR_WRITEINVALIDLEN
Purpose (short)	ISDU Write with invalid Length
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access with too short data length to an Index in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8034" (VAL_LENUNDRUN).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with <value> to <Index/Subindex> (length = correct length – 1 octet)
Input parameter	<value> = 0x00, 0x01, 0x02 (3 octets), <Index/Subindex> = 248 / 0 (Index 248 expects 4 octets) Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8034)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.9 ISDU Write with parameter value out of range

Table 239 defines the test conditions for this test case.

Table 239 – ISDU Write with parameter value out of range

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0231
Name	TCM_ALIC_AERR_WRITEPARAMOUTOFRNG
Purpose (short)	ISDU Write with parameter value out of range
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access with parameter values out of range to an Index in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8030" (PAR_VALOUTOFRNG).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> out of range to <Index/Subindex>
Input parameter	<value> = 0xFF, 0xFF (2 octets), <Index/Subindex> = 16382/ 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8030)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.10 ISDU Write with parameter value above limit

Table 240 defines the test conditions for this test case.

Table 240 – ISDU Write with parameter value above limit

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0232
Name	TCM_ALIC_AERR_WRITEPARAMABOVELIMIT
Purpose (short)	ISDU Write with parameter value above limit
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access with parameter values above limit to an Index in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8031" (PAR_VALGTLIM).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> above limit to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16381/ 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8031)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.11 ISDU Write with parameter value below limit

Table 241 defines the test conditions for this test case.

Table 241 – ISDU Write with parameter value below limit

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0233
Name	TCM_ALIC_AERR_WRITEPARAMBELOWLIMIT
Purpose (short)	ISDU Write with parameter value below limit
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access with parameter values below limit to an Index in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8032" (PAR_VALLTLIM).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> below limit to <Index/Subindex>
Input parameter	<value> = 0xFF (one octet), <Index/Subindex> = 16380 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8032)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.12 ISDU Write with invalid parameter set

Table 242 defines the test conditions for this test case.

Table 242 – ISDU Write with invalid parameter set

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0234
Name	TCM_ALIC_AERR_WRITEPARAMINVALID
Purpose (short)	ISDU Write with invalid parameter set
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access with invalid parameter values to an Index in the Master-Tester ("Device") is rejected with an application error. For example, lower threshold value is above upper threshold value. The response reports an ErrorType "0x8040" (PAR_SETINVALID).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with invalid parameter <value> to <Index/Subindex>
Input parameter	<value> = 0xFF, 0xFF (2 octets), <Index/Subindex> = 16379 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8040)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.13 ISDU Write while Device application fault

Table 243 defines the test conditions for this test case.

Table 243 – ISDU Write while Device application fault

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0235
Name	TCM_ALIC_AERR_WRITEDEVICEAPPFAULT
Purpose (short)	ISDU Write while Device application fault
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device"), whose technology specific application is not performing, is rejected with an application error. The response reports an ErrorType "0x8082" (APP_DEVNOTRDY).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with invalid parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16378 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8082)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.14 ISDU Write while Device application not ready

Table 244 defines the test conditions for this test case.

Table 244 – ISDU Write while Device application not ready

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0236
Name	TCM_ALIC_AERR_WRITEDEVICEAPPNOTREADY
Purpose (short)	ISDU Write while Device application not ready
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device"), whose technology specific application is not ready to perform, is rejected with an application error. The response reports an ErrorType "0x8082" (APP_DEVNOTRDY).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with invalid parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16377 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8082)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.15 ISDU Write to reserved Indices

Table 245 defines the test conditions for this test case.

Table 245 – ISDU Write to reserved Indices

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0237
Name	TCM_ALIC_AERR_WRITERESERVEDINDEX
Purpose (short)	ISDU Write to reserved Indices
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Table B.7, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to a reserved Index in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8011" (IDX_NOTAVAIL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with invalid parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 65535 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually. Hint: Depending on the individual fieldbus integration, other reserved Indices shall be chosen, which are not conflicting.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8011)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.10.16 ISDU Write to reserved Indices and no ISDU (V1.0)

Table 246 defines the test conditions for this test case.

Table 246 – ISDU Write to reserved Indices and no ISDU (V1.0)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0238
Name	TCM_ALIC_AERR_WRITERESERVEDINDEXNOISDU
Purpose (short)	ISDU Write to reserved Indices and unavailable ISDU is rejected with ErrorType.
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access to a reserved Index and unavailable ISDU in the Master-Tester ("Device") is rejected with an application error. The response reports an ErrorType "0x8011" (IDX_NOTAVAIL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") is set to SDCI V1.0 d) Master-Tester ("Device") does not support ISDU
Procedure	Write access with parameter <value> to reserved <Index/Subindex> and no ISDU
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x8011 or 0x5700)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.11 ISDU (Indexed Service Data Unit) – Derived ErrorTypes

8.11.1 ISDU Write response without busy indication

Table 247 defines the test conditions for this test case.

Table 247 – ISDU Write response without busy indication

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0239
Name	TCM_ALIC_DERR_WRITENOBUSY
Purpose (short)	ISDU Write response without "Device busy" bit indication reports Derived ErrorType.
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device") without indicating the "Device busy" bit in the ISDU Service/Length octet. The "Device" aborts the ISDU access and responds with "No Service". The response reports the derived ErrorType "0x1000" (COM_ERR).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16376 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x1000)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.11.2 ISDU Write response with timeout after busy indication

Table 248 defines the test conditions for this test case.

Table 248 – ISDU Write response with timeout after busy indication

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0240
Name	TCM_ALIC_DERR_WRITEAFTERBUSYTIMEOUT
Purpose (short)	ISDU Write response with timeout after busy indication reports Derived ErrorType
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] 10.7.6, Table 91, A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device"), which does not generate a response after an adequate time for the ISDU acknowledgement and despite indicating the "Device busy" bit in the ISDU Service/Length octet, is responded with an application error. The response reports a derived ErrorType "0x1000" (COM_ERR).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16376 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	a) Legacy-Master: ErrorType = 0x1000 b) Master: ErrorType = 0x1100
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.11.3 ISDU Write response with illegal service code

Table 249 defines the test conditions for this test case.

Table 249 – ISDU Write response with illegal service code

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0241
Name	TCM_ALIC_DERR_ILLSERVICECODE
Purpose (short)	ISDU Write response with illegal service code reports Derived ErrorType
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device") generating a response with wrong service code, is responded with an application error. The response reports a derived ErrorType "0x5700" (M_ISDU_ILLEGAL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16374 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x5700)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.11.4 ISDU Write response with wrong checksum (CHKPDU)

Table 250 defines the test conditions for this test case.

Table 250 – ISDU Write response with wrong checksum (CHKPDU)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0242
Name	TCM_ALIC_DERR_WRONGCHECKSUM
Purpose (short)	ISDU Write response with wrong checksum (CHKPDU) reports Derived ErrorType.
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device") generating a response with wrong CHKPDU, is responded with an application error. The response reports a derived ErrorType "0x5600" (M_ISDU_CHECKSUM).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16373 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x5600)
Test failed (examples)	Error not identified or unspecific error message
Results	Response: <none/ErrorType> <pass/fail>

8.11.5 ISDU Write response with reserved data length

Table 251 defines the test conditions for this test case.

Table 251 – ISDU Write response with reserved data length

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0244
Name	TCM_ALIC_DERR_WRITERESERVEDDL
Purpose (short)	ISDU Write response with reserved data length reports Derived ErrorType
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device") is responded with "reserved data length" and results in an application error. The response reports a derived ErrorType "0x1000" (COM_ERR) or 0x5700 (M_ISDU_ILLEGAL).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	a) Write access with parameter <value> to <Index/Subindex>. Response uses reserved data lengths, for example 0 and 1 with extended length (0, 16, 239, or 255) b) Checksum of the responses shall be always correct to avoid other ErrorTypes
Input parameter	<Index/Subindex> = 16372 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response and corresponding error message.
Test passed	Error identified (ErrorType 0x1000 or 0x5700) for all reserved data lengths
Test failed (examples)	Error not identified or unspecific error message for any of the reserved data lengths
Results	For all reserved data lengths: Response: <none/ErrorType> <pass/fail>

8.12 ISDU (Indexed Service Data Unit) – Limit checks

8.12.1 ISDU Read response without data

Table 252 defines the test conditions for this test case.

Table 252 – ISDU Read response without data

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0243
Name	TCM_ALIC_DERR_READNODATA
Purpose (short)	ISDU Read response without data reports no Derived ErrorType
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Read access to an Index in the Master-Tester ("Device") generating a positive response without data, is responded without error.
Precondition	a) Master is in SDCI communication mode b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Read access to <Index/Subindex>
Input parameter	<Index/Subindex> = 16372 / 0 Error codes shown on the fieldbus level may differ from the Device's ErrorType due to individual fieldbus mapping strategies. Test person shall enter the expected error code manually.
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response.
Test passed	Response delivers no data and returns without errors
Test failed (examples)	Error identified or unspecific error message
Results	Response with no data: <no error/ErrorType> <pass/fail>

8.12.2 ISDU Write with minimum data length (0 octets)

Table 253 defines the test conditions for this test case.

Table 253 – ISDU Write with minimum data length (0 octets)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0245
Name	TCM_ALIC_LIMT_WRITEMINDATALENGTH
Purpose (short)	ISDU Write with minimum data length (0 octet)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device") using the minimum data of 0 octets. The response shall be positive.
Precondition	a) Master is in SDCI communication mode b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = no data, <Index/Subindex> = 16000 / 0
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response.
Test passed	Service is carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	Response: <ok/ErrorType> <pass/fail>

8.12.3 ISDU Write with maximum service length (238 octets)

Table 254 defines the test conditions for this test case.

Table 254 – ISDU Write with maximum service length (238 octets)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0246
Name	TCM_ALIC_LIMT_WRITEMAXDATALENGTH
Purpose (short)	ISDU Write with maximum service length (238 octets)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to an Index in the Master-Tester ("Device") using the maximum service length of 238 octets. The response shall be positive.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00, 0x01 to 0xE7 (232 octets user data), <Index/Subindex> = 16001 / 0
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response or corresponding error message.
Test passed	Service is carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	Response: <ok/ErrorType> <pass/fail>

8.12.4 ISDU Read with maximum service length (238 octets)

Table 255 defines the test conditions for this test case.

Table 255 – ISDU Read with maximum service length (238 octets)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0248
Name	TCM_ALIC_LIMT_READMAXDATALENGTH
Purpose (short)	ISDU Read with maximum service length (238 octets)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Read access to an Index in the Master-Tester ("Device") using the minimum service length of 238 octets. The response shall be positive.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Read access to <Index/Subindex>
Input parameter	<Index/Subindex> = 16003 / 0
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response or corresponding error message.
Test passed	Service is carried out successfully: Expected : <value> = 0x01, 0x02 to 0xE8 (232 octets user data)
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	Response: <ok/ErrorType> <pass/fail>

2359 ### 8.12.5 ISDU Write to 8 bit Index and no Subindex

2360 Table 256 defines the test conditions for this test case.

2361 **Table 256 – ISDU Write to 8 bit Index and no Subindex**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0249
Name	TCM_ALIC_LIMT_WRITEINDEX8NOSUBINDEX
Purpose (short)	ISDU Write to 8 bit Index and no Subindex
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

2362

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to an 8 bit Index in the Master-Tester ("Device"). The response shall be positive.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 255 / 0
Post condition	-

2363

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response or corresponding error message.
Test passed	Service is carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	Response: <ok/ErrorType> <pass/fail>

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8.12.6 ISDU Write to 8 bit Index and 8 bit Subindex

Table 257 defines the test conditions for this test case.

Table 257 – ISDU Write to 8 bit Index and 8 bit Subindex

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0250
Name	TCM_ALIC_LIMT_WRITEINDEX8SUBINDEX8
Purpose (short)	ISDU Write to 8 bit Index and 8 bit Subindex
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access to an 8 bit Index and 8 bit Subindex in the Master-Tester ("Device"). The response shall be positive.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 255 / 255
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response or corresponding error message.
Test passed	Service is carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	Response: <ok/ErrorType> <pass/fail>

8.12.7 ISDU Write to 16 bit Index and 8 bit Subindex

Table 258 defines the test conditions for this test case.

Table 258 – ISDU Write to 16 bit Index and 8 bit Subindex

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0251
Name	TCM_ALIC_LIMT_WRITEINDEX16SUBINDEX8
Purpose (short)	ISDU Write to 16 bit Index and 8 bit Subindex
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to a 16 bit Index and 8 bit Subindex in the Master-Tester ("Device"). The response shall be positive.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 16004 / 1
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response or corresponding error message.
Test passed	Service is carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	Response: <ok/ErrorType> <pass/fail>

8.12.8 ISDU Write response without busy bit

Table 259 defines the test conditions for this test case.

Table 259 – ISDU Write response without busy bit

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0252
Name	TCM_ALIC_LIMT_IMMEDIATERESPNOBUSY
Purpose (short)	ISDU Write response without busy bit (immediate response)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, A.5.4, Table A.15, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to an 8 bit Index and 8 bit Subindex in the Master-Tester ("Device"). Master-Tester ("Device") generates an immediate response to the request without setting the "Device busy" bit.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 255 / 1
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response or corresponding error message.
Test passed	Service is carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	Response: <ok/ErrorType> <pass/fail>

8.12.9 ISDU Write response with busy bit

Table 260 defines the test conditions for this test case.

Table 260 – ISDU Write response with busy bit

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0253
Name	TCM_ALIC_LIMT_IMMEDIATERESPWITHBUSY
Purpose (short)	ISDU Write response after setting the busy bit
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, A.5.4, Table A.15, Annex C
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	ISDU Write access to an 8 bit Index and 8 bit Subindex in the Master-Tester ("Device"). Master-Tester ("Device") generates a response to the request setting the "Device busy" bit.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to <Index/Subindex>
Input parameter	<value> = 0x00 (one octet), <Index/Subindex> = 255 / 2
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check response or corresponding error message.
Test passed	Service is carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	Response: <ok/ErrorType> <pass/fail>

8.12.10 ISDU Write with maximum service Length (15 octets)

Table 261 defines the test conditions for this test case.

Table 261 – ISDU Write with maximum service Length (15 octets)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0254
Name	TCM_ALIC_LIMT_WRITEMAXSERVICELEN15
Purpose (short)	ISDU service (with maximum service length 15) is carried out.
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to several Index and Subindex combinations in the Master-Tester ("Device"). Master-Tester ("Device") with maximum service length 15. The response shall be positive.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to a) 8 bit Index and no Subindex, and Length = 15 b) 8 bit Index and 8 bit Subindex, and Length = 15 c) 16 bit Index and 8 bit Subindex, and Length = 15
Input parameter	a) <value> = 0x01, 0x02 to 0x0C (12 octets), <Index/Subindex> = 100 / 0 b) <value> = 0x01, 0x02 to 0x0B (11 octets), <Index/Subindex> = 100 / 1 c) <value> = 0x01, 0x02 to 0x0A (10 octets), <Index/Subindex> = 16005 / 1
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response or corresponding error message.
Test passed	Services are carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	For each combination: Response: <ok/ErrorType> <pass/fail>

8.12.11 ISDU Write with minimum service Extended Length (17)

Table 262 defines the test conditions for this test case.

Table 262 – ISDU Write with minimum service Extended Length (17)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0255
Name	TCM_ALIC_LIMT_WRITEMINSERVICEEXTLEN17
Purpose (short)	ISDU service (with minimum Extended Length 17) is carried out.
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 8.2.4.1.2; [9] A.5.2, Annex C
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	ISDU Write access to several Index and Subindex combinations in the Master-Tester ("Device"). Master-Tester ("Device") with minimum Extended Length 17. The response shall be positive.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Master-Tester ("Device") supports ISDU
Procedure	Write access with parameter <value> to a) 8 bit Index, no Subindex, and Length = 1, Extended Length = 17 b) 8 bit Index, 8 bit Subindex, and Length = 1, Extended Length = 17 c) 16 bit Index and 8 bit Subindex, and Length = 1, Extended Length = 17
Input parameter	a) <value> = 0x01, 0x02 to 0x0D (13 octets), <Index/Subindex> = 100 / 0 b) <value> = 0x01, 0x02 to 0x0C (12 octets), <Index/Subindex> = 100 / 1 c) <value> = 0x01, 0x02 to 0x0B (11 octets), <Index/Subindex> = 16005 / 1
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check response or corresponding error message
Test passed	Services are carried out successfully
Test failed (examples)	a) Service is not carried out successfully, or b) Unspecific error message
Results	For each combination: Response: <ok/ErrorType> <pass/fail>

8.13 Events

8.13.1 General

The Event propagation to the upper level system, for example a fieldbus, is not subject matter of this document. This behavior shall be defined in the corresponding "upper level systems integration" specification. Thus, there is no immediate Event acknowledgement of the Master as with the Legacy-Master. Therefore the timeout for waiting on the acknowledgement shall be adjustable in the Master-Tester.

8.13.2 Master receives Event without details (notification)

Table 263 defines the test conditions for this test case.

Table 263 – Master receives Event without details (notification)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0256
Name	TCM_ALIC_EVNT_NODETAILSNOTIFY
Purpose (short)	Master receives Event (notification) without details (notification)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex D
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master receives Event without details (StatusCode type 1, notification). Master extracts the EventCode (type 1), converts it accordingly into StatusCode (type 2) and transfers it to the upper level system. Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag.
Precondition	a) Master is in SDCI communication mode b) Master-Tester ("Device") in OPERATE
Procedure	a) Master-Tester ("Device") is prompted to prepare an Event message with Status Code type 1: all bits = 0, except bit 0 = "1". b) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). c) Master performs Event handling d) Master acknowledges the Event by writing back the (Event) StatusCode
Input parameter	Notification
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0xFF80 and EventQualifier = 0x54). b) Master acknowledges by writing to the StatusCode b) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

8.13.3 Master receives Event without details (Warning)

Table 264 defines the test conditions for this test case.

Table 264 – Master receives Event without details (Warning)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0257
Name	TCM_ALIC_EVNT_NODETAILSWARNING
Purpose (short)	Master receives Event without details (Warning)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex D
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master receives Event without details (StatusCode type 1, warning). Master extracts the EventCode (type 1), converts it accordingly into StatusCode (type 2) and transfers it to the upper level system. Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE
Procedure	a) Master-Tester ("Device") is prompted to prepare an Event message with Status Code type 1: all bits = 0, except bit 1 = "1". b) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). c) Master performs Event handling d) Master acknowledges the Event by writing back the (Event) StatusCode
Input parameter	Warning
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0xFF80 and EventQualifier = 0x64). b) Master acknowledges by writing to the StatusCode b) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

8.13.4 Master receives Event without details (Error)

Table 265 defines the test conditions for this test case.

Table 265 – Master receives Event without details (Error)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0258
Name	TCM_ALIC_EVNT_NODETAILSERROR
Purpose (short)	Master receives Event without details (Error)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex D
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master receives Event without details (StatusCode type 1, error). Master extracts the EventCode (type 1), converts it accordingly into StatusCode (type 2) and transfers it to the upper level system. Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE
Procedure	a) Master-Tester ("Device") is prompted to prepare an Event message with Status Code type 1: all bits = 0, except bit 3 = "1". b) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). c) Master performs Event handling d) Master acknowledges the Event by writing back the (Event) StatusCode
Input parameter	Error
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0xFF80 and EventQualifier = 0x74). b) Master acknowledges by writing to the StatusCode b) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

8.13.5 Master receives Event without details (parameter error)

Table 266 defines the test conditions for this test case.

Table 266 – Master receives Event without details (parameter error)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0259
Name	TCM_ALIC_EVNT_NODETAILSPARAMERROR
Purpose (short)	Master receives Event without details (parameter error)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex D
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master receives Event without details (StatusCode type 1, parameter error). Master extracts the EventCode (type 1), converts it accordingly into StatusCode (type 2) and transfers it to the upper level system. Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE
Procedure	a) Master-Tester ("Device") is prompted to prepare an Event message with Status Code type 1: all bits = 0, except bit 2 = "1". b) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). c) Master performs Event handling d) Master acknowledges the Event by writing back the (Event) StatusCode
Input parameter	Parameter error
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x6320 and EventQualifier = 0x74). b) Master acknowledges by writing to the StatusCode b) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

8.13.6 Master receives event without details (communication error)

Table 267 defines the test conditions for this test case.

Table 267 – Master receives event without details (communication error)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0260
Name	TCM_ALIC_EVNT_NODETAILSCOMMERROR
Purpose (short)	Master receives event without details (communication error)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex D
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master receives Event without details (StatusCode type 1, communication error). Master extracts the EventCode (type 1), converts it accordingly into StatusCode (type 2) and transfers it to the upper level system. Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag. This is an interoperability test for legacy Devices (V1.0).
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE
Procedure	a) Master-Tester ("Device") is prompted to prepare an Event message with Status Code type 1: all bits = 0, except bit 4 = "1". b) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). c) Master performs Event handling d) Master acknowledges the Event by writing back the (Event) StatusCode
Input parameter	Communication error
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0xFF10 and EventQualifier = 0x74). b) Master acknowledges by writing to the StatusCode b) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

8.13.7 Master receives event with details (single event)

Table 268 defines the test conditions for this test case.

Table 268 – Master receives event with details (single event)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0261
Name	TCM_ALIC_EVNT_WITHDETAILSSINGLEEVENT
Purpose (short)	Master receives event with details (single event)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex D
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master receives Event with details (StatusCode type 2). Master transfers the EventCode and EventQuaifier to the upper level system. Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Events are numbered from n = 1 to n = 6. d) "Activated Events" addresses are numbered from m = 0 to m = 5.
Procedure	a) Master-Tester ("Device") is prompted to prepare an Event n with EventCode = 0x1000 and EventQualifier = 0xF4. b) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). c) Master performs Event handling d) Master acknowledges the Event by writing back the (Event) StatusCode.
Input parameter	Single Event (type2; "General malfunction")
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x1000 and EventQualifier = 0xF4). b) Master acknowledges by writing to the StatusCode b) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to the upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	a) If Event code 0x1000, or b) If EventQualifier 0xF4 did not reach the upper level system, or c) If Event flag in Master-Tester ("Device") is not acknowledged.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

2457 ### 8.13.8 Master receives event with details (double event)

2458 Table 269 defines the test conditions for this test case.

2459 **Table 269 – Master receives event with details (double event)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0262
Name	TCM_ALIC_EVNT_WITHDETAILSDOUBLEEVENT
Purpose (short)	Master receives event with details (double event)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex D
Configuration / setup	Master-Tester ("Device")

2460

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master receives Event with details (StatusCode type 2). Master transfers it to the upper level system. Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag. This procedure can be carried out for different Events in the Event buffer. These Events are numbered with "n".
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Events are numbered from n = 1 to n = 6. d) "Activated Events" addresses are numbered from m = 0 to m = 5. e) Event buffer address assignment with y and z, where $y,z \in n$, $y \neq z$
Procedure	a) Master-Tester ("Device") is prompted to prepare two Events: - Event a with EventCode = 0x1000 and EventQualifier = 0xF4 - Event b with EventCode = 0x4000 and EventQualifier = 0xE4 b) It puts Event a to address n = y c) It puts Event b to address z. d) It sets bit 7 of the StatusCode to "1". e) It sets bit "m = y-1" of the StatusCode to 1. f) It sets bit "m = z-1" of the StatusCode to 1. g) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). h) Master performs Event handling i) Master acknowledges the Event by writing back the (Event) StatusCode.
Input parameter	Loop 1: Ev1: 0x1000 / 0xF4, Ev6: 0x4000 / 0xE4 Loop 2: Ev2: 0x1000 / 0xF4, Ev5: 0x4000 / 0xE4 Loop 3: Ev3: 0x1000 / 0xF4, Ev4: 0x4000 / 0xE4 Loop 4: Ev4: 0x1000 / 0xF4, Ev3: 0x4000 / 0xE4 Loop 5: Ev5: 0x1000 / 0xF4, Ev2: 0x4000 / 0xE4 Loop 6: Ev6: 0x1000 / 0xF4, Ev1: 0x4000 / 0xE4
Post condition	-

2461

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Master propagates the Event a to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x1000 and EventQualifier = 0xF4). a) Check whether Master propagates the Event b to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x4000 and EventQualifier = 0xE4). b) Master acknowledges by writing to the StatusCode b) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event a and Event b to the upper level system b) If Master acknowledges the Events c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	a) Event a with EventCode 0x1000, or b) EventQualifier 0xF4 did not reach the upper level system, or c) Event b with Eventcode 0x4000, or d) EventQualifier 0xE4 did not reach the upper level system, or

TEST CASE RESULTS	CHECK / REACTION
	e) If Event flag in Master-Tester ("Device") is not acknowledged.
Results	Event a: Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail> Event b: Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

2464 ### 8.13.9 Master receives event with details (six events)

2465 Table 270 defines the test conditions for this test case.

2466 **Table 270 – Master receives event with details (six events)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0263
Name	TCM_ALIC_EVNT_WITHDETAILSSIXEVENTS
Purpose (short)	Master receives event with details (six events)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6
Configuration / setup	Master-Tester ("Device")

2467

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master receives Event with details (StatusCode type 2). Master transfers it to the upper level system. Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag. This procedure can be carried out for different Events in the Event buffer. These Events are numbered with "n".
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Events are numbered from a to f d) "Activated Events" addresses are numbered from m = 0 to m = 5.
Procedure	a) Master-Tester ("Device") is prompted to generate six Events: - Event a with Eventcode = 0x1000 and EventQualifier = 0xF4 - Event b with Eventcode = 0x4000 and EventQualifier = 0xE4 - Event c with Eventcode = 0x5000 and EventQualifier = 0xD4 - Event d with Eventcode = 0x5500 and EventQualifier = 0xB4 - Event e with Eventcode = 0x6000 and EventQualifier = 0xA4 - Event f with Eventcode = 0x8000 and EventQualifier = 0x94 b) Master-Tester ("Device") puts Events into the Event buffer: - Event a to address n = 1 - Event b to address n = 2 - Event c to address n = 3 - Event d to address n = 4 - Event e to address n = 5 - Event f to address n= 6 d) Master-Tester ("Device") sets bit 7 of the StatusCode to "1" (= with details). e) Master-Tester ("Device") sets bits in m = 0 to 5 to "1" ("Activated Events") g) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). h) Master performs Event handling i) Master acknowledges the Event by writing back the (Event) StatusCode.
Input parameter	Six Events
Post condition	-

2468

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Master propagates the Event a through f to the uppper level system in an appropriate form (matching semantics or syntax of EventCode and EventQualifier, see procedure step a). b) Master acknowledges by writing to the StatusCode. b) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Evaluation a) is positive b) If Master acknowledges the Events c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	a) Events a through f did not reach the upper level system, or b) If Event flag in Master-Tester ("Device") is not acknowledged.
Results	Event a: Propagated information to the upper level system: <code> <pass/fail>

TEST CASE RESULTS	**CHECK / REACTION**	
	Master acknowledgement: <code> Event flag: <0/1> Event b: Propagated information to the upper level system: <code> Master acknowledgement: <code> Event flag: <0/1> Event c: Propagated information to the upper level system: <code> Master acknowledgement: <code> Event flag: <0/1> Event d: Propagated information to the upper level system: <code> Master acknowledgement: <code> Event flag: <0/1> Event e: Propagated information to the upper level system: <code> Master acknowledgement: <code> Event flag: <0/1> Event f: Propagated information to the upper level system: <code> Master acknowledgement: <code> Event flag: <0/1>	<pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail> <pass/fail>

2471 8.13.10 Master receives Event while in ISDU Write transfer (stopover)

2472 Table 271 defines the test conditions for this test case.

2473 **Table 271 – Master receives Event while in ISDU Write transfer (stopover)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0264
Name	TCM_ALIC_EVNT_WRITEISDUWITH EVENT
Purpose (short)	Master receives one Event while in ISDU transfer (stopover; no details)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex I
Configuration / setup	Master-Tester ("Device")

2474

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master receives one Event while in ISDU Write transfer (stopover; no details). The Event flag shall be set during transfer of an ISDU. The Master interrupts the ISDU and retrieves the Event content. After Event handling, the ISDU transfer shall be continued.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE
Procedure	a) Master starts writing an ISDU with 64 octets long ASCII string: "0123456789abc-defghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ+-" to Index 0x0018 b) Master-Tester ("Device") generates an Event during transmission of the ISDU. c) Master-Tester ("Device") is prompted to prepare an Event message with Status Code type 1: all bits = 0, except bit 2 = "1" (parameter error). d) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). e) Master performs Event handling f) Master resumes transfer of the ISDU d) Master acknowledges the Event by writing back the (Event) StatusCode
Input parameter	ASCII string for the ISDU; Event "Parameter error"
Post condition	-

2475

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x6320 and EventQualifier = 0x74). b) Master acknowledges by writing to the StatusCode c) Event flag shall be reset by the Master-Tester ("Device"). d) ISDU transfer shall be completed The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0") d) Index 0x0018 within the Master-Tester ("Device") contains the complete ASCII string
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail> Index 0x0018: <content> <pass/fail>

2476

2477

8.13.11 Master receives Event while in ISDU Read transfer (stopover)

Table 272 defines the test conditions for this test case.

Table 272 – Master receives Event while in ISDU Read transfer (stopover)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0265
Name	TCM_ALIC_EVNT_READISDUWITH EVENT
Purpose (short)	Master receives event while in ISDU Read transfer (stopover; no details)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master receives one Event while in ISDU Read transfer (stopover; no details). The Event flag shall be set during transfer of an ISDU. The Master interrupts the ISDU and retrieves the Event content. After Event handling, the ISDU transfer shall be continued.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE
Procedure	a) Master starts a Read ISDU from Index 0x0013. Content is the ProductID: "IO-Link Golden Device V1.0 test case ISDU_Stopover" b) Master-Tester ("Device") generates an Event during transmission of the ISDU. c) Master-Tester ("Device") is prompted to prepare an Event message with Status Code type 1: all bits = 0, except bit 2 = "1" (parameter error). d) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). e) Master performs Event handling f) Master resumes transfer of the ISDU d) Master acknowledges the Event by writing back the (Event) StatusCode
Input parameter	ProductID for the ISDU; Event "Parameter error"
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x6320 and EventQualifier = 0x74). b) Master acknowledges by writing to the StatusCode c) Event flag shall be reset by the Master-Tester ("Device"). d) ISDU transfer shall be completed The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0") d) Complete ProductID out of Index 0x0013 transferred to the upper level system
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail> Transfer from Index 0x0013: <ProductID> <pass/fail>

8.13.12 Master receives Event details while in ISDU Write transfer (stopover)

Table 273 defines the test conditions for this test case.

Table 273 – Master receives Event details while in ISDU Write transfer (stopover)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0266
Name	TCM_ALIC_EVNT_WRITEISDUWITH EVENTDETAILS
Purpose (short)	Master receives event while in ISDU Write transfer (stopover; with details)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master receives Event while in ISDU Write transfer (stopover; with details). The Event flag shall be set during transfer of an ISDU. The Master interrupts the ISDU and retrieves the Event content. After Event handling, the ISDU transfer shall be continued.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE
Procedure	a) Master starts writing an ISDU with 64 octets long ASCII string: "0123456789abc-defghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ+-" to Index 0x0018 b) During ISDU transfer the Master-Tester ("Device") is prompted to prepare an Event n = 1with EventCode = 0x1000 and EventQualifier = 0xF4. c) Master-Tester ("Device") sets bit 7 of the StatusCode to "1" (= with details). d) Master-Tester ("Device") sets bit in m = 0 to "1" ("Activated Events") e) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). f) Master performs Event handling g) Master resumes transfer of the ISDU h) Master acknowledges the Event by writing back the (Event) StatusCode.
Input parameter	ASCII string for the ISDU; Single Event (type2; "General malfunction")
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x1000 and EventQualifier = 0xF4). b) Master acknowledges by writing to the StatusCode c) Event flag shall be reset by the Master-Tester ("Device"). d) ISDU transfer shall be completed The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0") d) Index 0x0018 within the Master-Tester ("Device") contains the complete ASCII string
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail> Index 0x0018: <content> <pass/fail>

8.13.13 Master receives Event details while in ISDU Read transfer (stopover)

Table 274 defines the test conditions for this test case.

Table 274 – Master receives Event details while in ISDU Read transfer (stopover)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0267
Name	TCM_ALIC_EVNT_READISDUWITH EVENTDETAILS
Purpose (short)	Master receives event while in ISDU Read transfer (stopover; with details)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master receives one Event while in ISDU Read transfer (stopover; with details). The Event flag shall be set during transfer of an ISDU. The Master interrupts the ISDU and retrieves the Event content. After Event handling, the ISDU transfer shall be continued.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE
Procedure	a) Master starts a Read ISDU from Index 0x0013. Content is the ProductID: "IO-Link Golden Device V1.0 test case ISDU_Stopover" b) During ISDU transfer the Master-Tester ("Device") is prompted to prepare an Event n = 1 with EventCode = 0x1000 and EventQualifier = 0xF4. c) Master-Tester ("Device") sets bit 7 of the StatusCode to "1" (= with details). d) Master-Tester ("Device") sets bit in m = 0 to "1" ("Activated Events") e) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). f) Master performs Event handling g) Master resumes transfer of the ISDU h) Master acknowledges the Event by writing back the (Event) StatusCode.
Input parameter	ProductID for the ISDU; Single Event (type2; "General malfunction")
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x1000 and EventQualifier = 0xF4). b) Master acknowledges by writing to the StatusCode c) Event flag shall be reset by the Master-Tester ("Device"). d) ISDU transfer shall be completed The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0") d) Complete ProductID out of Index 0x0013 transferred to the upper level system
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail> Transfer from Index 0x0013: <ProductID> <pass/fail>

8.13.14 Master receives one selected Event from Device Event buffer

Table 275 defines the test conditions for this test case. This test case is for information only. It can not be performed due to missing features in the fieldbus integration specifications.

Table 275 – Master receives one selected Event from Device Event buffer

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0268
Name	TCM_ALIC_EVNT_ONEEVENTFROMBUFFER
Purpose (short)	Master receives one selected Event from Device Event buffer (with details)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master receives one selected Event from the Master-Tester ("Device") Event buffer (with details). Master transfers it to the upper level system. Master acknowledges the Events; the Master-Tester ("Device") resets the Event flag. This procedure can be carried out for different Events in the Event buffer. These Events are numbered with "n".
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Events are numbered from n = 1 to n = 6. d) "Activated Events" addresses are numbered from m = 0 to m = 5.
Procedure	a) Master-Tester ("Device") is prompted to generate an: - Event a with Eventcode = 0x1000 and EventQualifier = 0xF4 b) Master-Tester ("Device") puts Event into the Event buffer: - Event a to address n d) Master-Tester ("Device") sets bit 7 of the StatusCode to "1" (= with details). e) Master-Tester ("Device") sets bit in m = n-1 to "1" ("Activated Events") g) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). h) Master performs Event handling i) Master acknowledges the Event by writing back the (Event) StatusCode after an acknowledgement of the upper level system.
Input parameter	Event (type2; "General malfunction")
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x1000 and EventQualifier = 0xF4). b) Master acknowledges by writing to the StatusCode c) Event flag shall be reset by the Master-Tester ("Device") after an acknowledge ment of the upper level system. d) After the aknowledgement, the Master-Tester ("Device") can activate the next Event in the Event buffer (only 1 Event at a time). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

8.13.15 Master receives several selected Events from Device Event buffer

Table 276 defines the test conditions for this test case. This test case is for information only. It can not be performed due to missing features in the fieldbus integration specifications.

Table 276 – Master receives several selected Events from Device Event buffer

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0269
Name	TCM_ALIC_EVNT_MULTIPLEEVENTSFROMBUFFER
Purpose (short)	Master receives several selected Events from Device Event buffer (with details)
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.2.1; [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6
Configuration / setup	Master-Tester ("Device"), Device (according V1.1)

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master receives several selected Events from Master-Tester ("Device") Event buffer (with details). Master transfers them one at a time to the upper level system. Master acknowledges the Events; the Master-Tester ("Device") resets the Event flag. This procedure can be carried out for different Events in the Event buffer. These Events are numbered with "n".
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) Events are numbered from n = 1 to n = 6. d) "Activated Events" addresses are numbered from m = 0 to m = 5. e) Event buffer address assignment with y and z, where y,z $\in$ n, y $\neq$ z
Procedure	a) Master-Tester ("Device") is prompted to generate an Event: - Event a with Eventcode = 0x1000 and EventQualifier = 0xF4 b) Master-Tester ("Device") puts Events into the Event buffer: - Event a to address n = y - Event a to address n = z d) Master-Tester ("Device") sets bit 7 of the StatusCode to "1" (= with details). e) Master-Tester ("Device") sets bit in m = y-1 to "1" ("Activated Events") g) Master-Tester ("Device") sets the Event flag = 1 (within response CKS octet). h) Master performs Event handling i) Master acknowledges the Event by writing back the (Event) StatusCode.
Input parameter	Loop 1: Ev1: 0x1000 / 0xF4, Ev6: 0x4000 / 0xE4 Loop 2: Ev2: 0x1000 / 0xF4, Ev5: 0x4000 / 0xE4 Loop 3: Ev3: 0x1000 / 0xF4, Ev4: 0x4000 / 0xE4 Loop 4: Ev4: 0x1000 / 0xF4, Ev3: 0x4000 / 0xE4 Loop 5: Ev5: 0x1000 / 0xF4, Ev2: 0x4000 / 0xE4 Loop 6: Ev6: 0x1000 / 0xF4, Ev1: 0x4000 / 0xE4
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0x1000 and EventQualifier = 0xF4). b) Check whether Master writes back the StatusCode. c) Event flag shall be reset by the Master-Tester ("Device") after an acknowledge ment of the upper level system. The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) If Master propagates Event to upper level system b) If Master acknowledges the Event c) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	If one of the evaluation steps failed.

TEST CASE RESULTS	CHECK / REACTION	
Results	Propagated information to the upper level system: <code> Master acknowledgement: <code> Event flag: <0/1>	<pass/fail> <pass/fail> <pass/fail>

8.14 Data Storage (DS)

8.14.1 General

Some test cases need cleared Data Storage as a precondition to perform the test. One possibility is the re-configuration of the Master port.

8.14.2 DS-Upload upon request in PREOPERATE state

Table 277 defines the test conditions for this test case.

Table 277 – DS-Upload upon request in PREOPERATE state

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0270
Name	TCM_ALIC_STOR_PREOPUPLOADREQ
Purpose (short)	Data Storage upload upon request in PREOPERATE mode
Equipment under test (EUT)	Master
Test case version	1.2
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, Table B.9, B.2.4, Tables F.1, F.2
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Master is configured to support the entire Data Storage mechanism comprising directions upload and download. The Data Storage mechanism is tested in PRE-OPERATE mode with a concatenated list and a parameter set of maximum size specified in [9], clause B.2.3.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) Master in PREOPERATE mode. c) Master is configured for Upload enabled (see 11.2.2.6) d) Master-Tester ("Device") in PREOPERATE mode. e) Master-Tester ("Device") Data Storage unlocked (see B.2.4) f) Master-Tester ("Device") sets DS_UPLOAD_FLAG (see Table B.11)
Procedure	a) Master-Tester ("Device") sends Data Storage upload request Event b) Master reads this Event and acknowledges this Event (Write Event StatusCode) c) Master reads at least Index 3, Subindex 3, and Index 3, Subindex 2 d) Master sends DS_UploadStart e) Master reads all parameters listed in Index 3, Subindex 5 (Index_List) f) Master reads Parameter_Checksum in Index 3, Subindex 4 g) Master sends DS_UploadEnd
Input parameter	-
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check procedure steps b) to g)
Test passed	Master processes Data Storage upload according to procedure steps b) to g)
Test failed (examples)	Master did not process Data Storage upload according to procedure steps b) to g)
Results	Data Storage upload procedure correct: <yes/no> <pass/fail>

8.14.3 DS-Upload upon request in OPERATE state

Table 278 defines the test conditions for this test case.

Table 278 – DS-Upload upon request in OPERATE state

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0271
Name	TCM_ALIC_STOR_OPERUPLOADREQ
Purpose (short)	Data Storage upload upon request in OPERATE mode
Equipment under test (EUT)	Master
Test case version	1.1
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Master is configured to support the entire Data Storage mechanism comprising directions upload and download. The Data Storage mechanism is tested in OPERATE mode with a simple index list.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) Master in OPERATE mode. c) Master is configured for Upload enabled (see 11.2.2.6) d) Master-Tester ("Device") in OPERATE mode. e) Master-Tester ("Device") Data Storage unlocked (see B.2.4) f) Master-Tester ("Device") sets DS_UPLOAD_FLAG (see Table B.11)
Procedure	a) Master-Tester ("Device") sends Data Storage upload request Event b) Master reads this Event and acknowledges this Event (Write Event StatusCode) c) Master reads at least Index 3, Subindex 3, and Index 3, Subindex 2 d) Master sends DS_UploadStart e) Master reads all parameters listed in Index 3, Subindex 5 (Index_List) f) Master reads Parameter_Checksum in Index 3, Subindex 4 g) Master sends DS_UploadEnd
Input parameter	-
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check procedure steps b) to g)
Test passed	Master processes Data Storage upload according to procedure steps b) to g)
Test failed (examples)	Master did not process Data Storage upload according to procedure steps b) to g)
Results	Data Storage upload procedure correct: <yes/no> <pass/fail>

8.14.4 DS-Download upon mismatch of parameter sets (replacement)

Table 279 defines the test conditions for this test case.

Table 279 – DS-Download upon mismatch of parameter sets (replacement)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0272
Name	TCM_ALIC_STOR_PARAMMISMATCH
Purpose (short)	Data Storage download upon mismatch of parameter sets (Device replacement)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Master is configured to support the entire Data Storage mechanism comprising directions upload and download. The Master behavior in case of a Device replacement ("hot swap") is tested.
Precondition	a) Master supports the entire Data Storage mechanism. b) Master already finished a complete parameter upload successfully before (para meter set 1 is stored within Master) c) Master-Tester adjusted to play the role of the "New Device" (replacement) d) “New Device" offers a parameter set 2 different from parameter set 1 e) “New Device" in DI mode f) “New Device" offers identical VID, DID g) “New Device" does not set the DS_UPLOAD_FLAG h) InspectionLevel = TYPE_COMP
Procedure	a) Master establishes communication with Device validation b) Master switches to PREOPERATE mode c) Master reads at least Index 3, Subindex 4 (Parameter_Checksum) d) Master sends DS_DownloadStart e) Master writes all parameters of parameter set 1 f) Master sends DS_DownloadEnd g) Master reads Index 3, Subindex 4 (Parameter_Checksum)
Input parameter	Parameter set 1 and 2 (to be defined by the Test-Master)
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check procedure steps a) to g) b) Check correct parameter set 1 in "New Device"
Test passed	a) Master processes Data Storage download according to procedure steps a) to g) b) Parameter set in "New Device" is identical to parameter set 1
Test failed (examples)	a) Master does not follow sequence of test case procedure, or b) Master does not fulfill any step of the procedure, or c) Parameter set is not identical to parameter set 1
Results	Master processes Data Storage download correctly: <yes/no> <pass/fail>

8.14.5 DS-Download despite DS_UPLOAD_REQ from Device (PREOP)

Table 280 defines the test conditions for this test case.

Table 280 – DS-Download despite DS_UPLOAD_REQ from Device (PREOP)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0273
Name	TCM_ALIC_STOR_PROPDLDDESPITEULDREQ
Purpose (short)	DS-Download in PREOPERATE mode despite DS_UPLOAD_REQ Event from Device
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Master is configured to support the Data Storage mechanism for download only. Master behavior in case of a DS_UPLOAD_REQ of the Device is tested. The Master shall overwrite the parameter set of a Device in case of a DS_UPLOAD_REQ in PREOPERATE mode.
Precondition	a) A parameter set 1 is already stored within the Master b) Master is configured to support Data Storage for download only c) Master is in PREOPERATE mode d) Master-Tester ("Device") is in PREOPERATE mode
Procedure	a) Master-Tester ("Device") sends a DS_UPLOAD_REQ Event b) Master reads this Event and acknowledges this Event (Write Event StatusCode) c) Master reads at least Index 3, Subindex 4 (Parameter_Checksum) d) Master sends DS_DownloadStart e) Master writes all parameters of parameter set 1 f) Master sends DS_DownloadEnd g) Master reads Index 3, Subindex 4 (Parameter_Checksum)
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester)
Post condition / next test	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check Index 3, Subindex 4 (Parameter_Checksum). b) Check if download starts, if Parameter_Checksum does not match configured Parameter_Checksum of parameter set 1. c) Check if download is processed as described in [9] 11.3.3.
Test passed	a) Master processes Data Storage download according to procedure steps a) to g) b) Parameter set in "Device" is identical to parameter set 1
Test failed (examples)	a) Master does not follow sequence of test case procedure, or b) Master does not fulfill any step of the procedure, or c) Parameter set is not identical to parameter set 1
Results	Master processes Data Storage download correctly: <yes/no> <pass/fail>

8.14.6 DS-Download despite DS_UPLOAD_REQ from Device (OPERATE)

Table 281 defines the test conditions for this test case.

Table 281 – DS-Download despite DS_UPLOAD_REQ from Device (OPERATE)

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0274
Name	TCM_ALIC_STOR_OPERDLDDESPITEULDREQ
Purpose (short)	Data Storage download despite DS_UPLOAD_REQ from Device (OPERATE)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, 11.3.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Master is configured to support the Data Storage mechanism for download only. Master behavior in case of a DS_UPLOAD_REQ of the Device is tested. The Master shall overwrite the parameter set of a Device in case of a DS_UPLOAD_REQ in OPERATE mode.
Precondition	a) A parameter set 1 is already stored within the Master b) Master is configured to support Data Storage for download only c) Master is in OPERATE mode d) Master-Tester ("Device") is in OPERATE mode
Procedure	a) Master-Tester ("Device") sends a DS_UPLOAD_REQ Event b) Master reads this Event and acknowledges this Event (Write Event StatusCode) c) Master reads at least Index 3, Subindex 4 (Parameter_Checksum) d) Master sends DS_DownloadStart e) Master writes all parameters of parameter set 1 f) Master sends DS_DownloadEnd g) Master reads Index 3, Subindex 4 (Parameter_Checksum)
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester)
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check Index 3, Subindex 4 (Parameter_Checksum). b) Check if download starts, if Parameter_Checksum does not match configured Parameter_Checksum of parameter set 1. c) Check if download is processed as described in [9] 11.3.3.
Test passed	a) Master processes Data Storage download according to procedure steps a) to g) b) Parameter set in "Device" is identical to parameter set 1
Test failed (examples)	a) Master does not follow sequence of test case procedure, or b) Master does not fulfill any step of the procedure, or c) Parameter set is not identical to parameter set 1
Results	Master processes Data Storage download correctly: <yes/no> <pass/fail>

8.14.7 DS-Download upon mismatch of parameter sets (PREOPERATE)

Table 282 defines the test conditions for this test case.

Table 282 – DS-Download upon mismatch of parameter sets (PREOPERATE)

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0275
Name	TCM_ALIC_STOR_PROPDLDPARAMMISMATCH
Purpose (short)	Data Storage download upon mismatch of parameter sets (PREOPERATE)
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Master is configured to support the Data Storage mechanism for download only. If the Master detects a deviating parameter checksum directly after entering the PREOPERATE mode the Master shall overwrite the current parameter set in the "Device". This function to be tested in PREOPERATE mode.
Precondition	a) A parameter set 1 is already stored within the Master b) Master is configured to support Data Storage for download only c) InspectionLevel = TYPE_COMP d) Master-Tester ("Device") has set the DS_UPLOAD_FLAG e) Master-Tester provides parameter set 2
Procedure	a) Master establishes communication with "Device" validation b) Master switches to PREOPERATE mode c) Master reads at least Index 3, Subindex 4 (Parameter_Checksum) d) Master sends DS_DownloadStart e) Master writes all parameters of parameter set 1 f) Master sends DS_DownloadEnd g) Master reads Index 3, Subindex 4 (Parameter_Checksum)
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester)
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check procedure steps a) to g) b) Check correct parameter set 1 in "New Device"
Test passed	a) Master processes Data Storage download according to procedure steps a) to g) b) Parameter set in "New Device" is identical to parameter set 1
Test failed (examples)	a) Master does not follow sequence of test case procedure, or b) Master does not fulfill any step of the procedure, or c) Parameter set is not identical to parameter set 1
Results	Master processes Data Storage download correctly: <yes/no> <pass/fail>

8.14.8 Master verifies requested Data Storage size

Table 283 defines the test conditions for this test case.

Table 283 – Master verifies requested Data Storage size

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0276
Name	TCM_ALIC_STOR_STORAGESIZE
Purpose (short)	Master verifies requested Data Storage size
Equipment under test (EUT)	IO-Link Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Master is configured to support the entire Data Storage mechanism comprising directions upload and download. The Master shall detect whether it is able to store the whole parameter set by checking the Data_Storage_Size.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) The Master is configured to support the entire Data Storage mechanism c) Master-Tester ("Device") is in PREOPERATE mode. d) Master-Tester ("Device") Index 3, Subindex 3 is set to the maximum possible memory size (Data_Storage_Size = 0xFFFFFFFF).
Procedure	a) Device sends DS_UPLOAD_REQ Event b) Master reads at least Index 3, Subindex 3 (Data_Storage_Size) c) Master generates an error Event to the upper level system d) Master continues communication
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester)
Post condition / next test	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check procedure steps a) to d)
Test passed	a) Master does not process a download b) Master generates error Event to the upper level system c) Master continues communication
Test failed (examples)	a) Master starts download, or b) Master does not generate error Event to the upper level system, or c) Master stops communication
Results	Master generates error Event: <yes/no> <pass/fail> Master continues communication: <yes/no> <pass/fail>

2571 ### 8.14.9 Master sets port DS ActivationState and executes Upload

2572 Table 284 defines the test conditions for this test case.

2573 **Table 284 – Master sets port DS ActivationState and executes Upload**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0277
Name	TCM_ALIC_STOR_ACTIVATEUPLOAD
Purpose (short)	Master sets port DS ActivationState and executes Upload
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.2.2.6, 11.3, B.2.3, B.2.4, Table B.11
Configuration / setup	Master-Tester ("Device")

2574

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	After enabling the Data Storage handler of the Master, the Master shall check the Data Storage state of the "Device". The Master shall start Data Storage actions.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) Master is in OPERATE mode. c) Master-Tester ("Device") is in OPERATE mode. d) Master Data Storage ActivationState is “DEACTIVATED” e) Masterconfig Upload/Download is enabled f) Master-Tester ("Device") Data Storage unlocked
Procedure	a) Set Master Datastorage ActivationState to “ACTIVATED” b) Master reads at least Index 3, Subindex 2 (State_Property) c) Master sends DS_UploadStart d) Master reads all parameters listed in Iindex 3, Subindex 5 (Index_List) e) Master reads Index 3, Subindex 4 (Parameter_Checksum) f) Master sends DS_UploadEnd
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester)
Post condition / next test	-

2575

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check procedure steps a) to f)
Test passed	Master processes a correct upload of the parameter set of the "Device"
Test failed (examples)	a) Master does not follow the steps b) to f) of the test case procedure , or b) Master does not fulfill any step of the procedure, or c) Parameter set is not identical to parameter set 1
Results	Master processes correct upload: <yes/no> <pass/fail>

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2578 ### 8.14.10 DS Upload with Read on unavailable Index

2579 Table 285 defines the test conditions for this test case.

2580 **Table 285 – DS Upload with Read on unavailable Index**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0278
Name	TCM_ALIC_STOR_ULDINDEXNOTAVAILABLE
Purpose (short)	DS Upload with Read on unavailable Index
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")

2581

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	If a particular Index is not available during an upload sequence, the Master shall send a “DS-Break” to the "Device" and generate an error Event to the upper level system.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) Master is in PREOPERATE mode. c) Master-Tester ("Device") is in PREOPERATE mode. d) Master is configured for Upload/Download enabled (see 11.2.2.6) e) The list of Index 3, Subindex 5 of the Master-Tester ("Device") comprises an un-available index.
Procedure	a) Master-Tester ("Device") sends an DS_UPLOAD_REQ Event b) Master reads at least Index 3, Subindex 3 (Data_Storage_Size) c) Master reads at least Index 3, Subindex 2 (Data_Storage_State) d) Master reads at least Index 3, Subindex 5 (Index_List) e) Master sends DS_UploadStart f) Master detects the unavailable Index g) Master sends DS_Break h) Master generates an error Event to the upper level system
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester), Data_Storage_Size, Data_Storage_State, Index_List
Post condition / next test	-

2582

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check procedure steps b) to h)
Test passed	a) Master interrupts (break) an active upload sequence, and b) Master generates an error Event to the upper level system.
Test failed (examples)	a) Master does not follow the steps b) to h) of the test case procedure , or b) Master does not fulfill any step of the procedure
Results	Master sends DS_Break: <yes/no> <pass/fail> Master generates an error Event: <yes/no> <pass/fail>

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8.14.11 DS Upload with Read on Index with insufficient length

Table 286 defines the test conditions for this test case.

Table 286 – DS Upload with Read on Index with insufficient length

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0279
Name	TCM_ALIC_STOR_ULDINDEXINSUFFLENGTH
Purpose (short)	DS Upload with Read on Index with insufficient length
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	If a particular Index has insufficient length during a download (Write) sequence, the Master shall send a “DS-Break” to the "Device" and generate an error Event to the upper level system.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) Master is in PREOPERATE mode. c) Master-Tester ("Device") is in PREOPERATE mode. d) Master is configured for Upload/Download enabled (see 11.2.2.6) e) The list of Index 3, Subindex5 of the Master-Tester ("Device") comprises an Index with insufficient length (read length <> write length).
Procedure	a) Master-Tester ("Device") sends DataStorage-Request event b) Master reads at least Index 3, Subindex 3 (Data_Storage_Size) c) Master reads at least Index 3, Subindex 2 (Data_Storage_State) d) Master reads at least Index 3, Subindex 5 (Index_List) e) Master sends DS_DownloadStart f) Master detects a negative Write Response of the Index with insufficient length g) Master sends DS_Break h) Master generates an error Event to the upper level system
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester), Data_Storage_Size, Data_Storage_State, Index_List
Post condition / next test	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check procedure steps b) to h)
Test passed	a) Master interrupts (break) an active upload sequence, and b) Master generates an error Event to the upper level system.
Test failed (examples)	a) Master does not follow the steps b) to h) of the test case procedure , or b) Master does not fulfill any step of the procedure
Results	Master sends DS_Break: <yes/no> <pass/fail> Master generates an error Event: <yes/no> <pass/fail>

2592 ### 8.14.12 DS Upload trial with locked Device Data Storage

2593 Table 287 defines the test conditions for this test case.

2594 **Table 287 – DS Upload trial with locked Device Data Storage**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0280
Name	TCM_ALIC_STOR_DSLOCKED
Purpose (short)	DS Upload trial with locked Device Data Storage
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")

2595

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master shall detect the locked Data Storage of a Device. In this case the Master shall deny access for all data storage actions from its own data storage handler.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) Master is in OPERATE mode. c) Master-Tester ("Device") is in OPERATE mode. d) Master is configured for Upload/Download enabled (see 11.2.2.6) e) Master DataStorage Activationstate is “OFF” f) Master-Tester ("Device") Data_Storage_State is “LOCKED”
Procedure	a) Set Master DataStorage Activationstate to “ACTIVATED” b) Master reads at least Index 3, Subindex 2 (Data_Storage_State) c) Master detects the locked data storage state of Device d) Master does not send “DS_UploadStart” nor “DS_DownloadStart” e) Master sends an error Event to the upper level system
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester), Data_Storage_Size, Data_Storage_State, Index_List
Post condition / next test	-

2596

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check procedure steps b) to e)
Test passed	a) Master does not continue or start further Data Storage activities, and b) Master generates an error Event to the upper level system.
Test failed (examples)	a) Master starts further activities of Data Storage, or b) Master does not generate an error Event to the upper level system.
Results	Master shows no further DS activities: <yes/no> <pass/fail> Master generates an error Event: <yes/no> <pass/fail>

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8.14.13 DS Upload/Download blocks upper level system request

Table 288 defines the test conditions for this test case.

Table 288 – DS Upload/Download blocks upper level system request

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0281
Name	TCM_ALIC_STOR_ULDDLDBLOCKSULS
Purpose (short)	DS Upload/Download blocks higher level system request
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master shall deny an access of the upper level system to the "Device" during an Upload or Download sequence.
Precondition	a) Data Storage shall be cleared (see 8.14.1) b) Master is in OPERATE mode. c) Master-Tester ("Device") is in OPERATE mode. d) Master is configured for Upload/Download enabled (see 11.2.2.6) e) Master DataStorage Activationstate is “ACTIVATED”
Procedure	a) Master-Tester ("Device") sends an DS_UPLOAD_REQ Event b) Master reads Index 3 and starts Upload/Download sequence c) Upper level system sends first OD request to the "Device" d) Master responds first OD request with negative OD response (see 11.4) e) Master finishes Upload/Download sequence as intended f) Upper level system sends second OD request to the "Device" g) Master supports second OD request of the upper level system to "Device"
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester)
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check procedure steps b) to g)
Test passed	a) Master blocks OD requests during DS up/download, and b) Master allows OD request access to "Device" after completion of DS up/download
Test failed (examples)	a) Master does not block OD requests during DS up/download, or b) Master does not respond with negative OD response during DS up/download, or c) Master does not complete DS up/download, or d) Master does not support access to "Device" after DS up/download
Results	Master blocks OD request: <yes/no> <pass/fail> Master allows access after DS up/download: <yes/no> <pass/fail>

2606 8.14.14 DS Download overwrites parameter via port DS ActivationState

2607 Table 289 defines the test conditions for this test case.

2608 **Table 289 – DS Download overwrites parameter via port DS ActivationState**

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0282
Name	TCM_ALIC_STOR_ULDUPONSTATESWITCH
Purpose (short)	DS Download overwrites Device parameter via port DS ActivationState
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")

2609

TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Data Storage mechanism of the Master shall store a parameter set 1 of the "Device" when the Activationstate switches between “ACTIV” and “DEACTIVATED”.
Precondition	a) Master is in OPERATE mode. b) Master-Tester ("Device") is in OPERATE mode. c) Masters holds parameter set 1 for download from previous successful upload be fore Master is configured to upload/download enabled (see 11.2.2.6) d) Master DataStorage Activationstate is “ACTIVATED”
Procedure	a) Set Master DS Activationstate to “DEACTIVATED” b) Change parameter set 1 in the "Device" to parameter set 2 without setting DS_UPLOAD_REQ Event flag c) Set Master DS Activationstate to “ACTIVATED” d) Master reads at least Index 3, Subindex 4 (Parameter_Checksum) e) Master sends DS_DownloadStart f) Master writes all parameters of parameter set 1 g) Master sends DS_DownloadEnd
Input parameter	Parameter set 1 and 2 (to be defined by the Master-Tester)
Post condition / next test	-

2610

TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check procedure steps d) to g)
Test passed	If parameter set 1 is downloaded successfully into the "Device"
Test failed (examples)	If parameter set 1 is not restored successfully
Results	Parameter set 1 in the "Device": <yes/no> <pass/fail>

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8.14.15 Master clears DS after changing port configuration

Table 290 defines the test conditions for this test case.

Table 290 – Master clears DS after changing port configuration

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0283
Name	TCM_ALIC_STOR_ULDUPONPORTCONFIG
Purpose (short)	Master clears DS after changing port configuration
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.2.2.6, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	The Data Storage mechanism of the Master shall clear the parameter set after changing the "Device" identification of the Master port.
Precondition	a) Master contains Data Storage data object of a Device with VID / DID (set 1) b) Master is configured for upload/download enabled c) Master DataStorage ActivationState is "ACTIVATED"
Procedure	a) Set port configuration of the Master to VID / DID (set 2). This causes the Master to clear the DS b) Set port configuration of the Master back to VID / DID (set 1) c) Connect the "Device" (Master-Tester) with VID / DID (set 1)
Input parameter	VID / DID (set 1) and VID / DID (set 2)
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check behavior of the Master at STARTUP / PREOPERATE state in procedure step c) according to the procedure and evaluation steps in SDCI_TC_0277 (Table 284)
Test passed	If the master starts an upload of parameters from the device
Test failed (examples)	If the Master checks only the checksum of the Device Data Storage and does not upload the complete parameters set.
Results	Data Storage data object is empty: <yes/no> <pass/fail>

8.14.16 Master checks consistency of Device and stored DS object

Table 291 defines the test conditions for this test case.

Table 291 – Master checks consistency of Device and stored DS object

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0284
Name	TCM_ALIC_STOR_CONSISTENCYCHECK
Purpose (short)	Master checks consistency of Device and stored DS object via VID and DID
Equipment under test (EUT)	Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[9] 11.2, 11.3, B.2.3, B.2.4
Configuration / setup	Master-Tester ("Device")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	The Master shall check the consistency between the stored "Device" within the data storage data object and the data of the connected "Device". In case of an inconsistency the Master shall stop the Data Storage activities and generate an error Event to the upper level system.
Precondition	a) Master configured to InspectionLevel "NO_CHECK" b) Master contains Data Storage data object of a "Device" with VID / DID (set 1) c) Master is configured for upload/download enabled (see 11.2.2.6) d) Master DataStorage Activationstate is “ACTIVATED”
Procedure	a) Stop communication b) Change VID / DID in the "Device" to VID / DID (set 2) c) Start communication d) Master switches to PREOPERATE e) Master detects the inconsistency between the Data Storage data object VID / DID (set 1) and the "Device" VID / DID (set 2) f) Master generates an error Event to the upper level system g) Master continues communication
Input parameter	VID / DID (set 1) and VID / DID (set 2)
Post condition / next test	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	Check procedure steps d) to g)
Test passed	a) Master does not perform Data Storage up/download, and b) Master generates an error Event to the upper level system, and c) Master continues communication
Test failed (examples)	a) Master does not follow the steps d) to g) of the test case procedure , or b) Master does not fulfill any step of the procedure c) Master starts DS up- or download
Results	Master ignores DS up/download: <yes/no> <pass/fail> Master generates an error Event to the upper level system: <yes/no> <pass/fail> Master continues communication: <yes/no> <pass/fail>

8.15 Legacy Device ("V1.0")

8.15.1 General

Since a Master designed according to [9] shall support legacy Devices designed according to [13], it shall pass the following test cases.

8.15.2 Master detects legacy Device and establishes connection

Table 292 defines the test conditions for this test case.

Table 292 – Master detects legacy Device and establishes connection

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0285
Name	TCM_LGCY_MANY_DETECTANDCONNECT
Purpose (short)	Master detects legacy Device and establishes connection
Equipment under test (EUT)	Master
Test case version	1.1
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[13] 7.2.2.1, 9.3.3; [9] 9.2.3.2, A.2.6
Configuration / setup	Master-Tester ("Device" V1.0)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	This test checks the compatibility of the startup phase between the V1.1 Master and a V1.0 Device. The Master shall detect that a V1.0 Device is connected, and shall adjust its startup behavior.
Precondition	-
Procedure	a) Initiate Wake_up b) Read Direct Parameter page 1 (address 0x02 to 0x06) c) Do not react to Events from the "Device" (Event handler not started) d) Write the MasterCycleTime e) Write OPERATE f) Change to the target M-sequence type g) Read Serial Number (due to validation)
Input parameter	-
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check for the startup M-sequence types of [13] b) Check the data exchange after startup c) Check Read and Write to parameters within the legacy "Device"
Test passed	If the startup sequence performed according to [13]
Test failed (examples)	If M-sequence types are used outside [13]
Results	Start-up according to [13]: <yes/no> <pass/fail>

8.15.3 Master detects legacy Device and establishes interleave mode

Table 293 defines the test conditions for this test case.

Table 293 – Master detects legacy Device and establishes interleave mode

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0286
Name	TCM_LGCY_MANY_DETECTANDINTERLEAVE
Purpose (short)	Master detects legacy Device and establishes interleave mode
Equipment under test (EUT)	Master
Test case version	1.1
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[13] 9.3.3; [9] 9.2.3.5, A.2.6
Configuration / setup	Master-Tester ("Device" V1.0)
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	This test checks the compatibility of the startup phase between the V1.1 Master and a V1.0 Device which is using M-sequence TYPE_1 in interleave mode. The Master shall detect that a V1.0 Device is connected, and shall adjust its startup behavior.
Precondition	PD with 6 octets
Procedure	a) Initiate Wake_up b) Read Direct Parameter page 1 (address 0x02 to 0x06) c) Do not react to Events from the "Device" (Event handler not started) d) Write the MasterCycleTime e) Write OPERATE f) Change to the target M-sequence TYPE_1 (interleave) g) Read Serial Number (due to validation)
Input parameter	-
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	a) Check for the startup M-sequence types of [13] b) Check the data exchange after startup c) Check Read and Write to parameters within the legacy "Device"
Test passed	a) If the startup sequence performed according to [13], and b) If interleave M-sequence TYPE_1 is used
Test failed (examples)	If M-sequence types are used outside [13]
Results	Start-up according to [13]: <yes/no> <pass/fail> M-sequence TYPE_1 used: <yes/no> <pass/fail>

2645 8.15.4 Master receives an Event without details (Warning)

2646 Table 294 defines the test conditions for this test case.

2647 **Table 294 – Master receives an Event without details (Warning)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0287
Name	TCM_ALIC_EVNT_NODETAILSWARNING
Purpose (short)	Master receives an Event without details
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4.1 [9] 7.3.8.3, 8.3.3.1, 11.5, Annex A.6, Annex D
Configuration / setup	Master-Tester ("Device")

2648

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Master receives Event without details (StatusCode type 1, warning). Master extracts the EventCode (type 1), maps it accordingly into StatusCode (type 2) and transfers it to the upper level system. Similarly, the StatusCode indicates with 1 bit the validity of the Process Data. The Master shall read this information as soon as possible to indicate the actual state of the Process Data to the upper system. The Master acknowledges the Event; the Master-Tester ("Device") resets the Event flag.
Precondition	a) Master is in SDCI communication mode (Scan mode) b) Master-Tester ("Device") in OPERATE c) No Event in process
Procedure	a) Master-Tester ("Device") is prompted to prepare an Event message with Status-Code type 1: all bits = "0", except bit 1 = "1". b) Master-Tester ("Device") sets the Event flag = "1" (within response CKS octet). c) Master starts Event handling d) After reading the last Event information, the Master acknowledges the Event by writing back the (Event) StatusCode within ≤ 20 ms @COM2, 3 ms Master cycle time
Input parameter	Warning
Post condition / next test	-

2649

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check whether Master propagates the Event to the uppper level system in an appropriate form (matching semantics or syntax = EventCode = 0xFF80 and EventQualifier = 0x64). b) Master acknowledges by writing to the StatusCode c) Event flag shall be reset by the Master-Tester ("Device"). The mechanism shall be tested. However, the reported information (EventCode) is optional: Mapping into more general diagnosis information of an upper level system is possible or even nothing at all, e.g in case of a "notification".
Test passed	a) The master reads the event information b) If Master propagates Event to upper level system c) If Master acknowledges the Event within ≤ 20 ms @COM2, 3 ms Master cycle time d) If Master-Tester ("Device") resets Event flag (= "0")
Test failed (examples)	If one of the evaluation steps failed.
Results	Propagated information to the upper level system: <code> <pass/fail> Master acknowledgement: <code> <pass/fail> Event flag: <0/1> <pass/fail>

2650

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8.15.5 Master sends Idle after an accomplished ISDU service

Table 295 defines the test conditions for this test case.

Table 295 – Master sends Idle after an accomplished ISDU service

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0288
Name	TCM_LGCY_MANY_IDLEAFTERISDU
Purpose (short)	Master sends ISDU service "Idle" after an accomplished ISDU service
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[13] 7.3.6.3, Figure 47
Configuration / setup	Master-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	After completion of an ISDU command, the Master shall transmit at least one IDLE command to the Device as an acknowledgement of the ISDU service.
Precondition	Connection has been established with a very large MasterCycleTime
Procedure	a) To test this behavior, the MasterCycleTime shall be set to a very large value, e.g. 50 to 100 ms. b) An ISDU request shall be initiated. c) After the response, the application shall initiate the next request as soon as possible (during the next cycle time) d) The Master shall not start the next request without an ISDU IDLE message
Input parameter	ISDU request
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check if there is an IDLE message between the two ISDU services
Test passed	If there is an IDLE message
Test failed (examples)	If the next ISDU starts without an IDLE message
Results	IDLE message: <yes/no> <pass/fail>

8.15.6 ISDU Write interrupted by an Event leads to a Write error

Table 296 defines the test conditions for this test case.

Table 296 – ISDU Write interrupted by an Event leads to a Write error

TEST CASE ATTRIBUTES	**IDENTIFICATION / REFERENCE**
Identification (ID)	SDCI_TC_0289
Name	TCM_LGCY_MANY_EVENTINTERRUPTSISDU
Purpose (short)	ISDU Write interrupted by an Event leads to write error
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.1
Category / type	Master protocol test; test to pass (positive testing)
Specification (clause)	[13] 7.3.6.3, Figure 47; [9] Table C.2, C.3.8
Configuration / setup	Master-Tester
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	According to [13] the legacy "Device" can cancel an ongoing ISDU transfer via an Event. This Event shall lead to a Read error or Write error on the Master side.
Precondition	Connection has been established
Procedure	a) The Master initiates an ISDU Write with a too large length of data b) The legacy "Device" sends an Event (DL, Error, Event single shot, EventCode = "0x5200") during the ISDU service to abort it. c) The Master shall confirm this conflicting error to the application via Write error
Input parameter	ISDU with lengthy data
Post condition / next test	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Check if the Event leads to a Write error ("0x8033") at the Master application.
Test passed	If no Event is sent to the Master application and the ISDU service is responded with ErrorCode "0x8033".
Test failed (examples)	If any Event is sent to the Master application or an ErrorCode mismatch occurred.
Results	Event received by the upper level system: <yes/no> <pass/fail> ISDU service is not aborted: <yes/no> <pass/fail>

8.15.7 Master transforms PD_invalid Event into appropriate propagation

Table 297 defines the test conditions for this test case.

Table 297 – Master transforms PD_invalid Event into appropriate propagation

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0290
Name	TCM_LGCY_MANY_PDINVALIDEVENT
Purpose (short)	Master transforms PD_invalid Event into appropriate propagation
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4; [9] A.6.2, A.6.3
Configuration / setup	Master-Tester ("Device V1.0")
TEST CASE	**CONDITIONS / PERFORMANCE**
Purpose (detailed)	Master transforms a "PD invalid" Event from a legacy "Device" into an appropriate propagation form
Precondition	a) Master in communication mode. b) Master-Tester ("Device") is in OPERATE mode and provides valid Process Data values (PD valid).
Procedure	Master-Tester ("Device") is prompted to set the Process Data to invalid.
Input parameter	-
Post condition	-
TEST CASE RESULTS	**CHECK / REACTION**
Evaluation	Event bit shall be acknowledged in the legacy "Device".
Test passed	a) Master shall define the Process Data in the target system as invalid and the general Event treatment on the SDCI side shall be concluded. b) Event shall be acknowledged; Master-Tester ("Device") shall set its Event bit to 0.
Test failed (examples)	a) Master defines the Process Data in the upper level system as valid or general Event treatment on the SDCI side is not finished. b) Event bit in Master-Tester ("Device") is not acknowledged.
Results	Correct propagation of "PD invalid": <yes/no> <pass/fail> Event acknowledged: <yes/no> <pass/fail>

8.15.8 Master acknowledges PD valid Event and propagates PD

Table 298 defines the test conditions for this test case.

Table 298 – Master acknowledges PD valid Event and propagates PD

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_TC_0291
Name	TCM_LGCY_MANY_PDVALIDBEHAVIOR
Purpose (short)	Master acknowledges PD_valid Event and propagates PD
Equipment under test (EUT)	Master and Legacy-Master
Test case version	1.0
Category / type	Master protocol test, test to pass (positive testing)
Specification (clause)	[13] 7.2.4.4; [9] A.6.2, A.6.3
Configuration / setup	Master-Tester ("Device V1.0")

TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test if Master acknowledges PD_valid Event and propagates PD correctly.
Precondition	a) Master in communication mode. b) Master-Tester ("Device") is in OPERATE mode and provides invalid Process Data values (PD_invalid).
Procedure	a) Master-Tester ("Device") is prompted to set the Process Data to valid. b) It sets bit 6 (PD_Invalid) of the StatusCode (type 1) octet to 0. c) It then sets the Event bit to 1. d) The Master performs its Event handling. e) The Master acknowledges by writing back the StatusCode octet.
Input parameter	-
Post condition	-

TEST CASE RESULTS	CHECK / REACTION
Evaluation	a) Check if Process Data status is indicating the transition from PD_Invalid to PD_Valid (depending on the upper level system). b) Event bit shall be acknowledged in the Master-Tester ("Device").
Test passed	a) If transition PD_Invalid/PD_Valid is indicated to the upper level system, and b) if Event is acknowledged, and c) if Master-Tester ("Device") set its Event bit to 0.
Test failed (examples)	a) Transition PD_Invalid/PD_Valid is not indicated, or b) Event bit in Master-Tester ("Device") is not acknowledged.
Results	Transition PD_Invalid/PD_Valid is indicated: <yes/no> <pass/fail> Event is acknowledged: <yes/no> <pass/fail>

8.16 Test report template

The template is defined by the Master-Tester. The test report shall present at least the results of the test cases.

9 Environmental tests

9.1 General

Annex G in [9] defines the environmental tests (EMC) for the SDCI communication part of a Master/Device system. A passed EMC test is a precondition for a Manufacturer Declaration. It depends on the particular technology of a Device and the countries of deployment, whether additional environmental tests are necessary to achieve for example a CE mark for Europe.

9.2 Product specific standards

Usually, the product standard for a Master is the IEC 61131-2. For Devices the major product standard is the IEC 60947-1.

9.3 EMC tests

EMC tests in respect to a particular phenomenon are defined in the IEC 61000-4-x series. Details for the execution are described in Annex G.2 in [9] and in 4.4 or 4.5 respectively.

Hint: Length "L" in Figures G.4 and G.8 in [9] shall be as short as possible.

9.4 Test report templates

9.4.1 Overview

Tests are required for the following phenomena:

- Electrostatic discharge (ESD: IEC 61000-4-2)
- Electromagnetic field (HF: IEC 61000-4-3)
- Fast transients (Burst: IEC 61000-4-4)
- Conducted radio frequency (CRF: IEC 61000-4-6)

The SDCI manufacturer declaration of conformity comprises EMC tests according to Annex G.2.4 in [9]. The following forms or any other document may be used as long as it contains the same information.

9.4.2 ESD

Figure 14 shows a proposed template for ESD tests.

Project:	
Test Item:	
Responsible Party:	
Tester:	
Applied Standard/Guideline:	
Type of Device:	
Test Location:	
Time Range:	

Test Requirements/Results:				
Type of discharge	Requirement fulfilled?		Achieved ImmunityTest Voltage kV	PerformanceCriterion
	yes	no		
Contact discharge	☐	☐		
Air discharge	☐	☐		
HCP	☐	☐		
VCP	☐	☐		

Result:		
Test requirements are	☐	fulfilled
	☐	not fulfilled
Every single requirement must be met.		

Remarks:

Enclosures:

Date

Tester's Signature

Figure 14 – Proposed template for ESD tests

9.4.3 HF

Figure 15 shows a proposed template for HF tests.

Project:	
Test Item:	
Responsible Party:	
Tester:	
Applied Standard/Guideline:	
Type of Device:	
Test Location:	
Time Range:	

Test Requirements/Results:				
Type of HF Field	Requirement ful-filled?		Achieved Immunity Test Field V/m	Performance Criterion
	yes	no		
	☐	☐		
	☐	☐		
	☐	☐		
	☐	☐		

Result:		
Test requirements are	☐	fulfilled
	☐	not fulfilled
Every single requirement must be met.		

Remarks:

____

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____

Enclosures:

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____

______________________________ ______________________________

Date Tester's Signature

Figure 15 – Proposed template for HF tests

9.4.4 Burst

Figure 16 shows a proposed template for Burst tests.

Project:	
Test Item:	
Responsible Party:	
Tester:	
Applied Standard/Guideline:	
Type of Device:	
Test Location:	
Time Range:	

Test Requirements/Results:				
Type of burst	Requirement ful-filled?		Achieved Immunity Test Voltage kV	Performance Criterion
	yes	no		
power supply lines	☐	☐		
data lines	☐	☐		
	☐	☐		
	☐	☐		

Result:		
Test requirements are	☐	fulfilled
	☐	not fulfilled
Every single requirement must be met.		

Remarks:

____
____
____
____
____

Enclosures:

____
____

________________________ __________________________________
Date Tester’s Signature

Figure 16 – Proposed template for Burst tests

9.4.5 Conducted RF

Figure 17 shows a proposed template for conducted RF tests.

Project:	
Test Item:	
Responsible Party:	
Tester:	
Applied Standard/Guideline:	
Type of Device:	
Test Location:	
Time Range:	

Test Requirements/Results:				
Type of Frequency MHz	Requirement ful-filled?		Achieved Immunity Test Voltage V	Performance Criterion
	yes	no		
1326	☐	☐		
2712	☐	☐		
4068	☐	☐		
ISM	☐	☐		

Result:

Test requirements are ☐ fulfilled

☐ not fulfilled

Every single requirement must be met.

Remarks:

____

____

____

____

____

Enclosures:

____

____

______________________ Date

______________________ Tester's Signature

Figure 17 – Proposed template for conducted RF tests

9.4.6 Explanation of template terms

The terms in the templates are defined as follows:

- "Project" means for example the name of an SDCI Device.
- "Test Item" means the name and order number of the particular Device under test.
- "Responsible Party" means the manufacturer or a third party company who takes responsibility for the Device.
- "Tester" means the full name of the test person in charge.
- "Applied standards or guidelines" shall comprise at least [9] and a product standard such as IEC 60947-1
- "Type of Device" identifies the type of the device thus indicating the appropriate level of EMC test. Possible types are "open type", "cabinet" or "enclosed type".
- "Test Location" indicates the name and address of the EMC test laboratory.
- "Time Range" indicates the date and the duration of the test.

Annex A
(normative)
Test configurations and test tools

A.1 Test configurations

A.1.1 Overview

The test cases for the physical layer tests and data link layer tests can be executed with the help of

- A variable power supply between 20 V and 30 V
- Discrete components such as capacitors and resistors according to the particular test case
- A voltage meter and a current meter
- An oscilloscope for Wake-up pulses and eye-diagrams
- A logic analyzer for message timings
- A line-monitor to record protocol sequences

A.1.2 Measurement circuits for the physical layer tests

A.1.2.1 Measurement of static parameters

Figure A.1 shows the measurement circuit diagram for static parameters with the help of a voltage meter.

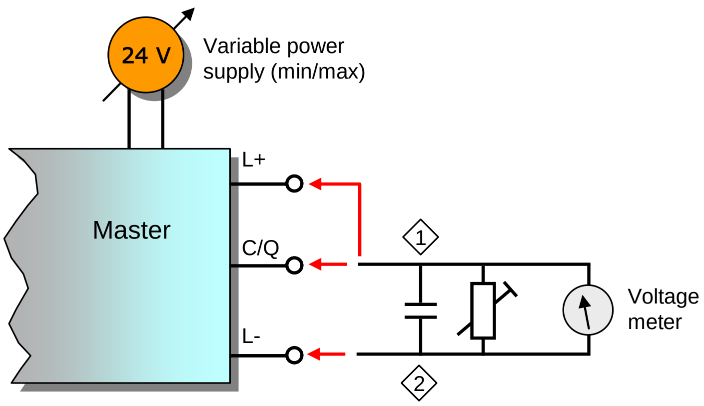
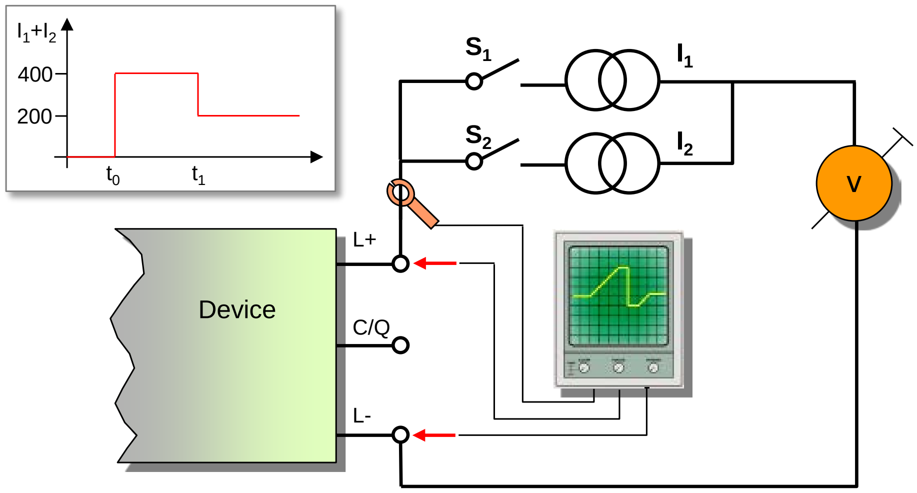


Figure A.1 – Measurement circuit diagram for static parameters

A.1.2.2 Measurement of power supply behavior

Figure A.2 shows the circuit diagram for the measurement of the power-on behavior of Devices.



Key

$I_1 = I_2 = 200$ mA

t_0: S_1, S_2 = on

t_1: S_1 = on, S_2 = off

$t_1 - t_0 = 50$ ms

Figure A.2 – Measurement circuit diagram for power supply behavior

A.1.2.3 Measurement of dynamic parameters

Figure A.3 shows the measurement circuit diagram for dynamic parameters with the help of an oscilloscope.

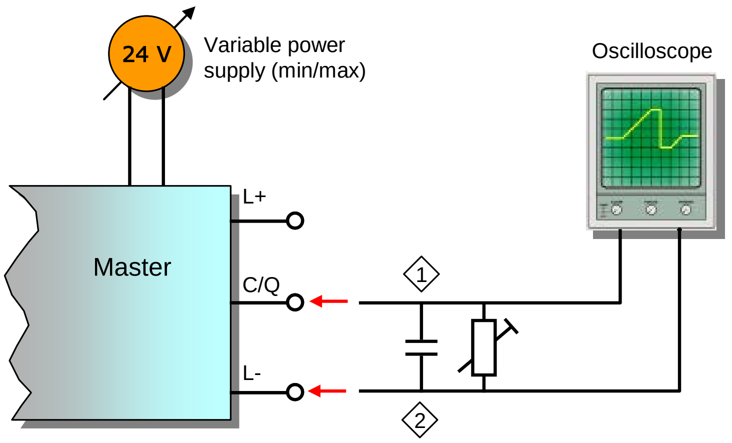


Figure A.3 – Measurement circuit diagram for dynamic parameters

A.1.2.4 Measurement of Master input thresholds

Figure A.4 shows the measurement circuit diagram for Master input thresholds with the help of an auxiliary variable voltage and a voltage meter.

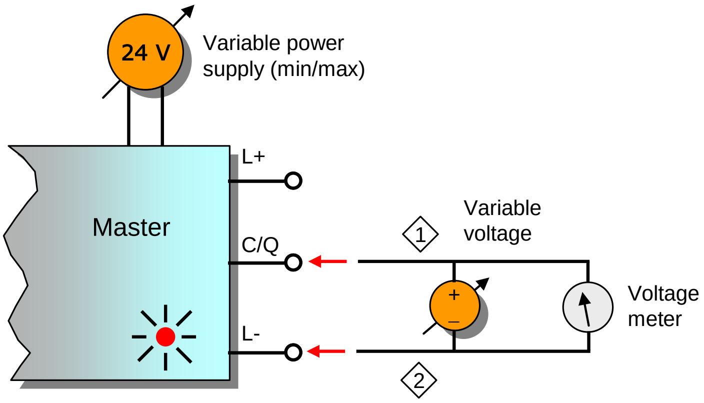


Figure A.4 – Measurement circuit diagram for input thresholds

A.1.2.5 Measurement of Wake-up requests (high)

Figure A.5 shows the measurement circuit diagram for Wake-up requests with the help of an oscilloscope if the steady state level (of a Device) is high.

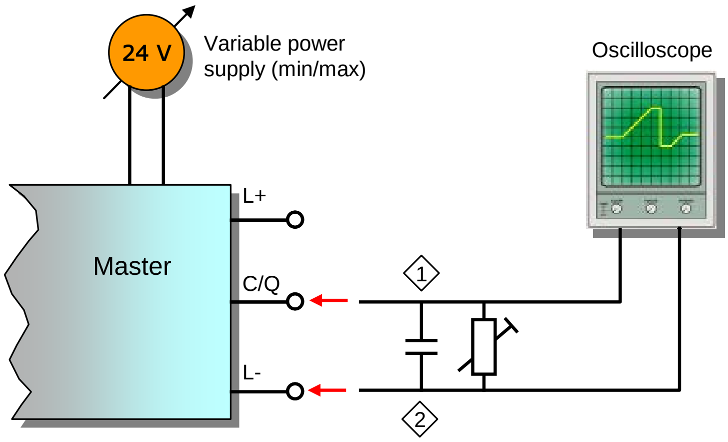


Figure A.5 – Measurement circuit diagram for Wake-up requests (high)

A.1.2.6 Measurement of Wake-up requests (low)

Figure A.6 shows the measurement circuit diagram for Wake-up requests with the help of an oscilloscope if the steady state level (of a Device) is low.

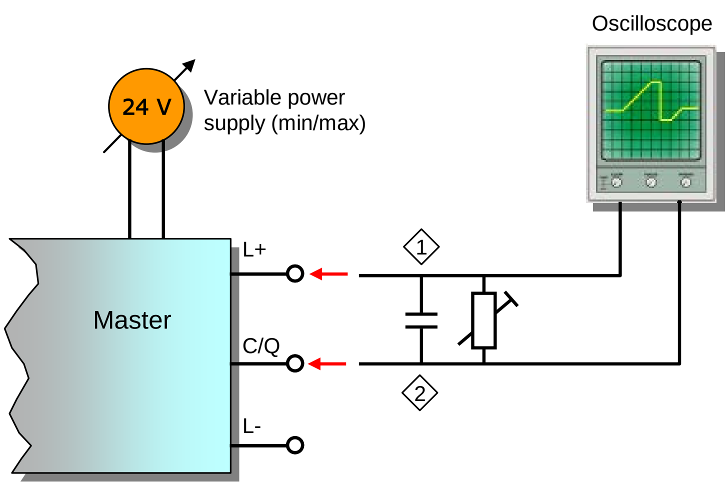


Figure A.6 – Measurement circuit diagram for Wake-up requests (low)

A.1.2.7 Measurement of dynamic parameters (Device output)

Figure A.7 shows the measurement circuit diagram for Device output signals with the help of an oscilloscope.

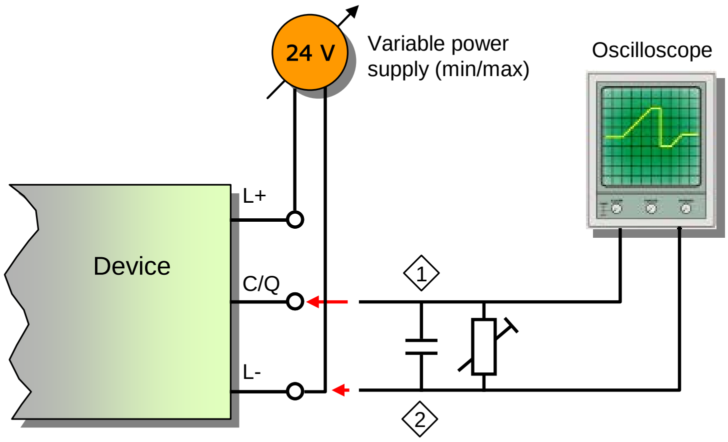


Figure A.7 – Measurement circuit diagram for dynamic parameters (output)

A.1.2.8 Measurement of dynamic parameters (Device input threshold)

Figure A.8 shows the measurement circuit diagram for Device input thresholds with the help of an auxiliary variable voltage and a voltage meter.

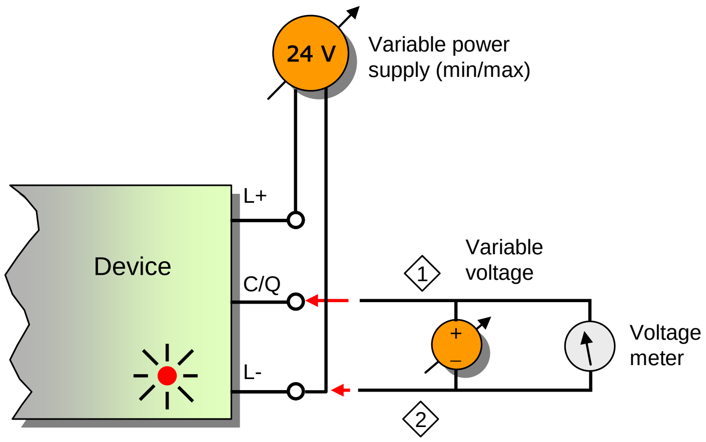


Figure A.8 – Measurement circuit diagram for input thresholds

A.1.2.9 Measurement of Wake-up requests (timing)

Figure A.9 shows the measurement circuit diagram for the timing of Wake-up requests with the help of an oscilloscope.

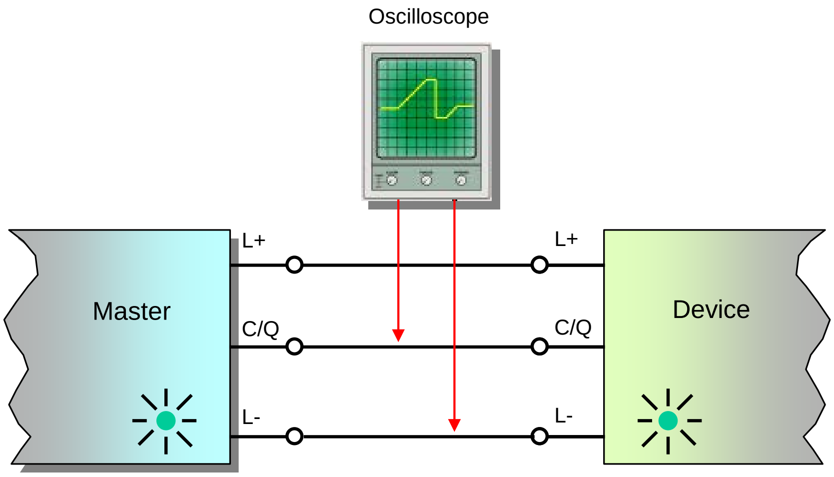


Figure A.9 – Measurement circuit diagram for Wake-up request timings

A.1.2.10 Measurement of Receive Enable after Wake-up (C/Q high)

Figure A.10 shows the circuit diagram for the measurement timing of t_{REN} (receive enable delay) with the help of an oscilloscope in case of C/Q =high.

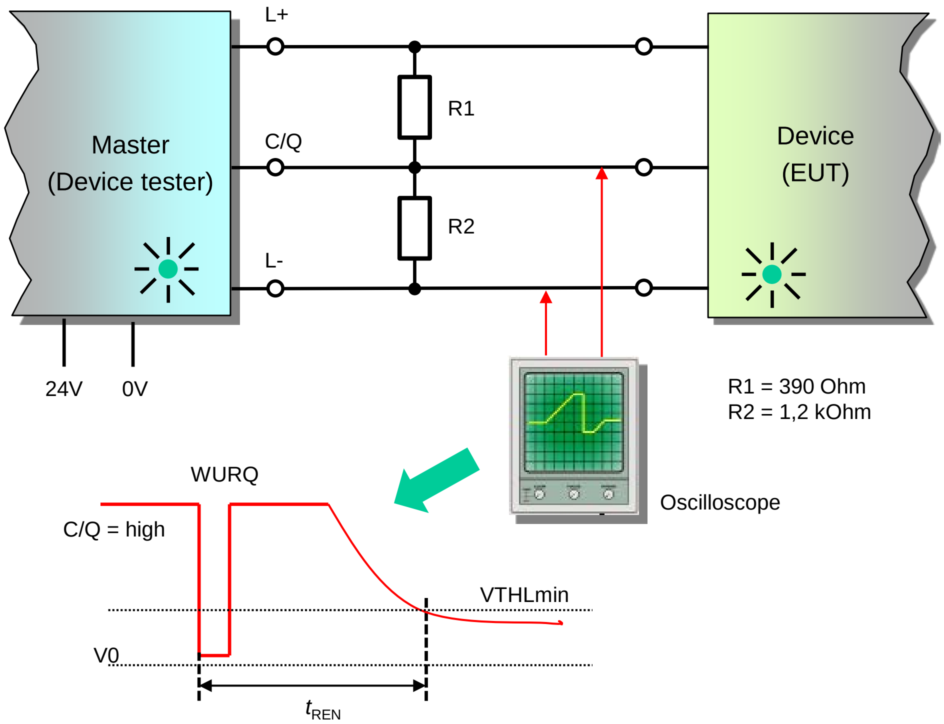


Figure A.10 – Measurement circuit diagram for timing t_{REN} (C/Q high)

A.1.2.11 Measurement of Receive Enable after Wake-up (C/Q low)

Figure A.11 shows the circuit diagram for the timing measurement of t_{REN} (receive enable delay) with the help of an oscilloscope in case of C/Q =low.

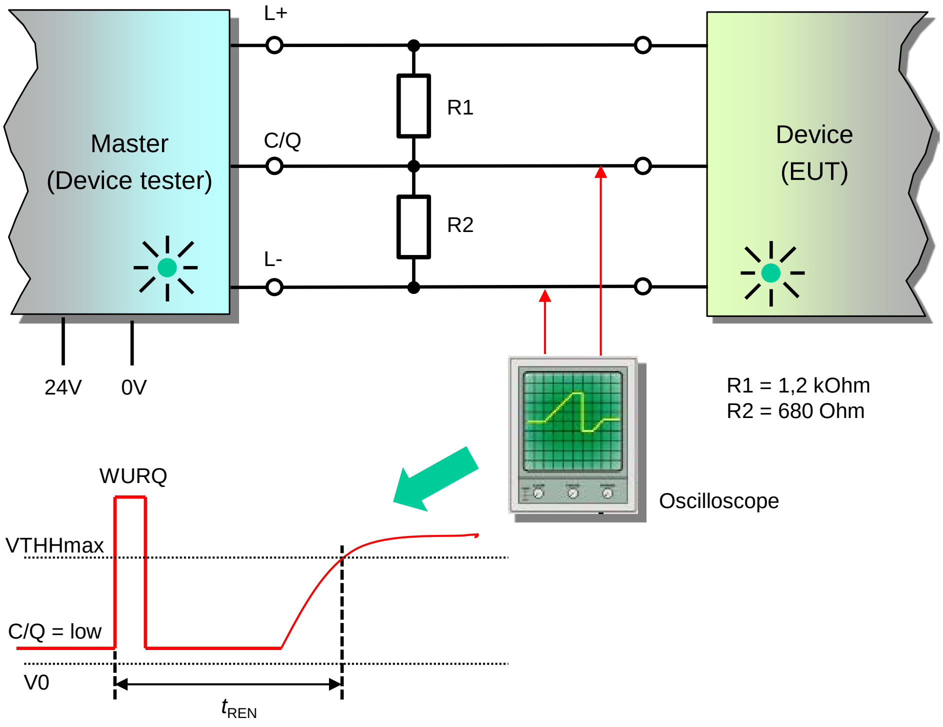


Figure A.11 – Measurement circuit diagram for timing t_{REN} (C/Q low)

A.1.2.12 Measurement of message timings

Figure A.12 shows the measurement circuit diagram for the timing of messages with the help of an oscilloscope or a logic analyzer.

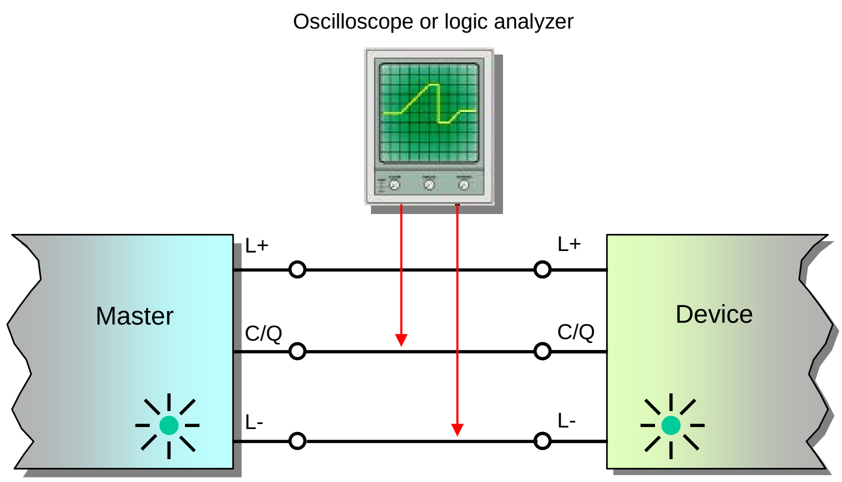


Figure A.12 – Measurement circuit diagram for message timings

A.1.2.13 Eye diagram measurement using a line simulation

Figure A.13 shows the circuit diagram for the eye diagram measurements using a line simulation as required load.

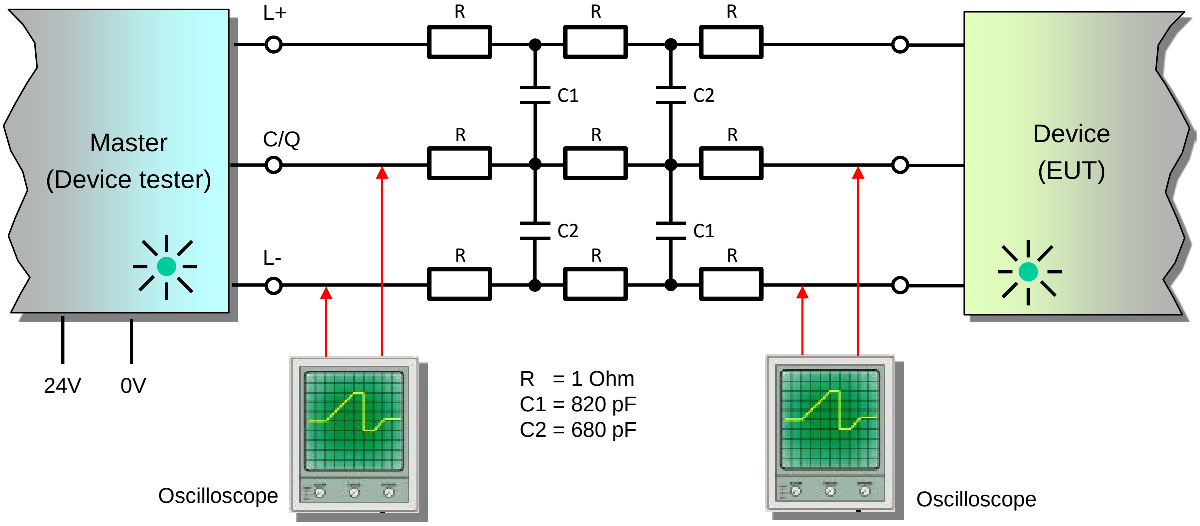


Figure A.13 – Eye diagram measurement using a line simulation

A.1.3 Protocol recording via a Line-Monitor

Usually the test cases assume that a test passed if data are written or read in the expected manner. Sometimes it is easier to observe the protocol steps with the help of a Line-Monitor that lists the Master request messages and the Device response messages in a convenient manner on the screen of a laptop.

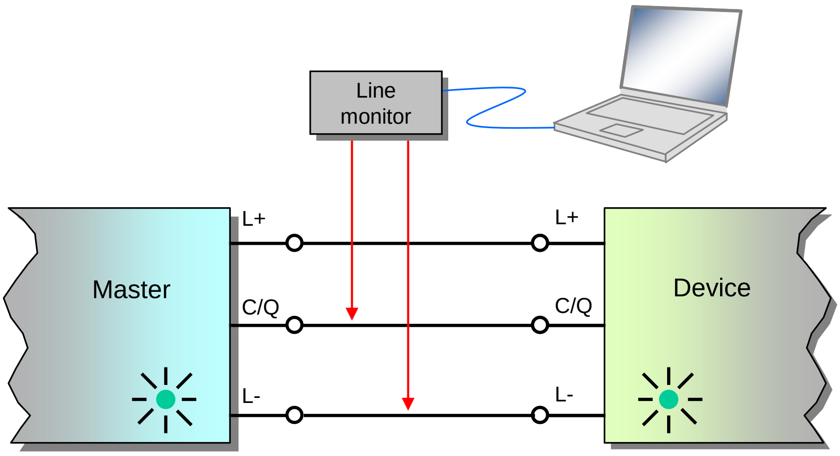


Figure A.14 – Message recording via a Line-Monitor

A.2 Device-Tester

A.2.1 Overview

In order to facilitate the tests of SDCI Master and Device and to ensure highest levels of conformity, several tools and the associated requirements are defined. These tools shall be type-approved by the organization mentioned in Annex D prior to any conformity testing for a manufacturer declaration.

A.2.2 Test principle

Figure A. shows the principle of a Device-Tester system comprising

- A Device-Tester hardware with at least one SDCI port, which can be a modified standard SDCI Master with an adequate communication interface to a personal computer,

- A personal computer supporting the communication interface of the Device-Tester hardware,
- A Device-Tester software running on that personal computer serving as a control and monitorring program for the Device-Tester hardware,
- An SDCI Device, the "equipment under test" (EUT) that shall be tested for conformity.

Table A.1 – System requirements for the Device-Tester

Requirement	Description
SR1	The Device-Tester system shall execute and evaluate the test cases defined in this specification. This can include some functions or behavior not defined in the SDCI specification, but is necessary to run the EUT into a specific state, e.g. generation of checksum errors.
SR2	The result of each test case and also additional information about the test execution shall be reported to the user (test report, log file). The user shall be able to store and print this information.
SR3	The conformity test cases shall be secured against manipulation.
SR4	Optional requirement: the Device-Tester can interpret a valid IODD and generate different settings which are required for the conformity test. In case of absence of the IODD file there shall be a possibility to edit the settings manually.

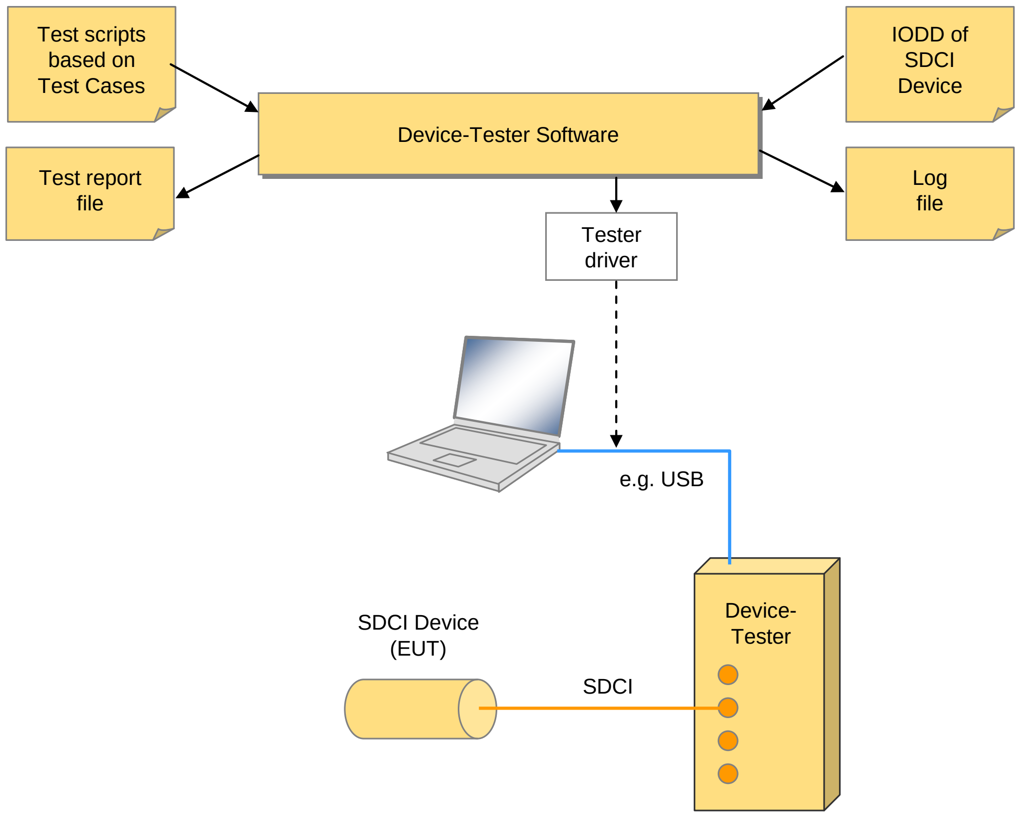


Figure A.15 – Principle of a Device-Tester system

A.3 IODD checker

The IODD checker is a free downloadable software tool for personal computers from the web server of the organization mentioned in Annex D. It formally checks the IODD for a particular Device against the XML schema defined in [3].

A.4 Master-Tester

A.4.1 Master-Tester using fieldbus communication

Figure A.16 shows the principle of a Master-Tester system comprising

- A Master-Tester hardware with any communication interface to a personal computer, e.g. USB (Universal Serial Bus),
- A personal computer supporting the communication interface of the Device-Tester hardware and a communication interface to an upper level system such as a fieldbus,
- A Master-Tester software running on that personal computer serving as a control and monitorring program for the Master-Tester hardware,
- An SDCI Master, the "equipment under test" (EUT) that shall be tested for conformity. This SDCI Master usually provides a communication interface to an upper level system such as a fieldbus

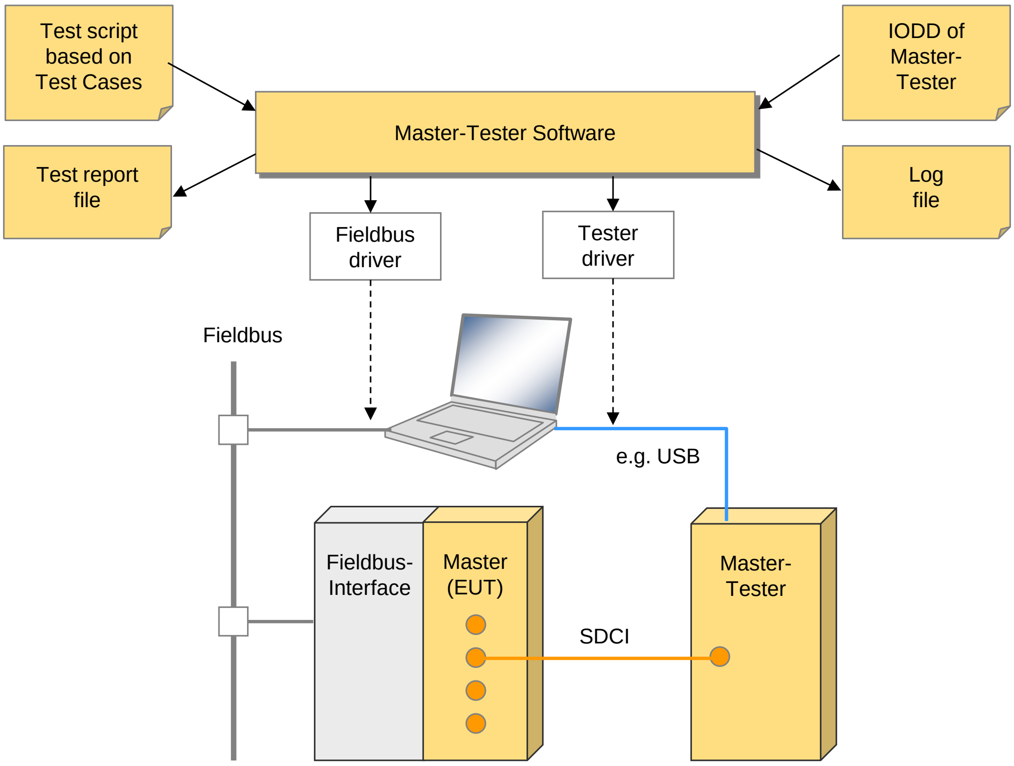


Figure A.16 – Principle of a Master-Tester system using fieldbus

A.4.2 Master-Tester using a separate Master communication interface

For embedded Masters without fieldbus connectivity or in cases, where the fieldbus approach is inappropriate a transmission independent communication protocol has been specified that can be used on RS 232 lines or other transmission mechanisms between a Master (EUT) and the PC running the Master-Tester software as shown in Figure A.17.

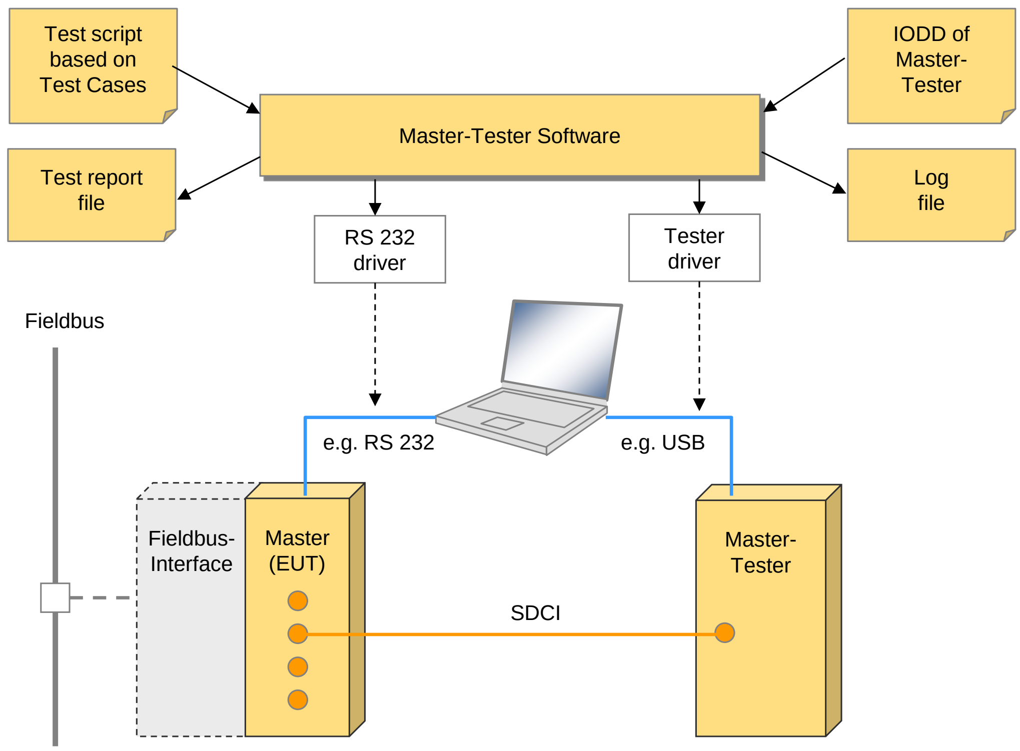


Figure A.17 – Principle of a Master-Tester system using a separate communication

The protocol is specified in A.4.4.

A.4.3 System requirements for Master-Tester

In order to facilitate the tests of SDCI Master and Device and to ensure highest levels of conformity, several tools and the associated requirements are defined. These tools shall be type-approved by the organization mentioned in Annex D prior to any conformity testing for a manufacturer declaration (see Table A.1 and Table A.2).

Table A.2 lists the system requirements for the approval of a Master-Tester system.

Table A.2 – System requirements for the Master-Tester

Requirement	Description
SR1	The test system shall execute and evaluate the test cases defined in this specification
SR2	It should be possible to define, execute and evaluate additional customer specific test cases.
SR3	The result of every test case and also additional information about test execution shall be reported to the user (test report, log file). The user shall be able to store and print this information.
SR4	The conformity test cases defined in this specification and also the user defined test cases should be coded in a script file (XML or TCL).
SR5	The conformity test script file shall be provided by test system supplier.
SR6	The conformity test script file shall be secured against manipulation.
SR7	For the sake of an approval of the test system, it shall have a PROFIBUS communication path between EUT (SDCI Master) and the personal computer.
SR8	A user shall be able to adapt the test system by other communication paths (other standard field bus, proprietary communication).
SR9	A user should be able to control and monitor the functionality of the Master-Tester by other applications such as existing test suites.
SR10	The test system manual shall be provided as PDF document. The user shall be able to read this document via freely available Adobe Reader software.

Requirement	Description
SR11	The Master-Tester software can be used to download new firmware updates to the Master-Tester. The download process can not be interrupted by the user. The software can not verify the content of the downloaded file. The user is responsible to use a valid and correct Master-Tester firmware update file.
SR12	Optional requirement: Master-Tester software can interpret a valid ("Master-Tester") IODD and send some settings to the Master-Tester. The Master-Tester uses these settings and simulates the "Device" described in the IODD.
SR13	The timeout for the time between entering the PREOPERATE state and leaving this state shall be adjustable in the Master tester

Table A.3 lists the functional requirements for the approval of a Master-Tester system.

Table A.3 – Functional requirements for the excution of test cases

Requirement	Description
FR1	Usecase 1: Simulation of an SDCI Device
FR2	Usecase 2: Error behavior (stack-Errors like checksum errors, invalid timing and application errors such as creation of ErrorCodes)
FR3	Usecase 3: Creation of status information (number of transmitted messages by the master, number erroneous messages)
FR4	Usecase 4: Stand-alone device for EMC tests
FR5	Hardware EMC Requirements: - IEC61000-4-4 (Burst) +/- 2 kV Crit. A; +/- 4 kV Crit. B - IEC61000-4-6 (RF) 13 V Crit. A
FR6	Hardware Requirements: - SDCI interface - Slew Rate > 200 ns - Signaling LED or display: error counter (with active reset) - Power LED - SDCI communication LED - USB interface V2.0 (API) - Power supply via SDCI (optional USB or battery or external supply) - Non-volatile storage of configuration (maximum 1024 octets) - Monitoring (optional as independent tool) - Trigger output (24 V/10 mA)
FR7	Configuration areas: - Device configuration (MinCycleTime, M-sequence Capability, RevisionID, ProcessDataIn, ProcessDataOut, VendorID, DeviceID, FunctionID, transmission rate) - IO data configuration (Input data adjustable, mirror output data onto input data, increment input data) - Event configuration (maximum 6 events, unique, cyclic, depending on output) - ISDU configuration (all Indices) - Stack configuration
FR8	SDCI functionality: - all transmission rates (4,8; 38,4; 230,4 kbit/s) - SIO-Mode - All valid M-sequence types (TYPE_0, TYPE_1_1, TYPE_1_2, TYPE_1_V, TYPE_2_1, TYPE_2_2, TYPE_2_3, TYPE_2_4, TYPE_2_5, TYPE_2_6, TYPE_2_V) - All specified IO configurations - All specified ISDU Indices - Direct Parameter page (Index 0 and 1)
FR9	Trigger incidences: - Begin of start-up sequence (Wake-up is detected) - New Process Data cycle started - New SDCI M-sequence detected - Start of a new ISDU request detected - New ISDU response is generated - An Event is generated - Errors (checksum, parity, frame, protocol)

A.4.4 Separate neutral communication tester protocol

A.4.4.1 General

For the tester protocol any point-to-point transmission is supposed such as RS 232 or even an SDCI communication.

A.4.4.2 Protocol characteristics

The initiator of a communication between the Master-Tester software (MTS) on a PC and the Master (EUT) is always the MTS. The Master responds to the request/status messages.

The data exchanged are interpreted as hexadecimal nibbles/octets. Each message in both directions starts with a T-Function ID, Number of octets (the message length in octets) and ends with a Checksum octet (CHKS). Figure A.18 shows this principle message structure.

Text strings shall be transferred from left (first character) to right (last character). For coding of text strings see [9].

Timings

The Master (EUT) shall first respond to any request message prior to starting the next message.

The MTS shall send request/status messages within a certain time period. This time period can vary and should be configurable within the PC application MTS. The recommended values are between 500 ms and 1000 ms.

Checksum

Each and every message ends with the checksum octet (CHKS). The message octets are XOR processed from first octet T-Function ID to the last octet CHKS, which is 0x00 at that time. The remainder is used for the CHKS value prior to sending the message. Applying the XOR processing at the receiver side shall lead to the result 0x00; otherwise the message has been corrupted.

Communication disconnection

When the MTS did not receive the response to a message it repeats the last request message. After two retries without response the MTS quits communication.

A.4.4.3 "Get identification" message

With the help of the "Get identification" message E_FNCID_GETINFO the identification data of the Master (EUT) can be acquired via the message type shown in Figure A.18. The request message contains as protocol data unit (PDU) the "Info ID" of the information desired from the Master.

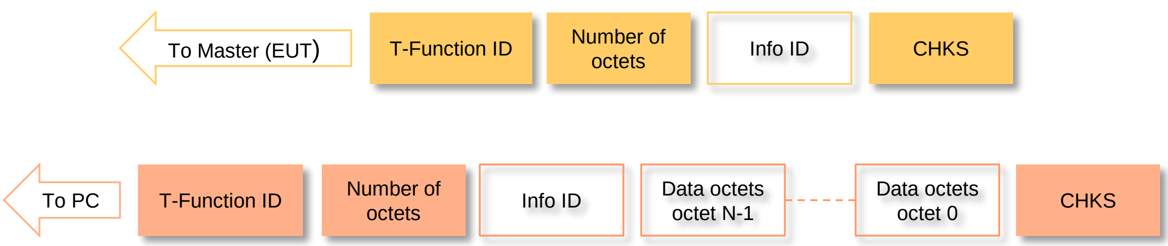


Figure A.18 – "Get identification" message sequence

The response message contains as PDU the "Info ID" code and the associated information. The number of "data octets" (N) indicates the length of the returned information, which is the number of message octets minus 4.

Table A.4 – The "Get identification" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_GETINFO (0x00)
S1	Number of octets	Number of message octets to be send to the Master
S2	Info ID	Info ID code according Table A.5
S3	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_GETINFO (0x00)
R1	Number of octets	Number of message octets returned from the Master
R2	Info ID	Info ID code according Table A.5 (expected: the same as in S2)
R3	Octet N-1 of data octets	First character of the information, e.g. vendor name
…	…	…
R3+N	Octet 0 of data octets	Last character of the information, e.g. vendor name
R4+N	CHKS	Checksum across the entire message to be returned

The "Info ID" names and codes are defined in Table A.5. For example the vendor name "FirstManu" would lead to the "Info ID" 0x00, to "F" as data octet N-1, and to "u" as data octet 0.

Table A.5 – Info ID names and codes

Info ID name	Info ID code	Definition
E_INFO_VENDOR	0x00	Vendor name
E_INFO_PRDNAME	0x01	Procuct name
E_INFO_PRDID	0x02	Product ID
E_INFO_SRNNUMB	0x03	Serial number
E_INFO_SWREV	0x04	Software revision
E_INFO_HWREV	0x05	Hardware revision
E_INFO_DESC	0x06	Description

A.4.4.4 Configuration messages

A.4.4.4.1 Overview

The configuration messages for the test interface layer provided in the Master (EUT) design deal with

- Input and output Process Data lengths and types (Figure A.19, PDE)
- Master (EUT) port set-up (Figure A.19, CM)
- Header, upload, download of the Data Storage (Figure A.19, DS)

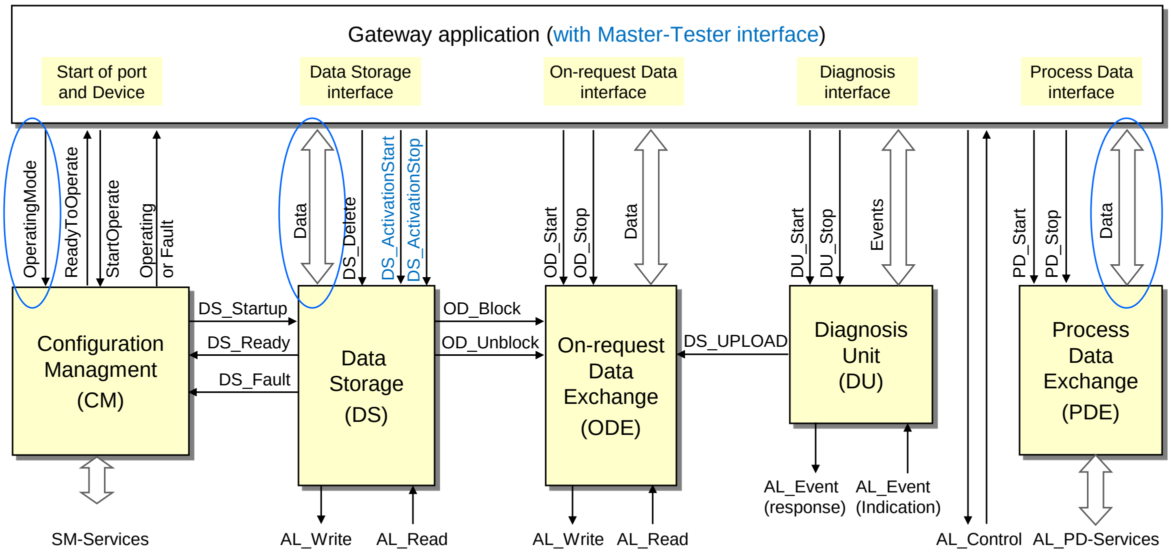


Figure A.19 – Master (EUT) test interface layers for Configuration

A.4.4.4.2 "Set PD interface" message

The structure of the Process Data (PD) to be used is set with this configuration message (E_FNCID_SETPDI). The structure is of type 16 bit unsigned integer, where octet 1 refers to the most significant octet, octet 0 to the least significant octet. Table A.6 shows the message sequence with the T-Function ID (S0 and R0), the number of octets (S1 and R1) and the PDU of the message sent (S2 to S5) and the message received (R2) according to Figure A.18.

Table A.6 – The "Set PD interface" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_SETPDI (0x01)
S1	Number of octets	Number of message octets sent to the Master
S2	Structure of PD out, octet 1	Most significant octet of a 16 bit unsigned integer output value
S3	Structure of PD out, octet 0	Least significant octet of a 16 bit unsigned integer output value
S4	Structure of PD in, octet 1	Most significant octet of a 16 bit unsigned integer input value
S5	Structure of PD in, octet 0	Least significant octet of a 16 bit unsigned integer input value
S6	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_SETPDI (0x01)
R1	Number of octets	Number of message octets returned from the Master
R2	Status code	Status of the PD interface parameterization (see Table A.7)
R3	CHKS	Checksum across the entire message to be returned

Table A.7 shows the status codes (R2) and definitions of response messages.

Table A.7 – Status codes and definitions

Status name	Status code	Definition
E_STATCODE_OK	0x00	Request successful accomplished
E_STATCODE_ERR	0x01	Error while performing request

A.4.4.4.3 "Get PD interface" message

Table A.8 shows the message sequence to be used to aquire the number of ports and the in/out PD structures from the Master (EUT).

Table A.8 – The "Get PD interface" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_GETPDI (0x02)
S1	Number of octets	Number of message octets sent to the Master
S2	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_GETPDI (0x02)
R1	Number of octets	Number of message octets returned from the Master
R2	Number of ports	8 bit unsigned integer
R3	Structure of PD out, octet 1	Most significant octet of a 16 bit unsigned integer output value
R4	Structure of PD out, octet 0	Least significant octet of a 16 bit unsigned integer output value
R5	Structure of PD in, octet 1	Most significant octet of a 16 bit unsigned integer input value
R6	Structure of PD in, octet 0	Least significant octet of a 16 bit unsigned integer input value
R7	CHKS	Checksum across the entire message to be returned

A.4.4.4.4 "Set port configuration" message

Table A.9 shows the message sequence to be used to set-up a particular Master (EUT) port.

NOTE Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

The port parameters are specified in [9].

Table A.9 – The "Set port configuration" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_SETPORTCNFPAR (0x04)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port to be configured (Unsigned8)
S3	Operating mode	Requested port mode (see Table A.10) (Unsigned8)
S4	Port cycle	Type of cycles (see Table A.11) (Unsigned8)
S5	Cycle time	Most significant octet 1 of port cycle time (x 100 µs)
S6	Cycle time	Least significant octet 0 of port cycle time (x 100 µs)
S7	PDConfig LenIn	Length of the incoming process data in bytes
S8	PDConfig PosIn	Process Data position in the input PD stream. Octet position count starts at "0" (see A.4.4.6.2 and Table A.28).
S9	PDConfig SrcOffsetIn	Not used
S10	PDConfig LenOut	Length of the outgoing process data in bytes
S11	PDConfig PosOut	Process Data position in the output PD stream. Octet position count starts at "0" (see A.4.4.6.2 and Table A.28).
S12	PDConfig SrcOffsetOut	Not used
S13	Vendor ID	Most significant octet 1 of the Vendor ID
S14	Vendor ID	Least significant octet 0 of the Vendor ID
S15	Device ID	Most significant octet 3 of the Device ID
…	…	…
S18	Device ID	Least significant octet 0 of the Device ID
S19	Serial number	Most significant octet 15 of the Device Serial number
…	…	…
S35	Serial number	Least significant octet 0 of the Device Serial number
S36	Inspection level	Inspection level (Unsigned8)

Octet No.	Octet name	Description
S37	DS activation state	Activation state of the Data Storage (Value 0 means - inactive, value 1 means - activate)
S38	DS download enable	Data Storage download enable (Value 0 means - disabled, value 1 means - enabled)
S39	DS upload enable	Data Storage upload enable (Value 0 means - disabled, value 1 means - enabled)
S40	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_SETPORTCNFPAR (0x04)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port configured (Unsigned8), expected: the same as in S2
R3	Status code	Status of the port configuration (see Table A.7)
R4	CHKS	Checksum across the entire message to be returned

Table A.10 shows the port operating modes and the associated coding.

Table A.10 – Port operating modes

Operating mode	Coding	Definition
E_OPMODE_INACTIVE	0x00	Switched off
E_OPMODE_DO	0x01	Digital output
E_OPMODE_DI	0x02	Digital input
E_OPMODE_FIXEDMODE	0x03	Fixed mode
E_OPMODE_SCANMODE	0x04	Scan mode

Table A.11 shows the port cycle states and the associated codings.

Table A.11 – Port cycle states

Port cycle	Coding	Definition
E_PORTCYCLE_FREERN	0x00	Free run
E_PORTCYCLE_FIXVAL	0x01	Fixed value
E_PORTCYCLE_MSGSYN	0x02	Message synchronization

A.4.4.4.5 "Get port configuration" message

Table A.12 shows the message sequence to be used to acquire the parameters of a particular Master (EUT) port.

NOTE Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

The port parameters are specified in [9].

Table A.12 – The "Get port configuration" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_GETPORTCNFPAR (0x05)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port to be read from (Unsigned8)
S3	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_ GETPORTCNFPAR (0x05)

Octet No.	Octet name	Description
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Configured port (Unsigned8), expected: the same as in S2
R3	Operating mode	Requested port mode (see Table A.10) (Unsigned8)
R4	Port cycle	Type of cycles (see Table A.11) (Unsigned8)
R5	Cycle time	Most significant octet 1 of port cycle time (x 100 µs)
R6	Cycle time	Least significant octet 0 of port cycle time (x 100 µs)
R7	PDConfig LenIn	Length of the incoming process data in bytes
R8	PDConfig PosIn	Process Data position in the input PD stream. Octet position count starts at "0" (see A.4.4.6.2 and Table A.28).
R9	PDConfig SrcOffsetIn	Not used
R10	PDConfig LenOut	Length of the outgoing process data in bytes
R11	PDConfig PosOut	Process Data position in the output PD stream. Octet position count starts at "0" (see A.4.4.6.2 and Table A.28).
R12	PDConfig SrcOffsetOut	Not used
R13	Vendor ID	Most significant octet 1 of the Vendor ID
R14	Vendor ID	Least significant octet 0 of the Vendor ID
R15	Device ID	Most significant octet 3 of the Device ID
…	…	…
R18	Device ID	Least significant octet 0 of the Device ID
R19	Serial number	Most significant octet 15 of the Device Serial number
…	…	…
R35	Serial number	Least significant octet 0 of the Device Serial number
R36	Inspection level	Inspection level (Unsigned8)
R37	DS activation state	Activation state of the Data Storage (Value 0 means - inactive, value 1 means - activate)
R38	DS download enable	Data Storage download enable (Value 0 means - disabled, val-ue 1 means - enabled)
R39	DS upload enable	Data Storage upload enable (Value 0 means - disabled, value 1 means - enabled)
R40	CHKS	Checksum across the entire message to be returned

3055

3056 #### A.4.4.4.6 "Set Data Storage header" message

3057 This feature is optional. The header of the Data Storage of one port is configured via this type
3058 of message. The Master (EUT) returns a status code whether the configuration succeeded or
3059 failed.

3060 NOTE Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

3061 Table A.13 shows the "Set Data Storage header" message sequence.

3062 **Table A.13 – The "Set Data Storage header" message sequence**

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_SETDSHDR (0x06)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port of the Storage Data to be configured (Unsigned8)
S3	Parameter checksum	Octet 3 of the Data Storage checksum [9]
S4	Parameter checksum	Octet 2 of the Data Storage checksum [9]
S5	Parameter checksum	Octet 1 of the Data Storage checksum [9]

Octet No.	Octet name	Description
S6	Parameter checksum	Octet 0 of the Data Storage checksum [9]
S7	Vendor ID	Most significant octet 1 of the Vendor ID within the header
S8	Vendor ID	Least significant octet 0 of the Vendor ID within the header
S9	Device ID	Most significant octet 3 of the Device ID within the header
...	...	...
S12	Device ID	Least significant octet 0 of the Device ID within the header
S13	Function ID	Most significant octet 1 of the Function ID within the header
S14	Function ID	Least significant octet 0 of the Function ID within the header
S15	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_SETDSHDR (0x06)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port of the Storage Data, expected: the same as in S2
R3	Status code	Status of the port configuration (see Table A.7)
R4	CHKS	Checksum across the entire message to be returned

A.4.4.4.7 "Get Data Storage header" message

This feature is optional. The Master (EUT) returns the header of the Data Storage of one port upon this message.

NOTE Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

Table A.14 shows the "Get Data Storage header" message sequence.

Table A.14 – The "Get Data Storage header" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_GETDSHDR (0x07)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port of the Storage Data to be read from (Unsigned8)
S15	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_GETDSHDR (0x07)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port of the Storage Data, expected: the same as in S2
R3	Parameter checksum	Octet 3 of the Data Storage checksum [9]
R4	Parameter checksum	Octet 2 of the Data Storage checksum [9]
R5	Parameter checksum	Octet 1 of the Data Storage checksum [9]
R6	Parameter checksum	Octet 0 of the Data Storage checksum [9]
R7	Vendor ID	Most significant octet 1 of the Vendor ID within the header
R8	Vendor ID	Least significant octet 0 of the Vendor ID within the header
R9	Device ID	Most significant octet 3 of the Device ID within the header
...	...	...
R12	Device ID	Least significant octet 0 of the Device ID within the header
R13	Function ID	Most significant octet 1 of the Function ID within the header
R14	Function ID	Least significant octet 0 of the Function ID within the header
R15	CHKS	Checksum across the entire message to be returned

A.4.4.4.8 "Upload Storage Data to the Master" message

This feature is optional. The entire Storage Data for one port is uploaded to the Master (EUT) via this message. The lengths of the Storage Data can vary. The number of "Storage Data" (N) indicates the length of the uploaded data, which is the number of message octets minus 4.

NOTE 1 The maximum size of the Storage Data is 2 048 octets. If the length of the Storage Data cannot be limited to 255-4 for the tests, the octet "Number of octets" within the messages can be extended to 2 octets.

NOTE 2 Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

Table A.15 shows the "Upload Storage Data to Master" message sequence.

Table A.15 – The "Upload Storage Data to Master" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_UPLDS (0x08)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port of the Storage Data (Unsigned8)
S3	Octet N-1 of Storage Data	First octet of the Storage Data
...	...	...
S3+N	Octet 0 of Storage Data	Last octet of the Storage Data
S4+N	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_UPLDS (0x08)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port of the Storage Data, expected: the same as in S2
R3	Status code	Status of the port configuration (see Table A.7)
R4	CHKS	Checksum across the entire message to be returned

A.4.4.4.9 "Download Storage Data from Master" message

This feature is optional. The entire Storage Data of one port is downloaded from the Master (EUT) via this message. The lengths of the Storage Data can vary. The number of "Storage Data" (N) indicates the length of the downloaded data, which is the number of message octets minus 4.

NOTE Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

Table A.16 shows the "Download Storage Data to Master" message sequence.

Table A.16 – The "Download Storage Data from Master" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_DWNDS (0x09)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port of the Storage Data (Unsigned8)
S4	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_DWNDS (0x09)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port of the Storage Data, expected: the same as in S2
R3	Octet N-1 of Storage Data	First octet of the Storage Data
...	...	...
R4+N	Octet 0 of Storage Data	Last octet of the Storage Data
R5+N	CHKS	Checksum across the entire message to be returned

A.4.4.5 Command messages

A.4.4.5.1 Overview

The command messages for the test interface layer provided in the Master (EUT) design deal with

- the control of the master applications via the OperatingMode, StartOperate, DS_Delete, OD_Start, OD_Stop, DU_Start, DU_Stop, PD_Start, and PD_Stop flags within the control message (see Figure A.20, green circled areas of the test interface layer)
- the control of the PD out valid / invalid flags via the AL_Control service (see Figure A.20, blue circled areas of the test interface layer)
- the initiation of new ISDU transfers via ISDU Read request messages using the data flow between the ODE and the On-request Data interface (see Figure A.20, red circled areas of the test interface layer)

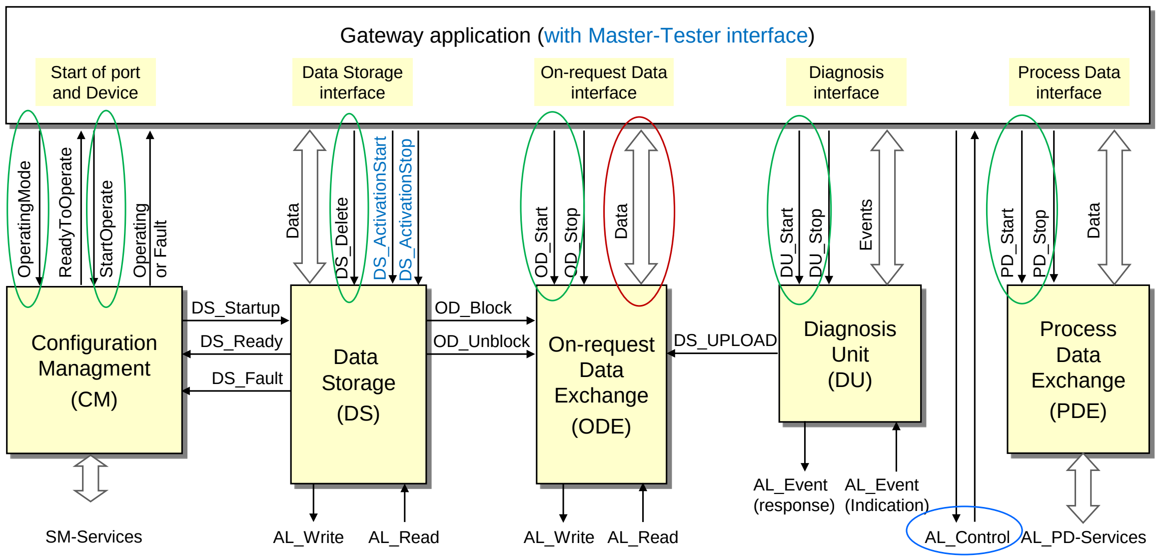


Figure A.20 – Master (EUT) test interface layers for Control

A.4.4.5.2 "Control" message

The Master-Tester Software (MTS) uses this message to send the test relevant triggers to the Master (EUT) and to send the PD out data stream. The Master response contains the entire Status information of the ports (see A.4.4.6.2).

Table A.17 focuses on the "Control" message of the sequence. The number of ports can vary. The port numbering starts at "1" in ascending order.

NOTE Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

The "Control Flags" require two octets per port. If the number of ports is N and the lenth of the output Process Data stream is M, the total length of the "Control" message is 2 + 2 x N + M +1. For more details on Process Data streams see Table A.28 and A.4.4.6.2.

Table A.17 – The "Control" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_CNTSTA (0x03)
S1	Number of octets	Number of message octets to be send to the Master
S2	Control Flags, octet 1, port 1	Upper trigger set for the test interface layer (seeTable A.18)
S3	Control Flags, octet 0, port 1	Lower trigger set for the test interface layer (seeTable A.19)
…	…	…

Octet No.	Octet name	Description
S(2N)	Control Flags, octet 1, port N	Upper trigger set for the test interface layer (seeTable A.18)
S(2N+1)	Control Flags, octet 0, port N	Lower trigger set for the test interface layer (seeTable A.19)
S(2N+2)	Octet M-1 of the PD out data	First octet of the output Process Data stream
...	...	...
S(2N+M)	Octet 0 of the PD out data	Last octet of the output Process Data stream
S(2N+M+1)	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_CNTSTA (0x03)
See A.4.4.6.2		

Table A.18 shows the upper set of the "Control Flags".

Table A.18 – Octet 1 of the Control Flags (upper trigger set)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Operating Mode	Start Operate	DS_Delete	Event Acknowledge	PD_Out valid	PD_Out invalid	DS_Activate start	DS_Activate stop

Table A.19 shows the lower set of the "Control Flags".

Table A.19 – Octet 0 of the Control Flags (lower trigger set)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
OD_Start	OD_Stop	DU_Start	DU_Stop	PD_Start	PD_Stop	Reserved	Reserved

Table A.20 specifies the particular activity caused by a Control Flag if its bit is set ("1").

Table A.20 – Control Flags definition

Flag No.	Bit name	Definition (if bit = "1")
15	OperatingMode	Indicates a port mode change to the Master. The desired port mode is first set via the *Set port configuration* message (see A.4.4.4.4)
14	StartOperate	Switches the port to the OPERATE state if it is already in "Ready to Operate" state.
13	DS_Delete	Clears Data Storage
12	EventAcknowledge	Acknowledges the indicated Event
11	PD_Out valid	Indicates valid output Process Data
10	PD_Out invalid	Indicates invalid output Process Data
9	DS_Activate start	Activates Data Storage
8	DS_Activate stopp	De-activates Data Storage
7	OD_Start	Starts the On-request Data Master application
6	OD_Stop	Stops the On-request Data Master application
5	DU_Start	Starts the Diagnosis Unit Master application
4	DU_Stop	Stops the Diagnosis Unit Master application
3	PD_Start	Starts the Process Data Exchange Master application

Flag No.	Bit name	Definition (if bit = "1")
2	PD_Stop	Stops the Process Data Exchange Master application
1	Reserved	Bit shall be "0" and shall not be evaluated
0	Reserved	Bit shall be "0" and shall not be evaluated

A.4.4.5.3 "ISDU request" message

A Write request or Read request Indexed Service Data Unit (ISDU) can be performed via this message. The ISDU request type, the Index and the Subindex are passed within the body of the message. The desired ISDU data octets can be transmitted via the Write request option. The length of the ISDU data amounts to the number of returned message octets minus 8.

NOTE Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

Table A.21 shows the "ISDU request" message sequence.

Table A.21 – The "ISDU request" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_ISDUREQ (0x0A)
S1	Number of octets	Number of message octets to be send to the Master
S2	Port number	Port for the ISDU Write or Read request (Unsigned8)
S3	ISDU request type	Write (0x00) or Read (0x01)
S4	Index	Upper octet 1 of the requested parameter Index, see [9]
S5	Index	Lower octet 0 of the requested parameter Index, see [9]
S6	Subindex	Parameter Subindex, see [9]
S7	ISDU data	*Optional in case of ISDU Write*: Most significant octet N-1 of the ISDU data
…	…	…
S(7+N)	ISDU data	*Optional in case of ISDU Write*: Least significant octet 0 of the ISDU data
S(7+N+1)	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_ISDUREQ (0x0A)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port for the ISDU request; expected: the same as in S2
R3	Status code	Status of the port configuration (see Table A.7)
R4	CHKS	Checksum across the entire message to be returned

A.4.4.6 Status messages

A.4.4.6.1 Overview

The status messages for the test interface layer provided in the Master (EUT) design deal with

- the indication of port Status Flags such as ReadyToOperate, Operating, Faults, etc. (see Figure A.21, green circled areas of the test interface layer)
- the ISDU request statuses and ISDU data streams between ODE and the On-request Data interface (see Figure A.21, blue circled areas of the test interface layer)
- the Event indication, display and acknowledgement between the DU and the Diagnosis interface (see Figure A.21, blue circled areas of the test interface layer)

- The PDE status and display of the input Process Data via the AL_Control service (see Figure A.21, blue circled areas of the test interface layer)

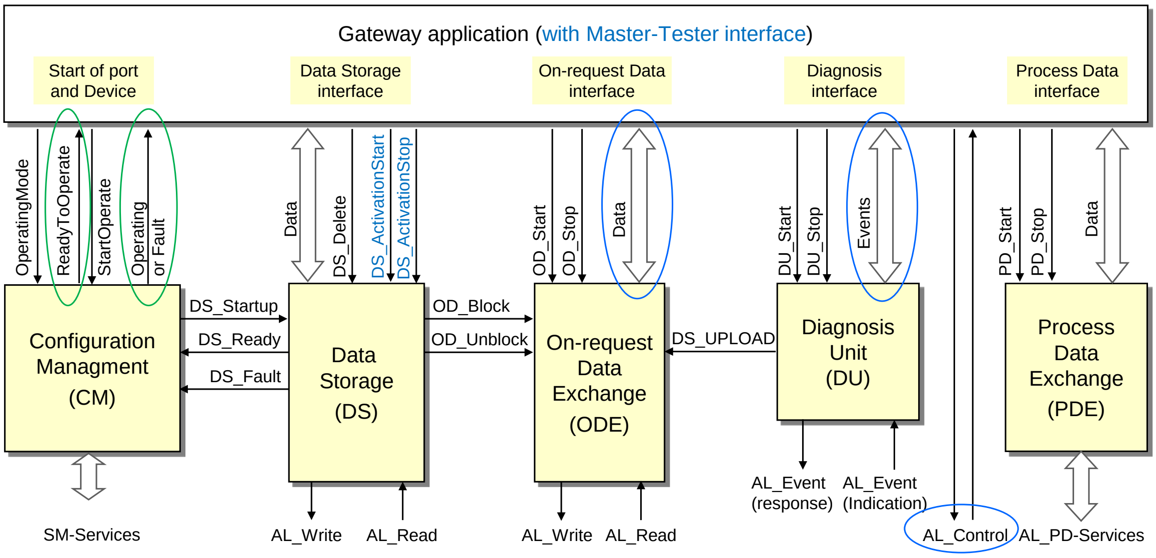


Figure A.21 – Master (EUT) test interface layers for Status

A.4.4.6.2 "Read Status" message

With the help of this type of message the statuses of the Master applications Communication, Events/Diagnosis Unit (DU), ISDU/On-request Data Exchange (ODE), Process Data Exchange (PDE) as well as PD input octet streams can be acquired.

Table A.22 focuses on the "Status" message (response) of the sequence. The "Control" message of the sequence is specified in A.4.4.5.2.

NOTE Port numbering starts at "1" whenever it is displayed. However, coding starts at 0x00.

Table A.22 – The "Status" message sequence

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_CNTSTA (0x03)
See A.4.4.5.2		
R0	T-Function ID	E_FNCID_CNTSTA (0x03)
R1	Number of octets	Number of message octets to be send to the Master
R2	Status Flags, octet 1, port 1	Upper flag set for the test interface layer (seeTable A.18)
R3	Status Flags, octet 0, port 1	Lower flag set for the test interface layer (see Table A.24)
…	…	…
R(2N)	Status Flags, octet 1, port N	Upper flag set for the test interface layer (see Table A.23)
R(2N+1)	Status Flags, octet 0, port N	Lower flag set for the test interface layer (see Table A.24)
R(2N+2)	Octet K-1 of the PD in data	First octet of the input Process Data stream
…	…	…
R(2N+K)	Octet 0 of the PD in data	Last octet of the input Process Data stream
R(2N+K+1)	CHKS	Checksum across the entire message to be send

Table A.23 shows the upper set of the "Status Flags".

3165 **Table A.23 – Octet 1 of the Status Flags (upper flag set)**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
ReadyTo Operate	Operating	Event indication	PD In Status	ODE Status	DU Status	PDE Status	Reserved

3166

3167 Table A.24 shows the lower set of the "Status Flags".

3168 **Table A.24 – Octet 0 of the Status Flags (lower flag set)**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Fault	Fault	Fault	Fault	ISDU Status	ISDU Status	ISDU Status	ISDU Status

3169

3170 Table A.25 specifies the particular activity caused by a Control Flag if its bit is set ("1").

3171 **Table A.25 – Status Flags definition**

Flag No.	Bit name	Definition
15	ReadyToOperate	Indicates that this port is in *ready to operate* state
14	Operating	Indicates that this port is in *operate* state
13	Event indication	Indicates that this port has a new Event
12	PD In Status	Indicates the validity of input Process Data at this port
11	ODE Status	ODE Master application switched off (= 0) or on (= 1)
10	DU Status	DU Master application switched off (= 0) or on (= 1)
9	PDE Status	PDE Master application switched off (= 0) or on (= 1)
8	Reserved	Bit shall be "0" and shall not be evaluated
7	Fault	Bit 3 of an enumerated "Fault" type field (see Table A.26)
6	Fault	Bit 2 of an enumerated "Fault" type field (see Table A.26)
5	Fault	Bit 1 of an enumerated "Fault" type field (see Table A.26)
4	Fault	Bit 0 of an enumerated "Fault" type field (see Table A.26)
3	ISDU request Status	Bit 3 of an enumerated "ISDU request" field (see Table A.27)
2	ISDU request Status	Bit 2 of an enumerated "ISDU request" field (see Table A.27)
1	ISDU request Status	Bit 1 of an enumerated "ISDU request" field (see Table A.27)
0	ISDU request Status	Bit 0 of an enumerated "ISDU request" field (see Table A.27)

3172

3173 Table A.26 shows the possible "Fault" types and the associated coding.

3174 **Table A.26 – "Fault" types**

Fault type	Coding	Definition
E_FAULT_NOFAULT	0x00	No fault
E_FAULT_COMLOST	0x01	Communication lost
E_FAULT_REVFAULT	0x02	Incorrect Revision
E_FAULT_COMPFAULT	0x03	Incompatibility
E_FAULT_SERNUMFAULT	0x04	Incorrect SerialNumber

3175

3176 Table A.27shows the possible "ISDU request" statuses and the associated coding.

Table A.27 – "ISDU request" statuses

Operating mode	Coding	Definition
E_ISDUREQSTAT_IDLE	0x00	No ISDU requested
E_ISDUREQSTAT_BUSY	0x01	Service busy
E_ISDUREQSTAT_OK	0x02	Request successfully completed
E_ISDUREQSTAT_ALERROR	0x03	Service completed with error
E_ISDUREQSTAT_SERVICENOTAVAILABLE	0x04	Service is not available

The output and input Process Data (PD) octet streams include the outgoing and incoming Process Data of all ports. The upper level control system and the Master (EUT) know the number of ports and the structure and lengths of the Process Data of all ports and are able to compose or decompose the PD octet stream.

For the test output and input Process Data (PD) octet streams it is required to describe the structure and the length in order for the Master to handle the individual parts of each and every port. The PDConfig LenIn and the PDConfig PosIn parameters specified in Table A.9 and Table A.12 determine the input PD length and position in the input PD octet stream per port. The PDConfig LenIn parameter determines the length of the input PD in number of octets, and the PDConfig PosIn parameter determines the input PD position within the input PD octet stream (in number of octets, starting with "0").

Table A.28 shows an example of an Input Process Data (PD) stream for a Master (EUT) with 4 ports.

Table A.28 – Example of an Input Process Data (PD) stream

Stream octet	Port	PD octet	PDConfig Lenin	PDConfig Posin
0	1	1 (most significant)	2	0
1	1	0 (least significant)	-	-
2	2	1 (most significant)	2	2
3	2	0 (least significant)	-	-
4	3	0	1	4
5	4	2 (most significant)	3	5
6	4	1	-	-
7	4	0 (least significant)	-	-

A.4.4.6.3 "ISDU result" message

After an ISDU request (see A.4.4.5.3) the MTS can check the status of the ISDU request via the ISDU request Status Flags (see Table A.25 and Table A.27) of the "Status" message. If the ISDU request Status is E_ISDUREQSTAT_OK or E_ISDUREQSTAT_ALERROR the result of the (read) request or the detailed error code respectively can be read back from the Master (EUT).

The "ISDU result" message sequences (Table A.30 or Table A.31) contain an "ISDU result" octet. The Master (EUT) will return different messages depending on the content of this octet (see Table A.29).

The ISDU results E_ISDUANS_NOREQ and E_ISDUANS_WRITEPOS are defined to avoid misunderstandings of the ISDU request results.

Table A.29 – "ISDU results" and codings

ISDU result	Coding	Definition	Message sequence
E_ISDUANS_NOREQ	0x00	No ISDU request pending	See Table A.32
E_ISDUANS_WRITEPOS	0x01	ISDU write request successfully completed	See Table A.34
E_ISDUANS_WRITENEG	0x02	Error upon ISDU write request	See Table A.31
E_ISDUANS_READPOS	0x03	ISDU read request successfully completed	See Table A.30
E_ISDUANS_READNEG	0x04	Error upon ISDU read request	See Table A.31

Table A.30 shows the "ISDU result" message sequence in case of a successful ISDU read request containing the ISDU read data stream octets. The length of the ISDU data amounts to the number of returned message octets minus 5.

Table A.30 – The "ISDU result" message sequence (no error)

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_ISDUGET (0x0B)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port to be read from (Unsigned8)
S4	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_ISDUGET (0x0B)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port to be read from; expected: the same as in S2
R3	ISDU result	E_ISDUANS_READPOS (0x03); see Table A.29
R4	Octet N-1 of ISDU data	First octet of the ISDU data stream
...	...	...
R5+N	Octet 0 of ISDU data	Last octet of the ISDU data stream
R6+N	CHKS	Checksum across the entire message to be returned

Table A.31 shows the "ISDU result" message sequence in case of an error while processing an ISDU read or write request.

Table A.31 – The "ISDU result" message sequence (error)

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_ISDUGET (0x0B)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port to be read from (Unsigned8)
S4	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_ISDUGET (0x0B)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port to be read from; expected: the same as in S2
R3	ISDU result	See Table A.29
R4	ISDU error codes (ErrorTypes)	See [9], clause C.2
R5	Additional errors (Derived ErrorTypes)	See [9], clause C.3
R6	CHKS	Checksum across the entire message to be returned

If the PC sends the ISDU get result message without a prior ISDU request, the EUT responds to this mistake as shown in Table A.32.

Table A.32 – The "ISDU result" message sequence (mistake)

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_ISDUGET (0x0B)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port to be read from (Unsigned8)
S4	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_ISDUGET (0x0B)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port to be read from; expected: the same as in S2
R3	ISDU result	E_ISDUANS_NOREQ (0x00); see Table A.29
R4	CHKS	Checksum across the entire message to be returned

After a successful write sequence between PC and EUT, the PC sends the ISDU get result message and the EUT responds as shown in Table A.33.

Table A.33 – The "ISDU result" message sequence (success)

Octet No.	Octet name	Description
S0	T-Function ID	E_FNCID_ISDUGET (0x0B)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port to be read from (Unsigned8)
S4	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_ISDUGET (0x0B)
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port to be read from; expected: the same as in S2
R3	ISDU result	E_ISDUANS_WRITEPOS (0x01); see Table A.29
R4	CHKS	Checksum across the entire message to be returned

A.4.4.6.4 "Read Event" message

If the Status Flag "Event indication" within the returned "Status" message (see A.4.4.6.2, Table A.23 – Bit 13, Table A.25) indicates a new Event, it can be acquired with the help of this "Read Event" message from the Master (EUT). This message reads only one Event from the Master. The returned message includes the number of remaining Events. After reading the Event, it can be acknowledged with the help of the "Control" message (see A.4.4.5.2, Table A.18 – Bit 12, Table A.20).

Table A.34 shows the "Read Event" message sequence with its arguments and definitions.

Table A.34 – The "Read Event" message sequence

Octet No.	Octet name	Definition
S0	T-Function ID	E_FNCID_RDEVENT (0x0C)
S1	Number of octets	Number of message octets sent to the Master
S2	Port number	Port to be read from (Unsigned8)
S15	CHKS	Checksum across the entire message to be send
R0	T-Function ID	E_FNCID_RDEVENT (0x0C)

Octet No.	Octet name	Definition
R1	Number of octets	Number of message octets returned from the Master
R2	Port number	Port to be read from; expected: the same as in S2
R3	Event status	Event ready to be read (0x00); No Event (0x01)
R4	Instance	Unknown instance (0x00); Application (0x01)
R5	Mode	Single shot (0x00); Event disappeared (0x01); Event appeared (0x02)
R6	Type	Single shot (0x00); Event disappeared (0x01); Event appeared (0x02)
R7	Origin	Remote (0x00); Local (0x01)
R8	Event code	Most significant octet 1 of the EventCode (see [9], annex D)
R9	Event code	Least significant octet 0 of the EventCode (see [9], annex D)
R10	Events left	Number of peding Events (Unsigned8)
R11	CHKS	Checksum across the entire message to be returned

Annex B
(normative)
Supplement to the legacy specification V1.0

B.1 General

The definitions in [9] are more comprehensive than the definitions in the predecessor [13]. In order to establish a reliable interoperation of legacy Master and Devices with their SDCI counterparts it is necessary to supplement the predecessor specification [13] by a few clarifications.

B.2 Legacy-Master power-on driver capability

If the actual power-on driver capability does not meet the requirements defined in [9], the measured value(s) of TC_0002 (5.2.2) shall be documented in the user manual of the Legacy-Master.

B.3 Legacy-Device power-on current consumption

If the actual power-on current consumption does not meet the requirements defined in [9], the measured value(s) of TC_0012 (5.3.2) shall be documented in the user manual of the Legacy-Device.

B.4 ISDU request and response abort

The "abort" feature is not specifically defined in [13]. All Legacy-Devices shall have implemented this behavior, which is tested in TC_0067 (6.5.17) and TC_0068 (6.5.18).

B.5 "Device 1.1" connected to a "Master 1.0"

A manufacturer or vendor of a Device without backward compatibility shall document the behavior of the Device in case it will be connected to a "Master 1.0" (6.8.2.2).

B.6 Maximum MasterCycleTime

The maximum MasterCycleTime for both Master and Legacy-Master is 134 ms. This limit is checked in TC_0089 (6.9.1).

B.7 Maximum MinCycleTime

The maximum MinCycleTime for both Device and Legacy-Device is 134 ms. This limit is checked in TC_0090 (6.9.2).

B.8 Write access to reserved system commands

A Write access to reserved system commands within a Legacy-Device returns a negative response: PAR_VALOUTOFRNG (0x8030). TC_0104 (6.10.2) is affected.

B.9 Time-out for Write access to system commands

Legacy-Devices shall respond within 5 s. TC_0105 (6.10.3) is affected.

B.10 Text string length for Application Specific Tag

Existing Legacy-Devices are permitted to have text string length <16 octets. In this case, the manufacturer or vendor shall document the text string length in the user manual. It is highly recommended to provide a minimum of 16 octets. TC_0122 (6.10.19) and TC_0123 (6.10.20) are affected.

B.11 Write access with invalid length

A Write access to reserved system commands within a Legacy-Device returns a negative response: PAR_VALOUTOFRNG (0x8030). TC_0141 (6.10.33) and TC_0142 (6.10.34) are affected.

B.12 IODD "reset to factory settings" verification

It is highly recommended for Legacy-Devices to show the behavior defined in [9]. Deviations shall be documented in the user manual. TC_0155 (7.3.5) is affected.

B.13 Fallback in PREOPERATE

If the Master does not support the Fallback through a command from the upper level system such as a fieldbus, the manufacturer or vendor of the Device or Legacy-Device respectively shall document the restriction or behavior in the user manual. TC_0213 (8.8.1) and TC_0214 (8.8.2) are affected.

Annex C
(normative)
Listing of test cases

C.1 Listing of test cases sorted by IDs

Table C.1 shows the Test cases and its references.

Table C.1 – Test cases sorted by IDs

SDCI TC ID	TC Name	Reference
TC_0001	TCM_PHYL_INTF_ISM	Table 9
TC_0002	TCM_PHYL_INTF_ISIRM	Table 10
TC_0003	TCM_PHYL_INTF_ILLM	Table 11
TC_0004	TCM_PHYL_INTF_VRESHIGH	Table 12
TC_0005	TCM_PHYL_INTF_VRESLOW	Table 13
TC_0006	TCM_PHYL_INTF_VTHHM	Table 14
TC_0007	TCM_PHYL_INTF_VTHLM	Table 15
TC_0008	TCM_PHYL_INTF_VHYSM	Table 16
TC_0009	TCM_PHYL_INTF_IQPKHM	Table 17
TC_0010	TCM_PHYL_INTF_IQPKLM	Table 18
TC_0011	TCD_PHYL_INTF_ISD	Table 20
TC_0012	TCD_PHYL_INTF_ISIRD	Table 21
TC_0013	TCD_PHYL_INTF_VRESHIGH	Table 22
TC_0014	TCD_PHYL_INTF_VRESLOW	Table 23
TC_0015	TCD_PHYL_INTF_IQQD	Table 24
TC_0016	TCD_PHYL_INTF_VTHHD	Table 25
TC_0017	TCD_PHYL_INTF_VTHLD	Table 26
TC_0018	TCD_PHYL_INTF_VHYSD	Table 27
TC_0019	TCD_PHYL_INTF_IQHD	Table 28
TC_0020	TCD_PHYL_INTF_IQLD	Table 29
TC_0021	TCM_PHYL_INTF_IQWUH	Table 31
TC_0022	TCM_PHYL_INTF_TWUH	Table 32
TC_0023	TCM_PHYL_INTF_IQWUL	Table 33
TC_0024	TCM_PHYL_INTF_TWUL	Table 34
TC_0025	TCD_PHYL_INTF_TWUH	Table 35
TC_0026	TCD_PHYL_INTF_TWUL	Table 36
TC_0027	TCD_PHYL_INTF_TRENHIGH	Table 37
TC_0028	TCD_PHYL_INTF_TRENLOW	Table 38
TC_0029	TCD_PHYL_INTF_TRDL	Table 39
TC_0030	TCM_PHYL_INTF_BITEYEMAXLOAD	Table 42
TC_0031	TCM_PHYL_INTF_BITEYEMINLOAD	Table 44
TC_0032	TCM_PHYL_INTF_UARTEYEMAXLOAD	Table 46
TC_0033	TCM_PHYL_INTF_UARTEYEMINLOAD	Table 48
TC_0034	TCD_DLPC_STUP_CYCTIME	Table 54
TC_0035	TCD_DLPC_STUP_STUPOPER1	Table 55
TC_0036	TCD_DLPC_STUP_STUPOPER2	Table 57

TC_0037	TCD_DLPC_OPER_OPERSTUP1	Table 58
TC_0038	TCD_DLPC_OPER_OPERSTAR2	Table 59
TC_0039	TCD_DLPC_PROP_READDPP1	Table 60
TC_0040	TCD_DLPC_PROP_WRITEDPP1	Table 62
TC_0041	TCD_DLPC_PROP_SHORTMESSAGE	Table 63
TC_0042	TCD_DLPC_PROP_WRITECOLL	Table 64
TC_0043	TCD_DLPC_PROP_SIMRESET	Table 65
TC_0044	TCD_DLPC_PROP_MSEQFAULT	Table 66
TC_0045	TCD_DLPC_OPER_READ	Table 67
TC_0046	TCD_DLPC_OPER_WRITE	Table 68
TC_0047	TCD_DLPC_OPER_NEGWRITE	Table 69
TC_0048	TCD_DLPC_OPER_WRITECOLL	Table 70
TC_0049	TCD_DLPC_OPER_SIMRESET	Table 71
TC_0051	TCD_DLPC_OPER_WRONGMSEQTYPE	Table 72
TC_0052	TCD_DLPC_ISDU_AVAILMSEQCAP	Table 73
TC_0053	TCD_DLIC_ISDU_IDLEBUSYCHECK	Table 74
TC_0054	TCD_DLIC_ISDU_READINDEX8	Table 75
TC_0055	TCD_DLIC_ISDU_READ8EXTLENGTH	Table 76
TC_0056	TCD_DLIC_ISDU_WRITE8	Table 77
TC_0057	TCD_DLIC_ISDU_READ8RESERVED	Table 78
TC_0058	TCD_DLIC_ISDU_READ8NOSUBINDEX	Table 79
TC_0059	TCD_DLIC_ISDU_READ16	Table 80
TC_0060	TCD_DLIC_ISDU_WRITE16	Table 81
TC_0061	TCD_DLIC_ISDU_READ16RESERVED	Table 82
TC_0062	TCD_DLIC_ISDU_READ16NOSUBINDEX	Table 83
TC_0063	TCD_DLIC_ISDU_WRITE8LENOVERRUN	Table 84
TC_0064	TCD_DLIC_ISDU_WRITE8WRONGLEN	Table 85
TC_0065	TCD_DLIC_ISDU_WRITE8WRONGCHECKSUM	Table 86
TC_0066	TCD_DLIC_ISDU_WRITE8ROINDEX	Table 87
TC_0067	TCD_DLIC_ISDU_ABORTREADREQ	Table 88
TC_0068	TCD_DLIC_ISDU_ABORTREADRESP	Table 89
TC_0069	TCD_DLIC_EVNT_OPERSINGLEEVENT	Table 90
TC_0070	TCD_DLIC_EVNT_PROPSINGLEEVENT	Table 91
TC_0071	TCD_DLIC_EVNT_OPEREVENTCLEAR	Table 92
TC_0072	TCD_DLIC_EVNT_OPERCOMMINTERRUPT	Table 93
TC_0073	TCD_DLIC_EVNT_OPERPOWERINTERRUPT	Table 94
TC_0074	TCD_DLIC_EVNT_OPERAPPEARDISAPPEAR	Table 95
TC_0075	TCD_DLIC_EVNT_OPERMULTEVENT	Table 96
TC_0076	TCD_DLIC_EVNT_OPERSHORTEVENT	Table 97
TC_0077	TCD_APPS_DSUP_NOFLAG	Table 98
TC_0078	TCD_APPS_DSUP_VIADOWNLOADSTORE	Table 99
TC_0079	TCD_APPS_DSUP_VIADOWNLOADSTORENOWRITE	Table 100
TC_0080	TCD_APPS_DSUP_VIALOCALCHANGE	Table 101
TC_0081	TCD_APPS_DSUP_PARABREAKABORT	Table 102
TC_0082	TCD_APPS_DSDN_PARAMODIFICATION	Table 103

TC_0083	TCD_APPS_DSDN_FACTORYRESET	Table 104
TC_0084	TCD_APPS_DSDN_PARABREAKABORT	Table 105
TC_0085	TCD_DLIC_COMP_STARTUP	Table 106
TC_0086	TCD_DLIC_COMP_TYPE1INTERLEAVE	Table 107
TC_0087	TCD_DLIC_COMP_PDINVALIDEVENT	Table 108
TC_0089	TCD_DLPC_STDP_MASTERCYCLETIME	Table 109
TC_0090	TCD_DLPC_STDP_MINCYCLETIME	Table 110
TC_0091	TCD_DLPC_STDP_MSEQCAPABILITY	Table 111
TC_0092	TCD_DLPC_STDP_REVISIONID	Table 112
TC_0093	TCD_DLPC_STDP_PDIN	Table 113
TC_0094	TCD_DLPC_STDP_PDOUT	Table 114
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Annex D
(informative)
Information on conformity testing of SDCI

Information about testing Masters and Devices for conformity with [9] and [18] can be obtained from the following organization:

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