

IO-Link Safety – Test & Assessment

Specification

Related to
**IO-Link Safety – System Extensions
Specification V1.1.3**
and
**IO-Link Test
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This version 1.1.3 of the IO-Link Safety – Test & Assessment specification has been prepared by the IO-Link Safety test team. It covers automated SCL test cases, functional test cases, change requests since V1.1, and requests from an assessment body.

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1 **0 Introduction**

2 **0.1 General**

3 The single-drop digital communication interface (SDCI) technology described in part 9 of the
4 IEC 61131 series focuses on small sensors and actuators in factory automation, which are
5 nowadays using tiny little and cost-effective microcontrollers. With the help of the SDCI
6 technology, the existing limitations of traditional signal connection technologies such as
7 switching 0/24 V, analog 0 to 10 V, etc. can be turned into a smooth migration to pure digital
8 communication. Classic sensors and actuators are usually connected to a fieldbus system via
9 input/output modules in so-called remote I/O peripherals. The SDCI Master function enables
10 these peripherals to map SDCI Devices onto a fieldbus system or build up direct gateways.
11 Thus, parameter data can be transferred from the PLC level down to the sensor/actuator level
12 and diagnosis data transferred back in turn by means of the SDCI communication. This is a
13 contribution to consistent parameter storage and maintenance support within a distributed
14 automation system. SDCI is compatible to classic signal switching technology according to part
15 2 of the IEC 61131 series.

16 The functional safety extensions for SDCI in [4] provide the necessary technology preconditions
17 for Master and Devices to be turned into functional safety FS-Master and FS-Devices if they
18 are developed according to safety standards such as IEC 61508/ISO13849.

19 This document specifies the test cases and associated test equipment for such FS-Master and
20 FS-Devices. It provides the necessary preconditions for conformity testing to ensure inter-
21 operability and allows manufacturers of FS-Master and FS-Devices to achieve a precondition
22 of an assessment by a safety assessment body.

23

24 **0.2 Patent declaration**

25 There are no known patents for the technologies specified in this document. However, attention
26 is drawn to the possibility that some of the elements of this document may be the subject of
27 patent rights. The IO-Link Community shall not be held responsible for identifying any or all
28 such patent rights.

29 The IO-Link Community maintains on-line data bases of patents relevant to their specifications.
30 Users are encouraged to consult the databases for the most up to date information concerning
31 patents.

IO-Link Safety – Test & Assessment

32
33

34 1 Scope

35 IEC 61131-9 specifies the Single-Drop digital Communication Interface (IO-Link™¹) technology
36 as a generic interface for connecting sensors and actuators (called Devices) to a Master unit,
37 which may be combined with gateway capabilities to become a fieldbus remote I/O node (see
38 [1]).

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

42 The SDCI technology specifies parameterization, cyclic exchange of process data, and
43 diagnosis as well as parameter Data Storage capabilities. It is also publicly available in [2].

44 The document "IO-Link Safety System Extensions" (see [4]) provides the necessary extensions
45 to the basic IO-Link interface and system standard for functional safety communication
46 including compatibility to OSSDe based sensors and the necessary configuration management.
47 These extensions modify the architecture and behavior of Masters and thus turn them into FS-
48 Masters. Devices are turned into FS-Devices.

49 This document specifies the test cases and associated test environments for FS-Master and
50 FS-Devices designed and developed according to [1] or [2], [4], and relevant resolved Change
51 Requests (CRs) within the Change Request Database described in [3]. It provides the
52 necessary preconditions for conformity testing to ensure interoperability and enables
53 manufacturers of FS-Master and FS-Devices to achieve conformity as a precondition of an
54 assessment by a safety assessment body.

55 This document refers to [9] as the common basis for testing the non-safety-related parts of FS-
56 Master and FS-Device. The common test cases are only referenced in this document. The
57 current status of the Change-Request-Database shall be observed.

58 The structure of this document is described in clause 4.2.

59 In cases where conformance tests in accredited Test Centers unveil intentional implementation
60 deviations or unintentional incorrect implementations that may have tremendous commercial
61 effects, the rules in [10] apply.

62 Conformity with [4] cannot be claimed unless the requirements of this document are met.

63 2 Normative references

64 The following documents, in whole or in part, are normatively referenced in this document and
65 are indispensable for its application. For dated references, only the edition cited applies. For
66 undated references, the latest edition of the referenced document (including any amendments)
67 applies.

68 IEC 60947-5-3, *Low-voltage switchgear and controlgear – Part 5-2: Control circuit devices and*
69 *switching elements – Proximity switches*

70 IEC 61000-1-2, *Electromagnetic compatibility (EMC) - Part 1-2: General - Methodology for the*
71 *achievement of functional safety of electrical and electronic systems including equipment with*
72 *regard to electromagnetic phenomena*

¹ IO-Link™ is a trade name of the "IO-Link Community". This information is given for the convenience of users of this specification and does not constitute an endorsement by the IO-Link Community of the trade name holder or any of its products. Compliance to this document 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".

- 73 IEC 61000-6-7, *Electromagnetic compatibility (EMC) - Part 6-7: Generic standards - Immunity*
74 *requirements for equipment intended to perform functions in a safety-related system (functional*
75 *safety) in industrial locations*
- 76 IEC 61131-2, *Programmable controllers – Part 2: Equipment requirements and tests*
- 77 IEC 61131-9, *Programmable controllers – Part 9: Single-drop digital communication interface*
78 *for small sensors and actuators (SDCI)*
- 79 IEC 61496-1, *Safety of machinery – Electro-sensitive protective equipment – Part 1: General*
80 *requirements and tests*
- 81 IEC 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-*
82 *related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-*
83 *related systems*
- 84 IEC 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-*
85 *related systems - Part 3: Software requirements*
- 86 IEC 61784-3:2016, *Industrial communication networks - Profiles - Part 3: Functional safety*
87 *fieldbuses - General rules and profile definitions*
- 88 IEC 62061, *Safety of machinery – Functional safety of safety-related electrical, electronic and*
89 *programmable electronic control systems*
- 90 IEC 62453, *Field device tool (FDT) interface specification*
- 91 ISO 12100:2010, *Safety of machinery – General principles for design – Risk assessment and*
92 *risk reduction*
- 93 ISO 13849-1:2015, *Safety of machinery – Safety-related parts of control systems – Part 1:*
94 *General principles for design*
- 95 ISO 14119:2013, *Safety of machinery – Interlocking devices associated with guards –*
96 *Principles for design and selection*

97 **3 Terms, definitions, symbols, abbreviated terms and conventions**

98 **3.1 Common terms and definitions**

99 For the purposes of this document, the terms and definitions given in IEC 61131-1 and IEC
100 61131-2, as well as the following apply.

101 **3.1.1**

102 **address**

103 part of the M-sequence control to reference data within data categories of a communication
104 channel

105 **3.1.2**

106 **application layer**

107 AL

108 <SDCI>² part of the protocol responsible for the transmission of Process Data objects and On-
109 request Data objects

110 **3.1.3**

111 **block parameter**

112 consistent parameter access via multiple Indices or Subindices

² Angle brackets indicate validity of the definition for the SDCI (IO-Link) technology

- 113 **3.1.4**
114 **checksum**
115 <SDCI> complementary part of the overall data integrity measures in the data link layer in
116 addition to the UART parity bit
- 117 **3.1.5**
118 **CHKPDU**
119 integrity protection data within an ISDU communication channel generated through XOR
120 processing the octets of a request or response
- 121 **3.1.6**
122 **coded switching**
123 SDCI communication, based on the standard binary signal levels of IEC 61131-2
- 124 **3.1.7**
125 **COM1**
126 SDCI communication mode with transmission rate of 4,8 kbit/s
- 127 **3.1.8**
128 **COM2**
129 SDCI communication mode with transmission rate of 38,4 kbit/s
- 130 **3.1.9**
131 **COM3**
132 SDCI communication mode with transmission rate of 230,4 kbit/s
- 133 **3.1.10**
134 **COMx**
135 one out of three possible SDCI communication modes COM1, COM2, or COM3
- 136 **3.1.11**
137 **communication channel**
138 logical connection between Master and Device
- 139 Note 1 to entry: Four communication channels are defined: process channel, page and ISDU channel (for
140 parameters), and diagnosis channel.
- 141 **3.1.12**
142 **communication error**
143 unexpected disturbance of the SDCI transmission protocol
- 144 **3.1.13**
145 **cycle time**
146 time to transmit an M-sequence between a Master and its Device including the following idle
147 time
- 148 **3.1.14**
149 **Device**
150 single passive peer to a Master such as a sensor or actuator
- 151 Note 1 to entry: Uppercase "Device" is used for SDCI equipment, while lowercase "device" is used in a generic
152 manner.
- 153 **3.1.15**
154 **Direct Parameters**
155 directly (page) addressed parameters transferred acyclically via the page communication
156 channel without acknowledgement
- 157 **3.1.16**
158 **dynamic parameter**
159 part of a Device's parameter set defined by on-board user interfaces such as teach-in buttons
160 or control panels in addition to the static parameters

- 161 **3.1.17**
162 **Event**
163 instance of a change of conditions in a Device
- 164 Note 1 to entry: Uppercase "Event" is used for SDCI Events, while lowercase "event" is used in a generic manner.
165 Note 2 to entry: An Event is indicated via the Event flag within the Device's status cyclic information, then acyclic
166 transfer of Event data (typically diagnosis information) is conveyed through the diagnosis communication channel.
- 167 **3.1.18**
168 **fallback**
169 transition of a port from coded switching to switching signal mode
- 170 **3.1.19**
171 **inspection level**
172 degree of verification for the Device identity
- 173 **3.1.20**
174 **interleave**
175 segmented cyclic data exchange for Process Data with more than 2 octets through subsequent
176 cycles
- 177 **3.1.21**
178 **ISDU**
179 indexed service data unit used for acyclic acknowledged transmission of parameters that can
180 be segmented in a number of M-sequences
- 181 **3.1.22**
182 **M-sequence**
183 sequence of two messages comprising a Master message and its subsequent Device message
- 184 **3.1.23**
185 **M-sequence control**
186 first octet in a Master message indicating the read/write operation, the type of the
187 communication channel, and the address, for example offset or flow control
- 188 **3.1.24**
189 **M-sequence error**
190 unexpected or wrong message content, or no response
- 191 **3.1.25**
192 **M-sequence type**
193 one particular M-sequence format out of a set of specified M-sequence formats
- 194 **3.1.26**
195 **Master**
196 active peer connected through ports to one up to n Devices and which provides an interface to
197 the gateway to the upper-level communication systems or PLCs
- 198 Note 1 to entry: Uppercase "Master" is used for SDCI equipment, while lowercase "master" is used in a generic
199 manner.
- 200 **3.1.27**
201 **message**
202 <SDCI> sequence of UART frames transferred either from a Master to its Device or vice versa
203 following the rules of the SDCI protocol
- 204 **3.1.28**
205 **On-request Data**
206 acyclically transmitted data upon request of the Master application consisting of parameters or
207 Event data

- 208 **3.1.29**
209 **physical layer**
210 first layer of the ISO-OSI reference model, which provides the mechanical, electrical, functional
211 and procedural means to activate, maintain, and de-activate physical connections for bit
212 transmission between data-link entities
- 213 Note 1 to entry: Physical layer also provides means for wake-up and fallback procedures.
214 [SOURCE: ISO/IEC 7498-1, 7.7.2, modified – text extracted from subclause, note added]
- 215 **3.1.30**
216 **port**
217 communication medium interface of the Master to one Device
- 218 **3.1.31**
219 **port operating mode**
220 state of a Master's port that can be either INACTIVE, DO, DI, FIXEDMODE, or SCANMODE
- 221 **3.1.32**
222 **Process Data**
223 input or output values from or to a discrete or continuous automation process cyclically
224 transferred with high priority and in a configured schedule automatically after start-up of a
225 Master
- 226 **3.1.33**
227 **Process Data cycle**
228 complete transfer of all Process Data from or to an individual Device that may comprise several
229 cycles in case of segmentation (interleave)
- 230 **3.1.34**
231 **single parameter**
232 independent parameter access via one single Index or Subindex
- 233 **3.1.35**
234 **SIO**
235 port operation mode in accordance with digital input and output defined in IEC 61131-2 that is
236 established after power-up or fallback or unsuccessful communication attempts
- 237 **3.1.36**
238 **static parameter**
239 part of a Device's parameter set to be saved in a Master for the case of replacement without
240 engineering tools
- 241 **3.1.37**
242 **switching signal**
243 binary signal from or to a Device when in SIO mode (as opposed to the "coded switching" SDCI
244 communication)
- 245 **3.1.38**
246 **system management**
247 SM
248 <SDCI> means to control and coordinate the internal communication layers and the exceptions
249 within the Master and its ports, and within each Device
- 250 **3.1.39**
251 **UART frame**
252 <SDCI> bit sequence starting with a start bit, followed by eight bits carrying a data octet,
253 followed by an even parity bit and ending with one stop bit
- 254 **3.1.40**
255 **wake-up**
256 procedure for causing a Device to change its mode from SIO to SDCI

257 **3.1.41**
258 **wake-up request**
259 WURQ
260 physical layer service used by the Master to initiate wake-up of a Device, and put it in a receive
261 ready state

262

263 **3.2 IO-Link Safety: Additional terms and definitions**

264 For the purposes of this document, the following additional terms and definitions apply.

265 **3.2.1**

266 **error**

267 discrepancy between a computed, observed, or measured value or condition and the true,
268 specified or theoretically correct value or condition

269 Note 1 to entry: Errors may be due to design mistakes within hardware/software and/or corrupted information due
270 to electromagnetic interference and/or other effects.

271 Note 2 to entry: Errors do not necessarily result in a *failure* or a *fault*.

272 SOURCE: [IEC 61508-4:2010], [IEC 61158]

273 **3.2.2**

274 **failure**

275 termination of the ability of a functional unit to perform a required function or operation of a
276 functional unit in any way other than as required

277 Note 1 to entry: The definition in IEC 61508-4 is the same, with additional notes.

278 Note 2 to entry: Failure may be due to an error (for example, problem with hardware/software design or message
279 disruption)

280 SOURCE: [IEC 61508-4:2010, modified], [ISO/IEC 2382-14.01.11, modified]

281 **3.2.3**

282 **fault**

283 abnormal condition that may cause a reduction in, or loss of, the capability of a functional unit
284 to perform a required function

285 Note 1 to entry: IEC 61508-4 defines "fault" as a state characterized by the inability to perform a required
286 function, excluding the inability during preventive maintenance or other planned actions, or due
287 to lack of external resources.

288 SOURCE: [IEC 61508-4:2010, modified], [ISO/IEC 2382-14.01.10, modified]

289 **3.2.4**

290 **FS-Device**

291 single passive peer such as a functional safety sensor or actuator to a Master with functional
292 safety capabilities

293 **3.2.5**

294 **FS-Master**

295 active peer with functional safety capabilities connected through ports to one up to n Devices
296 or FS-Devices and which provides an interface to the gateway to the upper-level communication
297 systems (NSR or SR) or controllers with functional safety capabilities

298 **3.2.6**

299 **FSP parameter**

300 parameter set for the administration and operation of the IO-Link Safety protocol

301 **3.2.7**

302 **FST parameter**

303 parameter set for the safety-related technology of an FS-Device, for example light curtain

304 **3.2.8**
 305 **Safety PDU**
 306 Safety Protocol Data Unit
 307 SPDU
 308 PDU transferred through the safety communication channel

309 [SOURCE: IEC 61784-3:2021, 3.1.47, modified – Notes have been removed and admitted term
 310 has been added.]

311 **3.2.9**
 312 **SCL Tests**

313 safety-related communication protocol tests based on systematically developed and certified
 314 test scripts whereat using protocol state machines, simulation, model checking, and automated
 315 testcase generation, which are lock-sealed by signature (e.g. CRC) and which can only be
 316 changed through an entire safety reassessment.

317 Note 1 to entry: Core part of both types of tests for FS-Device and FS-Master are the SCL test scripts in Clause
 318 9 and Clause 12 in this document.

319 **3.2.10**
 320 **Functional Tests**

321 non-safety-related visual, manual, or automated tests based on test-to-pass, test-to-fail, and
 322 test coverage analysis of specified functions such as protocol environment, parameterization,
 323 time conditions, and performance aspects, which can be updated according to approved change
 324 requests without impacting the SCL tests in test systems.

325

326 **3.3 Symbols and abbreviated terms**

AL	application layer	
BEP	bit error probability	
C/Q	connection for communication (C) or switching (Q) signal (SIO)	
CRC	cyclic redundancy check	
DDO	Device data object	
DI	digital input	
DL	data link layer	
DO	digital output	
DTI	Device Tool Interface	
FDI	Field Device Integration	[IEC 62769]
FDT	Field Device Tool	[IEC 62453]
FS	functional safety	
FSCP	functional safety communication profile (for example IEC 61784-3-x series)	
FSDT	FS-Device tester	
FS-AI	functional safety analog input	
FS-DI	functional safety digital input	
I/O	input / output	
IODD	IO Device Description	
IOPD	IO-Link Parameterization & Diagnostic tool	
IOL-S	IO-Link Safety	
L-	power supply (-)	
L+	power supply (+)	
SMTU	Safety Master Tester Unit	
SDTU	Safety Device Tester Unit	
N24	24 V extra power supply (-); Port class B	

NSR	non-safety-related	
OD	On-request Data	
OK	"OK", values or state correct	
OSSD	output signal switching device (self-testing electronic device with built-in OSSD)	[IEC 61496-1]
OSSDe	output signal switching device (self-testing electronic device with built-in OSSD)	[4]
OSSD1/2e	pin assignment of both OSSDe signals	[4]
OSSDm	output signal switching device (relay and solid state outputs)	[IEC 60947-5-5]
P24	24 V extra power supply (+); Port class B	
PD	Process Data	
PDin	functional safety input process data (from an FS-Master's view)	
PDout	functional safety output process data (from an FS-Master's view)	
PDCT	port and Device configuration tool	
PFH	(average) probability of a dangerous failure per hour	
PID	program interface description	
PL	physical layer	
PLC	programmable logic controller	
PS	power supply (measured in V)	
RIO	remote I/O	
SCL	safety communication layer	
SDCI	single-drop digital communication interface	[IEC 61131-9]
SIO	standard input output (digital switching mode)	[IEC 61131-2]
SM	system management	
SMTA	safety master tester application	
SDTA	safety device tester application	
SPDU	safety protocol data unit	
SR	safety-related	
SSI	synchronous serial interface (usually for encoders)	
TAF	temporary acknowledgment file	
TBF	temporary backchannel file	
TPF	temporary parameter file	
UART	universal asynchronous receiver transmitter	
UML 2	unified modeling language, edition 2	[ISO/IEC 19505-2]
WURQ	wake-up request pulse	
XML	extensible markup language	

327

328 3.4 Conventions

329 3.4.1 Test case template

330 This document uses a dedicated template as shown in Table 1 for the particular test cases. It
 331 contains explanations on how to use items in the left column.

332

Table 1 – Test case template

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_nnnn (nnnn = 4-digit consecutive number starting with 0001)
Name	Characteristic name of the test case (see 0)
Purpose (short)	Short description of the purpose of the test case (one line maximum)
Equipment under test (EUT)	FS- Master, FS- Device, IODD, DedicatedTool, FS-MasterTool
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 3.4.3
Specification (clause)	[Bibliography, nn], clause or subclause, figure, table, chart, etc.
Configuration / setup	For example: Reference-FS-Master and EUT (FS-Device)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Comprehensive description of the purpose of the test case (can be several lines). Shall not contain preconditions or instructions.
Precondition	Initial mode of the test set (both EUT and test environment) to be set prior to testing or ID of previous test. Examples: <i>Tester precondition/Measurement instrument pre-set</i> ... <i>EUT precondition</i> ...
Procedure	- Step by step description of the test, each step marked by characters a), b), c), etc. - Loops are possible (see [9]) - "Test step macros" are possible, shall be named "TS_<domain>_xxxx", and defined within the general clause. Examples: a) Test step macro α b) Evaluation 1) c) Single instruction d) Evaluation 2) ...
Test parameter	- Shall be specified using definitions within [2] - Can be identified using A), B), C), etc. - Shall be linked to procedure steps, for example a), b), c), etc. - Test loops can be used as specified in 3.3.1.3 in [9]
Post condition	Final mode of the EUT and its test environment. It is possible to keep evaluation results as input for subsequent test cases if a certain test case gets too complex.
TEST CASE RESULTS	CHECK / REACTION
Evaluation	- A sequence of steps, where the status of the EUT is checked at each step - Each evaluation step is linked to a procedure step - Each evaluation step to be marked by a numeric character 1), 2), 3), etc. Example: 1) Parameter β , Parameter γ , ... 2) Value λ ...
Test passed	Test verdict if defined expectations are fulfilled, such as: - Approve reaction at each evaluation step whether it is correct ("and") - In case of alternate paths are defined, they shall be approved as defined ("or"). - Approve if deviations can be tolerated as exceptions (see [10]).
Test failed (examples)	Describe incorrect reaction and describe the reasons for failing
Report	Create brief data of test results such as measurement values, states, Events, implementation exceptions, test exceptions (see [10]), etc., and if test passed or not passed. Data shall be sufficient for a test certificate (option).

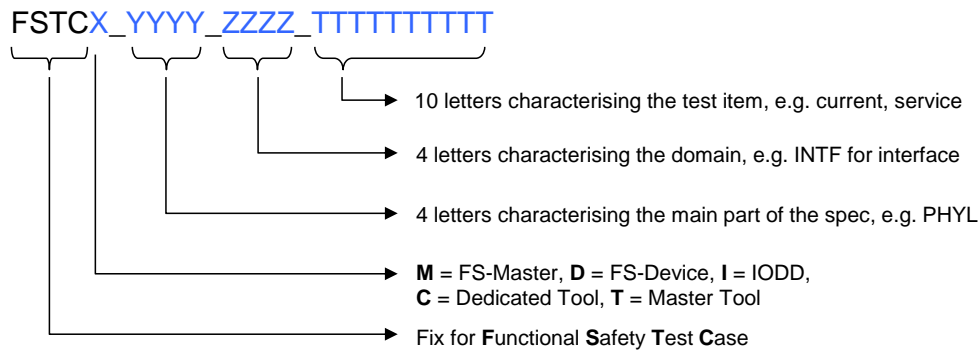
333

334

335

336 3.4.2 Naming of test cases

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



338

339

Figure 1 – Structure of the test case name

3.4.3 Categories and types of test cases

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

342

Table 2 – Test case categories

Category	Definition
Master Physical Layer test	Measure port voltages, currents, and timings
FS-Master OSSD test	Measure specific port voltages, currents, and timings
Device Physical Layer test	Measure Device voltages, currents, and timings
FS-Device OSSD test	Measure specific FS-Device voltages, currents, and timings
Master DL protocol test	Check Master protocol on DL level
FS-Master DL protocol test	Check FS-Master protocol specifics on DL level (e.g. READY pulse)
Device DL protocol test	Check Device protocol on DL level
FS-Device DL protocol test	Check FS-Device protocol specifics on DL level (e.g. READY pulse)
Master/Device protocol test	Master/Device interaction test on DL level
FS-Master/Device prot. test	FS-Master and FS-Device interaction test on DL level
Device PREOPERATE test	Device protocol test in PREOPERATE mode
FS-Device PREOPERATE test	FS-Device protocol test in PREOPERATE mode
Device OPERATE test	Device protocol test in OPERATE mode
FS-Device OPERATE test	FS-Device protocol test in OPERATE mode
Device ISDU test	Device ISDU protocol test
FS-Device ISDU test	FS-Device ISDU protocol test: FSP and FST parameterization
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 safety test	Test whether IODD is conforming to IO-Link Safety Extensions spec.
IODD verification test	Test whether IODD and the actual FS-Device parameter are matching
IODD verify test (FSP)	Test whether IODD and the actual FS-Device parameter are matching
IODD verification test	Test whether IODD and the actual FS-Device parameter are matching
Master Data Storage test	Test of Master's Data Storage mechanisms

343

Table 3 shows the used test case types within this document.

344

345

Table 3 – Test case types

Category	Definition
Test-to-pass	Positive test. A function shall perform as specified. Usually, the tests of a domain are beginning with these tests, where no stress is applied.
Test-to-fail	Negative or stress test. A function shall react with a defined behavior, for example an error indication when boundary conditions are exceeded.

346

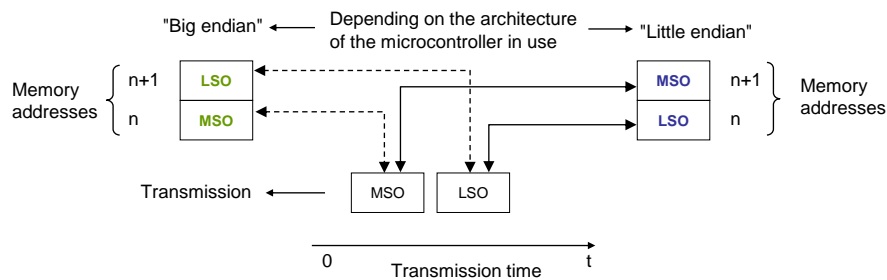
347 3.4.4 Naming of variables

348 Due to the possible implementation of the test cases in software, all used symbols and
 349 abbreviated terms in this document (see 3.3) are written in upper case letters without
 350 superscript or subscript.

351 3.4.5 Memory and transmission octet order

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

354 NOTE Existing microcontrollers can differ in the way WORD based data types are stored in memory: "big endian"
 355 and "little endian". If designs are not taking into account this fact, octets can be erroneously permuted for
 356 transmission.



357

358

Figure 2 – Memory and transmission octet order

359 3.4.6 Behavioral descriptions

360 The notations of UML 2 are used, mainly timing diagrams [7].

361 4 Strategy for testing IO-Link Safety devices

362 4.1 Purpose of this test specification

363 This document specifies the test cases and the necessary test equipment for FS-Master and
 364 FS-Devices in conjunction with its parent documents [9] and [4]. It covers OSSDe feature tests
 365 as well as functional safety communication protocol tests. It covers also relevant test cases out
 366 of [9] via references since both FS-Master and FS-Device are based on IO-Link Technology as
 367 "black channel".

368 The functional safety communication protocol tests are derived from a UML state machine
 369 simulation engine and automated to a large extent.

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

372 4.2 Structure of this document

373 Clause 5 specifies the test cases for the physical layer test of FS-Master and FS-Devices. They
 374 mainly require individual manual tests of both signal channels Pin4 and Pin2 (OSSDe) with
 375 variable power supplies, voltage and current meters as well as oscilloscopes.

376 Clause 6 specifies the XML schema and business rules tests for IODDs of FS-Devices using
377 XML snippet files and the IO-Link Checker Tool. Additional test cases verify the consistency of
378 the particular IODD and the actual FSP and FST parameters within the associated Device.

379 Clause 7 specifies additional test cases for FS-Devices verifying the consistency of the
380 particular IODD and the actual FSP and FST parameters within the associated FS-Device and
381 its operational modes.

382 Clause 8 specifies additional test cases for FS-Devices regarding safety measures such as the
383 VerifyRecord and the protocol watchdog.

384 Clause 9 contains the automatically generated test cases via UML modelling, model checking
385 and simulation for the safety communication layer (protocol) of the FS-Device.

386 Clause 10 specifies additional test cases for an FS-Device in a reference FS-Master system.

387 Clause 11 specifies the FS-Master Port operations test.

388 Clause 12 contains the automatically generated test cases via UML modelling, model checking
389 and simulation for the safety communication layer (protocol) of the FS-Master.

390 Clause 13 specifies additional test cases for an FS-Master with reference FS-Devices.

391 Clause 14 specifies additional test cases for an FS-Master Tool regarding IODD and Dedicated
392 Tool operations.

393 Clause 15 provides information on required environmental tests and relevant EMC standards
394 as well as special approaches for functional safety.

395 Annex A describes the test tools, their requirements, and the test configurations. Annex B
396 specifies requirements for safety assessments. Annex C provides information about support for
397 conformance testing. Annex D refers to the Manufacturer Declaration for FS-Master and FS-
398 Device. Annex E provides an index on all test cases in this document. Annexes A, B, and D are
399 safety-related.

400 **4.3 Conformity classes**

401 **4.3.1 Overview**

402 All FS-Devices shall support ISDU and thus the rules in Clause 4.3.3 of [9] apply.

403 **4.3.2 FS-Devices with OSSDe**

404 Safety devices with a single stop function such as e-stop buttons, two-hands control, mats, light
405 curtain, etc. are candidates to become an FS-Device with both OSSDe and digital safety
406 communication and thus serving the markets for FS-DI modules in both the classic remote I/Os
407 as well as the extended functionality with identification, parameterization, diagnosis, and Data
408 Storage features to participate in modern automation concepts when connected to an FS-
409 Master.

410 **4.3.3 FS-Devices without OSSDe**

411 Safety devices with measurement capabilities such as for temperature, strain, torque, pressure,
412 object types, distance, position, rotation, or multi-sensing, or actuators such as motor starters,
413 drives, and mechatronics containing sensors and actuators such as door locks, grippers, low
414 voltage witch gears are candidates to become an FS-Device without OSSDe.

415 FS-Devices without OSSDe can benefit from extra 24 V power via class B.

416 **4.3.4 FS-Master**

417 FS-Master shall support all features specified in [4], which are not marked explicitly as optional.
418 All Ports shall provide power supply ≥ 200 mA, at least one Port shall supply 1000 mA.

419 4.3.5 FS-Master with FS-DI/OSSDe support

420 FS-Master can provide FS-DI/OSSDe support to benefit from existing safety devices on the
421 market as long as there are no versions available with SDCI-FS.

422 4.3.6 FS-Master with Port Class B

423 An FS-Master with Ports Class B is possible, however without FS-DI/OSSDe support. The rules
424 in Clause 5.4.2 of [2] apply.

425 4.4 Test of FS-Devices

426 4.4.1 General

427 In general, the rules in Clause 5.1 of [9] apply.

428 4.4.2 Compatibility with non-safety Master (tester) Ports

429 4.4.2.1 Device properties for the analysis of the test behavior

430 It may happen that an FS-Device is connected to a Port in the non-safety mode of an FS-
431 Master/Master or a USB-Master. Since some start-up features of the FS-Devices such as ready
432 pulse and OSSDe are "unknown" to a non-safety Master Port, they may impair (test)
433 functionality. It is not possible, to avoid completely all possible conflicts due to the huge number
434 of deployments of Masters in the field and fortunately these cases do not occur very often.

435 However, this cannot be assumed for Device tester ("USB-Master") in general and therefore
436 the possible conflicts have been analyzed with the help of a dummy representing a typical FS-
437 Device and a tester representing a typical Master Port.

438 Table 4 shows the characteristics of the dummy FS-Device for the analysis.

439 **Table 4 – Features of the dummy FS-Device**

Feature	Characteristic/value	Remark
Self-testing time	3 s	–
Ready pulse	Implemented as specified	–
Switching to OSSDe mode	1.1 s after the Ready pulse as specified in [4]	After switching to OSSDe mode, the FS-Device shall not react on any wake-up or other disturbances.
No OSSDe mode	1. FS-Device is awaiting wake-up pulse 2. FS-Device reacts on "fallback" command	1. Regular behavior 2. FS-Device switches to SIO mode

440

441 Table 5 shows possible conflicts and references the remedies.

442 **Table 5 – Possible conflicts**

Tester (Master) behavior	FS-Device behavior	Remedy
Master Port starts wake-up after starting time of the FS-Device, which includes self-test and other waiting times (total > 4,2 s).	FS-Device switches automatically to OSSDe mode and does not react on wake-up	R1
Master Port does not send the VerifyRecord.	FS-Device sends Event 0xB00A	R2
Test of PDInvalid cannot be performed	FS-Device only provides PDInvalid information if SCL is in SPDU exchange mode	R3
Test of SystemComand "Application Reset"	FS-Device requires more unchanged parameters	R4
Test of other SystemCommands	FS-Device rejects them in armed mode	R5

443

444 Table 6 shows the requirements for retrofitting of Device testers. Those modified testers can
445 be used to perform standard tests according to [9].

446

Table 6 – Retrofitting of Device testers for IO-Link Safety

Remedy	Requirements	Reference
R1	Device tester shall support the safety start-up: - Port Power Off/On ("Power cycle") - Await Ready pulse - Regular wake-up procedure - VerifyRecord not required	All TestCases requiring "Power cycle"
R2	Event 0xB00A shall be ignored	SDCI_TC_0072 (see Table 9)
R3	Device tester shall send VerifyRecord and start SCL	SDCI_TC_0312, SDCI_TC_0313 (see Table 9)
R4	"AuthenticityRecord" shall be treated in the same manner as "ApplicationSpecificTag" or "FunctionTag"	SDCI_TC_0317, SDCI_TC_0318 (see Table 9)
R5	The Device tester shall support the change to commissioning mode (see Clause G.1 in [4]) and perform the tests subsequently. The Device tester shall ensure the proper parameter set in the FS-Device after the test.	SDCI_TC_0317 (see Table 9)

447

4.4.3 Physical Layer tests

449 Figure 3 shows the workflow for physical layer tests. They mainly comprise measurements of
450 the I/Q connection, which is necessary for OSSDe.

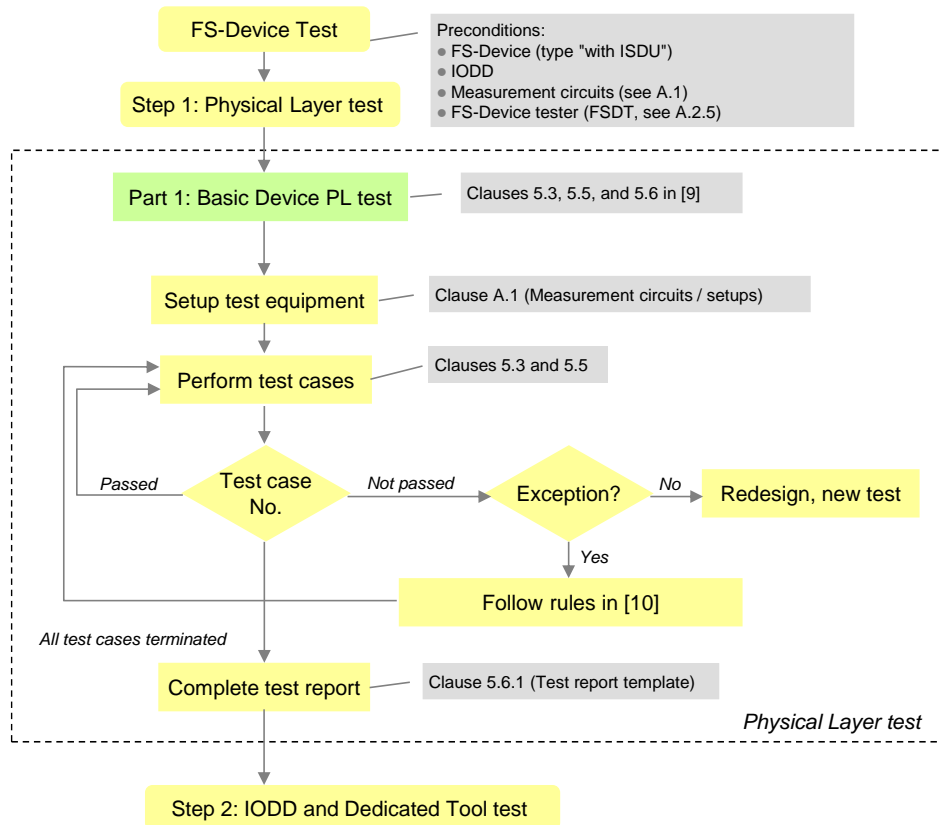
451 Table 7 lists the test cases to be performed during step 1. It contains the non-safety test cases
452 in its first part and the safety-specific test cases within its second part.

453

Table 7 – Physical layer tests

Major feature	Test cases	Remarks
Power and signal levels (C/Q)	See Clause 5.3 in [9]	–
Wake-up detection	See Clause 5.5 in [9]	–
Waveform and timings	See Clause 5.6 in [9]	–
Signal on I/Q	FSTC_0006 to _0007	Clause 5.3 in this document
Discrepancy, test pulses, Ready pulse	FSTC_0013 to _0017	Clause 5.5 in this document

454



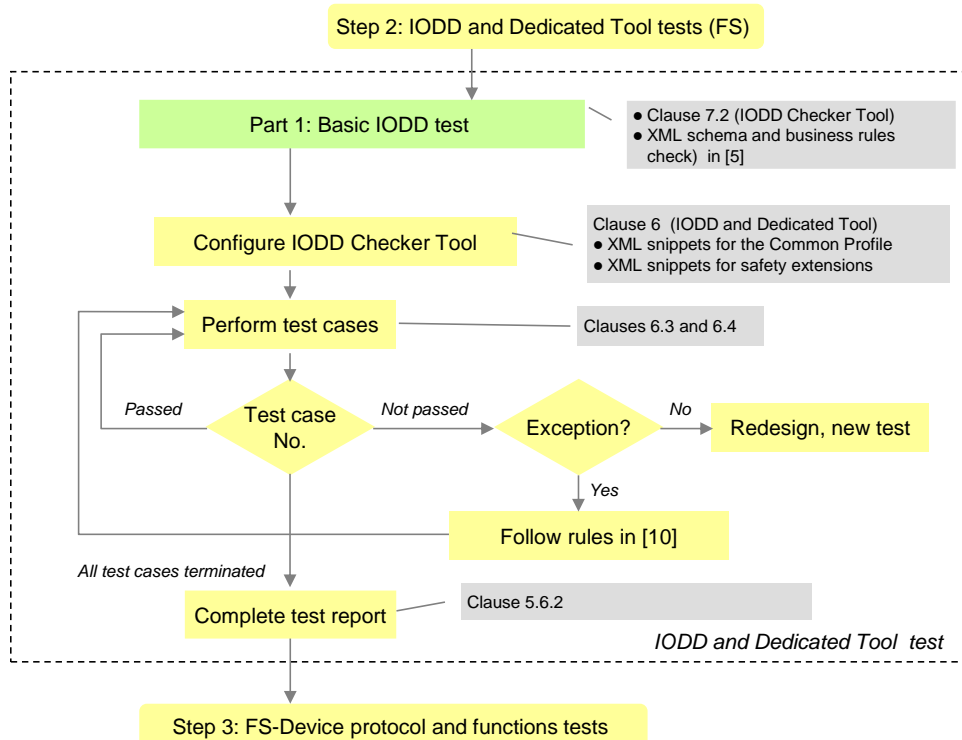
455

456

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

457 **4.4.4 IODD and Dedicated Tool tests**

458 The rules in Clause 7.1 of [9] apply. Figure 4 shows the workflow for IODD and Dedicated Tool tests of the FS-Device. Basic IODD tests are specified in [5].
 459



460

461

Figure 4 – Step 2 of the FS-Device test sequence (IODD + Dedicated Tool)

462 Table 8 lists the test cases to be performed during step 2. It contains the test cases for the non-
 463 safety parameters within the first part and the safety-specific within the second part.

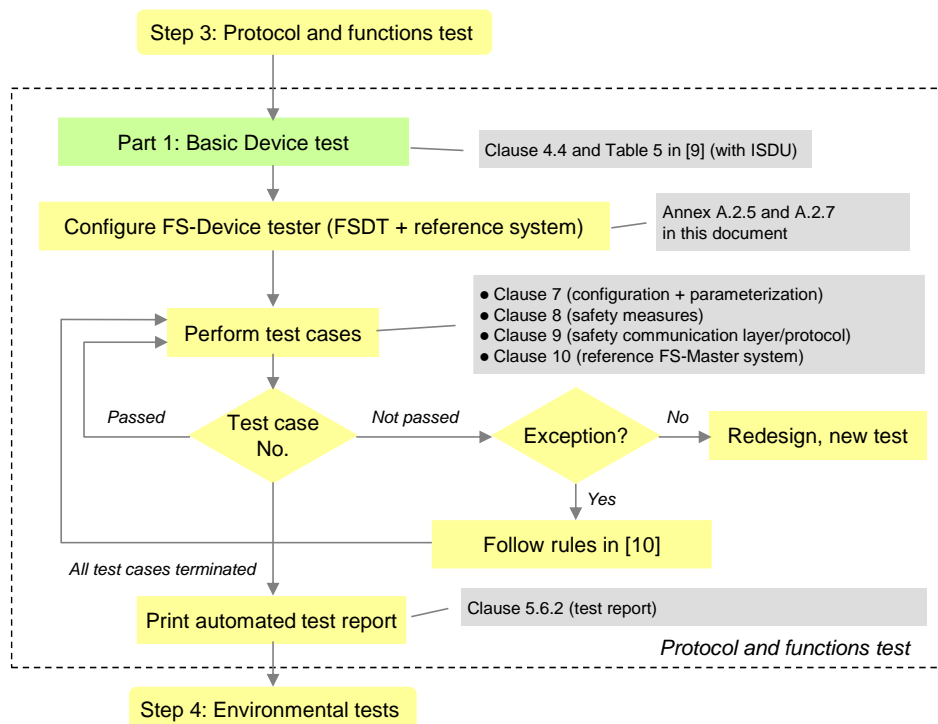
464 **Table 8 – IODD and Dedicated Tool of FS-Device**

Major feature	Test cases	Remarks
Basic IODD schema and business rules	See [5]	-
IODD (FS) + CRC	FSTC_0018	Clause 6.3 in this document
Dedicated Tool	FSTC_0019	Clause 6.4 in this document

465

466 **4.4.5 FS-Device protocol and functions tests**

467 Figure 5 shows the workflow for protocol and functions testing. Tests are restricted to FS-
 468 Devices with ISDU and Data Storage according to [2] and [3].



469

470 **Figure 5 – Step 3 of the FS-Device test sequence (protocol + functions)**

471 Table 9 lists the test cases to be performed during step 3. It contains the test cases for the
 472 "black channel" operations of an FS-Device within the first part and the safety-specific within
 473 the second part.

474 **Table 9 – Set of protocol test cases for FS-Devices**

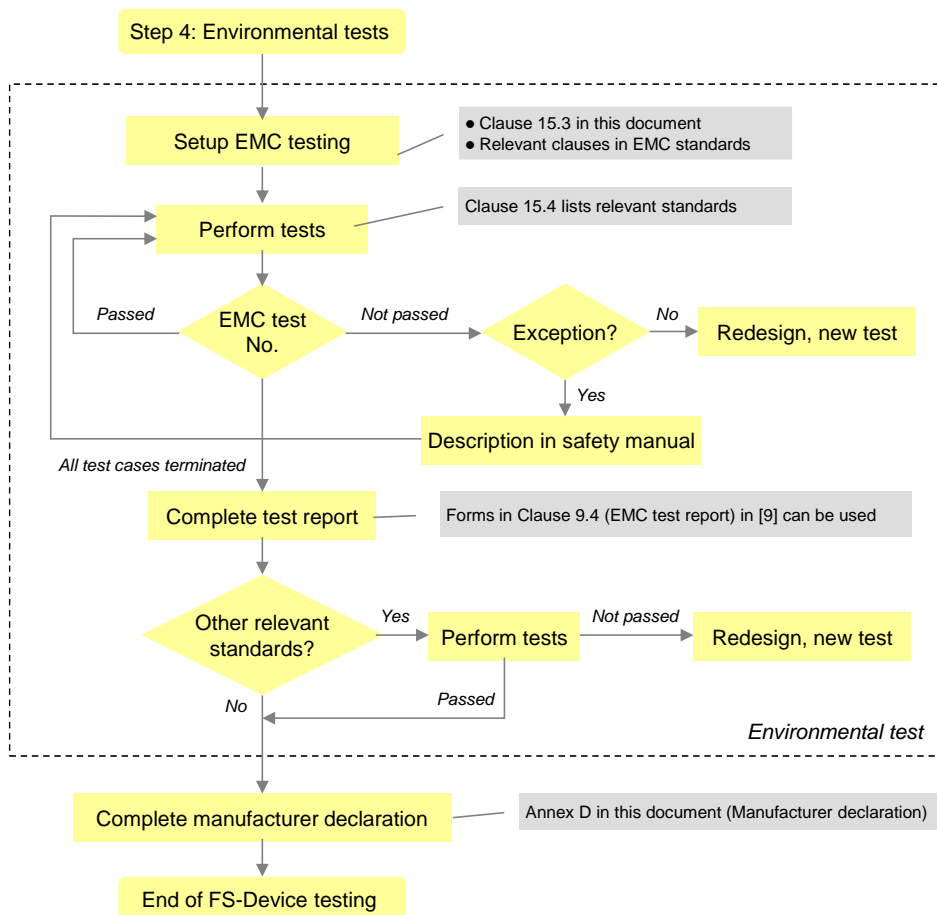
Major feature	Test cases	Remarks
STARTUP	See 6.2 in [9]	-
PREOPERATE	See 6.3 in [9]	-
OPERATE	See 6.4 in [9]	For SDCI_TC_0312 and SDCI_TC_0313 see Table 6
ISDU	See 6.5 in [9]	-
Events	See 6.6 in [9]	For SDCI_TC_0072 see Table 6
Data Storage	See 6.7 in [9]	-
Direct Parameter page 1	See 6.9 in [9]	-

Major feature	Test cases	Remarks
Predefined parameters	See 6.10 in [9]	-
Block parameter	See 6.11 in [9]	-
IODD based parameter verification	See 7.3 in [9]	-
IODD based functional system tests	See 7.4 in [9]	For SDCI_TC_0317 and SDCI_TC_0318 see Table 6
Configuration + parameterization	FSTC_0020 to _0034	Clause 7 in this document
Safety measures	FSTC_0035 to _0051	Clause 8 in this document
Safety protocol (SCL)	FSTC_0052 to _0147	Clause 9 in this document
Dedicated Tool, replacement, Events	FSTC_0148 to _0154	Clause 10 in this document

475

476 **4.4.6 Environment**

477 Figure 6 shows step 4 of the FS-Device test. It contains references to the relevant clauses in
 478 this specification and consists of EMC tests according to generic or product-specific standards
 479 specified in 15.2. A successfully terminated FS-Device test can be completed by a manufacturer
 480 declaration as defined in Annex D.



481

482

Figure 6 – Step 4 of the FS-Device test sequence (EMC)

483 **4.5 Test of FS-Masters**

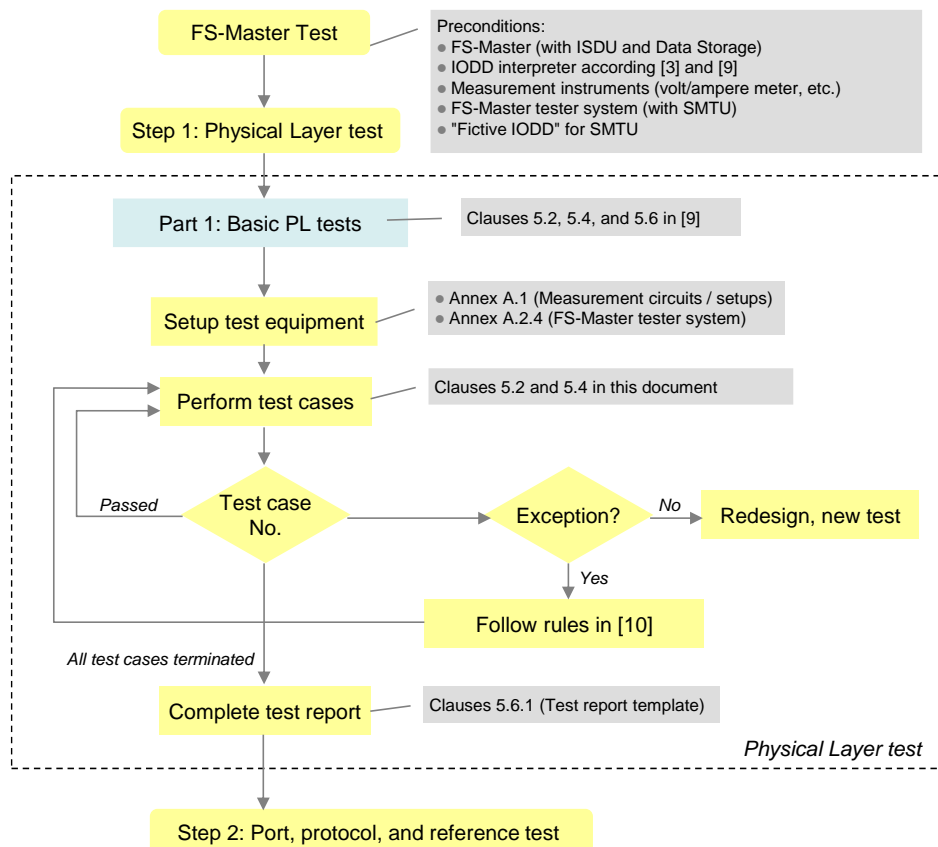
484 **4.5.1 General**

485 The test of FS-Masters consists of four steps: Physical layer test, Port operations and protocol
 486 test, FS-Master Tool test, and environmental test. The requirements for FS-Master-Tester are
 487 specified in A.2.4 and A.4.

488 **4.5.2 Physical Layer tests**

489 Figure 7 illustrates step 1 of the FS-Master test sequence. It contains references to the relevant
 490 clauses in [9] and in this specification and consists of a visual check and manually performed
 491 measurements.

492 If the FS-Master shows specific connectors, cables, or color codings, these deviations shall be
 493 documented within the user manual with respect to the original definitions in [2] and [4].



494

495 **Figure 7 – Step 1 of the FS-Master test sequence (PL)**

496 Table 10 lists the test cases to be performed during step 1. It contains the non-safety test cases
 497 in its first part and the safety-specific test cases within its second part.

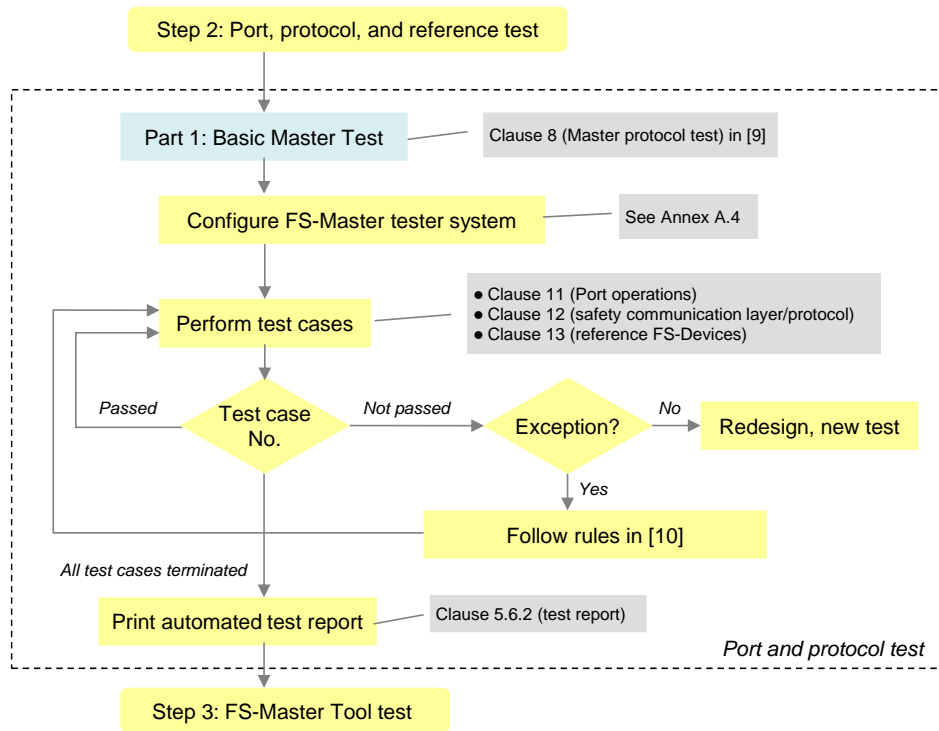
498 **Table 10 – Physical layer tests**

Major feature	Test cases	Remarks
Power and signal levels	Clause 5.2 in [9]	–
Wake-up detection	Clause 5.4 in [9]	–
Waveform and timings	Clause 5.6 in [9]	–
Port Power OFF/ON and Signal on I/Q	FSTC_0001 to _0005	See 5.2 in this document
Discrepancy, test pulse resilience and Ready	FSTC_0008 to _0012	See 5.4 in this document

499

500 **4.5.3 Port operations, protocol, and reference tests**

501 Figure 8 illustrates step 2 of the FS-Master test.



502

503 **Figure 8 – Step 2 of the FS-Master test sequence (Protocol)**

504 Table 11 lists the FS-Master Port operations and protocol tests. It contains the non-safety test
 505 cases in its first part and the safety-specific test cases within its second part.

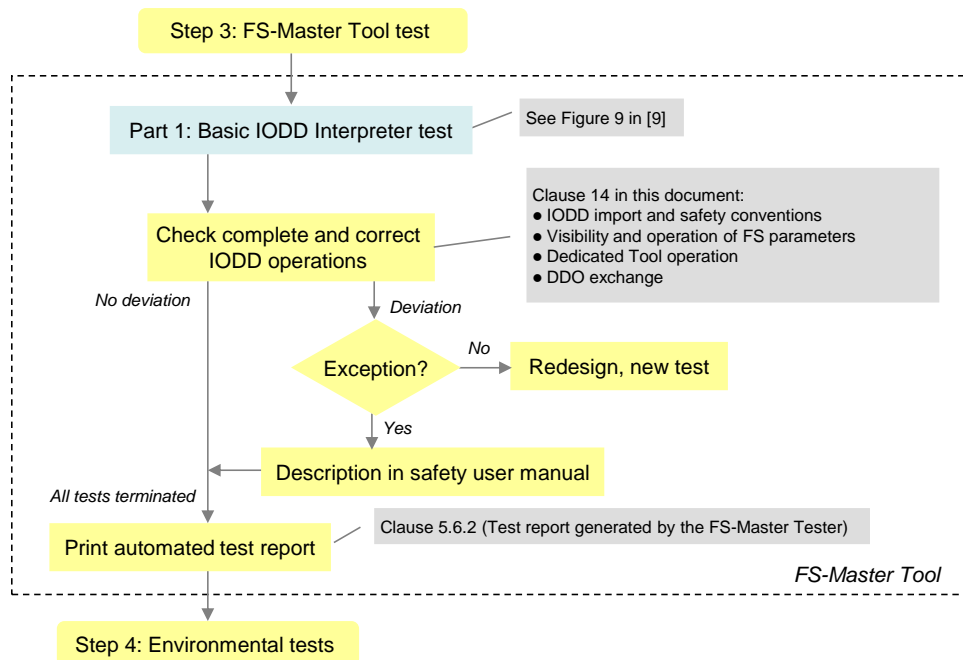
506 **Table 11 – FS-Master protocol tests**

Major feature	Test cases	Remarks
Timings	Clause 8.2 in [9]	–
Process Data (PD)	Clause 8.3 in [9]	–
On-request Data (OD)	Clause 8.4 in [9]	–
STARTUP	Clause 8.5 in [9]	–
PREOPERATE	Clause 8.6 in [9]	–
OPERATE	Clause 8.7 in [9]	–
Fallback	Clause 8.8 in [9]	–
Retry	Clause 8.9 in [9]	–
ISDU (applic. errors)	Clause 8.10 in [9]	–
ISDU (derived errors)	Clause 8.11 in [9]	–
ISDU (limit checks)	Clause 8.12 in [9]	–
Events	Clause 8.13 in [9]	–
Data Storage	Clause 8.14 in [9]	–
Port operations	FSTC_0155 to _0163 FSTC_0196 to _0197	See 11 in this document
Safety protocol (SCL)	FSTC_0164 to _0176	See 12 in this document
Reference FS-Devices	FSTC_0177 to _0189	See 13 in this document

507

508 **4.5.4 FS-Master Tool**

509 Figure 9 illustrates step 3 of the FS-Master test. It contains references to the relevant clauses
 510 in [9] and in this specification and consists of tests regarding importability (CRC signature check)
 511 and display conventions (yellow color), as well as parameter access via DTI and DDO exchange.



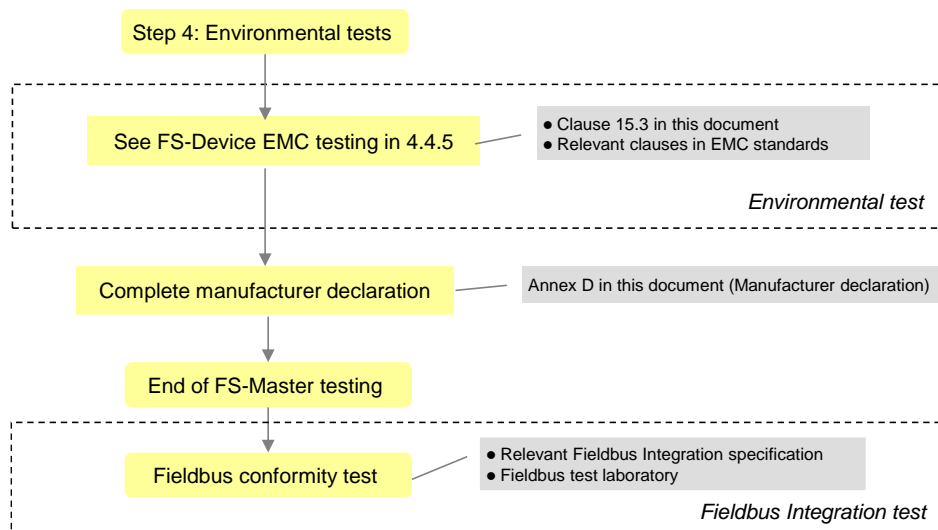
512

Step 4: Environmental tests

513 **Figure 9 – Step 3 of the FS-Master test sequence (FS-Master Tool)**

514 **4.5.5 Environment**

515 Figure 10 illustrates step 4 of the FS-Master test. It contains references to the relevant clauses
 516 in this specification and consists of EMC tests according to generic or product-specific
 517 standards specified in 15.2. A successfully terminated FS-Master test can be completed by a
 518 manufacturer declaration as defined in Annex D.



519

520 **Figure 10 – Step 4 of the FS-Master test (EMC)**

521

522 **5 Physical Layer (PL) tests**

523 **5.1 General**

524 The approach, nature and coverage of the FS-Device and FS-Master physical layer tests are
525 described in 4.4.3 and 4.5.2. Figure 3 and Figure 7 illustrate the entire test procedure including
526 the safety part.

527 The tests of static characteristics of FS-Master Ports comprise Power OFF/ON and the I/Q pin,
528 which is required for OSSDe2 (FS-DI). The tests of dynamic characteristics of FS-Master Ports
529 comprise Ready pulse, discrepancy of OSSDe signals, OSSDe test pulses, and Wake-up delay.

530 The tests of static characteristics of FS-Devices comprise power consumption and residual
531 voltages at OSSDe2 (I/Q pin). The tests of dynamic characteristics of FS-Devices comprise
532 discrepancy of OSSDe signals, OSSDe test pulses, Ready pulse duration, and delay to OSSDe
533 operation.

534 **5.2 Static characteristics of the FS-Master interface (FS-DI)**535 **5.2.1 Power1 switchable OFF/ON**

536 Table 12 defines the test conditions for this test case.

537 **Table 12 – Power1 switchable OFF/ON**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0001
Name	FSTCM_PHYL_PWR1_SWITCHABLE
Purpose (short)	Power1 on any port can be switched OFF and ON
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master Physical Layer test, test-to-pass
Specification (clause)	[4] 4.1.4, 5.9
Configuration / setup	Variable Master input voltage PSM and variable current sink according to Figure A.1
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Measure voltage VSM at different loads while Power1 = OFF/ON
Precondition	Test setup: Current sink between L+ and L-, voltmeter in parallel. EUT: PORT_DI (see A.4.2 in [9])
Procedure	a) Identify current capability of tested port (1000 mA or 200 mA) and memorize as ISMmax value ;see field "Test parameter" b) Select first PSM and ISM value ;see field "Test parameter" c) Apply PSM value to Master ;see field "Test parameter" d) Adjust current sink to ISM value ;see field "Test parameter" e) Turn On Power1 f) Measure VSM in ON state g) Evaluation 1) h) Wait for 1 s i) Turn Off Power1 j) Measure VSM in OFF state k) Evaluation 2) l) Repeat from d) with next ISM value m) Repeat from c) with next PSM value.
Test parameter	PSM = {PSMmin, PSMmax} ;according to user manual ISM = {ISMmax, 0 mA} ;ISMmax according to user manual
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Determine maximum VSM (ON state) compared with value of previous loop 2) Determine minimum VSM (OFF state) compared with value of previous loop
Test passed	Maximum value of VSM ≤ 1 V in OFF state, and ;1 V is reasonable practical value Minimum value of VSM ≥ 20 V in ON state
Test failed	Maximum value of VSM > 1 V in OFF state, or ;1 V is reasonable practical value Minimum value of VSM < 20 V in ON state
Report	Maximum VSM (ON state): <value> <ok nok> Minimum VSM (OFF state): <value> <ok nok>

540

541 **5.2.2 High-level input threshold voltage at I/Q**

542 Table 13 defines the test conditions for this test case.

543 **Table 13 – High-level input threshold voltage at I/Q**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0002
Name	FSTCM_PHYL_OSSD_HIGHVIMIQ
Purpose (short)	Test of static input high-level threshold at I/Q
Equipment under test (EUT)	FS-Master with I/Q support
Test case version	1.0
Category / type	FS-Master PL test, test-to-pass
Specification (clause)	[4] 5.3.4, Table 6; [2] 11.2.20, Figure 113
Configuration / setup	The digital input signal for a rising edge of the I/Q input is being monitored (see Figure A.1)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Measurement of the high-level threshold at I/Q
Precondition	Test setup: Voltage source with value VIMIQ between I/Q and L- EUT: PORT_DI (see A.4.2 in [9])
Procedure	a) Set supply voltage of Master to first PSM value ;see field Test parameter b) Sweep voltage VIMIQ at I/Q from 5 V to 15 V in steps of maximum 0,1 V c) Exemplary: Repeat SMI_PDInIQ until DI_I/Q = 1 d) Measure VIMIQ Transition e) Evaluation 1) f) Repeat from b) with next PSM value
Test parameter	PSM = {PSMmin, PSMmax} ;according to user manual
Post condition	Memorize VIMIQ at DI transition 0→1 (all PSM)
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check voltage VIMIQ at DI transition "low" to "high"
Test passed	All checks: 10,5 V < VIMIQ < 13 V (range of VTHHM)
Test failed (examples)	Any of the checks failed
Report	VIMIQ @ Transition 0→1 (PSMmin): <value> <ok nok> VIMIQ @ Transition 0→1 (PSMmax): <value> <ok nok>

546

547 **5.2.3 Low-level input threshold voltage at I/Q**

548 Table 14 defines the test conditions for this test case.

549 **Table 14 – Low-level input threshold voltage at I/Q**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0003
Name	FSTCM_PHYL_OSSD_LOWVIMIQ
Purpose (short)	Test of static input low-level threshold at I/Q
Equipment under test (EUT)	FS-Master with I/Q support
Test case version	1.0
Category / type	FS-Master PL test, test-to-pass
Specification (clause)	[4] 5.3.4, Table 6; [2] 11.2.20, Figure 113
Configuration / setup	The digital input signal for a falling edge of the I/Q input is being monitored (see Figure A.1)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Measurement of the low-level threshold at I/Q
Precondition	Test setup: Voltage source with value VIMIQ between I/Q and L- EUT: PORT_DI (see A.4.2 in [9])
Procedure	a) Set supply voltage of Master to first PSM value ;see field Test parameter b) Sweep voltage VIMIQ at I/Q from 15 V to 5 V in steps of maximum 0,1 V c) Exemplary: Repeat SMI_PDInIQ until DI_I/Q = 0 d) Measure VIMIQ Transition e) Evaluation 1) f) Repeat from b) with next PSM value
Test parameter	PSM = {PSMmin, PSMmax} ;according to user manual
Post condition	Memorize VIMIQ at DI transition 1→0 (all PSM)
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check voltage VIMIQ at DI transition "high" to "low"
Test passed	All checks: 8,0 V < VIMIQ < 11,5 V (range of VTHLM)
Test failed (examples)	Any of the checks failed
Report	VIMIQ @ Transition 1→0 (PSMmin): <value> <ok nok> VIMIQ @ Transition 1→0 (PSMmax): <value> <ok nok>

552

553 **5.2.4 Input hysteresis voltage at I/Q**

554 Table 15 defines the test conditions for this test case.

555 **Table 15 – Input hysteresis voltage at I/Q**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0004
Name	FSTCM_PHYL_OSSD_VHYSMCI
Purpose (short)	Calculation of input hysteresis at I/Q
Equipment under test (EUT)	FS-Master with I/Q support
Test case version	1.0
Category / type	FS-Master PL test, test-to-pass
Specification (clause)	[4] 5.3.4, Table 6
Configuration / setup	See FSTC_0002 and FSTC_0003
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Calculation of the hysteresis voltage at I/Q
Precondition	Value VIMIQ from FSTC_0002 is available for all PSM values Value VIMIQ from FSTC_0003 is available for all PSM values
Procedure	–
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	For all PSM values: VHYSMCI = Value VIMIQ(FSTC_0002) – Value VIMIQ(FSTC_0003)
Test passed	For all PSM values: Voltage VHYSMCI is ≥ 0 V
Test failed (examples)	For any PSM value: Voltage VHYSMCI is < 0 V
Report	VHYSMCI (PSMmin): <value> <ok nok> VHYSMCI (PSMmax): <value> <ok nok>

558

559 **5.2.5 Load current at I/Q**

560 Table 16 defines the test conditions for this test case.

561 **Table 16 – Load current at I/Q**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0005
Name	FSTCM_PHYL_OSSD_LOADIQ
Purpose (short)	Load current at I/Q of FS-Master Port
Equipment under test (EUT)	FS-Master with I/Q support
Test case version	1.0
Category / type	FS-Master PL test, test-to-pass
Specification (clause)	[4] 5.5, Table 8
Configuration / setup	The input current at I/Q of the FS-Master Port is being monitored (see Figure A.1).
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Quiescent current at FS-Master Port I/Q in input mode. Monitor current flowing into I/Q.
Precondition	Test setup: Voltage source with value VIMIQ between L- and I/Q EUT: PORT_DI (see A.4.2 in [9])
Procedure	a) Set supply voltage of Master to first PSM value ;Test parameter b) Measure VSM c) Set voltage VIMIQ = 5V d) Measure current ILLM into I/Q e) Evaluation 1) f) Set voltage VIMIQ = 5,1 V g) Measure current ILLM into I/Q h) Evaluation 2) i) Set voltage VIMIQ = 15V j) Measure current ILLM into I/Q k) Evaluation 3) l) Set voltage VIMIQ = measured value of VSM in b) m) Measure current ILLM into I/Q n) Evaluation 4) o) Repeat from b) with next PSM value
Test parameter	PSM = {PSMmin, PSMmax} (according to user manual)
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check ILLM < 15 mA 2) Check 2 mA < ILLM < 15 mA 3) Check 2 mA < ILLM < 15 mA 4) Check 2 mA < ILLM < 15 mA
Test passed	All checks OK
Test not passed (examples)	Any of the checks above failed
Report	ILLM (VIMIQ = 5 V, PSMmin): <value> <ok nok> ILLM (VIMIQ = 5,1 V, PSMmin): <value> <ok nok> ILLM (VIMIQ = 15 V, PSMmin): <value> <ok nok> ILLM (VIMIQ = measured value of VSM, PSMmin): <value> <ok nok> ILLM (VIMIQ = 5 V, PSMmax): <value> <ok nok> ILLM (VIMIQ = 5,1 V, PSMmax): <value> <ok nok> ILLM (VIMIQ = 15 V, PSMmax): <value> <ok nok> ILLM (VIMIQ = measured value of VSM, PSMmax): <value> <ok nok>

564

565 **5.3 Static characteristics of the FS-Device interface**566 **5.3.1 General**

567 Power consumption of an FS-Device is already tested via NSR tests according to [9]. Warnings
568 in case of current limits > 200 mA are checked via user manual in 7.2.3.

569 This clause focuses on tests of signal behavior on I/Q pin of an FS-Device.

570 **5.3.2 High-side residual voltage at FS-Device OSSD2**

571 Table 17 defines the test conditions for this test case. It is only applicable for Devices with
572 OSSD.

573 **Table 17 – High-side residual voltage at FS-Device OSSD2**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0006
Name	FSTCD_PHYL_OSSD_HSRESVOLT
Purpose (short)	Static high-side driver capability
Equipment under test (EUT)	FS-Device with OSSD output
Test case version	1.0
Category / type	FS-Device PL test, test-to-pass
Specification (clause)	[4] 5.4, Table 7
Configuration / setup	The high-side output level of the FS-Device OSSD2 output is measured while connected to a current sink (see Figure A.2, method ①)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Driver capability of the FS-Device high-side driver. Measurement of the voltage drop VIQ between L+ and I/Q (OSSD2) under load condition of 50 mA.
Precondition	PL-Tester: Voltage source with value VSD between L+ and L- EUT: FS-Device in OSSD mode with signals in high state
Procedure	a) Apply first supply voltage VSD to the Device ;Test parameter b) Apply current sink with 50 mA from I/Q (OSSD2) to L- c) Measure voltage VIQ between L+ and I/Q (OSSD2) d) Evaluation 1) e) Repeat from b) with next VSD value
Test parameter	VSD = {18 V, 30 V}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check VIQ
Test passed	For all VSD values: $VIQ \leq 3,0 \text{ V}$
Test not passed (examples)	For any VSD value: $VIQ > 3,0 \text{ V}$
Report	VIQ (VSD = 18 V): <value> <ok nok> VIQ (VSD = 30 V): <value> <ok nok>

576

577 **5.3.3 Low-side residual voltage at FS-Device OSSD2**578 Table 18 defines the test conditions for this test case. It is only applicable for Devices with
579 OSSD.580 **Table 18 – Low-side residual voltage at FS-Device OSSD2**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0007
Name	FSTCD_PHYL_OSSD_LSRESVOLT
Purpose (short)	Static low-side driver capability
Equipment under test (EUT)	FS-Device with OSSD output
Test case version	1.0
Category / type	FS-Device PL test, test-to-pass
Specification (clause)	[4] 5.4, Table 7
Configuration / setup	The low-side output level of the FS-Device OSSD2 output is measured while connected to a current source (see Figure A.2, method ②)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Driver capability of the FS-Device low-side driver. Measurement of the voltage drop between negative supply L- and I/Q (OSSD2) output at source current of 50 mA
Precondition	Test setup: Voltage source with value VSD between L+ and L- EUT: FS-Device in OSSD mode with signals in low state
Procedure	a) Apply first supply voltage VSD to the FS-Device ;Test parameter b) Apply current source with 50 mA from I/Q (OSSD2) to L+ c) Measure voltage VIQ between I/Q (OSSD2) and L- d) Evaluation 1) e) Repeat from b) with next VSD value
Test parameter	VSD = {18 V, 30 V}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check VIQ
Test passed	For all VSD values: VIQ ≤ 3,0 V
Test not passed (examples)	For any VSD value: VIQ > 3,0 V
Report	VIQ (VSD = 18 V): <value> <ok nok> VIQ (VSD = 30 V): <value> <ok nok>

583

584 **5.4 Dynamic characteristics of the FS-Master interface**585 **5.4.1 FS-DI and OSSD sensor with and without READY pulse**

586 Table 19 defines the test conditions for this test case.

587 **Table 19 – FS-DI and OSSD sensor with and without READY pulse**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE	
Identification (ID)	SDCI_FSTC_0008	
Name	FSTCM_PHYL_INTF_OSSDSENS	
Purpose (short)	Start-up of FS-Master Port with OSSD sensor with and without READY pulse	
Equipment under test (EUT)	FS-Master	
Test case version	1.0	
Category / type	FS-Master Physical Layer test, test-to-pass	
Specification (clause)	[4] 5.3.3, Figure 20, Figure 21; 5.4, Table 7	
Configuration / setup	OSSD signal generator (see A.2.2) connected to EUT	
TEST CASE	CONDITIONS / PERFORMANCE	
Purpose (detailed)	Test of FS-Master Port start-up when connected to FS-Devices with different OSSD behavior, e.g. without READY pulse, with READY pulse, or antivalent switching.	
Precondition	Test setup: OSSD signal generator EUT: Configured to "OSSDe" Port mode, FS-Master Tool with SMI_PortPowerOffOn and SMI_SPDUIn services	
Procedure	a) Select first OSSD-sequence ;Test parameter b) Apply first signal slot of OSSD-sequence c) Perform power cycle of FS-Master Port d) Read Process Data via SMI_SPDUIn service e) Apply next signal slot(s) of OSSD-sequence f) Read SR Process Data via SMI_FSPDInOut service ;returns ArgBlock "FSPDInOut" g) If OSSD sequence > OS 3: Wait on SMI_PortEvent ;returns ArgBlock "PortEvent" h) Evaluation 1) i) Repeat from b) with next OSSD-sequence ;Test parameter	
Test parameter	OSSD-sequences: OS 1 = {HH, LL}, OS 2 = {LL, HH}, OS 3 = {LL, HL(1 ms), LL(1 s), HH},	OS 4 = {LH, LH}, OS 5 = {HL, HL}, OS 6 = {LL, HL}, OS 7 = {HH, LH}.
Post condition	–	
TEST CASE RESULTS	CHECK / REACTION	
Evaluation	1) Check ArgBlock "FSPDInOut.SPDUIn0" 2) Check ArgBlock "PortEvent"	
Test passed	OS1: "Low" detected after transition to signal slot 2 <LL>. OS2: "High" detected after transition to slot 2 <HH>. OS3: "High" detected after transition to slot 4 <HH>. OS4: "Low" detected instantly and Port Event = 0x20F0 OS5: "Low" detected instantly and Port Event = 0x20F0 OS6: "Low" detected after transition to slot 2 (HL) and Port Event = 0x20F0 OS7: "Low" detected after transition to slot 2 (LH) and Port Event = 0x20F0	
Test failed (examples)	Any incorrect detection(s) during evaluation	
Report	"Low" (Demand) detected: <yes/no> <ok nok> "High" (Activation) detected: <yes/no> <ok nok> "Low" (Antivalent) detected: <yes/no> <ok nok> Correct Port Event detected: <yes/no> <ok nok>	

588

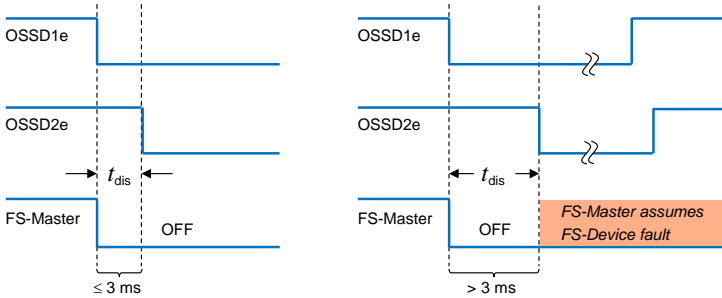
589 **5.4.2 FS-DI and discrepancy evaluation**

590 Table 20 defines the test conditions for this test case.

591 **Table 20 – FS-DI and discrepancy evaluation**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0009
Name	FSTCM_PHYL_INTF_DISCREPANCY
Purpose (short)	Behavior of Port at tolerable and intolerable discrepancy times (see Figure 11)
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master Physical Layer test, test-to-pass
Specification (clause)	[4] clause 5.5, Table 8
Configuration / setup	OSSD signal generator (see A.2.2) connected to EUT
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Behavior of Port at tolerable and intolerable discrepancy times
Precondition	Test setup: OSSD signal generator EUT: Configured to "OSSDE" Port mode, FS-Master Tool with SMI_PortPowerOffOn and SMI_SPDUIn services
Procedure	a) Select first value of tdis b) Power cycle of Master Port c) Run "OSSD startup sequence" d) Run first "OSSD test sequence" e) Read SR Process Data via SMI_FSPDInOut service f) If tdis = 10 ms Wait on SMI_PortEvent service g) Evaluation 1) h) Repeat from b) with next OSSD test sequence i) Repeat all OSSD test sequences from b) with next value of tdis <i>;Test parameter ;Test parameter ;returns ArgBlock "FSPDInOut" ;returns ArgBlock "PortEvent"</i>
Test parameter	OSSD startup sequence: {LL(2 s), HL(1 ms), LL(1 s)} <i>;Startup</i> OSSD test sequences 1: {LL(2 s), HL(tdis), HH} <i>;Low-High Transition</i> 2: {LL(2 s), LH(tdis), HH} <i>;Low-High Transition</i> 3: {HH(2 s) HL(tdis), LL} <i>;High-Low Transition</i> 4: {HH(2 s) LH(tdis), LL} <i>;High-Low Transition</i> tdis = {3 ms, 10 ms}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Argblock OSSDIN=FSPDInOut.SPDUIn0 2) Check ArgBlock "PortEvent"
Test passed	No Port Event 0x20F0, and <i>;tdis = 3 ms</i> OSSDIN = "Low" and Port Event 0x20F0 <i>;tdis = 10 ms</i>
Test failed (examples)	Any incorrect detection(s) during evaluation
Report	No Port Event detected at tdis = 3 <i><yes/no> <ok nok></i> "Low" detected at tdis =10 ms <i><yes/no> <ok nok></i> Correct Port Event at tdis = 10 ms detected: <i><yes/no> <ok nok></i>

594



595

596

Figure 11 – Discrepancy behavior

597 The discrepancy time given in [4] specifies the max. discrepancy time, a Device may generate.

598 The discrepancy time in Figure 11 specifies the min. discrepancy time, a Master shall tolerate

599 without generating a safety relevant reaction.

600 **5.4.3 Test pulse resilience**

601 Table 21 defines the test conditions for this test case.

602 **Table 21 – Test pulse resilience**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0010
Name	FSTCM_PHYL_INTF_TESTPULSERES
Purpose (short)	Behavior of Port at test pulse skews (time-shift)
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master Physical Layer test, test-to-pass
Specification (clause)	[4] 5.3.2.2, 5.3.2.3, 5.5, Table 8
Configuration / setup	OSSD signal generator (see A.2.2) connected to EUT
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Behavior of Port at test pulse skews (time-shift)
Precondition	Test setup: OSSD signal generator EUT: Configured to "OSSDE" Port mode, FS-Master Tool with SMI_SPDUIn services
Procedure	a) Choose first value of tc b) Start test pulse sequence {<p(Tp, ti) >, <p(Tp, ti, tc)>} c) Read 10 times SR PD via SMI_FSPDInOut service d) Evaluation 1) e) Repeat from b) with next value of tc <i>;Test parameter ;at OSSD signal "high" ;returns ArgBlock "FSPDInOut" ;Test parameter</i>
Test parameter	Tp = 10 ms, ti = 1 ms, tc = {0 ms, 1 ms, -1 ms, 5 ms, -5 ms}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Argblock "FSPDInOut.SPDUIn0"
Test passed	For all repetitions and loops: No "Low" and no Port Events
Test failed (examples)	Any "Low" or Events
Report	No "Low" and no Events: <yes/no> <ok nok>

605

606 **5.4.4 READY pulse detection**

607 Table 22 defines the test conditions for this test case.

608 **Table 22 – Ready pulse detection**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0011
Name	FSTCM_PHYL_INTF_READYDETECT
Purpose (short)	Behavior of Port on READY pulse; limits of detection
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master Physical Layer test, test-to-pass
Specification (clause)	[4] 5.3.3, Figure 21; 5.4, Table 7; 5.7, Figure 27
Configuration / setup	FS-Master Tester system
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	FS-Master Port behavior upon variable time-to-Ready-pulse t2R and Ready pulse duration tRP
Precondition	SMTU: SMTU_STANDARD_STATE_32 EUT: PORT_MIXFSCOM
Procedure	a) Choose first values of t2R and tRP ;Test parameter b) Perform SMTU_Ready_Wait(t2R, tRP) ;see A.4.7 c) Power ON cycle of FS-Device d) TM_AWAIT (t2R) ;before and beyond Ready pulse e) Read SR Process Data via SMI_FSPDInOut service ;returns ArgBlock "FSPDInOut" f) Evaluation 1) g) Repeat from b) with next t2R h) Repeat from b) with next tRP
Test parameter	t2R = {5 s, (5+1) s}, ;optional: value from IODD instead of default = 5 s tRP = {0,5 ms, 1 ms}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Argblock "FSPDInOut.SPDUIn0"
Test passed	Safety communication started, and ;t2R = 5 s Safety communication did not start (timeout) ;t2R = (5+1) s
Test failed (examples)	Safety communication did not start, and/or ;t2R = 5 s Safety communication started ;t2R = (5+1) s
Report	Safety communication: <yes/no> <ok nok>

611

612 **5.4.5 Wake-up delay after Ready pulse**

613 Table 22 defines the test conditions for this test case

614 **Table 23 – Wake-up delay after Ready pulse**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0012
Name	FSTCM_PHYL_INTF_WAKEUPTOREADYDELAY
Purpose (short)	After Ready pulse, FS-Master waits tRW before Wake-up
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master Physical Layer test, test-to-pass
Specification (clause)	[4] 5.3.3, Figure 21; 5.4, Table 7; 5.7, Figure 27
Configuration / setup	FS-Master Tester system
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	After Ready pulse, FS-Master waits a time tRW before Wake-up sequence
Precondition	SMTU: SMTU_STANDARD_STATE_32 EUT: PORT_MIXFSCOM
Procedure	a) Choose first value of tRP b) Perform SMTU_Ready_Wait(2 s, tRP) c) Power ON cycle of "FS-Device" d) Measure time tRW from falling edge of READY-pulse to rising edge of WURQ e) Repeat from b) with next tRP <i>;Test parameter ;see A.4.7</i>
Test parameter	tRP = {0,5 ms, 1 ms}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check measurement value
Test passed	tRW ≥ 50 μs
Test failed (examples)	tRW < 50 μs
Report	tRW ≥ 50 μs: <yes/no> <ok nok>

617

618 **5.5 Dynamic characteristics of the FS-Device interface**619 **5.5.1 Equivalent switching and discrepancy time**

620 Table 24 defines the test conditions for this test case.

621 **Table 24 – Equivalent switching and discrepancy time**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE	
Identification (ID)	SDCI_FSTC_0013	
Name	FSTCD_PHYL_OSSD_DISCREP	
Purpose (short)	Equivalent switching and discrepancy time limits	
Equipment under test (EUT)	FS-Device	
Test case version	1.0	
Category / type	FS-Device Physical Layer test, test-to-pass	
Specification (clause)	[4] 5.3.2.2, 5.3.2.3, 5.4, Table 7, [8]	
Configuration / setup	Measurement circuit of Figure A.4	
TEST CASE	CONDITIONS / PERFORMANCE	
Purpose (detailed)	Measurement of an FS-Device's equivalent switching and discrepancy times and conformity check with [4] and [8]	
Precondition	EUT: in OSSDe mode (OFF state)	
Procedure	a) Trigger FS-Device to toggle it's outputs from low to high b) Measure time between rising edges of both OSSD signals c) Evaluation 1) d) Trigger FS-Device to toggle it's outputs from high to low e) Measure time between falling edges of both OSSD signals f) Evaluation 2) g) Repeat from a) 100 times	;Test parameter ;Test parameter
Test parameter	Information on how to change FS-Device's OSSD states (OFF/ON)	
Post condition	–	
TEST CASE RESULTS	CHECK / REACTION	
Evaluation	1) Check discrepancy times of rising edges and memorize maximum absolute value 2) Check discrepancy times of falling edges and memorize maximum absolute value	
Test passed	Absolute value of maximum discrepancy time ≤ 2 ms	NOTE
Test failed (examples)	Absolute value of maximum discrepancy time > 2 ms	
Report	Maximum discrepancy time low to high: <value> Maximum discrepancy time high to low: <value>	<ok nok> <ok nok>
NOTE	Maximum discrepancy time = maximum t_{disD} + maximum t_i (possible adjacent test pulse)	

624

625 **5.5.2 Test pulse duration**

626 Table 25 defines the test conditions for this test case.

627 **Table 25 – Test pulse duration**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0015
Name	FSTCD_PHYL_INTF_TESTPULSDURATION
Purpose (short)	FS-Device's test pulses duration
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device Physical Layer test, test-to-pass
Specification (clause)	[4] 5.3.2.2, 5.3.2.3, Figure 19; 5.4, Table 7
Configuration / setup	Measurement circuit of Figure A.4
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Measurement of an FS-Device's test pulse duration and conformity check
Precondition	EUT: in OSSDe mode (ON state) Measurement circuit: load = Type 1 input acc. IEC 61131-2
Procedure	a) Apply first PSD value ;Test parameter b) Measure time between falling and rising edge of a test pulse on OSSDe1 c) Evaluation 1) d) Measure time between falling and rising edge of a test pulse on OSSDe2 e) Evaluation 2) f) Repeat from b) 100 times g) Repeat from b) with next PSD value
Test parameter	PSD = {18 V, 30 V}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check duration of test pulse and memorize maximum value Ti1max 2) Check duration of test pulse and memorize maximum value Ti2max
Test passed	Ti1max ≤ 1 ms, and Ti2max ≤ 1 ms
Test failed (examples)	Ti1max > 1 ms, or Ti2max > 1 ms
Report	Maximum duration of test pulses at OSSDe1: <value> <ok nok> Maximum duration of test pulses at OSSDe2: <value> <ok nok>

630

631 **5.5.3 Ready pulse duration**

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

633 **Table 26 – Ready pulse duration**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE	
Identification (ID)	SDCI_FSTC_0016	
Name	FSTCD_PHYL_INTF_READYPULSDUR	
Purpose (short)	FS-Device's Ready pulse duration	
Equipment under test (EUT)	FS-Device	
Test case version	1.0	
Category / type	FS-Device Physical Layer test, test-to-pass	
Specification (clause)	[4] 5.3.3, Figure 21; 5.4, Table 7; 5.7, Figure 27	
Configuration / setup	Measurement circuit of Figure A.4	
TEST CASE	CONDITIONS / PERFORMANCE	
Purpose (detailed)	Measurement of an FS-Device's Ready pulse duration and conformity check	
Precondition	EUT: Power off	
Procedure	a) Apply first PSD value b) Measure time t_{RP} between rising and falling edge of Ready pulse on OSSDe1 ; <i>Test parameter</i> c) Evaluation 1) d) Repeat from b) with next PSD value	
Test parameter	PSD = {18 V, 30 V}	
Post condition	–	
TEST CASE RESULTS	CHECK / REACTION	
Evaluation	1) Check and memorize t_{RP} @ PSD = 18 V and 30 V	
Test passed	For both supply voltages: $500\ \mu s \leq t_{RP} \leq 1000\ \mu s$	
Test failed (examples)	Any of the values of $t_{RP} < 500\ \mu s$ or $> 1000\ \mu s$	
Report	t_{RP} @ 18V: <value> t_{RP} @ 30V: <value>	<ok nok> <ok nok>

637 **5.5.4 End of Ready pulse to OSSD**

638 Table 27 defines the test conditions for this test case.

639 **Table 27 – End of Ready pulse to OSSD**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0017
Name	FSTCD_PHYL_INTF_READY2OSSD
Purpose (short)	FS-Device's end of Ready pulse to OSSDe operation
Equipment under test (EUT)	FS-Device with OSSDe capability
Test case version	1.0
Category / type	FS-Device Physical Layer test, test-to-pass
Specification (clause)	[4] clause 5.3.3, Figure 21; clause 5.4, Table 7; clause 5.7, Figure 27
Configuration / setup	Measurement circuit of Figure A.4
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Measurement of an FS-Device's end of READY pulse to OSSDe operation time and conformity check
Precondition	EUT: Power OFF (preset to ON state)
Procedure	a) Prepare FS-Device for outputs "high" immediately after OSSDe start b) Apply PSD = 24 V to EUT c) Wait until end of Ready pulse d) Measure time t1 e) Wait until OSSDe1 or OSSDe2 change to ON state ("high") f) Measure time t2 g) Evaluation 1)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Determine tRO = t2 – t1
Test passed	tRO ≥ 1,1 s
Test failed (examples)	tRO < 1,1 s
Report	tRO: <value> <ok nok>

642

643 **5.6 Test report templates**644 **5.6.1 Template for the test report of PL tests**

645 Table 28 shows the template for the test reports of PL tests.

646 **Table 28 – Template for the test report of PL tests**

Test Case ID	Test report	ok/ nok	Statement/ Exception
SDCI_FSTC_0001	Maximum VSM (ON state): <value> Minimum VSM (OFF state): <value>		
SDCI_FSTC_0002	VIMIQ @ Transition 0→1 (PSMmin): <value> VIMIQ @ Transition 0→1 (PSMmax): <value>		
SDCI_FSTC_0003	VIMIQ @ Transition 1→0 (PSMmin): <value> VIMIQ @ Transition 1→0 (PSMmax): <value>		
SDCI_FSTC_0004	VHYSMCI (PSMmin): <value> VHYSMCI (PSMmax): <value>		
SDCI_FSTC_0005	ILLM (VIMIQ = 5 V, PSMmin): <value> ILLM (VIMIQ = 5,1 V, PSMmin): <value> ILLM (VIMIQ = 15 V, PSMmin): <value> ILLM (VIMIQ = measured value of VSM, PSMmin): <value> ILLM (VIMIQ = 5 V, PSMmax): <value> ILLM (VIMIQ = 5,1 V, PSMmax): <value> ILLM (VIMIQ = 15 V, PSMmax): <value> ILLM (VIMIQ = measured value of VSM, PSMmax): <value>		
SDCI_FSTC_0006	VIQ (VSD = 18 V): <value> VIQ (VSD = 30 V): <value>		
SDCI_FSTC_0007	VIQ (VSD = 18 V): <value> VIQ (VSD = 30 V): <value>		
SDCI_FSTC_0008	"Low" (Demand) detected: <yes/no> "High" (Activation) detected: <yes/no> "Low" (Antivalent) detected: <yes/no> Correct Port Event detected: <yes/no>		
SDCI_FSTC_0009	"Low" detected: <yes/no> "Low" detected: <yes/no> Correct Port Event detected: <yes/no>		
SDCI_FSTC_0010	No "Low" and no Events: <yes/no>		
SDCI_FSTC_0011	Safety communication: <yes/no>		
SDCI_FSTC_0012	tRW ≥ 50 μs: <yes/no>		
SDCI_FSTC_0013	Maximum discrepancy time low to high: <value> Maximum discrepancy time high to low: <value>		
SDCI_FSTC_0015	Maximum duration of test pulses at OSSDe1: <value> Maximum duration of test pulses at OSSDe2: <value>		
SDCI_FSTC_0016	tRP @ 18V: <value> tRP @ 30V: <value>		
SDCI_FSTC_0017	tRO: <value>		

647

648 **5.6.2 Test report summaries of automated test cases**649 Templates are defined by the particular tester equipments. The complete test reports shall
650 present at least the information of the report fields of the test cases.

651 **6 IODD and Dedicated Tool tests**

652 **6.1 Overview**

653 Any FS-Device comes with an IODD including FSP parameters for functional safe communi-
654 cation and usually FST parameters for the possibility of adjusting the particular technology (e.g.
655 optical sensor) to user automation applications and optionally a Dedicated Tool.

656 Tests of an IODD shall be performed using the IODD Checker Tool, which can be downloaded
657 from the website indicated in Annex C. The extra requirements for the IODD Checker Tool due
658 to the safety extensions are specified in 6.2. These requirements include XML-Snippets for the
659 Common Profile and for IO-Link Safety. XML-Snippets support the presentation of user
660 interfaces and the automated IODD testing.

661 IODD test cases are specified in 6.3.

662 For FS-Devices without parameters for their individual technology (so-called FST parameter)
663 no other tool is required besides the IODD. FS-Devices with FST parameter also come with a
664 Dedicated Tool at least for the calculation of the TechParCRC value to be transferred into the
665 FSP_TechParCRC field of the FS-Master Tool.

666 Dedicated Tool test cases are specified in 10.2.

667

668 **6.2 Requirements for the IODD Checker (expanded schema test for safety)**

669 **6.2.1 Basic requirements and business rules for FS-Devices**

670 Basically, the requirements defined in [5] apply. Additional business rules for IODDs of FS-
671 Devices to be checked are defined in 6.3.

672 **6.2.2 XML snippets for the Common Profile**

673 The XML snippets for the Common Profile are contained in its .zip file downloadable from the
674 website indicated in Annex C. The name of the corresponding draft XML file is *IODD-*
675 *CommonProfile_Snippets_V1.1.0.xml*.

676 **6.2.3 XML snippets for safety extensions**

677 The XML snippets for safety extensions are specified in [4] and contained in an extra file named
678 *IODD-SafetyProfile_Snippets1.1.3.xml*. Both can be downloaded in a .zip file from the website
679 indicated in Annex C.

680 **6.3 IODD test via Checker Tool (conformity and CRC signatures)**

681 Table 29 defines the test conditions for this test case.

682 **Table 29 – IODD test via Checker Tool (conformity and CRC signatures)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0018
Name	FSTCI_IODD_FSPD_IODDPARAMDESCCRC
Purpose (short)	Conformity of IODD of FS-Device and correct CRC signatures
Equipment under test (EUT)	IODD of FS-Device
Test case version	1.0
Category / type	IODD verify test
Specification (clause)	[4] clause A.1, E.5.6; [6]
Configuration / setup	IODD Checker Tool + XML snippets
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check conformity of IODD of FS-Device with the help of the Checker Tool downloadable from the official IO-Link website. Base checks are supplemented by extensions from Common Profile specification and IO-Link Safety specification (XML snippets). CRC signature across the entire IODD is checked as well as the CRC signature "FSP_ParamDescCRC". The IODD Checker Tool provides correct CRC signature values if found values have been identified as incorrect.
Precondition	Up to date IODD Checker Tool downloaded from the Internet and XML snippet files
Procedure	a) Perform conformance testing with the help of standard IODD Checker Tool using IODD XML schema based on IODD specification V1.1.3 b) Evaluation 1) c) Perform test on Common Profile parameters using the file " <i>IODD-CommonProfile_Snippets_V1.1.0.xml</i> " d) Evaluation 2) e) Perform test on Safety parameters using the file " <i>IODD-SafetyProfile-Snippets1.1.3.xml</i> " f) Evaluation 3) g) Perform test on Protocol Mode "Input/Output length" using ProcessData Collection (see [5]) h) Evaluation 4) i) Replace CRC signature value of FSP_ParamDescCRC in IODD with suggested value of the Tool if value was incorrect j) Perform IODD check again k) Evaluation 5)
Test parameter	–
Post condition	Value of FSP_ParamDescCRC

684

TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Tool report 2) Check report on Common Profile parameters 3) Check report on Safety parameters 4) Check report on Protocol Mode 5) Check Tool report and value of "FSP_ParamDescCRC"
Test passed	All reports OK and value correct
Test failed (examples)	Any report NOK and/or value incorrect
Report	IODD with correct "FSP_ParamDescCRC" parameter: <yes/no> <ok nok>

685

686 **6.4 Availability of the Dedicated Tool**

687 Table 30 defines the test conditions for this test case.

688 **Table 30 – Availability of the Dedicated Tool**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0019
Name	FSTCI_IODD_FSPD_DEDICTOOL
Purpose (short)	Availability of Dedicated Tool or adequate means for TechParCRC determination
Equipment under test (EUT)	FS-Device with FST parameter
Test case version	1.0
Category / type	IODD verify test: Dedicated Tool
Specification (clause)	[4] clause A.1, E.5.6
Configuration / setup	IODD Finder, user manual
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	An FS-Device with FST parameters shall provide either a Dedicated Tool for the calculation of the TechParCRC value corresponding to the parameter setting or other adequate means such as a table within the user manual.
Precondition	–
Procedure	a) User manual: Dedicated Tool suitable for FS-Device? - .exe program - designation, - version, - relation to FS-Device b) Evaluation 1) c) If no Dedicated Tool: Adequate means available d) Evaluation 2)
Test parameter	–
Post condition	Usable Dedicated Tool or adequate means available
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check items 2) Optional: adequate means sufficient and mentioned in assessment report
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Dedicated Tool OK: <yes/no> <ok nok>

691

692

693 **7 FS-Device configuration and parameterization tests**694 **7.1 Overview**

695 The FS-Device configuration and parameterization tests comprise the necessary information
 696 about the product to test, the FSP protocol parameter availability and limits including securing
 697 via CRC signature, the FST technology parameter availability and limits including securing via
 698 CRC signature, and setup of operational modes such as "Commissioning" and "Armed".

699 **7.2 FS-Device meta data**700 **7.2.1 Manuals and safety assessment certificate**

701 Table 31 defines the test conditions for this test case.

702 **Table 31 – Manuals and safety assessment certificate**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0020
Name	FSTCD_CONF_INFO_DOCUMENTS
Purpose (short)	Check user/safety manuals for exceptions, properties, and certificates
Equipment under test (EUT)	User/safety manual of FS-Device and Dedicated Tool
Test case version	1.0
Category / type	FS-Device test
Specification (clause)	[4] "highly recommended" feature status, Table 8, Annex H.6, [6] p2 (conventions)
Configuration / setup	–
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Manufacturers/vendors are obliged to inform in a user manual about not implemented "highly recommended" features, and to provide a "Safety Manual" as well as a safety assessment certificate.
Precondition	–
Procedure	a) Identify in user manual not implemented "highly recommended" features b) Identify information in safety manual according to Annex H.6 in [4] c) Identify functional safety assessment report (certificate)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check exceptions in user manual 2) Check required parameters in safety manual 3) Check statements for relevant aspects of the particular standard (IEC 61508 /ISO13849), the assessment body, and the certificate number
Test passed	Exceptions permitted, and Safety Manual correct (at least WCDT, OFDT), and Certificate accepted and noted in test report
Test failed (examples)	Any check incorrect
Report	Documents OK: <yes/no> <ok nok>

705

706 **7.2.2 Connector and cable information**

707 Table 32 defines the test conditions for this test case.

708 **Table 32 – Connector and cable information**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0021
Name	FSTCD_CONF_INFO_CONNECTCABLE
Purpose (short)	Check user/safety manuals for connector and cable information (OSSDe)
Equipment under test (EUT)	User/safety manual of FS-Device and Dedicated Tool
Test case version	1.0
Category / type	FS-Device test
Specification (clause)	[4] 4.1.4, Figure 9
Configuration / setup	–
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check user/safety manuals for connector and cable information for OSSDe operation.
Precondition	–
Procedure	a) Identify in user manual connector Pin layout in case of M type connector b) Identify cable recommendations with respect to robustness and loop resistance
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Pin layout 2) Check recommendations on robustness and loop resistance
Test passed	Pin layouts are correct, and Robustness recommendations for cable coating such as "tear proof" and "cut resistant" as well as for loop resistance such that minimum supply voltages are guaranteed at maximum supply current are available
Test failed (examples)	Any check incorrect
Report	Documents OK: <yes/no> <ok nok>

711

712 **7.2.3 FS-Device default behavior**

713 Table 33 defines the test conditions for this test case.

714 **Table 33 – FS-Device default behavior**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0022
Name	FSTCD_CONF_INFO_DEFAULTBEHAVIOR
Purpose (short)	FS-Device information: Consumption, Ready pulse, test pulses, watchdog
Equipment under test (EUT)	User manual of FS-Device
Test case version	1.0
Category / type	FS-Device test
Specification (clause)	[4] Table 7, Table 8
Configuration / setup	–
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	FS-Device information: Power consumption, Ready pulse, test pulses, watchdog
Precondition	–
Procedure	a) Identify parameter "Power consumption" in safety/user manual b) Identify parameter "Time delay before availability" in safety/user manual c) Identify parameter "Test pulse duration (t_i)" in safety/user manual d) Identify parameter "Period of test pulses (T_p)" in safety/user manual e) Identify "Watchdog" value recommendations
Test parameter	–
Post condition	Memorize power consumption, Ready pulse, test pulses, watchdog
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check "Power consumption" information 2) Check parameter "Time delay before availability" and "FSP_Time2Ready" in IODD 3) Check parameter "Test pulse duration (t_i)" 4) Check parameter "Period of test pulses (T_p)" 5) Check values of "Watchdog" and default "FSP_Watchdog" in IODD
Test passed	Values and recommendations are indicated if > 200 mA and ≤ 1000 mA, and Parameter value corresponds to value of FSP_Time2Ready in IODD, and Parameter value within specified borders, and Parameter value within specified borders, and Parameter value corresponds to value of "FSP_Watchdog" in IODD
Test failed (examples)	Values are not indicated in case of > 200 mA or > 1000 mA, or any other check incorrect
Report	Documents OK: <yes/no> <ok nok>

717

718 **7.3 FSP parameter range limits and invalid values**719 **7.3.1 Invalid value of parameter "FSP_Port"**

720 Table 34 defines the test conditions for this test case.

721 **Table 34 – Invalid value of parameter "FSP_Port"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0023
Name	FSTCD_CONF_FSPD_PORTINVAL
Purpose (short)	Detection of invalid value of parameter "FSP_Port"
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test: test-to-fail
Specification (clause)	[4] Annex A
Configuration / setup	FS-Device-Tester-Unit
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Detection of invalid value of parameter "FSP_Port" (outside specified range)
Precondition	EUT in OPERATE (configured for commissioning operation) FSDT in OPERATE (configured for commissioning operation)
Procedure	a) Write FSP authenticity parameter record (0x4200), e.g. via SMI_DeviceWrite <i>;see field test parameter</i> b) Evaluation 1) c) Evaluation 2)
Test parameter	FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 0, FSP_AuthentCRC = 25195
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write response 2) Check Events
Test passed	Negative Write response with one of (0x8030, 0x8032, 0x8040 or 0x8041), and No Events
Test failed (examples)	Incorrect Write response, and/or Unexpected Events
Report	Correct negative Write response: <yes/no> <ok nok> No Events received: <yes/no> <ok nok>

724

725 **7.3.2 Invalid value of signature "FSP_AuthentCRC"**

726 Table 35 defines the test conditions for this test case.

727 **Table 35 – Invalid value of signature "FSP_AuthentCRC"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE	
Identification (ID)	SDCI_FSTC_0024	
Name	FSTCD_CONF_FSPD_AUTHENTCRCINVAL	
Purpose (short)	Detection of invalid value of signature "FSP_AuthentCRC"	
Equipment under test (EUT)	FS-Device	
Test case version	1.0	
Category / type	FS-Device test: test-to-fail	
Specification (clause)	[4] Annex A	
Configuration / setup	FS-Device-Tester-Unit	
TEST CASE	CONDITIONS / PERFORMANCE	
Purpose (detailed)	Detection of invalid value of signature "FSP_AuthentCRC" (outside specified range)	
Precondition	EUT in OPERATE (commissioning operation, FSP_TechParCRC = 0) FSDT in OPERATE (commissioning operation)	
Procedure	a) Write FSP authenticity parameter record (0x4200), e.g. via SMI_DeviceWrite ;see field test parameter b) Evaluation 1) c) Evaluation 2)	
Test parameter	FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11457	
Post condition	–	
TEST CASE RESULTS	CHECK / REACTION	
Evaluation	1) Check Write response 2) Check Events	
Test passed	Negative Write response with one of 0x8040, 0x8041 and No Events	
Test failed (examples)	Incorrect Write response, and/or Unexpected Events	
Report	Correct negative Write response: <yes/no> No Events received: <yes/no>	<ok nok> <ok nok>

730

731 **7.3.3 Invalid value of parameter "FSP_ProtVersion"**

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

733 **Table 36 – Invalid value of parameter "FSP_ProtVersion"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0025
Name	FSTCD_CONF_FSPD_PROTVINVAL
Purpose (short)	Detection of invalid value of parameter "FSP_ProtVersion"
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test: test-to-fail
Specification (clause)	[4] Annex A
Configuration / setup	FS-Device-Tester-Unit
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Detection of invalid value of parameter "FSP_ProtVersion" (outside IODD)
Precondition	EUT in OPERATE (commissioning operation, FSP_TechParCRC = 0) FSDT in OPERATE (commissioning operation)
Procedure	a) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite ;see field test parameter with A) b) Evaluation 1) c) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite ;see field test parameter with B) d) Evaluation 2)
Test parameter	FSP protocol parameter record for cases A) and B): FSP_ProtVersion = A) or B), ;see values at the end of field FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC ;values for case A) or B) A) FSP_ProtVersion = defaultValue in IODD - 1 B) FSP_ProtVersion = defaultValue in IODD + 1
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write response 2) Check Write response
Test passed	Negative Write responses for Write attempts: In case of 1): 0x8030 (out of range) In case of 2): 0x8030 (out of range)
Test failed (examples)	Incorrect or no negative Write responses
Report	Correct negative Write responses: <yes/no> <ok nok>

736

737 **7.3.4 Invalid value of parameter "FSP_ProtMode"**

738 Table 37 defines the test conditions for this test case.

739 **Table 37 – Invalid value of parameter "FSP_ProtMode"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0026
Name	FSTCD_CONF_FSPD_PMODEINVAL
Purpose (short)	Detection of invalid value of parameter "FSP_ProtMode"
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test: test-to-fail
Specification (clause)	[4] Annex A
Configuration / setup	FS-Device-Tester-Unit
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Detection of invalid value of parameter "FSP_ProtMode" (outside specified range and IODD). This test also proves that test parameter values are not accepted by FS Device.
Precondition	EUT in OPERATE (commissioning operation, FSP_TechParCRC = 0) FSDT in OPERATE (commissioning operation)
Procedure	a) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite ;see field test parameter with A) b) Evaluation 1) c) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite ;see field test parameter with B) d) Evaluation 2) e) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite ;see field test parameter with C) f) Evaluation 3) g) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite ;see field test parameter with D) h) Evaluation 4)
Test parameter	FSP protocol parameter record for cases A), B), C), and D): FSP_ProtVersion = defaultValue in IODD; FSP_ProtMode = A), B), C), or D), ;see values at the end of field FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC ;values for case A), B), C) or D) A) FSP_ProtMode = defaultValue in IODD - 1 B) FSP_ProtMode = defaultValue in IODD + 1 C) FSP_ProtMode = 0xF9 D) FSP_ProtMode = 0xFA
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write response 2) Check Write response 3) Check Write response 4) Check Write response
Test passed	Negative Write responses for Write attempts: In case of 1): 0x8030 (out of range) In case of 2): 0x8030 (out of range) In case of 3): 0x8030 (out of range) In case of 4): 0x8030 (out of range)
Test failed (examples)	Incorrect or no negative Write responses
Report	Correct negative Write responses: <yes/no> <ok nok>

742

743 **7.3.5 Invalid range of parameter "FSP_Watchdog"**

744 Table 38 defines the test conditions for this test case.

745 **Table 38 – Invalid range of parameter "FSP_Watchdog"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0027
Name	FSTCD_CONF_FSPD_WDOGRANGE
Purpose (short)	Detection of invalid range of parameter "FSP Watchdog"
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test: test-to-fail
Specification (clause)	[4] Annex A
Configuration / setup	FS-Device-Tester-Unit
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Detection of invalid value of parameter "FSP_Watchdog" (outside specified range and IODD). FSP parameter range value test based on IODD/specification
Precondition	EUT in OPERATE (commissioning operation, FSP_TechParCRC = 0) FSDT in OPERATE (commissioning operation)
Procedure	a) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite <i>;see field test parameter with A)</i> b) Evaluation 1) c) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite <i>;see field test parameter with B)</i> d) Evaluation 2) e) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite <i>;see field test parameter with C)</i> f) Evaluation 3)
Test parameter	FSP protocol parameter record for cases A), B), and optionally C): FSP_ProtVersion = defaultValue in IODD; FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = A), B), or C), <i>;see values at the end of field</i> FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC <i>;values for case A), B), C) or D)</i> A) FSP_Watchdog = 0 B) FSP_Watchdog = lowerValue in IODD - 1 C) FSP_Watchdog = upperValue in IODD + 1 <i>;only if upperValue in IODD < 65535</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write response and Event 2) Check Write response and Event 3) Check Write response and Event
Test passed	Negative Write responses for Write attempts: In case of 1): 0x8032 (below limit) In case of 2): 0x8032 (below limit) In case of 3): 0x8031 (above limit)
Test failed (examples)	Incorrect or no negative Write responses
Report	Correct negative Write responses: <yes/no> <ok nok>

748

749 **7.3.6 Invalid value of signature "FSP_ProtParCRC"**

750 Table 39 defines the test conditions for this test case.

751 **Table 39 – Invalid value of signature "FSP_ProtParCRC"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0028
Name	FSTCD_CONF_FSPD_PRCRCINVAL
Purpose (short)	Detection of invalid value of signature "FSP_ProtParCRC"
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test: test-to-fail
Specification (clause)	[4] Annex A
Configuration / setup	FS-Device-Tester-Unit
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Detection of invalid value of signature "FSP_ProtParCRC" based on calculation
Precondition	EUT in OPERATE (commissioning operation, FSP_TechParCRC = 0) FSDT in OPERATE (commissioning operation)
Procedure	a) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite <i>;see field test parameter</i> b) Evaluation 1) c) Evaluation 2)
Test parameter	FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD; FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = invalid CRC <i>;e.g. decrement calculated value</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write response 2) Check Events
Test passed	Negative Write response with one of 0x8040, 0x8041, and No Events
Test failed (examples)	Incorrect Write response, and/or Unexpected Events
Report	Correct negative Write response: <yes/no> No Events received: <yes/no> <ok nok> <ok nok>

754

755 **7.4 FST parameterization**756 **7.4.1 Default FST parameter (for OSSDe operation)**

757 Table 40 defines the test conditions for this test case.

758 **Table 40 – Default FST parameter (for OSSDe operation)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0029
Name	FSTCD_CONF_DEFAULTFST
Purpose (short)	FST parameter of FS-Device in delivery state retrieved as indicated in IODD
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test: test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Tester-Unit
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	FST parameter of FS-Device in delivery state retrieved as indicated in IODD. FSP_TechParCRC from FS-Device matches calculation performed by Test Tool.
Precondition	EUT in delivery state
Procedure	a) Read parameter in fst_param (start with first value) ;see IODD b) Evaluation 1) c) Repeat with next parameter from a) ;see field test parameter d) Calculate FSP_TechParCRC for all fst_param using Dedicated Tool / User manual e) Read parameter FSP_TechParCRC f) Evaluation 2)
Test parameter	fst_param = {all FST parameter in IODD}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Compare value "defaultValue" of FST parameter in IODD with read parameter from EUT 2) Compare calculated FSP_TechParCRC with FSP_TechParCRC read from EUT
Test passed	All comparisons show equal values
Test failed (examples)	Any comparison is showing not equal values
Report	Comparison equal: <yes/no> <ok nok>

761

762 **7.4.2 IODD versus FST parameters in FS-Device**

763 Table 41 defines the test conditions for this test case.

764 **Table 41 – IODD versus FST parameters in FS-Device**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0030
Name	FSTCD_CONF_IODDFSTPAR
Purpose (short)	FST parameter in IODD accessible in FS-Device as indicated
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test: test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Tester-Unit
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	FST parameter in IODD accessible in FS-Device as indicated
Precondition	EUT in OPERATE (commissioning operation, FSP_TechParCRC = 0) FSDT in OPERATE (commissioning operation)
Procedure	a) Get Index/Subindex of parameter in fst_param (start with first) b) Read parameter if read access allowed c) Evaluation 1) d) Write parameter with read value if write access allowed e) Evaluation 2) f) Repeat from a)
Test parameter	fst_param = {all FST parameter in IODD}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Read response 2) Check Write response
Test passed	All responses positive
Test failed (examples)	Any response negative
Report	Responses positive: <yes/no> <ok nok>

767

768 **7.4.3 TechParCRC via Dedicated Tool**

769 Table 42 defines the test conditions for this test case.

770 **Table 42 – TechParCRC via Dedicated Tool**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0031
Name	FSTCD_CONF_CRCDEDTOOL
Purpose (short)	CRC signature calculation of "Dedicated Tool" fits to calculation of FS-Device
Equipment under test (EUT)	FS-Device and Dedicated Tool or alternative method
Test case version	1.1
Category / type	FS-Device test: test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	TechParCRC signature calculation of "Dedicated Tool" fits to calculation of FS-Device (FSP_TechParCRC)
Precondition	EUT in delivery state
Procedure	a) Set some FST parameter of EUT and retrieve FSP_TechParCRC ;see user manual for method b) Write FST parameter to EUT c) Evaluation 1) d) Write valid FSP_AuthRecord and FSP_ProtocolRecord to EUT e) Evaluation 2) f) Set valid Set PortConfig with FSP_VerifyRecord ; e.g. via SMI_PortConfiguration using ArgBlock 0x8100 g) Wait for Port state "SPDU_EXCHANGE" ; e.g. via ArgBlock FSPortStatusList h) Evaluation 3)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write responses 2) Check Write responses 3) Check Port state
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

773

774 **7.4.4 Switch to OSSDe operation after parameterization**

775 Table 43 defines the test conditions for this test case.

776 **Table 43 – Switch to OSSDe operation after parameterization**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE	
Identification (ID)	SDCI_FSTC_0032	
Name	FSTCD_CONF_SWTOOSSD	
Purpose (short)	FST parameterization cycle: COM → OSSDe → COM	
Equipment under test (EUT)	FS-Device	
Test case version	1.0	
Category / type	FS-Device test: test-to-pass	
Specification (clause)	[4]	
Configuration / setup	FS-Device-Tester	
TEST CASE	CONDITIONS / PERFORMANCE	
Purpose (detailed)	FST parameterization cycle: COM → OSSDe → COM	
Precondition	EUT: in out-of-box configuration	
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 ;see field test parameter b) Wait for port state OPERATE c) Write FSP protocol parameter record (0x4201) ;see A) d) Evaluation 1) e) Write FSP authenticity parameter record (0x4200) ;see B) f) Evaluation 2) g) Port power Off/On e.g. via SMI_PortPowerOffOn h) Wait for Port state "SCL_ENABLED" e.g. via ArgBlock FSPortStatusList i) Evaluation 3) j) Set PortConfig to OSSDE k) Port power Off/On e.g. via SMI_PortPowerOffOn l) Wait FSP_TimeToReady m) Get PDIn e.g. via SMI_FSPDInOut service ;return ArgBlock "FSPDInOut" n) Evaluation 4) o) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 ;see test parameter p) Port power Off/On q) Wait for Port state "SCL_ENABLED" r) Evaluation 5)	
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IO DD, FSP_ProtMode = defaultValue in IO DD, FSP_Watchdog = defaultValue in IO DD, FSP_IOStructCRC = defaultValue in IO DD, FSP_TechParCRC = valid CRC signature, FSP_ProtParCRC = valid CRC signature	B) FSP authenticity parameter: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 ;CRC: Responsibility of tester
Post condition	-	
TEST CASE RESULTS	CHECK / REACTION	
Evaluation	1) Check Write response 2) Check Write response 3) Check Port state 4) Check OSSDe input (e.g. via ArgBlock FSPDInOut.SPDUIn0) 5) Check Port state	
Test passed	All checks correct	
Test failed (examples)	Any check incorrect	
Report	Values OK: <yes/no>	<ok nok>

779

780 **7.5 Setup operational modes (Annex G)**781 **7.5.1 Setup "commissioning test"**

782 Table 45 defines the test conditions for this test case.

783 **Table 44 – Setup "commissioning test"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0033
Name	FSTCD_CONF_SETUPCOMMI
Purpose (short)	Setup "commissioning test" as specified
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test, test-to-pass
Specification (clause)	[4] Annex G
Configuration / setup	FS-Device-Tester (FSDT)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Setup "commissioning test" as specified.
Precondition	EUT: in out-of-box configuration
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 ;see field test parameter b) Wait for port state OPERATE c) Write FSP protocol parameter record (0x4201) ;see A) d) Evaluation 1) e) Write FSP authenticity parameter record (0x4200) ;see B) f) Evaluation 2) g) Port power Off/On e.g. via SMI_PortPowerOffOn h) Wait for Port state "SCL_ENABLED" e.g. via ArgBlock FSPortStatusList i) Evaluation 3)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC signature ;responsibility of tester B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456
Post condition	-
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write response 2) Check Write response 3) Check Port state
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

786

787 **7.5.2 Setup "armed"**

788 Table 45 defines the test conditions for this test case.

789 **Table 45 – Setup "armed"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0034
Name	FSTCD_CONF_SETUPARMED
Purpose (short)	Setup "armed" as specified
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test: test-to-pass
Specification (clause)	[4] Annex G
Configuration / setup	FS-Device-Tester-Unit
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Setup "armed" as described
Precondition	EUT in OPERATE (commissioning operation, FSP_TechParCRC = 0) FSDT in OPERATE (commissioning operation)
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 ;see field test parameter b) Wait for Port state "SCL_ENABLED" e.g. via ArgBlock FSPortStatusList c) Write FSP protocol parameter record (0x4201) ;see A) d) Evaluation 1) e) Write FSP authenticity parameter record (0x4200) ;see B) f) Evaluation 2) g) Port power Off/On e.g. via SMI_PortPowerOffOn h) Wait for Port state "SCL_ENABLED" e.g. via ArgBlock FSPortStatusList i) Evaluation 3)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature ;responsibility of tester FSP_ProtParCRC = valid CRC signature ;responsibility of tester B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write response 2) Check Write response 3) Check Port state
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

792

793 **8 FS-Device safety measure tests**794 **8.1 Overview**

795 The FS-Device protocol tests comprise the various constellations of the VerifyRecord prior to
 796 start of the Safety Communication Layer (SCL). It also comprises special tests such as the
 797 protocol watchdog timer and evidence of correct implementation of the watchdog trigger as well
 798 as the exceptional handling whenever a CRC signature calculation results in "0".

799 **8.2 Verification (VerifyRecord)**800 **8.2.1 Correct VerifyRecord and FSP_TechParCRC ("armed")**

801 Table 46 defines the test conditions for this test case. It checks whether an FS-Device starts
 802 SCL communication in "armed" mode (operation not monitored) after reception of a valid
 803 VerifyRecord and FSP_TechParCRC ≠ 0.

804 **Table 46 – Correct VerifyRecord and FSP_TechParCRC ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0035
Name	FSTCD_PARM_VRFY_ARMED
Purpose (short)	Correct VerifyRecord and FSP_TechParCRC ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-pass
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is going to start SCL communication ("armed") after reception of a valid VerifyRecord with FSP_TechParCRC ≠ 0.
Precondition	EUT: Configured for armed operation <i>;see field test parameter</i> FSDT: Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "SCL_ENABLED" e.g. via ArgBlock FSPortStatusList c) Repeat SMI_FSPDInOut until change (observe <timeout>) <i>;ArgBlock FSPDInOut</i> d) Evaluation 1)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 <timeout> = 1s
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check change
Test passed	No <timeout> occurred
Test failed (examples)	<timeout>
Report	SPDU exchange: <negative/positive> <ok nok>

807

808 **8.2.2 Correct VerifyRecord and FSP_TechParCRC ("commissioning")**

809 Table 47 defines the test conditions for this test case. It checks whether an FS-Device starts
 810 SCL communication in "commissioning - test" mode (operation monitored by personel) after
 811 receiving a valid VerifyRecord and FSP_TechParCRC =0.

812 **Table 47 – Correct VerifyRecord and FSP_TechParCRC ("commissioning")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0036
Name	FSTCD_PARM_VRFY_COMMISTEST
Purpose (short)	Correct VerifyRecord and FSP_TechParCRC ("commissioning test")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-pass
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is going to start SCL communication ("commissioning test") when receiving a valid VerifyRecord with FSP_TechParCRC = 0.
Precondition	EUT configured for commissioning operation <i>;see field test parameter</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "SCL_ENABLED" e.g. via ArgBlock FSPortStatusList c) Repeat SMI_FSPDInOut until change (observe <timeout>) <i>;ArgBlock FSPDInOut</i> d) Evaluation 1)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check change
Test passed	No <timeout>
Test failed (examples)	<timeout>
Report	SPDU exchange: <negative/positive> <ok nok>

815

816 **8.2.3 Missing VerifyRecord at start-up ("armed")**

817 Table 48 defines the test conditions for this test case. It checks whether an FS-Device refuses
 818 to start SCL communication when VerifyRecord is missing in "armed" mode (operation not
 819 monitored).

820 **Table 48 – Missing VerifyRecord at start-up ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0037
Name	FSTCD_PARM_VRFY_ARMEDNOVFY
Purpose (short)	Missing VerifyRecord at start-up ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS-Device is not going to start SCL communication without receiving a valid and matching VerifyRecord within twice the time required for regular start-up.
Precondition	EUT configured for armed operation <i>;see field test parameter</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> FSDT: Do NOT send FSP_VerifyRecord b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456
Post condition	-
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB00A received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB00A received: <yes/no> <i><ok nok></i>

823

824 **8.2.4 Missing VerifyRecord at start-up ("commissioning")**

825 Table 49 defines the test conditions for this test case. It checks whether an FS-Device refuses
 826 to start SCL communication when VerifyRecord is missing in "commissioning – test" mode
 827 (monitored operation).

828 **Table 49 – Missing VerifyRecord at start-up ("commissioning")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0038
Name	FSTCD_PARM_VRFY_TESTNOVFY
Purpose (short)	Missing VerifyRecord at start-up ("commissioning test")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("commissioning test") without receiving a valid VerifyRecord within twice the time required for regular start-up.
Precondition	EUT configured for commissioning operation <i>;see field test parameter</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> FSDT: Do NOT send FSP_VerifyRecord b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB00A received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB00A received: <yes/no> <i><ok nok></i>

831

832 **8.2.5 Incorrect FSP_TechParCRC ("commissioning")**

833 Table 50 defines the test conditions for this test case. It checks whether an FS-Device refuses
 834 to start SCL communication when FSP_TechParCRC \neq 0 in "commissioning – test" mode
 835 (monitored operation). An Event shall be raised.

836 **Table 50 – Incorrect FSP_TechParCRC ("commissioning")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0039
Name	FSTCD_PARM_VRFY_TECHPARNO
Purpose (short)	Incorrect FSP_TechParCRC when "commissioning test"
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("commissioning test") without receiving a valid VerifyRecord with FSP_TechParCRC = 0.
Precondition	EUT configured for commissioning operation <i>;see A) and B)</i> FSDT port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of C) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB007 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB007 received: <yes/no> <i><ok nok></i>

839

840

841 **8.2.6 Incorrect FSP_TechParCRC ("armed")**

842 Table 51 defines the test conditions for this test case. It checks whether an FS-Device refuses
 843 to start SCL communication when FSP_TechParCRC = 0 in "armed" mode (operation not
 844 monitored). An Event shall be raised.

845 **Table 51 – Incorrect FSP_TechParCRC ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0040
Name	FSTCD_PARM_VRFY_TECHPAR0
Purpose (short)	Incorrect FSP_TechParCRC ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") without receiving a valid VerifyRecord with FSP_TechParCRC ≠ 0.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of C) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, <i>;responsibility of tester</i> FSP_TechParCRC = valid CRC signature + 1, <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB007 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB007 received: <yes/no> <i><ok nok></i>

848

849

850 **8.2.7 Unexpected authenticity 1 ("armed")**

851 Table 52 defines the test conditions for this test case. It checks whether an FS-Device refuses
 852 to start SCL communication in case of VerifyRecord with unexpected authenticity 1 in "armed"
 853 mode (operation not monitored). This corresponds to the use case of a misconnected FS-Device
 854 to a correct Port but to an incorrect FS-Master. In this case an Event shall be raised.

855 **Table 52 – Unexpected authenticity 1 ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0041
Name	FSTCD_PARM_VRFY_AUTH1WRONG
Purpose (short)	Unexpected authenticity 1 ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1, clause B.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with unexpected AUTH1 parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and C) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP authenticity parameter record: FSCP_Authenticity_1 = 2, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 26664
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB003 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB003 received: <yes/no> <i><ok nok></i>

860 **8.2.8 Unexpected authenticity 2 ("armed")**

861 Table 53 defines the test conditions for this test case. It checks whether an FS-Device refuses
 862 to start SCL communication in case of VerifyRecord with unexpected authenticity 2 in "armed"
 863 mode (operation not monitored). This corresponds to the use case of a misconnected FS-Device
 864 to a correct Port but to an incorrect FS-Master. In this case an Event shall be raised.

865 **Table 53 – Unexpected authenticity 2 ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0042
Name	FSTCD_PARM_VRFY_AUTH2WRONG
Purpose (short)	Unexpected authenticity 2 ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1, clause B.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with unexpected AUTH2 parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and C) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 3, FSP_Port = 1, FSP_AuthentCRC = 24853
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB003 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB003 received: <yes/no> <i><ok nok></i>

868

869 **8.2.9 Unexpected Port ("armed")**

870 Table 54 defines the test conditions for this test case. It checks whether an FS-Device refuses
 871 to start SCL communication in case of VerifyRecord with unexpected Port in "armed" mode
 872 (operation not monitored). This corresponds to the use case of a misconnected FS-Device to
 873 an incorrect Port but to a correct FS-Master. In this case an Event shall be raised.

874 **Table 54 – Unexpected Port ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0043
Name	FSTCD_PARM_VRFY_PORTWRONG
Purpose (short)	Unexpected Port ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1, clause B.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with unexpected authentication port parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and C) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 2, FSP_AuthentCRC = 65341
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB004 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB004 received: <yes/no> <i><ok nok></i>

877

878 **8.2.10 Incorrect authenticity CRC signature ("armed")**

879 Table 55 defines the test conditions for this test case. It checks whether an FS-Device refuses
 880 to start SCL communication in case of VerifyRecord with incorrect authenticity CRC signature
 881 in "armed" mode (operation not monitored). In this case an Event shall be raised.

882 **Table 55 – Incorrect authenticity CRC signature ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0044
Name	FSTCD_PARM_VRFY_AUTHCRCWRG
Purpose (short)	Incorrect authenticity CRC signature ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1, clause B.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with incorrect FSP_AuthentCRC parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of A) and C) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11457
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB005 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB005 received: <yes/no> <i><ok nok></i>

885

886 **8.2.11 Incorrect protocol parameter CRC signature ("armed")**

887 Table 55 defines the test conditions for this test case. It checks whether an FS-Device refuses
 888 to start SCL communication in case of VerifyRecord with incorrect protocol parameter CRC
 889 signature in "armed" mode (operation not monitored). In this case an Event shall be raised.

890 **Table 56 – Incorrect protocol parameter CRC signature ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0045
Name	FSTCD_PARM_VRFY_PPARCRCWRG
Purpose (short)	Incorrect protocol parameter CRC signature ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1, clause B.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with incorrect FSP_ProtParCRC parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of C) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, <i>;responsibility of tester</i> FSP_TechParCRC = valid CRC signature, FSP_ProtParCRC = valid CRC signature + 1 <i>;responsibility of tester</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB006 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB006 received: <yes/no> <i><ok nok></i>

893

894 **8.2.12 Incorrect technology parameter CRC signature ("armed")**

895 Table 55 defines the test conditions for this test case. It checks whether an FS-Device refuses
 896 to start SCL communication in case of VerifyRecord with incorrect technology parameter CRC
 897 signature in "armed" mode (operation not monitored). In this case an Event shall be raised.

898 **Table 57 – Incorrect technology parameter CRC signature ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0046
Name	FSTCD_PARM_VRFY_TPARCRCWRG
Purpose (short)	Incorrect technology parameter CRC signature ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1, clause B.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with incorrect FSP_TechParCRC parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of C) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, <i>;responsibility of tester</i> FSP_TechParCRC = 0, <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB007 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB007 received: <yes/no> <i><ok nok></i>

901

902 **8.2.13 Incorrect IO structure CRC signature ("armed")**

903 Table 58 defines the test conditions for this test case. It checks whether an FS-Device refuses
 904 to start SCL communication in case of VerifyRecord with incorrect technology parameter CRC
 905 signature in "armed" mode (operation not monitored). In this case an Event shall be raised.

906 **Table 58 – Incorrect IO structure CRC signature ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0047
Name	FSTCD_PARM_VRFY_IOSTCRCWRG
Purpose (short)	Incorrect IO structure CRC signature ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1, clause B.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with incorrect FSP_IO_StructCRC parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of C) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature, <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD + 1, <i>;responsibility of tester</i> FSP_TechParCRC = valid CRC signature, <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB008 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB008 received: <yes/no> <i><ok nok></i>

909

910 **8.2.14 Invalid watchdog time ("armed")**

911 Table 59 defines the test conditions for this test case. It checks whether an FS-Device refuses
 912 to start SCL communication in case of VerifyRecord with invalid watchdog time in "armed" mode
 913 (operation not monitored). In this case an Event shall be raised.

914 **Table 59 – Invalid watchdog time ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0048
Name	FSTCD_PARM_VRFY_WDTIMEINVL
Purpose (short)	Invaield watchdog time ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1, clause B.1, A.2.6
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with invalid "WD timeout" value.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of C) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1) d) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = 0, <i>;responsibility of tester</i> FSP_IOStructCRC = defaultValue in IODD, <i>;responsibility of tester</i> FSP_TechParCRC = valid CRC signature, <i>;responsibility of tester</i> FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state 2) Check Events
Test passed	Port state is "OPERATE", and Event 0xB009 received
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <i><ok nok></i> Event 0xB009 received: <yes/no> <i><ok nok></i>

917

918 **8.2.15 Invalid protocol version ("armed")**

919 Table 60 defines the test conditions for this test case. It checks whether an FS-Device refuses
 920 to start SCL communication in case of VerifyRecord with incorrect protocol version in "armed"
 921 mode (operation not monitored). In this case no Event shall be raised.

922 **Table 60 – Invalid protocol version ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0049
Name	FSTCD_PARM_VRFY_PVERSINVL
Purpose (short)	Invalid protocol version ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with invalid protocol version parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of C) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD + 1, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, <i>;responsibility of tester</i> FSP_TechParCRC = valid CRC signature, FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state
Test passed	Port state is "OPERATE"
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <ok nok>

925

926 **8.2.16 Invalid protocol mode ("armed")**

927 Table 61 defines the test conditions for this test case. It checks whether an FS-Device refuses
 928 to start SCL communication in case of VerifyRecord with incorrect protocol mode in "armed"
 929 mode (operation not monitored). In this case no Event shall be raised.

930 **Table 61 – Invalid protocol mode ("armed")**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0050
Name	FSTCD_PARM_VRFY_PMODEINVL
Purpose (short)	Invalid protocol mode ("armed")
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device PREOPERATE test: test-to-fail
Specification (clause)	[4] clause 10.4.1, clause 10.4.3.1, clause 11.7.6, clause G.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Make sure that an FS Device is not going to start SCL communication ("armed") when receiving VerifyRecord with invalid protocol mode parameter.
Precondition	EUT configured for armed operation <i>;see A) and B)</i> FSDT Port config DEACTIVATED
Procedure	a) Set PortConfig with FSP_VerifyRecord with values of C) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 <i>;see field test parameter</i> b) Wait for Port state "OPERATE" e.g. via ArgBlock FSPortStatusList c) Evaluation 1)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_2 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456 C) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD + 1, FSP_ProtMode = 10, FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, <i>;responsibility of tester</i> FSP_TechParCRC = valid CRC signature, FSP_ProtParCRC = valid CRC signature <i>;responsibility of tester</i>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Port state
Test passed	Port state is "OPERATE"
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <ok nok>

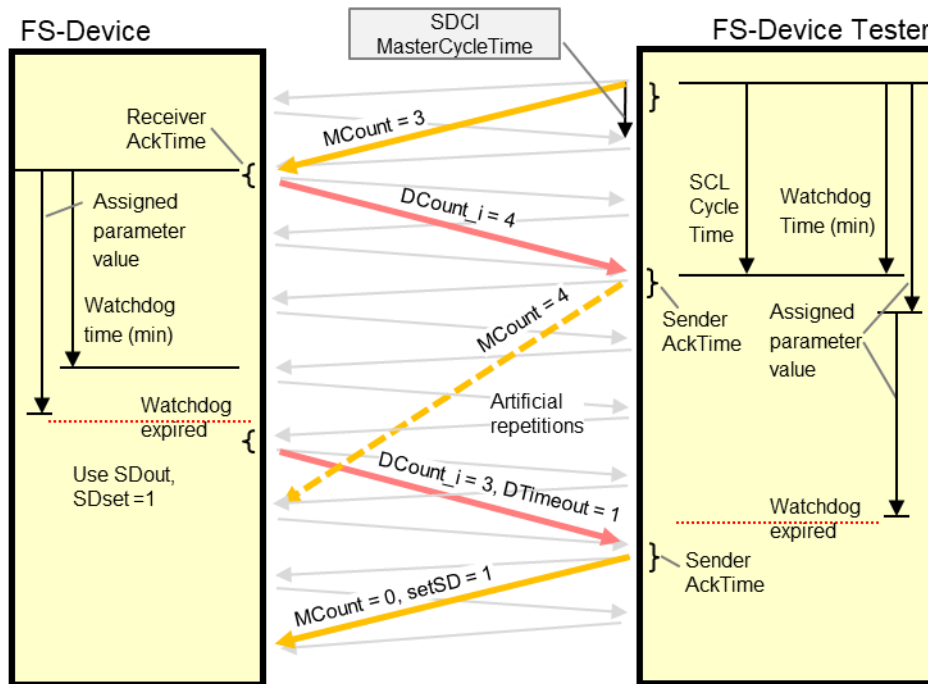
933

934 **8.3 Special SCL tests**

935 **8.3.1 Principle of FS-Device watchdog timer test**

936 In 13.6.1, the general concepts on worst-case delay times (WCDDT) and one fault delay times
 937 (OFDT) as well as watchdog timer testing for FS-Master are explained. The test case for FS-
 938 Devices follows a similar concept.

939 Figure 12 illustrates, how the watchdog timer of an FS-Device is tested. The FS-Device Tester
 940 controls the FS-Device in such a way that the FS-Master SPDU ("MCount = 4") is delayed
 941 through artificial repetitions. For details see 8.3.2.



942

943

944 **Figure 12 – Principle of FS-Device watchdog timer test**

945 Usually, the SCL software is triggered by the IO-Link communication, which is determined by
 946 the Master cycle time. Thus, the reaction of the SCL on expiration of the watchdog depends
 947 on how the SCL software samples the IO-Link messages with SPDU as shown in Figure 13.



948

949 **Figure 13 – Influence of SCL sampling effects**

950 In best case, the expiration of the watchdog coincides with the sampling. In worst case, the
 951 expiration is just behind sampling and the safety reaction is delayed correspondingly.

952 It is highly recommended for the designer of an FS-Device to choose the default value of the
 953 parameter FSP_Watchdog in IODD such that one extra SCL cycle time is included.

954 **8.3.2 FS-Device watchdog timer test**955 Table 62 defines the test conditions for this test case. The base protocol watchdog function of
956 the SCL is tested in 9.2.957 **Table 62 – FS-Device watchdog timer test**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0051
Name	FSTCD_SCLD_WATCHDOGANDIODD
Purpose (short)	Check whether FS-Device watchdog timeout coincides with IODD value
Equipment under test (EUT)	FS-Device and IODD
Test case version	1.1
Category / type	FS-Device test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether FS-Device's safety reaction time upon watchdog timeout coincides with the FSP_Watchdog value in the IODD (see also 13.6.2).
Precondition	EUT: Configured for armed operation ; <i>see field test parameter</i> FSDT: Port config DEACTIVATED FS Device SCL cycle time $t_{scl,d}$, SCL cycle time of Master = $t_{scl,m} = 0$
Procedure	a) Set PortConfig with FSP_VerifyRecord values of A) and B) ; <i>see field test parameter</i> b) Wait for Port state "OPERATE" c) delay the generation of SPDU in the FSDTU with the maximum number of cycles not exceeding the time t_{lp} ; <i>see field test parameter</i> d) Line monitor to measure timeouts for 1 min (Status Bit0 = 0, DTimeout) e) Evaluation 1) f) delay the generation of SPDU in the FSDTU with the minimum number of cycles exceeding the time t_{sf} . ; <i>see field test parameter</i> g) Line monitor to measure timeouts for 1 min (Status Bit0 = 0, DTimeout), break if a timeout has occurred h) Evaluation 2)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog (t_{wd}) = min cycle time from IODD * 100 t_{ct} = Master cycle time which is used during test $t_{lp} = 0.9 t_{wd} - 2t_{ct} - t_{scl,d}$ $t_{sf} = 1.1 + 2t_{ct} + t_{scl,d}$ FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature ; <i>responsibility of tester</i> FSP_ProtParCRC = valid CRC signature ; <i>responsibility of tester</i> B) FSP authenticity parameter record: FSCP_Authenticity_1 = 1, FSCP_Authenticity_1 = 2, FSP_Port = 1, FSP_AuthentCRC = 11456
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check timeouts 2) Check timeouts
Test passed	No timeout occurred in 1) At least 1 timeout occurred in 2)
Test failed (examples)	If a timeout occurred in 1) or no timeout occurred in 2)
Report	Watchdog within limits <ok not ok>

960 **8.3.3 Watchdog retrigger and CRC exception (0 → 1)**

961 8.3.1 defines the conditions for this test case. Some critical safety features cannot be tested by
962 IO-Link on-board equipment and shall be assessed during the development process via
963 verification and validation activities according to appropriate clauses in IEC 61508-3 as also
964 mentioned in 13.6.1.

965 Manufacturer to prove that the SCL watchdog timer is only retriggered when MCount has been
966 incremented and a calculated SPDU CRC signature of "0" will be changed to "1".

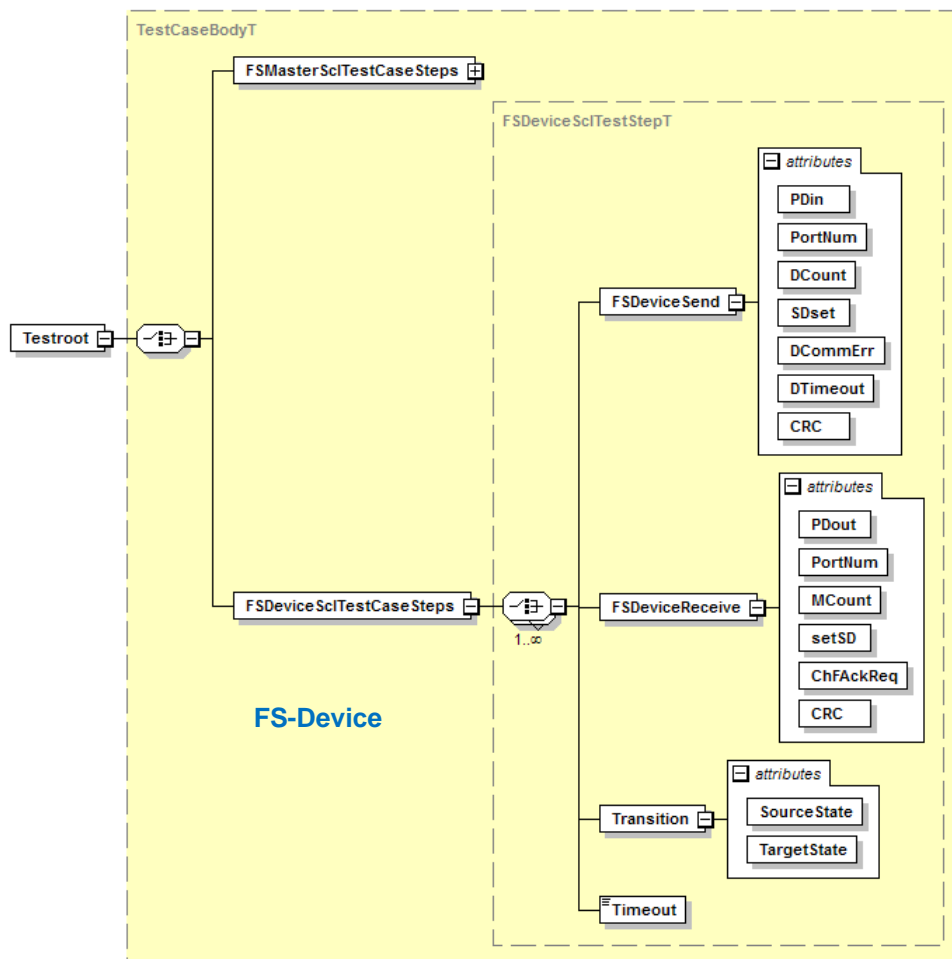
967 **9 FS-Device safety communication layer tests**

968 **9.1 Interface for the FS-Device SCL test scripts**

969 The test scripts for the automated safety layer test are encoded as XML files. Each and every
 970 test script ("FSDeviceSciTestCaseSteps") consists of test step instructions as described in
 971 Table 63. The XML Schema of the interface parameters for the FS-Device automated safety
 972 layer test is illustrated in Figure 14. It is similar to the XML format of the message types for the
 973 FS-Master (see 12.1).

974 However, the test scripts for the FS-Device do not contain test data for the "technology"
 975 interface. An upper tester is not intended for the FS-Device test. During the execution of the
 976 test scripts, the "technology" data has always its configured initial value.

977 **NOTE** The general concept of SCL protocol conformance testing is described in A.2.3. The automated safety layer
 978 tester for FS-Devices is described in A.2.5.



979

980 **Figure 14 – Schema of steps and parameters/attributes**

981 Table 63 defines the FS-Device interface parameters.

982 **Table 63 – FS-Device interface parameters**

Test step instructions	Parameter	Value range
FSDeviceSend (FS-Device → Test System)	PDin	SD –Test System expects SD values (= 0) PD – Test System expects PD values (> 0)
	PortNum	valid –Test System expects configured port number
	DCount	0 to 7
	SDset	0, 1

Test step instructions	Parameter	Value range
	DCommErr	0, 1
	DTimeout	0, 1
	CRC	valid – Test System expects correct CRC-Signature
FSDeviceReceive (Test System → FS-Device)	PDout	PD – Test System sends PD values (> 0)
	PortNum	valid – Test System sends configured port number invalid – Test System sends not configured port number
	MCount	0 to 7
	setSD	0, 1
	ChFAckReq	0, 1
	CRC	valid – Test System sends correct CRC-Signature invalid – Test System sends incorrect CRC-Signature
Timeout (Test System → FS-Device)		Test System sends no new message within a time delay \geq DTime. See for example 9.2.3.
Transition (Tag)	SourceState	This parameter is informative and will be inserted only in test logging from test system
	TargetState	This parameter is informative and will be inserted only in test logging from test system

983

984 The test step instructions comprise test messages from and to the FS-Device, Timeout, and
985 Transition tags.

986 Test messages sent by the FS-Device test object (EUT) are specified with the message type
987 "FSDeviceSend". The test message type "FSDeviceReceive" describes test messages that are
988 received by the FS-Device in a test scenario. Both messages are defining test data that are
989 received from or sent to the IO-Link communication Port.

990 The test step instruction "Timeout" specifies for how long the test system shall not send a
991 response. This time shall be greater than the watchdog time of the EUT (DTime).

992 The XML tag "Transition" is used for traceability of test messages with respect to the expected
993 transition of the state machine specified in [4]. This information is only descriptive and has no
994 impact on the test flow of the test tool.

995 **9.2 FS-Device SCL test suite**996 **9.2.1 Test script 1**

997 Table 64 defines the test conditions for this test case. The associated XML file contains steps
 998 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

999 **Table 64 – FS-Device test script 1**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0052
Name	FSTCD_SCLD_FLOW_NOERRMC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 46 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_1.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1002

1003 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_1.xml":

```

1004 <?xml version="1.0" encoding="UTF-8"?>
1005 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1006 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_1" date="20.11.2018: 14:01:13.942">
1007   <FSDeviceSclTestCaseSteps>
1008     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1009     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1010     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1011     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1012     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1013     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1014     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1015     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1016     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1017     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1018     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1019     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1020     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1021     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1022     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1023     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1024     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1025     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
1026     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1027     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1028     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1029     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>

```



```
1030 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
1031 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1032 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
1033 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1034 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1035 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="1" ChFAckReq="0" CRC="valid"/>
1036 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1037 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1038 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1039 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1040 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1041 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1042 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1043 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1044 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1045 </FSDeviceScfTestCaseSteps>
1046 </Testroot>
1047
1048
```

1049 **9.2.2 Test script 2**

1050 Table 65 defines the test conditions for this test case. The associated XML file contains steps
1051 and message parameters for the state flow check in case of a setSD error and MCount = 0.

1052 **Table 65 – FS-Device test script 2**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0053
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_2.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1055

1056 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_2.xml":

```

1057 <?xml version="1.0" encoding="UTF-8"?>
1058 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1059 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_2" date="20.11.2018: 14:01:13.942">
1060   <FSDeviceSciTestCaseSteps>
1061     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1062     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1063     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1064     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1065     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1066     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1067     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1068     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1069     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1070     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1071     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1072     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1073     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1074     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1075     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1076     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1077     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1078     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1079     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1080     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1081     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1082     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1083     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
1084     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1085     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1086     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
1087 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1088 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
1089 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1090 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1091 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1092 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1093 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1094 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1095 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1096 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1097 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1098 </FSDeviceScITestSteps>
1099 </Testroot>
1100
```

1101 **9.2.3 Test script 3**

1102 Table 66 defines the test conditions for this test case. The associated XML file contains steps
 1103 and message parameters for the state flow check in case of no error, MCount = 5, and Timeout.

1104 **Table 66 – FS-Device test script 3**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0054
Name	FSTCD_SCLD_FLOW_SETSD0MC5TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_3.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1107

1108 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_3.xml":

```

1109 <?xml version="1.0" encoding="UTF-8"?>
1110 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1111 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_3" date="20.11.2018: 14:01:13.942">
1112   <FSDeviceSciTestCaseSteps>
1113     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1114     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1115     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
1116     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1117     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1118     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1119     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1120     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
1121     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1122     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1123     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1124     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1125     <Timeout/>
1126     <Transition SourceState="WaitOnSPDU_26" TargetState="PrepareResponse_25"/>
1127     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1128     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1129     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
1130     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1131     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1132     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1133     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="0" DTimeout="1" CRC="valid"/>
1134     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1135     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1136     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1137     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1138     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>

```

```
1139 </FSDeviceSciTestCaseSteps>
1140 </Testroot>
1141
1142
```

1143 **9.2.4 Test script 4**

1144 Table 67 defines the test conditions for this test case. The associated XML file contains steps
 1145 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1146 **Table 67 – FS-Device test script 4**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0055
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_4.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1149

1150 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_4.xml":

```

1151 <?xml version="1.0" encoding="UTF-8"?>
1152 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1153 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_4" date="20.11.2018: 14:01:13.942">
1154   <FSDeviceSciTestCaseSteps>
1155     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1156     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1157     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1158     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1159     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1160     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1161     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1162     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1163     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1164     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1165     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1166     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1167     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1168     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1169     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1170     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1171     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1172     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1173     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1174     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1175     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1176     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1177     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1178     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1179     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1180     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>

```

```
1181     <FSDeviceSend PDIn="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1182 </FSDeviceSclTestCaseSteps>
1183 </Testroot>
1184
```

```
1185
```

1186 **9.2.5 Test script 5**

1187 Table 68 defines the test conditions for this test case. The associated XML file contains steps
1188 and message parameters for the state flow check in case of a setSD error and MCount = 0.

1189 **Table 68 – FS-Device test script 5**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0056
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_5.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1192

1193 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_5.xml":

```

1194 <?xml version="1.0" encoding="UTF-8"?>
1195 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1196 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_5" date="20.11.2018: 14:01:13.943">
1197   <FSDeviceSclTestCaseSteps>
1198     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1199     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1200     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1201     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1202     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1203     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1204     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1205     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="invalid"/>
1206     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1207     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1208     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1209     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1210     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1211     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1212     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1213     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1214   </FSDeviceSclTestCaseSteps>
1215 </Testroot>
1216

```


1217 **9.2.6 Test script 6**

1218 Table 69 defines the test conditions for this test case. The associated XML file contains steps
 1219 and message parameters for the state flow check in case of a setSD error, MCount = 2, and
 1220 Timeout.

1221 **Table 69 – FS-Device test script 6**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0057
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_6.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1224

1225 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_6.xml":

```

1226 <?xml version="1.0" encoding="UTF-8"?>
1227 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1228 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_6" date="20.11.2018: 14:01:13.943">
1229   <FSDeviceSciTestCaseSteps>
1230     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1231     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1232     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1233     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1234     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1235     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1236     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1237     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1238     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1239     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1240     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1241     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1242     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
1243     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1244     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1245     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1246     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1247     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
1248     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1249     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1250     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1251     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1252     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
1253     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>

```

```
1254 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
1255 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1256 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1257 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="1" ChFAckReq="0" CRC="valid"/>
1258 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1259 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1260 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1261 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1262 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
1263 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1264 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1265 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1266 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1267 </FSDeviceSciTestCaseSteps>
1268 </Testroot>
1269
```

1270 **9.2.7 Test script 7**

1271 Table 70 defines the test conditions for this test case. The associated XML file contains steps
 1272 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1273 **Table 70 – FS-Device test script 7**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0058
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_7.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1276

1277 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_7.xml":

```

1278 <?xml version="1.0" encoding="UTF-8"?>
1279 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1280 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_7" date="20.11.2018: 14:01:13.943">
1281   <FSDeviceSclTestCaseSteps>
1282     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1283     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1284     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1285     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1286     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1287     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1288     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1289     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1290     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1291     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1292     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1293     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1294     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
1295     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1296     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1297     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1298     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1299   </FSDeviceSclTestCaseSteps>
1300 </Testroot>
1301

```

1302

1303 **9.2.8 Test script 8**

1304 Table 71 defines the test conditions for this test case. The associated XML file contains steps
 1305 and message parameters for the state flow check in case of no error, MCount = 7, and Timeout.

1306 **Table 71 – FS-Device test script 8**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0059
Name	FSTCD_SCLD_FLOW_SETSD0MC7TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_8.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1309

1310 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_8.xml":

```

1311 <?xml version="1.0" encoding="UTF-8"?>
1312 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1313 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_8" date="20.11.2018: 14:01:13.943">
1314 <FSDeviceSclTestCaseSteps>
1315 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1316 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1317 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
1318 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1319 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1320 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1321 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1322 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1323 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1324 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1325 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1326 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1327 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
1328 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1329 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1330 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1331 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1332 </FSDeviceSclTestCaseSteps>
1333 </Testroot>
1334

```

1335

1336

1337 **9.2.9 Test script 9**

1338 Table 72 defines the test conditions for this test case. The associated XML file contains steps
 1339 and message parameters for the state flow check in case of a CRC error and MCount = 0, and
 1340 Timeout.

1341 **Table 72 – FS-Device test script 9**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0060
Name	FSTCD_SCLD_FLOW_CRC1MC0TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_9.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1344

1345 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_9.xml":

```

1346 <?xml version="1.0" encoding="UTF-8"?>
1347 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1348 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_9" date="20.11.2018: 14:01:13.943">
1349   <FSDeviceSclTestCaseSteps>
1350     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1351     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1352     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1353     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1354     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1355     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1356     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1357     <Timeout/>
1358     <Transition SourceState="WaitOnSPDU_26" TargetState="PrepareResponse_25"/>
1359     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1360     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1361     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
1362     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1363     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1364     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1365     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1366   </FSDeviceSclTestCaseSteps>
1367 </Testroot>
1368

```

1369

1370 **9.2.10 Test script 10**

1371 Table 73 defines the test conditions for this test case. The associated XML file contains steps
 1372 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1373 Timeout.

1374 **Table 73 – FS-Device test script 10**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0061
Name	FSTCD_SCLD_FLOW_SETSD1MC0TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_10.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1377

1378 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_10.xml":

```

1379 <?xml version="1.0" encoding="UTF-8"?>
1380 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1381 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_10" date="20.11.2018: 14:01:13.943">
1382   <FSDeviceSciTestCaseSteps>
1383     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1384     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1385     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1386     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1387     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1388     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1389     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1390     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1391     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1392     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1393     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1394     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1395     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1396     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1397     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1398     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1399     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1400     <Timeout/>
1401     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1402     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1403     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="1" CRC="valid"/>
1404     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
1405     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1406     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>

```

```
1407     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1408     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1409     </FSDeviceSciTestCaseSteps>
1410 </Testroot>
1411
```

1412 **9.2.11 Test script 11**

1413 Table 74 defines the test conditions for this test case. The associated XML file contains steps
1414 and message parameters for the state flow check in case of a setSD error and MCount = 0.

1415 **Table 74 – FS-Device test script 11**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0062
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_11.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1418

1419 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_11.xml":

```

1420 <?xml version="1.0" encoding="UTF-8"?>
1421 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1422 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_11" date="20.11.2018: 14:01:13.944">
1423   <FSDeviceSciTestCaseSteps>
1424     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1425     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1426     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1427     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1428     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1429     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1430     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1431     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1432     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1433     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1434     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1435     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1436     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1437     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1438     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1439     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1440     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1441     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1442     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1443     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1444     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1445     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1446     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1447     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1448     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1449     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```



```
1450 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1451 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1452 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1453 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1454 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1455 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1456 </FSDeviceSciTestCaseSteps>
1457 </Testroot>
1458
1459
```

1460 **9.2.12 Test script 12**

1461 Table 75 defines the test conditions for this test case. The associated XML file contains steps
 1462 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1463 DCommErr.

1464 **Table 75 – FS-Device test script 12**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0063
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_12.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1467

1468 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_12.xml":

```

1469 <?xml version="1.0" encoding="UTF-8"?>
1470 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1471 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_12" date="20.11.2018: 14:01:13.944">
1472   <FSDeviceSclTestCaseSteps>
1473     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1474     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1475     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1476     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1477     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1478     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1479     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1480     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
1481     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1482     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1483     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1484     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1485     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1486     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1487     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1488     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1489   </FSDeviceSclTestCaseSteps>
1490 </Testroot>
1491

```

1492

1493 **9.2.13 Test script 13**

1494 Table 76 defines the test conditions for this test case. The associated XML file contains steps
 1495 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1496 DCommErr.

1497 **Table 76 – FS-Device test script 13**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0064
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_13.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1500

1501 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_13.xml":

```

1502 <?xml version="1.0" encoding="UTF-8"?>
1503 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1504 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_13" date="20.11.2018: 14:01:13.944">
1505   <FSDeviceSclTestCaseSteps>
1506     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1507     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1508     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1509     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1510     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1511     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1512     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1513     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
1514     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1515     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1516     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1517     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1518     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1519     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1520     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1521     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1522   </FSDeviceSclTestCaseSteps>
1523 </Testroot>
1524

```

1525 **9.2.14 Test script 14**

1526 Table 77 defines the test conditions for this test case. The associated XML file contains steps
 1527 and message parameters for the state flow check in case of no error, MCount = 2, and
 1528 DCommErr.

1529 **Table 77 – FS-Device test script 14**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0065
Name	FSTCD_SCLD_FLOW_SETSD0MC2DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_14.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1532

1533 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_14.xml":

```

1534 <?xml version="1.0" encoding="UTF-8"?>
1535 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1536 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_14" date="20.11.2018: 14:01:13.944">
1537   <FSDeviceSclTestCaseSteps>
1538     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1539     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1540     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1541     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1542     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1543     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1544     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1545     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1546     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1547     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1548     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1549     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1550     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1551     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1552     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1553     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1554     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1555   </FSDeviceSclTestCaseSteps>
1556 </Testroot>
1557

```

1558

1559 **9.2.15 Test script 15**

1560 Table 78 defines the test conditions for this test case. The associated XML file contains steps
 1561 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1562 DCommErr.

1563 **Table 78 – FS-Device test script 15**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0066
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_15.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1566

1567 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_15.xml":

```

1568 <?xml version="1.0" encoding="UTF-8"?>
1569 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1570 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_15" date="20.11.2018: 14:01:13.944">
1571   <FSDeviceSclTestCaseSteps>
1572     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1573     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1574     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1575     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1576     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1577     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1578     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1579     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1580     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1581     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1582     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1583     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1584     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1585     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1586     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1587     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1588     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1589     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1590     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1591     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1592     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1593     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1594     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1595     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
1596 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1597 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1598 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1599 </FSDeviceSclTestCaseSteps>
1600 </Testroot>
1601
```

1602 **9.2.16 Test script 16**

1603 Table 79 defines the test conditions for this test case. The associated XML file contains steps
 1604 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1605 DCommErr.

1606 **Table 79 – FS-Device test script 16**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0067
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_16.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1609

1610 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_16.xml":

```

1611 <?xml version="1.0" encoding="UTF-8"?>
1612 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1613 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_16" date="20.11.2018: 14:01:13.944">
1614   <FSDeviceSclTestCaseSteps>
1615     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1616     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1617     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1618     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1619     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1620     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1621     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1622     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1623     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1624     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1625     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1626     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1627     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1628     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1629     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1630     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1631     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1632     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1633     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1634     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1635     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1636     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1637     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
1638     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
1639 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1640 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1641 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1642 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1643 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1644 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1645 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1646 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1647 </FSDeviceSciTestCaseSteps>
1648 </Testroot>
```


1649 **9.2.17 Test script 17**

1650 Table 80 defines the test conditions for this test case. The associated XML file contains steps
 1651 and message parameters for the state flow check in case of a PortNum error and MCount = 0.

1652 **Table 80 – FS-Device test script 17**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0068
Name	FSTCD_SCLD_FLOW_PNERRMC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_17.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1655

1656 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_17.xml":

```

1657 <?xml version="1.0" encoding="UTF-8"?>
1658 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1659 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_17" date="20.11.2018: 14:01:13.944">
1660   <FSDeviceSclTestCaseSteps>
1661     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1662     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1663     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1664     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1665     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1666     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1667     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1668   </FSDeviceSclTestCaseSteps>
1669 </Testroot>
1670

```

1671

1672 **9.2.18 Test script 18**

1673 Table 81 defines the test conditions for this test case. The associated XML file contains steps
1674 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

1675 **Table 81 – FS-Device test script 18**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0069
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_18.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1678

1679 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_18.xml":

```

1680 <?xml version="1.0" encoding="UTF-8"?>
1681 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1682 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_18" date="20.11.2018: 14:01:13.944">
1683   <FSDeviceSclTestCaseSteps>
1684     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1685     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1686     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1687     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1688     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1689     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1690     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1691     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1692     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1693     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1694     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1695     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1696   </FSDeviceSclTestCaseSteps>
1697 </Testroot>
1698
1699

```

1700 **9.2.19 Test script 19**

1701 Table 82 defines the test conditions for this test case. The associated XML file contains steps
 1702 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1703 DCommErr.

1704 **Table 82 – FS-Device test script 19**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0070
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_19.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1707

1708 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_19.xml":

```

1709 <?xml version="1.0" encoding="UTF-8"?>
1710 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1711 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_19" date="20.11.2018: 14:01:13.944">
1712   <FSDeviceSclTestCaseSteps>
1713     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1714     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1715     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1716     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1717     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1718     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1719     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1720     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
1721     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1722     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1723     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1724     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
1725     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1726     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1727     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1728     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1729   </FSDeviceSclTestCaseSteps>
1730 </Testroot>
1731

```

1732 **9.2.20 Test script 20**

1733 Table 83 defines the test conditions for this test case. The associated XML file contains steps
 1734 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1735 DCommErr.

1736 **Table 83 – FS-Device test script 20**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0071
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_20.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1739

1740 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_20.xml":

```

1741 <?xml version="1.0" encoding="UTF-8"?>
1742 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1743 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_20" date="20.11.2018: 14:01:13.944">
1744   <FSDeviceSclTestCaseSteps>
1745     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1746     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1747     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1748     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1749     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1750     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1751     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1752     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="invalid"/>
1753     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1754     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1755     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1756     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1757     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1758     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1759     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1760     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1761   </FSDeviceSclTestCaseSteps>
1762 </Testroot>
1763

```

1764 **9.2.21 Test script 21**

1765 Table 84 defines the test conditions for this test case. The associated XML file contains steps
 1766 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1767 DCommErr.

1768 **Table 84 – FS-Device test script 21**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0072
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_21.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1771

1772 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_21.xml":

```

1773 <?xml version="1.0" encoding="UTF-8"?>
1774 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1775 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_21" date="20.11.2018: 14:01:13.944">
1776   <FSDeviceSclTestCaseSteps>
1777     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1778     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1779     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1780     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1781     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1782     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1783     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1784     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="invalid"/>
1785     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1786     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1787     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1788     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
1789     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1790     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1791     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1792     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1793   </FSDeviceSclTestCaseSteps>
1794 </Testroot>
1795

```

1796

1797 **9.2.22 Test script 22**

1798 Table 85 defines the test conditions for this test case. The associated XML file contains steps
 1799 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1800 DCommErr.

1801 **Table 85 – FS-Device test script 22**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0073
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_22.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1804

1805 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_22.xml":

```

1806 <?xml version="1.0" encoding="UTF-8"?>
1807 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1808 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_22" date="20.11.2018: 14:01:13.945">
1809   <FSDeviceSclTestCaseSteps>
1810     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1811     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1812     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1813     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1814     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1815     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1816     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1817     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
1818     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1819     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1820     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1821     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1822     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1823     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1824     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1825     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1826   </FSDeviceSclTestCaseSteps>
1827 </Testroot>
1828
1829

```

1830 **9.2.23 Test script 23**

1831 Table 86 defines the test conditions for this test case. The associated XML file contains steps
 1832 and message parameters for the state flow check in case of a setSD error, MCount = 1, and
 1833 DCommErr.

1834 **Table 86 – FS-Device test script 23**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0074
Name	FSTCD_SCLD_FLOW_SETSD1MC1DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_23.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1837

1838 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_23.xml":

```

1839 <?xml version="1.0" encoding="UTF-8"?>
1840 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1841 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_23" date="20.11.2018: 14:01:13.945">
1842   <FSDeviceSclTestCaseSteps>
1843     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1844     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1845     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1846     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1847     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1848     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1849     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1850     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1851     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1852     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1853     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1854     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1855     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1856     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
1857   </FSDeviceSclTestCaseSteps>
1858 </Testroot>
1859

```

1860 **9.2.24 Test script 24**

1861 Table 87 defines the test conditions for this test case. The associated XML file contains steps
 1862 and message parameters for the state flow check in case of a setSD error, MCount = 1, and
 1863 DCommErr.

1864 **Table 87 – FS-Device test script 24**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0075
Name	FSTCD_SCLD_FLOW_SETSD1MC1DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_24.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1867

1868 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_24.xml":

```

1869 <?xml version="1.0" encoding="UTF-8"?>
1870 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1871 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_24" date="20.11.2018: 14:01:13.945">
1872 <FSDeviceSclTestCaseSteps>
1873 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1874 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1875 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1876 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1877 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1878 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1879 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1880 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1881 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1882 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1883 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1884 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1885 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1886 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1887 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1888 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1889 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1890 </FSDeviceSclTestCaseSteps>
1891 </Testroot>

```

1892

1893

1894 **9.2.25 Test script 25**

1895 Table 88 defines the test conditions for this test case. The associated XML file contains steps
1896 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1897 **Table 88 – FS-Device test script 25**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0076
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_25.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1900

1901 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_25.xml":

```

1902 <?xml version="1.0" encoding="UTF-8"?>
1903 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1904 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_25" date="20.11.2018: 14:01:13.945">
1905   <FSDeviceSciTestCaseSteps>
1906     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1907     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1908     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1909     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1910     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1911     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1912     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1913     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1914     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1915     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1916     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1917     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1918     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1919     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
1920   </FSDeviceSciTestCaseSteps>
1921 </Testroot>
1922

```

1923

1924 **9.2.26 Test script 26**

1925 Table 89 defines the test conditions for this test case. The associated XML file contains steps
 1926 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1927 **Table 89 – FS-Device test script 26**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0077
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_26.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1930

1931 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_26.xml":

```

1932 <?xml version="1.0" encoding="UTF-8"?>
1933 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1934 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_26" date="20.11.2018: 14:01:13.945">
1935   <FSDeviceSclTestCaseSteps>
1936     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1937     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1938     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1939     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1940     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1941     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1942     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1943     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1944     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1945     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1946     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1947     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1948     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1949     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1950     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1951     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1952     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1953   </FSDeviceSclTestCaseSteps>
1954 </Testroot>

```

1955

1956

1957 **9.2.27 Test script 27**

1958 Table 90 defines the test conditions for this test case. The associated XML file contains steps
 1959 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1960 **Table 90 – FS-Device test script 27**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0078
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_27.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1963

1964 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_27.xml":

```

1965 <?xml version="1.0" encoding="UTF-8"?>
1966 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1967 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_27" date="20.11.2018: 14:01:13.945">
1968   <FSDeviceSclTestCaseSteps>
1969     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1970     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1971     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1972     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1973     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1974     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1975     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1976     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1977     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1978     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1979     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1980     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1981     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1982     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1983     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1984     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1985     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1986   </FSDeviceSclTestCaseSteps>
1987 </Testroot>

```

1988

1989

1990 **9.2.28 Test script 28**

1991 Table 91 defines the test conditions for this test case. The associated XML file contains steps
 1992 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

1993 **Table 91 – FS-Device test script 28**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0079
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_28.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

1996

1997 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_28.xml":

```

1998 <?xml version="1.0" encoding="UTF-8"?>
1999 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2000 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_28" date="20.11.2018: 14:01:13.945">
2001   <FSDeviceSciTestCaseSteps>
2002     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2003     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2004     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2005     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2006     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2007     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2008     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2009     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2010     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2011     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2012     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2013     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2014     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2015     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2016   </FSDeviceSciTestCaseSteps>
2017 </Testroot>
2018

```

2019

2020 **9.2.29 Test script 29**

2021 Table 92 defines the test conditions for this test case. The associated XML file contains steps
2022 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

2023 **Table 92 – FS-Device test script 29**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0080
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_29.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2026

2027 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_29.xml":

```

2028 <?xml version="1.0" encoding="UTF-8"?>
2029 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2030 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_29" date="20.11.2018: 14:01:13.945">
2031   <FSDeviceSclTestCaseSteps>
2032     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2033     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2034     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2035     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2036     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2037     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2038     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2039     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2040     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2041     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2042     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2043     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2044     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2045     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2046     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2047     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2048     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2049   </FSDeviceSclTestCaseSteps>
2050 </Testroot>

```

2051

2052

2053 **9.2.30 Test script 30**

2054 Table 92 defines the test conditions for this test case. The associated XML file contains steps
2055 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

2056 **Table 93 – FS-Device test script 30**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0081
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_30.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2059

2060 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_30.xml":

```

2061 <?xml version="1.0" encoding="UTF-8"?>
2062 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2063 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_30" date="20.11.2018: 14:01:13.945">
2064   <FSDeviceSclTestCaseSteps>
2065     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2066     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2067     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2068     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2069     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2070     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2071     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2072     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2073     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2074     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2075     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2076     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2077     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2078     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2079     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2080     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2081     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2082   </FSDeviceSclTestCaseSteps>
2083 </Testroot>
2084

```

2085

2086 **9.2.31 Test script 31**

2087 Table 94 defines the test conditions for this test case. The associated XML file contains steps
2088 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2089 **Table 94 – FS-Device test script 31**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0082
Name	FSTCD_SCLD_FLOW_SETSD0MC3TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_31.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2092

2093 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_31.xml":

```

2094 <?xml version="1.0" encoding="UTF-8"?>
2095 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2096 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_31" date="20.11.2018: 14:01:13.945">
2097   <FSDeviceSciTestCaseSteps>
2098     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2099     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2100     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2101     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2102     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2103     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2104     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2105     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2106     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2107     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2108     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2109     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2110     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2111     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2112   </FSDeviceSciTestCaseSteps>
2113 </Testroot>
2114

```

2115

2116 **9.2.32 Test script 32**

2117 Table 95 defines the test conditions for this test case. The associated XML file contains steps
2118 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2119 **Table 95 – FS-Device test script 32**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0083
Name	FSTCD_SCLD_FLOW_SETSD0MC3TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_32.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2122

2123 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_32.xml":

```

2124 <?xml version="1.0" encoding="UTF-8"?>
2125 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2126 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_32" date="20.11.2018: 14:01:13.945">
2127   <FSDeviceSclTestCaseSteps>
2128     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2129     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2130     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2131     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2132     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2133     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2134     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2135     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2136     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2137     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2138     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2139     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2140     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2141     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2142     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2143     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2144     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2145   </FSDeviceSclTestCaseSteps>
2146 </Testroot>
2147

```

2148

2149 **9.2.33 Test script 33**

2150 Table 96 defines the test conditions for this test case. The associated XML file contains steps
2151 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2152 **Table 96 – FS-Device test script 33**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0084
Name	FSTCD_SCLD_FLOW_SETSD0MC3TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_33.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2155

2156 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_33.xml":

```

2157 <?xml version="1.0" encoding="UTF-8"?>
2158 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2159 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_33" date="20.11.2018: 14:01:13.945">
2160   <FSDeviceSclTestCaseSteps>
2161     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2162     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2163     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2164     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2165     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2166     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2167     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2168     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2169     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2170     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2171     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2172     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2173     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2174     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2175     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2176     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2177     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2178   </FSDeviceSclTestCaseSteps>
2179 </Testroot>
2180

```

2181 **9.2.34 Test script 34**

2182 Table 97 defines the test conditions for this test case. The associated XML file contains steps
2183 and message parameters for the state flow check in case of no error, MCount = 4, and Timeout.

2184 **Table 97 – FS-Device test script 34**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0085
Name	FSTCD_SCLD_FLOW_SETSD0MC4TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_34.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2187

2188 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_34.xml":

```

2189 <?xml version="1.0" encoding="UTF-8"?>
2190 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2191 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_34" date="20.11.2018: 14:01:13.945">
2192   <FSDeviceSciTestCaseSteps>
2193     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2194     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2195     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2196     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2197     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2198     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2199     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2200     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2201     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2202     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2203     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2204     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2205     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2206     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2207   </FSDeviceSciTestCaseSteps>
2208 </Testroot>
2209

```

2210 **9.2.35 Test script 35**

2211 Table 98 defines the test conditions for this test case. The associated XML file contains steps
 2212 and message parameters for the state flow check in case of no error, MCount = 4, and Timeout.

2213 **Table 98 – FS-Device test script 35**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0086
Name	FSTCD_SCLD_FLOW_SETSD0MC4TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_35.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2216

2217 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_35.xml":

```

2218 <?xml version="1.0" encoding="UTF-8"?>
2219 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2220 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_35" date="20.11.2018: 14:01:13.946">
2221   <FSDeviceSclTestCaseSteps>
2222     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2223     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2224     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2225     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2226     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2227     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2228     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2229     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2230     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2231     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2232     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2233     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2234     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2235     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2236     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2237     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2238     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2239   </FSDeviceSclTestCaseSteps>
2240 </Testroot>
2241

```

2242 **9.2.36 Test script 36**

2243 Table 99 defines the test conditions for this test case. The associated XML file contains steps
2244 and message parameters for the state flow check in case of no error, MCount = 4, and Timeout.

2245 **Table 99 – FS-Device test script 36**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0087
Name	FSTCD_SCLD_FLOW_SETSD0MC4TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_36.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2248

2249 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_36.xml":

```

2250 <?xml version="1.0" encoding="UTF-8"?>
2251 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2252 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_36" date="20.11.2018: 14:01:13.946">
2253   <FSDeviceSclTestCaseSteps>
2254     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2255     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2256     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2257     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2258     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2259     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2260     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2261     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2262     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2263     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2264     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2265     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2266     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2267     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2268     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2269     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2270     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2271   </FSDeviceSclTestCaseSteps>
2272 </Testroot>
2273

```

2274 **9.2.37 Test script 37**

2275 Table 100 defines the test conditions for this test case. The associated XML file contains steps
2276 and message parameters for the state flow check in case of no error, MCount = 5, and Timeout.

2277 **Table 100 – FS-Device test script 37**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0088
Name	FSTCD_SCLD_FLOW_SETSD0MC5TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_37.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2280

2281 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_37.xml":

```

2282 <?xml version="1.0" encoding="UTF-8"?>
2283 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2284 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_37" date="20.11.2018: 14:01:13.946">
2285   <FSDeviceSciTestCaseSteps>
2286     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2287     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2288     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2289     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2290     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2291     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2292     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2293     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2294     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2295     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2296     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2297     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2298     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2299     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2300   </FSDeviceSciTestCaseSteps>
2301 </Testroot>
2302

```

2303 **9.2.38 Test script 38**

2304 Table 101 defines the test conditions for this test case. The associated XML file contains steps
2305 and message parameters for the state flow check in case of no error, MCount = 5, and Timeout.

2306 **Table 101 – FS-Device test script 38**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0089
Name	FSTCD_SCLD_FLOW_SETSD0MC5TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_38.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2309

2310 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_38.xml":

```

2311 <?xml version="1.0" encoding="UTF-8"?>
2312 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2313 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_38" date="20.11.2018: 14:01:13.946">
2314 <FSDeviceSclTestCaseSteps>
2315 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2316 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2317 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2318 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2319 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2320 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2321 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2322 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2323 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2324 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2325 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2326 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2327 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2328 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2329 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2330 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2331 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2332 </FSDeviceSclTestCaseSteps>
2333 </Testroot>
2334

```

2335 **9.2.39 Test script 39**

2336 Table 102 defines the test conditions for this test case. The associated XML file contains steps
2337 and message parameters for the state flow check in case of no error, MCount = 5, and Timeout.

2338 **Table 102 – FS-Device test script 39**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0090
Name	FSTCD_SCLD_FLOW_SETSD0MC5TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_39.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2341

2342 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_39.xml":

```

2343 <?xml version="1.0" encoding="UTF-8"?>
2344 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2345 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_39" date="20.11.2018: 14:01:13.946">
2346   <FSDeviceSclTestCaseSteps>
2347     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2348     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2349     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2350     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2351     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2352     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2353     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2354     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2355     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2356     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2357     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2358     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2359     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2360     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2361     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2362     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2363     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2364   </FSDeviceSclTestCaseSteps>
2365 </Testroot>

```

2366

2367

2368 **9.2.40 Test script 40**

2369 Table 103 defines the test conditions for this test case. The associated XML file contains steps
2370 and message parameters for the state flow check in case of no error, MCount = 6, and Timeout.

2371 **Table 103 – FS-Device test script 40**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0091
Name	FSTCD_SCLD_FLOW_SETSD0MC6TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_40.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2374

2375 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_40.xml":

```

2376 <?xml version="1.0" encoding="UTF-8"?>
2377 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2378 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_40" date="20.11.2018: 14:01:13.946">
2379   <FSDeviceSciTestCaseSteps>
2380     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2381     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2382     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2383     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2384     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2385     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2386     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2387     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2388     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2389     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2390     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2391     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2392     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2393     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2394   </FSDeviceSciTestCaseSteps>
2395 </Testroot>
2396

```


2397 **9.2.41 Test script 41**

2398 Table 104 defines the test conditions for this test case. The associated XML file contains steps
 2399 and message parameters for the state flow check in case of no error, MCount = 6, and Timeout.

2400 **Table 104 – FS-Device test script 41**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0092
Name	FSTCD_SCLD_FLOW_SETSD0MC6TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_41.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2403

2404 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_41.xml":

```

2405 <?xml version="1.0" encoding="UTF-8"?>
2406 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2407 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_41" date="20.11.2018: 14:01:13.946">
2408   <FSDeviceSclTestCaseSteps>
2409     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2410     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2411     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2412     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2413     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2414     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2415     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2416     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2417     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2418     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2419     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2420     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2421     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2422     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2423     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2424     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2425     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2426   </FSDeviceSclTestCaseSteps>
2427 </Testroot>
2428

```

2429 **9.2.42 Test script 42**

2430 Table 105 defines the test conditions for this test case. The associated XML file contains steps
 2431 and message parameters for the state flow check in case of no error, MCount = 7, and Timeout.

2432 **Table 105 – FS-Device test script 42**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0093
Name	FSTCD_SCLD_FLOW_SETSD0MC7TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_42.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2435

2436 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_42.xml":

```

2437 <?xml version="1.0" encoding="UTF-8"?>
2438 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2439 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_42" date="20.11.2018: 14:01:13.946">
2440   <FSDeviceSciTestCaseSteps>
2441     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2442     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2443     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2444     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2445     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2446     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2447     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2448     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2449     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2450     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2451     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2452     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2453     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2454     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2455   </FSDeviceSciTestCaseSteps>
2456 </Testroot>
2457

```

2458 **9.2.43 Test script 43**

2459 Table 106 defines the test conditions for this test case. The associated XML file contains steps
2460 and message parameters for the state flow check in case of no error, MCount = 7, and Timeout.

2461 **Table 106 – FS-Device test script 43**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0094
Name	FSTCD_SCLD_FLOW_SETSD0MC7TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_43.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2464

2465 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_43.xml":

```

2466 <?xml version="1.0" encoding="UTF-8"?>
2467 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2468 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_43" date="20.11.2018: 14:01:13.946">
2469   <FSDeviceSclTestCaseSteps>
2470     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2471     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2472     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2473     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2474     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2475     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2476     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2477     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2478     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2479     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2480     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2481     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2482     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
2483     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2484     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2485     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2486     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2487   </FSDeviceSclTestCaseSteps>
2488 </Testroot>
2489

```

2490 **9.2.44 Test script 44**

2491 Table 107 defines the test conditions for this test case. The associated XML file contains steps
2492 and message parameters for the state flow check in case of no error, MCount = 7, and Timeout.

2493 **Table 107 – FS-Device test script 44**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0095
Name	FSTCD_SCLD_FLOW_SETSD0MC7TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_44.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2496

2497 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_44.xml":

```

2498 <?xml version="1.0" encoding="UTF-8"?>
2499 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2500 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_44" date="20.11.2018: 14:01:13.946">
2501   <FSDeviceSclTestCaseSteps>
2502     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2503     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2504     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2505     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2506     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2507     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2508     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2509     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2510     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2511     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2512     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2513     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2514     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2515     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2516     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2517     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2518     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2519   </FSDeviceSclTestCaseSteps>
2520 </Testroot>
2521

```

2522 **9.2.45 Test script 45**

2523 Table 108 defines the test conditions for this test case. The associated XML file contains steps
2524 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
2525 DCommErr.

2526 **Table 108 – FS-Device test script 45**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0096
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_45.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2529

2530 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_45.xml":

```

2531 <?xml version="1.0" encoding="UTF-8"?>
2532 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2533 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_45" date="20.11.2018: 14:01:13.946">
2534   <FSDeviceSclTestCaseSteps>
2535     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2536     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2537     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2538     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2539     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2540     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2541     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2542     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="invalid"/>
2543     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2544     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2545     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2546     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2547     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2548     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2549     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2550     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2551   </FSDeviceSclTestCaseSteps>
2552 </Testroot>
2553

```

2554 **9.2.46 Test script 46**

2555 Table 109 defines the test conditions for this test case. The associated XML file contains steps
 2556 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 2557 DCommErr.

2558 **Table 109 – FS-Device test script 46**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0097
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_46.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2561

2562 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_46.xml":

```

2563 <?xml version="1.0" encoding="UTF-8"?>
2564 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2565 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_46" date="20.11.2018: 14:01:13.946">
2566   <FSDeviceSclTestCaseSteps>
2567     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2568     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2569     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2570     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2571     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2572     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2573     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2574     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="invalid"/>
2575     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2576     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2577     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2578     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2579     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2580     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2581     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2582     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2583   </FSDeviceSclTestCaseSteps>
2584 </Testroot>
2585

```

2586 **9.2.47 Test script 47**

2587 Table 110 defines the test conditions for this test case. The associated XML file contains steps
 2588 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 2589 DCommErr.

2590 **Table 110 – FS-Device test script 47**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0098
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_47.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2593

2594 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_47.xml":

```

2595 <?xml version="1.0" encoding="UTF-8"?>
2596 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2597 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_47" date="20.11.2018: 14:01:13.946">
2598   <FSDeviceSclTestCaseSteps>
2599     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2600     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2601     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2602     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2603     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2604     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2605     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2606     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="invalid"/>
2607     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2608     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2609     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2610     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2611     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2612     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2613     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2614     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2615   </FSDeviceSclTestCaseSteps>
2616 </Testroot>
2617

```

2618 **9.2.48 Test script 48**

2619 Table 111 defines the test conditions for this test case. The associated XML file contains steps
 2620 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2621 DCommErr.

2622 **Table 111 – FS-Device test script 48**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0099
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_48.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2625

2626 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_48.xml":

```

2627 <?xml version="1.0" encoding="UTF-8"?>
2628 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2629 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_48" date="20.11.2018: 14:01:13.947">
2630   <FSDeviceSclTestCaseSteps>
2631     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2632     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2633     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2634     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2635     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2636     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2637     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2638     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
2639     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2640     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2641     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2642     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2643     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2644     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2645     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2646     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2647   </FSDeviceSclTestCaseSteps>
2648 </Testroot>
2649

```


2650 **9.2.49 Test script 49**

2651 Table 112 defines the test conditions for this test case. The associated XML file contains steps
 2652 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2653 DCommErr.

2654 **Table 112 – FS-Device test script 49**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0100
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_49.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2657

2658 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_49.xml":

```

2659 <?xml version="1.0" encoding="UTF-8"?>
2660 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2661 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_49" date="20.11.2018: 14:01:13.947">
2662   <FSDeviceSclTestCaseSteps>
2663     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2664     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2665     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2666     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2667     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2668     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2669     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2670     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
2671     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2672     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2673     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2674     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2675     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2676     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2677     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2678     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2679   </FSDeviceSclTestCaseSteps>
2680 </Testroot>
2681

```

2682 **9.2.50 Test script 50**

2683 Table 113 defines the test conditions for this test case. The associated XML file contains steps
 2684 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

2685 **Table 113 – FS-Device test script 50**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0101
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_50.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2688

2689 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_50.xml":

```

2690 <?xml version="1.0" encoding="UTF-8"?>
2691 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2692 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_50" date="20.11.2018: 14:01:13.947">
2693   <FSDeviceSclTestCaseSteps>
2694     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2695     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2696     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2697     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2698     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2699     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2700     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2701     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2702     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2703     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2704     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2705     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2706     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
2707     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2708     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2709     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2710     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2711   </FSDeviceSclTestCaseSteps>
2712 </Testroot>
2713

```

2714 **9.2.51 Test script 51**

2715 Table 114 defines the test conditions for this test case. The associated XML file contains steps
 2716 and message parameters for the state flow check in case of no error, MCount = 2, and
 2717 DCommErr.

2718 **Table 114 – FS-Device test script 51**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0102
Name	FSTCD_SCLD_FLOW_SETSD0MC2DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_51.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2721

2722 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_51.xml":

```

2723 <?xml version="1.0" encoding="UTF-8"?>
2724 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2725 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_51" date="20.11.2018: 14:01:13.947">
2726   <FSDeviceSclTestCaseSteps>
2727     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2728     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2729     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2730     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2731     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2732     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2733     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2734     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2735     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2736     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2737     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2738     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2739     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
2740     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2741     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2742     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2743     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2744   </FSDeviceSclTestCaseSteps>
2745 </Testroot>
2746

```

2747 **9.2.52 Test script 52**

2748 Table 115 defines the test conditions for this test case. The associated XML file contains steps
2749 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2750 **Table 115 – FS-Device test script 52**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0103
Name	FSTCD_SCLD_FLOW_SETSD0MC3TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_52.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2753

2754 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_52.xml":

```

2755 <?xml version="1.0" encoding="UTF-8"?>
2756 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2757 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_52" date="20.11.2018: 14:01:13.947">
2758   <FSDeviceSclTestCaseSteps>
2759     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2760     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2761     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2762     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2763     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2764     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2765     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2766     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2767     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2768     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2769     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2770     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2771     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
2772     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2773     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2774     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2775     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2776   </FSDeviceSclTestCaseSteps>
2777 </Testroot>
2778

```

2779 **9.2.53 Test script 53**

2780 Table 116 defines the test conditions for this test case. The associated XML file contains steps
2781 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2782 **Table 116 – FS-Device test script 53**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0104
Name	FSTCD_SCLD_FLOW_SETSD0MC3TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_53.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2785

2786 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_53.xml":

```

2787 <?xml version="1.0" encoding="UTF-8"?>
2788 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2789 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_53" date="20.11.2018: 14:01:13.947">
2790   <FSDeviceSclTestCaseSteps>
2791     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2792     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2793     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2794     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2795     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2796     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2797     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2798     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2799     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2800     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2801     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2802     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2803     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
2804     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2805     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2806     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2807     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2808   </FSDeviceSclTestCaseSteps>
2809 </Testroot>
2810

```

2811 **9.2.54 Test script 54**

2812 Table 117 defines the test conditions for this test case. The associated XML file contains steps
2813 and message parameters for the state flow check in case of no error, MCount = 4, and Timeout.

2814 **Table 117 – FS-Device test script 54**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0105
Name	FSTCD_SCLD_FLOW_SETSD0MC4TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_54.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2817

2818 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_54.xml":

```

2819 <?xml version="1.0" encoding="UTF-8"?>
2820 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2821 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_54" date="20.11.2018: 14:01:13.947">
2822   <FSDeviceSclTestCaseSteps>
2823     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2824     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2825     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2826     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2827     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2828     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2829     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2830     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2831     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2832     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2833     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2834     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2835     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
2836     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2837     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2838     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2839     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2840   </FSDeviceSclTestCaseSteps>
2841 </Testroot>
2842

```

2843 **9.2.55 Test script 55**

2844 Table 118 defines the test conditions for this test case. The associated XML file contains steps
 2845 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2846 DCommErr.

2847 **Table 118 – FS-Device test script 55**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0106
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_55.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2850

2851 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_55.xml":

```

2852 <?xml version="1.0" encoding="UTF-8"?>
2853 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2854 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_55" date="20.11.2018: 14:01:13.947">
2855   <FSDeviceSclTestCaseSteps>
2856     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2857     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2858     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2859     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2860     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2861     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2862     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2863     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2864     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2865     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2866     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2867     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2868     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2869     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2870     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2871     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2872     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2873   </FSDeviceSclTestCaseSteps>
2874 </Testroot>
2875

```

2876 **9.2.56 Test script 56**

2877 Table 119 defines the test conditions for this test case. The associated XML file contains steps
2878 and message parameters for the state flow check in case of setSD error and MCount = 0.

2879 **Table 119 – FS-Device test script 56**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0107
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_56.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2882

2883 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_56.xml":

```

2884 <?xml version="1.0" encoding="UTF-8"?>
2885 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2886 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_56" date="20.11.2018: 14:01:13.947">
2887   <FSDeviceSclTestCaseSteps>
2888     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2889     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2890     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2891     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2892     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2893     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2894     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2895     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2896     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2897     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2898     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2899     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2900     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2901     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2902     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2903     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2904     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2905     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2906     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
2907   </FSDeviceSclTestCaseSteps>
2908 </Testroot>
2909

```


2910 **9.2.57 Test script 57**

2911 Table 120 defines the test conditions for this test case. The associated XML file contains steps
 2912 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2913 DCommErr.

2914 **Table 120 – FS-Device test script 57**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0108
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_57.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2917

2918 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_57.xml":

```

2919 <?xml version="1.0" encoding="UTF-8"?>
2920 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2921 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_57" date="20.11.2018: 14:01:13.947">
2922   <FSDeviceSclTestCaseSteps>
2923     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2924     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2925     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2926     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2927     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2928     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2929     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2930     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2931     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2932     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2933     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2934     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2935     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2936     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2937     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2938     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2939     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2940     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2941     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2942     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2943     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2944   </FSDeviceSclTestCaseSteps>
2945 </Testroot>
2946

```

2947 **9.2.58 Test script 58**

2948 Table 121 defines the test conditions for this test case. The associated XML file contains steps
 2949 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2950 DCommErr.

2951 **Table 121 – FS-Device test script 58**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0109
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_58.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2954

2955 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_58.xml":

```

2956 <?xml version="1.0" encoding="UTF-8"?>
2957 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2958 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_58" date="20.11.2018: 14:01:13.947">
2959   <FSDeviceSclTestCaseSteps>
2960     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2961     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2962     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2963     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2964     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2965     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2966     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2967     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2968     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2969     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2970     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2971     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2972     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2973     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2974     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2975     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2976     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2977     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2978     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2979     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2980     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2981   </FSDeviceSclTestCaseSteps>
2982 </Testroot>
2983

```

2984 **9.2.59 Test script 59**

2985 Table 122 defines the test conditions for this test case. The associated XML file contains steps
 2986 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2987 DCommErr.

2988 **Table 122 – FS-Device test script 59**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0110
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_59.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

2991

2992 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_59.xml":

```

2993 <?xml version="1.0" encoding="UTF-8"?>
2994 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2995 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_59" date="20.11.2018: 14:01:13.947">
2996   <FSDeviceSclTestCaseSteps>
2997     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2998     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2999     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3000     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3001     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3002     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3003     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3004     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3005     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3006     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3007     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3008     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3009     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="0" CRC="valid"/>
3010     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3011     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3012     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3013     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3014     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="invalid"/>
3015     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3016     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3017     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3018   </FSDeviceSclTestCaseSteps>
3019 </Testroot>
3020

```

3021 **9.2.60 Test script 60**

3022 Table 123 defines the test conditions for this test case. The associated XML file contains steps
 3023 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3024 DCommErr.

3025 **Table 123 – FS-Device test script 60**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0111
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_60.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3028

3029 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_60.xml":

```

3030 <?xml version="1.0" encoding="UTF-8"?>
3031 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3032 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_60" date="20.11.2018: 14:01:13.948">
3033   <FSDeviceSclTestCaseSteps>
3034     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3035     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3036     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3037     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3038     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3039     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3040     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3041     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3042     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3043     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3044     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3045     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3046     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="0" CRC="valid"/>
3047     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3048     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3049     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3050     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3051     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="invalid"/>
3052     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3053     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3054     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3055   </FSDeviceSclTestCaseSteps>
3056 </Testroot>
3057

```

3058 **9.2.61 Test script 61**

3059 Table 124 defines the test conditions for this test case. The associated XML file contains steps
3060 and message parameters for the state flow check in case of setSD error and MCount = 0.

3061 **Table 124 – FS-Device test script 61**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0112
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_61.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3064

3065 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_61.xml":

```

3066 <?xml version="1.0" encoding="UTF-8"?>
3067 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3068 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_61" date="20.11.2018: 14:01:13.948">
3069   <FSDeviceSclTestCaseSteps>
3070     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3071     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3072     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3073     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3074     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3075     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3076     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3077     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3078     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3079     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3080     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3081     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3082     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3083     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3084     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3085     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3086     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3087     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3088     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3089   </FSDeviceSclTestCaseSteps>
3090 </Testroot>
3091

```

3092 **9.2.62 Test script 62**

3093 Table 124 defines the test conditions for this test case. The associated XML file contains steps
 3094 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3095 DCommErr.

3096 **Table 125 – FS-Device test script 62**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0113
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_62.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3099

3100 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_62.xml":

```

3101 <?xml version="1.0" encoding="UTF-8"?>
3102 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3103 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_62" date="20.11.2018: 14:01:13.948">
3104   <FSDeviceSclTestCaseSteps>
3105     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3106     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3107     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3108     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3109     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3110     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3111     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3112     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3113     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3114     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3115     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3116     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3117     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3118     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3119     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3120     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3121     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3122     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3123     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3124     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3125     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3126   </FSDeviceSclTestCaseSteps>
3127 </Testroot>
3128

```

3129 **9.2.63 Test script 63**

3130 Table 126 defines the test conditions for this test case. The associated XML file contains steps
 3131 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3132 DCommErr.

3133 **Table 126 – FS-Device test script 63**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0114
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_63.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3136

3137 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_63.xml":

```

3138 <?xml version="1.0" encoding="UTF-8"?>
3139 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3140 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_63" date="20.11.2018: 14:01:13.948">
3141   <FSDeviceSciTestCaseSteps>
3142     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3143     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3144     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3145     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3146     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3147     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3148     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3149     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3150     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3151     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3152     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3153     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3154     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3155     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3156     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3157     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3158     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3159     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3160     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3161     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3162     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3163     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3164   </FSDeviceSciTestCaseSteps>
3165 </Testroot>

```

3166 **9.2.64 Test script 64**

3167 Table 127 defines the test conditions for this test case. The associated XML file contains steps
 3168 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3169 DCommErr.

3170 **Table 127 – FS-Device test script 64**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0115
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_64.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3173

3174 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_64.xml":

```

3175 <?xml version="1.0" encoding="UTF-8"?>
3176 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3177 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_64" date="20.11.2018: 14:01:13.948">
3178   <FSDeviceSciTestCaseSteps>
3179     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3180     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3181     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3182     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3183     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3184     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3185     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3186     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3187     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3188     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3189     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3190     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3191     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3192     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3193     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3194     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3195     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3196     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3197     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3198     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3199     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3200     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3201   </FSDeviceSciTestCaseSteps>
3202 </Testroot>

```


3203 **9.2.65 Test script 65**

3204 Table 128 defines the test conditions for this test case. The associated XML file contains steps
3205 and message parameters for the state flow check in case of setSD error and MCount = 0.

3206 **Table 128 – FS-Device test script 65**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0116
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_65.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3209

3210 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_65.xml":

```

3211 <?xml version="1.0" encoding="UTF-8"?>
3212 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3213 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_65" date="20.11.2018: 14:01:13.948">
3214   <FSDeviceSciTestCaseSteps>
3215     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3216     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3217     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3218     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3219     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3220     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3221     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3222     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3223     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3224     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3225     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3226     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3227     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3228     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3229     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3230     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3231     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3232     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3233     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3234     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3235     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3236     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3237     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3238     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3239   </FSDeviceSciTestCaseSteps>
3240 </Testroot>

```

3241 **9.2.66 Test script 66**

3242 Table 129 defines the test conditions for this test case. The associated XML file contains steps
3243 and message parameters for the state flow check in case of setSD error and MCount = 0.

3244 **Table 129 – FS-Device test script 66**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0117
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_66.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3247

3248 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_66.xml":

```

3249 <?xml version="1.0" encoding="UTF-8"?>
3250 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3251 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_66" date="20.11.2018: 14:01:13.948">
3252   <FSDeviceSciTestCaseSteps>
3253     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3254     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3255     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3256     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3257     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3258     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3259     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3260     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3261     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3262     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3263     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3264     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3265     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3266     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3267     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3268     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3269     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3270     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3271     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3272     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3273     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3274     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3275     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3276     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3277     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3278     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>

```

```
3279 </FSDeviceSciTestCaseSteps>  
3280 </Testroot>  
3281
```

3282 **9.2.67 Test script 67**

3283 Table 130 defines the test conditions for this test case. The associated XML file contains steps
 3284 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3285 DCommErr.

3286 **Table 130 – FS-Device test script 67**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0118
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_67.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3289

3290 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_67.xml":

```

3291 <?xml version="1.0" encoding="UTF-8"?>
3292 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3293 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_67" date="20.11.2018: 14:01:13.948">
3294   <FSDeviceSclTestCaseSteps>
3295     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3296     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3297     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3298     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3299     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3300     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3301     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3302     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3303     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3304     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3305     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3306     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3307     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3308     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3309     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3310     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3311     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3312     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3313     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3314     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3315     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3316     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3317     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3318     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3319     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3320     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3321     </FSDeviceSciTestCaseSteps>
3322 </Testroot>
3323
```

3324 **9.2.68 Test script 68**

3325 Table 131 defines the test conditions for this test case. The associated XML file contains steps
3326 and message parameters for the state flow check in case of setSD error and MCount = 0.

3327 **Table 131 – FS-Device test script 68**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0119
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_68.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3330

3331 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_68.xml":

```

3332 <?xml version="1.0" encoding="UTF-8"?>
3333 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3334 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_68" date="20.11.2018: 14:01:13.948">
3335   <FSDeviceSciTestCaseSteps>
3336     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3337     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3338     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3339     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3340     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3341     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3342     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3343     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3344     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3345     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3346     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3347     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3348     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3349     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3350     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3351     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3352     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3353     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3354     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3355     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3356     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3357     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3358     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3359     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3360   </FSDeviceSciTestCaseSteps>
3361 </Testroot>

```

3362 **9.2.69 Test script 69**

3363 Table 132 defines the test conditions for this test case. The associated XML file contains steps
3364 and message parameters for the state flow check in case of setSD error, MCount = 0, and
3365 DCommErr.

3366 **Table 132 – FS-Device test script 69**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0120
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_69.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3369

3370 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_69.xml":

```

3371 <?xml version="1.0" encoding="UTF-8"?>
3372 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3373 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_69" date="20.11.2018: 14:01:13.948">
3374 <FSDeviceSclTestCaseSteps>
3375 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3376 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3377 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3378 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3379 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3380 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3381 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3382 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3383 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3384 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3385 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3386 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3387 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3388 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3389 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3390 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3391 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3392 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3393 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3394 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3395 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3396 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3397 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3398 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3399     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3400     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3401     </FSDeviceSciTestCaseSteps>
3402 </Testroot>
3403
```


3404 **9.2.70 Test script 70**

3405 Table 133 defines the test conditions for this test case. The associated XML file contains steps
 3406 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3407 DCommErr.

3408 **Table 133 – FS-Device test script 70**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0121
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_70.xml"
Test parameter	See Table 63 and XML file
Post condition	-
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3411

3412 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_70.xml":

```

3413 <?xml version="1.0" encoding="UTF-8"?>
3414 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3415 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_70" date="20.11.2018: 14:01:13.949">
3416   <FSDeviceSciTestCaseSteps>
3417     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3418     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3419     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3420     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3421     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3422     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3423     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3424     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3425     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3426     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3427     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3428     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3429     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3430     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3431     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3432     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3433     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3434     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3435     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3436     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3437     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3438     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3439     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3440     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3441     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3442     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3443     </FSDeviceSciTestCaseSteps>
3444 </Testroot>
3445
```

3446 **9.2.71 Test script 71**

3447 Table 134 defines the test conditions for this test case. The associated XML file contains steps
 3448 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3449 DCommErr.

3450 **Table 134 – FS-Device test script 71**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0122
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_71.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3453

3454 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_71.xml":

```

3455 <?xml version="1.0" encoding="UTF-8"?>
3456 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3457 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_71" date="20.11.2018: 14:01:13.949">
3458   <FSDeviceSclTestCaseSteps>
3459     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3460     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3461     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3462     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3463     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3464     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3465     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3466     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3467     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3468     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3469     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3470     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3471     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3472     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3473     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3474     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3475     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3476     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3477     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3478     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3479     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3480     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3481     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
3482     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3483     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3484     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3485     </FSDeviceSciTestCaseSteps>
3486 </Testroot>
3487
```

3488 **9.2.72 Test script 72**

3489 Table 135 defines the test conditions for this test case. The associated XML file contains steps
 3490 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3491 DCommErr.

3492 **Table 135 – FS-Device test script 72**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0123
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_72.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3495

3496 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_72.xml":

```

3497 <?xml version="1.0" encoding="UTF-8"?>
3498 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3499 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_72" date="20.11.2018: 14:01:13.949">
3500 <FSDeviceSclTestCaseSteps>
3501 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3502 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3503 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3504 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3505 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3506 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3507 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3508 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3509 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3510 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3511 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3512 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3513 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3514 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3515 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3516 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3517 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3518 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3519 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3520 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3521 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3522 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3523 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="invalid"/>
3524 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3525     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3526     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3527     </FSDeviceSciTestCaseSteps>
3528 </Testroot>
3529
```

3530 **9.2.73 Test script 73**

3531 Table 136 defines the test conditions for this test case. The associated XML file contains steps
 3532 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3533 DCommErr.

3534 **Table 136 – FS-Device test script 73**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0124
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_73.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3537

3538 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_73.xml":

```

3539 <?xml version="1.0" encoding="UTF-8"?>
3540 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3541 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_73" date="20.11.2018: 14:01:13.949">
3542 <FSDeviceSclTestCaseSteps>
3543 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3544 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3545 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3546 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3547 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3548 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3549 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3550 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3551 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3552 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3553 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3554 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3555 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3556 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3557 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3558 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3559 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3560 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3561 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3562 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3563 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3564 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3565 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3566 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3567 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3568 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3569 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3570 </FSDeviceSclTestCaseSteps>
3571 </Testroot>
3572
```


3573 **9.2.74 Test script 74**

3574 Table 137 defines the test conditions for this test case. The associated XML file contains steps
 3575 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3576 DCommErr.

3577 **Table 137 – FS-Device test script 74**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0125
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_74.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3580

3581 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_74.xml":

```

3582 <?xml version="1.0" encoding="UTF-8"?>
3583 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3584 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_73" date="20.11.2018: 14:01:13.949">
3585   <FSDeviceSclTestCaseSteps>
3586     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3587     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3588     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3589     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3590     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3591     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3592     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3593     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3594     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3595     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3596     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3597     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3598     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3599     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3600     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3601     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3602     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3603     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3604     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3605     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3606     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3607     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3608     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3609     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3610     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3611     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3612     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3613     </FSDeviceSclTestCaseSteps>
3614 </Testroot>
3615
3616
```

3617 **9.2.75 Test script 75**

3618 Table 138 defines the test conditions for this test case. The associated XML file contains steps
 3619 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3620 DCommErr.

3621 **Table 138 – FS-Device test script 75**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0126
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_75.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3624

3625 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_75.xml":

```

3626 <?xml version="1.0" encoding="UTF-8"?>
3627 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3628 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_75" date="20.11.2018: 14:01:13.950">
3629   <FSDeviceSclTestCaseSteps>
3630     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3631     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3632     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3633     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3634     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3635     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3636     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3637     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3638     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3639     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3640     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3641     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3642     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3643     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3644     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3645     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3646     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3647     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3648     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3649     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3650     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3651     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3652     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
3653     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3654     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3655     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3656     </FSDeviceSciTestCaseSteps>
3657 </Testroot>
3658
```

```
3659
```

3660 **9.2.76 Test script 76**

3661 Table 139 defines the test conditions for this test case. The associated XML file contains steps
3662 and message parameters for the state flow check in case of setSD error and MCount = 0.

3663 **Table 139 – FS-Device test script 76**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0127
Name	FSTCD_SCLD_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_76.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3666

3667 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_76.xml":

```

3668 <?xml version="1.0" encoding="UTF-8"?>
3669 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3670 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_76" date="20.11.2018: 14:01:13.950">
3671   <FSDeviceSciTestCaseSteps>
3672     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3673     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3674     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3675     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3676     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3677     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3678     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3679     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3680     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3681     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3682     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3683     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3684     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3685     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3686     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3687     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3688     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3689     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3690     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3691     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3692     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3693     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3694     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3695     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3696     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3697     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
3698 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3699 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3700 <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3701 </FSDeviceSclTestCaseSteps>
3702 </Testroot>
3703
3704
```

3705 **9.2.77 Test script 77**

3706 Table 140 defines the test conditions for this test case. The associated XML file contains steps
 3707 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3708 DCommErr.

3709 **Table 140 – FS-Device test script 77**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0128
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_77.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3712

3713 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_77.xml":

```

3714 <?xml version="1.0" encoding="UTF-8"?>
3715 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3716 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_77" date="20.11.2018: 14:01:13.950">
3717   <FSDeviceSclTestCaseSteps>
3718     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3719     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3720     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3721     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3722     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3723     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3724     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3725     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3726     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3727     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3728     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3729     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3730     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3731     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3732     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3733     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3734     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3735     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3736     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3737     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3738     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3739     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3740     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3741     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3742 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3743 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3744 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3745 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3746 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3747 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3748 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3749 </FSDeviceSclTestCaseSteps>
3750 </Testroot>
3751
3752
```


3753 **9.2.78 Test script 78**

3754 Table 141 defines the test conditions for this test case. The associated XML file contains steps
3755 and message parameters for the state flow check in case of setSD error, MCount = 0, and
3756 DCommErr.

3757 **Table 141 – FS-Device test script 78**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0129
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_78.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3760

3761 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_78.xml":

```

3762 <?xml version="1.0" encoding="UTF-8"?>
3763 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3764 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_78" date="20.11.2018: 14:01:13.950">
3765   <FSDeviceSclTestCaseSteps>
3766     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3767     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3768     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3769     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3770     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3771     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3772     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3773     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3774     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3775     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3776     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3777     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3778     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3779     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3780     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3781     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3782     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3783     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3784     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3785     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3786     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3787     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3788     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3789     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3790 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3791 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3792 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3793 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3794 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3795 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3796 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3797 </FSDeviceSclTestCaseSteps>
3798 </Testroot>
3799
3800
```

3801 **9.2.79 Test script 79**

3802 Table 142 defines the test conditions for this test case. The associated XML file contains steps
 3803 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3804 DCommErr.

3805 **Table 142 – FS-Device test script 79**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0130
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_79.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3808

3809 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_79.xml":

```

3810 <?xml version="1.0" encoding="UTF-8"?>
3811 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3812 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_79" date="20.11.2018: 14:01:13.951">
3813   <FSDeviceSclTestCaseSteps>
3814     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3815     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3816     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3817     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3818     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3819     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3820     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3821     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3822     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3823     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3824     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3825     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3826     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3827     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3828     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3829     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3830     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3831     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3832     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3833     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3834     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3835     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3836     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3837     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3838 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3839 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3840 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3841 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
3842 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3843 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3844 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3845 </FSDeviceSclTestCaseSteps>
3846 </Testroot>
3847
3848
```

3849 **9.2.80 Test script 80**

3850 Table 143 defines the test conditions for this test case. The associated XML file contains steps
 3851 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3852 DCommErr.

3853 **Table 143 – FS-Device test script 80**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0131
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_80.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3856

3857 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_80.xml":

```

3858 <?xml version="1.0" encoding="UTF-8"?>
3859 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3860 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_80" date="20.11.2018: 14:01:13.951">
3861   <FSDeviceSclTestCaseSteps>
3862     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3863     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3864     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3865     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3866     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3867     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3868     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3869     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3870     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3871     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3872     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3873     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3874     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3875     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3876     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3877     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3878     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3879     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3880     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3881     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3882     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3883     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3884     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3885     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3886 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3887 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3888 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3889 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
3890 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3891 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3892 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3893 </FSDeviceSclTestCaseSteps>
3894 </Testroot>
3895
3896
```

3897 **9.2.81 Test script 81**

3898 Table 144 defines the test conditions for this test case. The associated XML file contains steps
3899 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

3900 **Table 144 – FS-Device test script 81**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0132
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_81.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3903

3904 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_81.xml":

```

3905 <?xml version="1.0" encoding="UTF-8"?>
3906 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3907 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_81" date="20.11.2018: 14:01:13.951">
3908   <FSDeviceSciTestCaseSteps>
3909     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3910     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3911     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3912     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3913     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3914     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3915     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
3916     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3917     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3918     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3919     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3920     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3921     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3922     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3923     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3924     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3925     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3926     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3927     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3928     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3929     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3930     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3931     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3932     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3933     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
3934     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
3935 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3936 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3937 <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3938 </FSDeviceSclTestCaseSteps>
3939 </Testroot>
3940
3941
```


3942 **9.2.82 Test script 82**

3943 Table 145 defines the test conditions for this test case. The associated XML file contains steps
3944 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

3945 **Table 145 – FS-Device test script 82**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0133
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_82.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3948

3949 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_82.xml":

```

3950 <?xml version="1.0" encoding="UTF-8"?>
3951 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3952 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_82" date="20.11.2018: 14:01:13.951">
3953   <FSDeviceSciTestCaseSteps>
3954     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3955     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3956     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3957     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3958     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3959     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3960     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
3961     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3962     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3963     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3964     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3965     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3966     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3967     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3968     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3969     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3970     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3971     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3972     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3973     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3974     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3975     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3976     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3977     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3978     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
3979     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
3980 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3981 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3982 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3983 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3984 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3985 </FSDeviceSclTestCaseSteps>
3986 </Testroot>
3987
```

3988

3989 **9.2.83 Test script 83**

3990 Table 146 defines the test conditions for this test case. The associated XML file contains steps
3991 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

3992 **Table 146 – FS-Device test script 83**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0134
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_83.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

3995

3996 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_83.xml":

```

3997 <?xml version="1.0" encoding="UTF-8"?>
3998 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3999 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_83" date="20.11.2018: 14:01:13.952">
4000   <FSDeviceSciTestCaseSteps>
4001     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4002     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4003     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4004     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4005     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4006     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4007     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4008     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4009     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4010     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4011     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4012     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4013     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4014     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4015     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4016     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4017     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4018     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4019     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4020     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4021     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4022     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4023     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4024     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4025     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4026     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4027 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4028 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4029 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4030 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4031 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4032 </FSDeviceSclTestCaseSteps>
4033 </Testroot>
4034
4035
```

4036 **9.2.84 Test script 84**

4037 Table 147 defines the test conditions for this test case. The associated XML file contains steps
4038 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4039 **Table 147 – FS-Device test script 84**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0135
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_84.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4042

4043 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_84.xml":

```

4044 <?xml version="1.0" encoding="UTF-8"?>
4045 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4046 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_84" date="20.11.2018: 14:01:13.952">
4047   <FSDeviceSciTestCaseSteps>
4048     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4049     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4050     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4051     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4052     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4053     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4054     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4055     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4056     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4057     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4058     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4059     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4060     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4061     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4062     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4063     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4064     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4065     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4066     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4067     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4068     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4069     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4070     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4071     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4072     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4073     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4074 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4075 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4076 <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
4077 </FSDeviceSclTestCaseSteps>
4078 </Testroot>
4079
4080
```

4081 **9.2.85 Test script 85**

4082 Table 148 defines the test conditions for this test case. The associated XML file contains steps
4083 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4084 **Table 148 – FS-Device test script 85**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0136
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_85.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4087

4088 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_85.xml":

```

4089 <?xml version="1.0" encoding="UTF-8"?>
4090 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4091 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_85" date="20.11.2018: 14:01:13.952">
4092   <FSDeviceSciTestCaseSteps>
4093     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4094     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4095     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4096     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4097     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4098     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4099     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4100     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4101     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4102     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4103     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4104     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4105     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4106     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4107     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4108     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4109     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4110     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4111     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4112     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4113     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4114     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4115     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4116     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4117     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4118     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4119 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4120 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4121 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4122 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4123 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4124 </FSDeviceSclTestCaseSteps>
4125 </Testroot>
4126
4127
```


4128 **9.2.86 Test script 86**

4129 Table 149 defines the test conditions for this test case. The associated XML file contains steps
4130 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4131 **Table 149 – FS-Device test script 86**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0137
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_86.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4134

4135 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_86.xml":

```

4136 <?xml version="1.0" encoding="UTF-8"?>
4137 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4138 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_86" date="20.11.2018: 14:01:13.952">
4139   <FSDeviceSciTestCaseSteps>
4140     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4141     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4142     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4143     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4144     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4145     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4146     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4147     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4148     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4149     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4150     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4151     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4152     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4153     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4154     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4155     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4156     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4157     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4158     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4159     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4160     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4161     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4162     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4163     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4164     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4165     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4166 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4167 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4168 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4169 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4170 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4171 </FSDeviceSclTestCaseSteps>
4172 </Testroot>
4173
4174
```

4175 **9.2.87 Test script 87**

4176 Table 150 defines the test conditions for this test case. The associated XML file contains steps
4177 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

4178 **Table 150 – FS-Device test script 87**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0138
Name	FSTCD_SCLD_FLOW_SETSD0MC3TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_87.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4181

4182 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_87.xml":

```

4183 <?xml version="1.0" encoding="UTF-8"?>
4184 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4185 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_87" date="20.11.2018: 14:01:13.952">
4186   <FSDeviceSciTestCaseSteps>
4187     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4188     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4189     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4190     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4191     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4192     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4193     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4194     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4195     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4196     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4197     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4198     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4199     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4200     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4201     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4202     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4203     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4204     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4205     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4206     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4207     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4208     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4209     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4210     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4211     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4212     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4213     <FSDeviceSend PDIn="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4214     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4215     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
4216 </FSDeviceSclTestCaseSteps>
4217 </Testroot>
4218
4219
```

4220 **9.2.88 Test script 88**

4221 Table 151 defines the test conditions for this test case. The associated XML file contains steps
4222 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

4223 **Table 151 – FS-Device test script 88**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0139
Name	FSTCD_SCLD_FLOW_SETSD0MC3TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_88.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4226

4227 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_88.xml":

```

4228 <?xml version="1.0" encoding="UTF-8"?>
4229 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4230 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_88" date="20.11.2018: 14:01:13.953">
4231   <FSDeviceSciTestCaseSteps>
4232     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4233     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4234     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4235     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4236     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4237     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4238     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4239     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4240     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4241     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4242     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4243     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4244     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4245     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4246     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4247     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4248     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4249     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4250     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4251     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4252     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4253     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4254     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4255     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4256     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4257     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4258 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4259 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4260 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4261 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4262 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4263 </FSDeviceSclTestCaseSteps>
4264 </Testroot>
4265
4266
```

4267 **9.2.89 Test script 89**

4268 Table 152 defines the test conditions for this test case. The associated XML file contains steps
 4269 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 4270 DCommErr.

4271 **Table 152 – FS-Device test script 89**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0140
Name	FSTCD_SCLD_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_89.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4274

4275 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_89.xml":

```

4276 <?xml version="1.0" encoding="UTF-8"?>
4277 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4278 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_89" date="20.11.2018: 14:01:13.953">
4279   <FSDeviceSclTestCaseSteps>
4280     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4281     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4282     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
4283     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4284     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4285     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4286     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4287     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4288     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4289     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4290     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4291     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4292     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4293     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4294     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4295     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4296     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4297     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4298     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4299     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4300     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4301     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4302     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4303     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
4304 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4305 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4306 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4307 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4308 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4309 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4310 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4311 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4312 </FSDeviceSciTestCaseSteps>
4313 </Testroot>
4314
4315
```


4316 **9.2.90 Test script 90**

4317 Table 153 defines the test conditions for this test case. The associated XML file contains steps
4318 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4319 **Table 153 – FS-Device test script 90**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0141
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_90.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4322

4323 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_90.xml":

```

4324 <?xml version="1.0" encoding="UTF-8"?>
4325 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4326 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_90" date="20.11.2018: 14:01:13.953">
4327   <FSDeviceSciTestCaseSteps>
4328     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4329     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4330     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4331     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4332     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4333     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4334     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4335     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4336     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4337     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4338     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4339     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4340     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4341     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4342     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4343     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4344     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4345     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4346     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4347     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4348     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4349     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4350     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4351     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4352     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4353     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4354 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4355 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
4356 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4357 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4358 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4359 </FSDeviceSclTestCaseSteps>
4360 </Testroot>
4361
4362
```

4363 **9.2.91 Test script 91**

4364 Table 154 defines the test conditions for this test case. The associated XML file contains steps
4365 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

4366 **Table 154 – FS-Device test script 91**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0142
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_91.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4369

4370 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_91.xml":

```

4371 <?xml version="1.0" encoding="UTF-8"?>
4372 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4373 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_91" date="20.11.2018: 14:01:13.954">
4374   <FSDeviceSciTestCaseSteps>
4375     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4376     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4377     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4378     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4379     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4380     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4381     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4382     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4383     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4384     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4385     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4386     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4387     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4388     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4389     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4390     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4391     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4392     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4393     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4394     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4395     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4396     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4397     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4398     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4399     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4400     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4401 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4402 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
4403 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4404 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4405 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4406 </FSDeviceSclTestCaseSteps>
4407 </Testroot>
4408
4409
```

4410 **9.2.92 Test script 92**

4411 Table 155 defines the test conditions for this test case. The associated XML file contains steps
4412 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

4413 **Table 155 – FS-Device test script 92**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0143
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_92.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4416

4417 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_92.xml":

```

4418 <?xml version="1.0" encoding="UTF-8"?>
4419 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4420 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_92" date="20.11.2018: 14:01:13.954">
4421   <FSDeviceSciTestCaseSteps>
4422     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4423     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4424     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4425     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4426     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4427     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4428     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4429     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4430     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4431     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4432     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4433     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4434     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4435     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4436     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4437     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4438     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4439     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4440     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4441     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4442     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4443     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4444     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4445     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4446     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4447     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4448 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4449 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="invalid"/>
4450 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4451 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4452 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4453 </FSDeviceSclTestCaseSteps>
4454 </Testroot>
4455
4456
```

4457 **9.2.93 Test script 93**

4458 Table 156 defines the test conditions for this test case. The associated XML file contains steps
4459 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

4460 **Table 156 – FS-Device test script 93**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0144
Name	FSTCD_SCLD_FLOW_SETSD0MC3
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_93.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4463

4464 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_93.xml":

```

4465 <?xml version="1.0" encoding="UTF-8"?>
4466 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4467 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_93" date="20.11.2018: 14:01:13.954">
4468   <FSDeviceSciTestCaseSteps>
4469     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4470     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4471     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4472     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4473     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4474     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4475     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4476     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4477     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4478     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4479     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4480     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4481     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4482     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4483     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4484     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4485     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4486     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4487     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4488     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4489     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4490     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4491     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4492     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4493     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4494     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4495 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4496 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4497 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4498 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4499 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4500 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4501 </FSDeviceSciTestCaseSteps>
4502 </Testroot>
4503
4504
```


4505 **9.2.94 Test script 94**

4506 Table 157 defines the test conditions for this test case. The associated XML file contains steps
4507 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

4508 **Table 157 – FS-Device test script 94**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0145
Name	FSTCD_SCLD_FLOW_SETSD0MC1TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_94.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4511

4512 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_94.xml":

```

4513 <?xml version="1.0" encoding="UTF-8"?>
4514 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4515 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_94" date="20.11.2018: 14:01:13.954">
4516   <FSDeviceSciTestCaseSteps>
4517     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4518     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4519     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4520     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4521     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4522     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4523     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4524     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4525     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4526     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4527     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4528     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4529     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4530     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4531     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4532     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4533     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4534     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4535     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4536     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4537     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4538     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4539     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4540     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4541     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4542     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4543 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4544 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4545 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4546 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4547 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4548 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4549 </FSDeviceSciTestCaseSteps>
4550 </Testroot>
4551
4552
```

4553 **9.2.95 Test script 95**

4554 Table 158 defines the test conditions for this test case. The associated XML file contains steps
4555 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

4556 **Table 158 – FS-Device test script 95**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0146
Name	FSTCD_SCLD_FLOW_SETSD0MC3TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_95.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4559

4560 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_95.xml":

```

4561 <?xml version="1.0" encoding="UTF-8"?>
4562 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4563 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_95" date="20.11.2018: 14:01:13.954">
4564   <FSDeviceSciTestCaseSteps>
4565     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4566     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4567     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4568     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4569     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4570     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4571     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4572     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4573     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4574     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4575     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4576     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4577     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4578     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4579     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4580     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4581     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4582     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4583     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4584     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4585     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4586     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4587     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4588     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4589     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4590     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4591 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4592 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
4593 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4594 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4595 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4596 </FSDeviceSclTestCaseSteps>
4597 </Testroot>
4598
4599
```

4600 **9.2.96 Test script 96**

4601 Table 159 defines the test conditions for this test case. The associated XML file contains steps
4602 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4603 **Table 159 – FS-Device test script 96**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0147
Name	FSTCD_SCLD_FLOW_SETSD0MC2TO
Purpose (short)	
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device automated SCL protocol test
Specification (clause)	[4] clause 11.3.3, Figure 42 (services); clause 11.5.3, Figure 47 (state chart)
Configuration / setup	See Table 63
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Device waiting for the first message
Procedure	See XML file "IO-Link-Safety_spec_device_final_testsuite_testcase_96.xml"
Test parameter	See Table 63 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4606

4607 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_96.xml":

```

4608 <?xml version="1.0" encoding="UTF-8"?>
4609 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4610 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_96" date="20.11.2018: 14:01:13.955">
4611   <FSDeviceSciTestCaseSteps>
4612     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4613     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4614     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4615     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4616     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4617     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4618     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4619     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4620     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4621     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4622     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4623     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4624     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4625     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4626     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4627     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4628     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4629     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4630     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4631     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4632     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4633     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4634     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4635     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4636     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4637     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4638 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4639 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
4640 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4641 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4642 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4643 </FSDeviceSclTestCaseSteps>
4644 </Testroot>
4645
4646
```

4647 **10 FS-Device in reference system tests**

4648 **10.1 Overview and reference systems**

4649 The FS-Device in reference system tests comprise tests, where a complete (DTI) and approved
4650 FS-Master reference system including FS-Master Tool is available. Rules for reference systems
4651 are defined in A.2.7.

4652 IODD testing is specified in Clause 6 and therefore interoperability of the particular IODD of an
4653 FS-Device with the reference FS-Master system can be assumed. In case, an IODD tested with
4654 the help of the Checker Tool cannot be imported, the testing of the FS-Device shall be continued
4655 as far as possible, and in parallel, the manufacturer of the reference system shall be contacted
4656 for clarification.

4657 The availability of the Dedicated Tool has been checked in Clause 6.4. It is not necessary,

- 4658 • if an FS-Device has no parameters for its particular technology (no FST parameter), or
4659 • if the manufacturer of an FS-Device provides CRC signature values (TechParCRC) for any
4660 FST parameter combination (e.g. via user manual), which can be entered into the
4661 FSP_TechParCRC field of the FS-Master Tool.

4662

4663 The FS-Device in reference system tests comprise tests of the Dedicated Tool, behavior of the
4664 FS-Device in case of correct or incorrect FSP protocol parameter, and test of Events that are
4665 not covered by other test cases anyway.

4666 **10.2 Dedicated Tool**4667 **10.2.1 Invokability via registry**

4668 Table 160 defines the test conditions for this test case.

4669 **Table 160 – Invokability via registry**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0148
Name	FSTCD_REFT_INVOKEDEDITOOL
Purpose (short)	"Dedicated Tool" of the FS-Device can be launched/invoked
Equipment under test (EUT)	Dedicated Tool of FS-Device
Test case version	1.0
Category / type	DTI test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Reference-System and user manual
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	"Dedicated Tool" is dedicated to the FS-Device and can be launched/invoked
Precondition	–
Procedure	a) Install Dedicated Tool according to user manual b) Evaluation 1) c) Launch/invoke Dedicated Tool d) Evaluation 2)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check registry: UUID, AppPath, PID-File, VendorID, and DeviceID 2) Check display
Test passed	Registry values OK and match information in user manual, and FST parameters are visible according to user manual
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

4672

4673 **10.2.2 Calculation of TechParCRC**

4674 Table 161 defines the test conditions for this test case.

4675 **Table 161 – Calculation of TechParCRC**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0149
Name	FSTCD_REFT_CALCDEDITOOOL
Purpose (short)	Dedicated Tool presents FST parameter, calculates and displays TechParCRC value
Equipment under test (EUT)	Dedicated Tool of FS-Device (no back channel in DTI communication)
Test case version	1.0
Category / type	DTI test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Reference-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Dedicated Tool presents FST parameter, recalculates TechParCRC upon parameter changes, and displays the TechParCRC signature value in decimal form.
Precondition	–
Procedure	a) Launch/invoke Dedicated Tool b) Evaluation 1) c) Modify FST parameter values d) Evaluation 2) e) Copy & Paste TechParCRC signature to FS-Master Tool f) Evaluation 3) g) Perform commissioning of FS-Device (EUT) h) Evaluation 4)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check availability of TechParCRC display (decimal value) 2) Check changes in TechParCRC display 3) Check reaction of FS-Master Tool (FSP_TechParCRC field) 4) Check behavior of reference system with connected FS-Device
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

4678

4679 **10.2.3 DTI communication/Back Channel**

4680 Table 162 defines the test conditions for this test case. This test is optional.

4681 **Table 162 – DTI communication/Back Channel**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0150
Name	FSTCD_REFT_BACKDEDITOOL
Purpose (short)	Dedicated Tool presents FST parameter, calculates and displays TechParCRC value
Equipment under test (EUT)	Dedicated Tool of FS-Device (with back channel in DTI communication)
Test case version	1.0
Category / type	DTI test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Reference-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	FS-Master Tool invokes Dedicated Tool and passes over FST parameter via TPF. Subsequently, calculation of TechParCRC upon parameter changes takes place. Parameter values and TechParCRC are returned to FS-Master Tool via TBF ("Back Channel"). After parameter changes in FS-Master Tool, an update of the parameter values in the Dedicated Tool shall not occur automatically but only upon invocation of the Dedicated Tool.
Precondition	–
Procedure	a) Launch/invoke Dedicated Tool b) Evaluation 1) c) Try changing parameter values in FS-Master Tool d) Evaluation 2) e) Close Dedicated Tool f) Evaluation 3) g) Modify FST parameter values in FS-Master Tool h) Relaunch Dedicated Tool i) Evaluation 4) j) Evaluation 5) k) Perform commissioning of FS-Device (EUT) l) Evaluation 6)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check availability of TechParCRC display (decimal value) in Dedicated Tool (memorize CRC value) 2) Editing of values in FS-Master Tool shall be blocked 3) Check identical TechParCRC display (decimal value) in FS-Master Tool (see 1)) 4) Compare parameter values in displays of Dedicated Tool and FS-Master Tool (parameter values shall match) 5) Compare FST_TechParCRC on FS-Master Tool with TechParCRC of Dedicated Tool (CRC values should differ due to parameter changes) 6) Check behavior of reference system with connected FS-Device
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

4684

4685 **10.2.4 DTI communication to FS-Device**

4686 Table 163 defines the test conditions for this test case. This test is optional.

4687 **Table 163 – DTI communication to FS-Device**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0151
Name	FSTCD_REFT_COMMDEDITool
Purpose (short)	DTI communication from Dedicated Tool to FS-Device
Equipment under test (EUT)	Dedicated Tool of FS-Device (with DTI communication and online access)
Test case version	1.0
Category / type	DTI test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Reference-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	DTI communication from Dedicated Tool to FS-Device
Precondition	User manual
Procedure	a) Launch/invoke Dedicated Tool b) Evaluation 1) c) Get access to FS-Device d) Evaluation 2)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check availability of connection display 2) Check connection to FS-Device
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

4690

4691 **10.3 FS-Device replacement**4692 **10.3.1 Correct FSP parameter values (Out-of-box)**

4693 Table 164 defines the test conditions for this test case.

4694 **Table 164 – Correct FSP parameter values**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0152
Name	FSTCD_REFT_CORRECTFSTVALUES
Purpose (short)	Replace configured FS-Device by same FS-Device with out-of-box parameters
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Replace configured FS-Device by same FS-Device with out-of-box parameters
Precondition	EUT in armed mode, FSP_TechParCRC valid) FSDT in OPERATE (armed operation)
Procedure	a) Set FSDT Validation&Backup to 3: Backup + Restore e.g. via SMI_PortConfig b) Wait for Event 0xFF27 c) Set FSDT Validation&Backup to 4: Restore e.g. SMI_PortConfig d) Write System Command 131 "Back-to-box" e.g. SMI_DeviceWrite e) Evaluation 1) f) Port power Off/On e.g. via SMI_PortPowerOffOn g) Wait for Port state "SCL_ENABLED" e.g. via ArgBlock FSPortStatusList h) Evaluation 2)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Write response 2) Check Port state
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

4697

4698 **10.3.2 Incorrect FSP parameter values**

4699 Table 165 defines the test conditions for this test case.

4700 **Table 165 – Incorrect FSP parameter values**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0153
Name	FSTCD_REFT_INCORRECTFSPVALUES
Purpose (short)	Replace configured FS-Device by same FS-Device with different parameters
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test, test-to-fail
Specification (clause)	[4] Figure 56, Table A.1
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Replace configured FS-Device by same FS-Device with different parameters
Precondition	EUT in armed mode, FSP_TechParCRC valid) FSDT in OPERATE (armed operation)
Procedure	a) Read FSP protocol parameter record (0x4201) e.g. SMI_DeviceRead b) Evaluation 1) c) Change parameter in WDTime and set FSP_TechParCRC = 0 ;prepare values d) Write changed FSP protocol parameter record (0x4201) e.g. SMI_DeviceWrie e) Evaluation 2) f) Set FSP_TechParCRC to valid value ;prepare values g) Write changed FSP protocol parameter record (0x4201) e.g. SMI_DeviceWrie h) Evaluation 3) f) Port power Off/On e.g. via SMI_PortPowerOffOn g) Wait for Port state "OPERATE" e.g. ArgBlock PortStatusList h) Evaluation 4)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Read response 2) Check Write response 3) Check Write response 4) Check Event
Test passed	All ISDU responses OK, and Event 0xB009 received
Test failed (examples)	Any check incorrect and/or Event 0xB009 not received
Report	Values OK: <yes/no> <ok nok>

4703

4704 **10.4 Events**4705 **10.4.1 Overview**

4706 Most of the FS-Device Events are already covered within the context of other test cases. Table
4707 166 contains a list of Clauses and the concerned EventCodes.

4708 **Table 166 – List of FS-Device Events in other test cases**

Clause	EventCode	Description
8.2.7, 8.2.8, 11.3.4, 13.5.2	0xB003	Unexpected authentication code
8.2.10	0xB005	Incorrect FSP_AuthentCRC
10.3.2, 8.2.14	0xB009	Watchdog time out of specification (e.g. "0")
8.2.11	0xB006	Incorrect FSP_ProtParCRC
8.2.3, 8.2.4	0xB00A	No FSP_VerifyRecord received
8.2.5, 8.2.6, 8.2.12	0xB007	Incorrect FSP_TechtParCRC
8.2.9	0xB004	Unexpected authentication Port
8.2.13	0xB008	Incorrect FSP_IO_StructCRC

4709

4710 Remaining Events are tested in 10.4.2.

4711 **10.4.2 Events@communication**

4712 Table 167 defines the test conditions for this test case.

4713 **Table 167 – Events@communication**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0154
Name	FSTCD_REFT_COMMINTERRUPT
Purpose (short)	Events when communication is interrupted due to errors at SPDU exchange
Equipment under test (EUT)	FS-Device
Test case version	1.0
Category / type	FS-Device test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Device-Tester
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Events when communication is interrupted due to errors at SPDU exchange
Precondition	EUT: in armed mode FSDT: in OPERATE (armed operation)
Procedure	a) FSDT send SPDU with wrong CRC b) Evaluation 1) c) FSDT send SPDU with correct CRC d) FSDT send SPDU with incorrect Counter e) Evaluation 2) f) FSDT send SPDU with correct Counter g) FSDT stop sending SPDUs h) Evaluation 3)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check for Event 0xB000 ;Transmission error (CRC signature) 2) Check for Event 0xB001 ;Transmission error (Counter) 3) Check for Event 0xB002 ;Transmission error (Timeout)
Test passed	All Events received correctly
Test failed (examples)	Any Event incorrect or missing
Report	Event 0xB000 received: <yes/no> <ok nok> Event 0xB001 received: <yes/no> <ok nok> Event 0xB002 received: <yes/no> <ok nok>

4716

- 4717 **10.5 Test with reference FS-Master**
 4718 **10.5.1 Test in regular automation environment**
 4719 Table 168 defines the test conditions for this test case.

4720

4721

Table 168 – Test of FS-Device with Reference FS-Master

4722

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0198
Name	FSTCD_REFT_RM
Purpose (short)	Basic test of FS_Device with Reference FS-Master
Equipment under test (EUT)	FS-Device, IODD, Dedicated Tool
Test case version	1.0
Category / type	Test of basic functionality with reference FS-Master
Specification (clause)	[4]
Configuration / setup	FS-Device, IODD and dedicated tool (if available) applied to a reference FS-Master
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test of basic functionality of the EUT together with a reference FS-Master to show that the EUT is able to establish a safety communication also in regular automation environments.
Precondition	Setup of FS-Reference Master with Master Tool, Engineering and PLC.
Procedure	a) Setup FS-Reference Master System b) Connect EUT c) Configure FS-Device (opt. using Dedicated Tool) d) Evaluation 1) e) Start safe communication f) Evaluation 2) g) execute optional additional tests h) Evaluation 3)
Test parameter	-
Post condition	-
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check FSP_VerifyRecord 2) Check safety communication 3) Check results of additional tests
Test passed	1) FSP_VerifyRecord is available 2) Safety communication has started 3) All additional tests show expected results
Test failed (examples)	At least one test shows unexpected results
Report	Values OK : <yes/no>

4724

4725 **11 FS-Master Port operations tests**4726 **11.1 Overview**

4727 The FS-Master Port operations test cases comprise the necessary information about the
 4728 product to test, the basic FS-Master operations such as identification, authorization, and FSCP
 4729 authenticity from an upper-level FSCP system and are part of the Functional Tests. Other test
 4730 cases deal with Port power OFF/ON, VerifyRecord for verification, detection of misconnection,
 4731 and safe FS-Device replacement. It is up to the manufacturer to assure complete testing for all
 4732 implemented ports.

4733 **11.2 FS-Master meta data**4734 **11.2.1 User manual and safety assessment certificate**

4735 The test case checks whether not implemented “highly recommended” features are documented.

4736 Table 169 defines the test conditions for this test case.

4737 **Table 169 – User manual and safety assessment certificate**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0155
Name	FSTCM_INFO_DOCUMENTS
Purpose (short)	Check user/safety manuals for exceptions, properties, and certificates
Equipment under test (EUT)	User/safety manual of FS-Master and Master Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] "highly recommended" feature status, Annex H.6
Configuration / setup	–
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Manufacturers/vendors are obliged to inform in a user manual about not implemented "highly recommended" features and to provide a "Safety Manual" as well as a safety assessment certificate.
Precondition	–
Procedure	a) Identify in user manual not implemented "highly recommended" features b) Identify information in safety manual according to Annex H.6 in [4] c) Identify functional safety assessment certificate
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check exceptions in user manual 2) Check required parameters in safety manual 3) Check statements for relevant aspects of particular standard (IEC 61508/ISO13849), the assessment body, and the certificate number
Test passed	Exceptions permitted, and Safety Manual available (for example "product mission time", "safety level - SIL/PL", "probability of a dangerous failure per hour – PFH", and statements on delay times for the calculation of safety function response times, and Certificate accepted and noted in test report
Test failed (examples)	Any check incorrect
Report	Documents OK: <yes/no> <ok nok>

4740

4741 **11.2.2 Connector and cable information**

4742 Table 170 defines the test conditions for this test case.

4743 **Table 170 – Connector and cable information**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0156
Name	FSTCM_CONF_INFO_CONNECTCABLE
Purpose (short)	Check user/safety manuals for connector and cable information (OSSDe)
Equipment under test (EUT)	User/safety manual of FS-Master
Test case version	1.0
Category / type	FS-Master test
Specification (clause)	[4] 4.1.4, Figure 9
Configuration / setup	–
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check user/safety manuals for connector and cable information for OSSDe operation.
Precondition	–
Procedure	a) Identify in user manual connector Pin layout in case of M type connector b) Identify cable recommendations with respect to robustness and loop resistance
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Pin layout 2) Check recommendations on robustness and loop resistance
Test passed	Pin layouts are correct, and Robustness recommendations for cable coating such as "tear proof" and "cut resistant" as well as for loop resistance such that minimum supply voltages are guaranteed at maximum supply current are available
Test failed (examples)	Any check incorrect
Report	Documents OK: <yes/no> <ok nok>

4746

4747 **11.2.3 Default behavior (power, OSSDe, configurations)**

4748 Table 33 defines the test conditions for this test case.

4749 **Table 171 – Default behavior (power, OSDDe, configurations)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0157
Name	FSTCM_CONF_INFO_DEFAULTPARAM
Purpose (short)	FS-Master information: Power supply, OSSDe filter, Port configurations
Equipment under test (EUT)	User manual of FS-Master
Test case version	1.0
Category / type	FS-Master test
Specification (clause)	[4] Table 7, Table 8
Configuration / setup	–
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	FS-Master information: Power supply (derating), OSSDe filter, Port configurations
Precondition	–
Procedure	a) Identify parameter "Port power supply" in safety/user manual b) Identify parameter "Discrepancy time" in safety/user manual c) Identify parameter "Filter time" in safety/user manual d) Identify "Port configurations" in safety/user manual e) Identify "Safety function response time" information
Test parameter	–
Post condition	Memorize power supply, OSSDe filter values, Port configurations, response time
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check "Port power supply" information 2) Check parameter "Discrepancy time" 3) Check parameter "Filter time" 4) Check possible Port configurations 5) Check SFRT information
Test passed	At least one Port can provide a current of $ISM_{max} \geq 1000$ mA, and Value of "Discrepancy time - t_{dis} " = 3 ms, and Value of "Filter time" = 1ms according to test pulse duration t_i , and Port configurations comply with specification, and SFRT information refers to integration specification and IEC 61784-3 if appropriate
Test failed (examples)	Any check incorrect
Report	Documents OK: <yes/no> <ok nok>

4752

4753 **11.3 FS-Master operations**4754 **11.3.1 FS-Master identification**

4755 Table 172 defines the test conditions for this test case.

4756 **Table 172 – FS-Master identification**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0158
Name	FSTCM_INFO_FSMIDENT
Purpose (short)	Get FS-Master identification
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[2] 11.2.4
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Get FS-Master identification via service SMI_MasterIdentification
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_MasterIdentification(ArgBlock = 0x0001) ;returns Argblock "MasterIdent" b) Evaluation 1)
Test parameter	–
Post condition	VendorID, MasterID, MasterType, Features_1, MaxNumberOfPorts, PortTypes
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Argblock "MasterIdent"
Test passed	MasterIdent.VendorID corresponds to manual and IO-Link reference, and MasterIdent.MasterID corresponds to manual, and ;vendor specific MasterIdent.MasterType = 3, and ;FS-Master MasterIdent.Features_1.Bit 2 = 1, and ;PortPowerOffOn MasterIdent.MaxNumberOfPorts corresponds to Manual, and ;max number = n MasterIdent.PortTypes[0 to n] = {3, 4, or 5} ;no OSSD, OSSD, or Class B
Test failed (examples)	Any check incorrect
Report	Identification OK: <yes/no> <ok nok>

4759

4760 **11.3.2 FS-Master access and authenticity**

4761 Table 173 defines the test conditions for this test case.

4762 **Table 173 – FS-Master authenticity**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0159
Name	FSTCM_INFO_FSMAUTHENT
Purpose (short)	Get FS-Master authenticity
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] 10.2.2
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Get FS-Master authenticity via service SMI_FSMasterAccess
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_FSMasterAccess(ArgBlock = 0x0100 <PW, RPW, Role>) ; <i>Test parameter ;returns Argblock "FSCPAuthenticity"</i> b) Evaluation 1)
Test parameter	PW = FSMasterPassword ; <i>acquired from manual</i> RPW = FSResetMasterPW = 0x0000 ; <i>default, no reset of PW</i> Role = 0x00 ; <i>default</i>
Post condition	FSCP_Authenticity1, FSCP_Authenticity2
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check ArgBlock "FSCPAuthenticity"
Test passed	Both elements correspond to settings from upper-level FSCP system
Test failed (examples)	Any check incorrect
Report	Authenticity OK: <yes/no> <ok nok>

4765

4766 **11.3.3 PREOPERATE – verification**

4767 The test case checks that the VerifyRecord is properly sent to the FS-Device during start-up.

4768 Table 174 defines the test conditions for this test case.

4769 **Table 174 – PREOPERATE – verification**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0161
Name	FSTCM_FSOP_PREOPVERIFY
Purpose (short)	Check whether VerifyRecord is sent to FS-Device
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.1
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] Annex A.2.10
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether VerifyRecord is sent to FS-Device
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_PortConfig (ABPS_FSCONFIG_SAFECOM) b) Wait for Port state "OPERATE" ;e.g. via ArgBlock FSPortStatusList c) SMTU_VerifyRecord_Get ;returns "VerifyRecord" d) Evaluation 1)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Compare values of "VerifyRecord" with FSP parameters in Port configuration
Test passed	All compared parameters match
Test failed (examples)	Any comparison failed
Report	Values OK: <yes/no> <ok nok>

4772

4773 **11.3.4 PREOPERATE – misconnection**

4774 The test case checks whether the FS-Master detects that an FS-Device with unexpected
4775 authenticity is connected.

4776 Table 175 defines the test conditions for this test case.

4777 **Table 175 – PREOPERATE – misconnection**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0162
Name	FSTCM_FSOP_PREOPMISSCONNECT
Purpose (short)	FS-Master indicates FS-Device misconnection
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.1
Category / type	FS-Master test, test-to-fail
Specification (clause)	[4] Annex G.4
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether misconnection is detected
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMTU_Authent_Set(Authent1=<different>) ;different Authent1 selected b) SMI_PortConfig (ABPS_FSCONFIG_SAFECOM) c) Status = SMI_PortStatus(AB = 0x9100) ; returns FSPortStatusList d) Repeat with c) until status = SCL_ENABLED e) Evaluation 1) f) Wait on SMI-DeviceEvent ; returns DeviceEvent g) Evaluation 2
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check ArgBlock "FSPortStatusList" 2) Check ArgBlock "DeviceEvent"
Test passed	FSPortStatusList.PortStatusInfo = 8, and ;SCL_ENABLED EventCode = 0xB003 ;unexpected authentication code
Test failed (examples)	Any other PortStatusInfo, or other Eventcodes, or no Event
Report	Event: <yes/no> <ok nok> FS-Device EventCode: <value> <ok nok>

4780

4781 **11.3.5 PREOPERATE – replacement**

4782 Table 176 defines the test conditions for this test case.

4783 **Table 176 – PREOPERATE – replacement**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0163
Name	FSTCM_FSOP_PREOPREPLACE
Purpose (short)	FS-Master performs FS-Device replacement correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] Annex G.3
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether FS-Master performs FS-Device replacement correctly (Back-to-box)
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32 <i>;no FST Parameter</i>
Procedure	a) SMI_PortPowerOffOn(ABPS_PORT_OFF) b) SMTU_Authent_Set(Authent1/2=0, Port=0, CRC=0) <i>;"Authenticity" = 0</i> c) SMI_PortPowerOffOn(ABPS_PORT_ON) d) Wait 3 s <i>;self test time = 2 s</i> e) SMI_PortStatus(ArgBlock = 0x9100) <i>;returns ArgBlock "FSPortStatusList"</i> f) Evaluation 1) g) Wait on SMI_DeviceEvent <i>;returns ArgBlock "DeviceEvent"</i> h) Evaluation 2) i) Wait on SMI_PortEvent <i>;returns ArgBlock "PortEvent"</i> k) Evaluation 3)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check ArgBlock "FSPortStatusList" 2) Check ArgBlock "DeviceEvent" 3) Check ArgBlock "PortEvent"
Test passed	FSPortStatusList.PortStatusInfo = 8, and <i>;SCL_ENABLED</i> None of the FS EventCodes <i>;see Annex B in [4]</i>
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

4786

4787 **11.3.6 Ready Pulse Start**

4788 Table 179 defines the test conditions for this test case.

4789 **Table 177 – READY Pulse detection**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0196
Name	FSTCM_DLMH_READY
Purpose (short)	Check that FS-Master executes after port status change a PortPowerOffOn and waits for a ready pulse of the Device
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] 7.2 Figure 29
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check that Port PowerOffOn and Startup Timing for Ready pulse is correct and measure FSP_MinShutDownTime
Precondition	EUT: PORT_POWER_OFF SMTU: SMTU_STANDARD_STATE_32 ; <i>no FST Parameter</i>
Procedure	a) PortPowerOn b) SMTU_PowerOffTime_Start c) SMI_PortConfig (ABPS_FSCONFIG_SAFECOM) ; <i>Start safe communication</i> d) SMTU_SPDU_Change ; <i>Communication started</i> e) Evaluation 1 f) POT = SMTU_PowerOffTime_Get ; <i>get PowerOffTime</i> g) Evaluation 2
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check that SMTU_SPDU_Change has returned 2) Check POT
Test passed	1) SMTU_SPDU_Change return within Timeout 2) POT >= FSP_MinShutDownTime
Test failed (examples)	Timeout occurred POT < FSP_MinShutDownTime
Report	Values OK: <yes/no> <ok nok>

4792

4793

4794 **11.3.7 Start Repetition**

4795 Table 178 defines the test conditions for this test case.

4796 **Table 178 – Start Repetition**

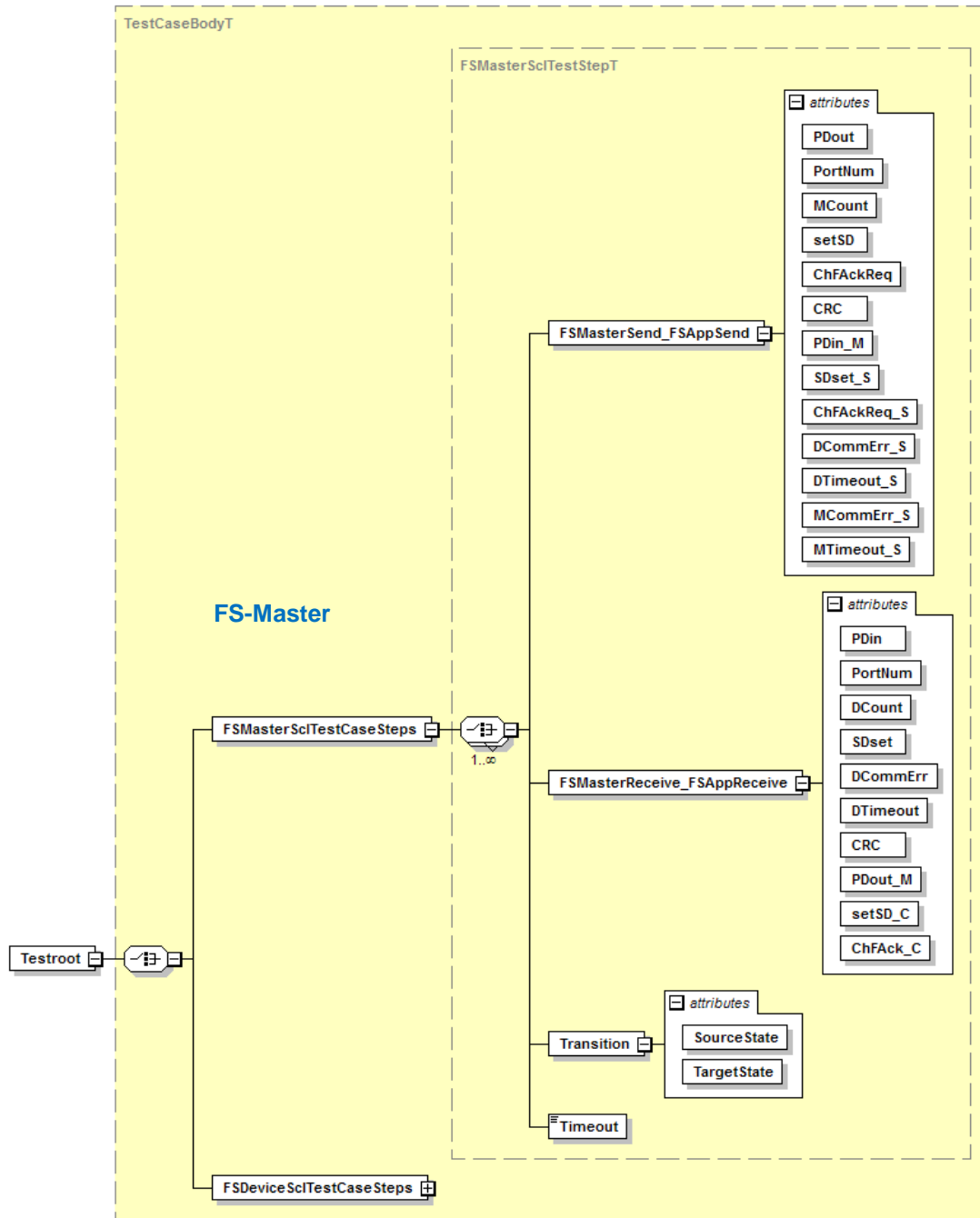
TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE	
Identification (ID)	SDCI_FSTC_197	
Name	FSTCM_DLMH_READY_REPEAT	
Purpose (short)	Check that FS-Master executes after port status change cycles PortPowerOffOn and until FS-Device enters safe communication	
Equipment under test (EUT)	FS-Master + Tool	
Test case version	1.0	
Category / type	FS-Master test, test-to-fail	
Specification (clause)	[4] 7.2 Figure 29	
Configuration / setup	FS-Master-Tester-System	
TEST CASE	CONDITIONS / PERFORMANCE	
Purpose (detailed)	Check that Port PowerOffOn is repeated after missed ready pulse	
Precondition	EUT: PORT_POWER_OFF SMTU: SMTU_STANDARD_STATE_32 ;No FST Parameter	
Procedure	a) SMI_PortConfig (ABPS_FSCONFIG_SAFECOM) ;RP set to default = 5s b) SMTU_Ready_Wait (t2R = 6.5s, tRP=0.75ms) ;RP issued too late c) STM_WAIT (FSP_MinShutDownTime*1.1) ;Wait ShutDownTime d) ps= SMTU_PowerState_Get ;Check if power is on e) Repeat from d) while ps == PowerOn f) Evaluate 1 ;Power is off 2nd time	
Test parameter	–	
Post condition	–	
TEST CASE RESULTS	CHECK / REACTION	
Evaluation	1) Check ps	
Test passed	1) ps = Power Off	
Test failed (examples)	Timeout occurred	
Report	Values OK: <yes/no>	<ok nok>

4799

4800 **12 FS-Master safety communication layer tests**4801 **12.1 Interface for the FS-Master SCL test scripts**

4802 The test scripts for the automated safety layer tests are encoded as XML files. Each and every
 4803 test script ("FSMasterSciTestCaseSteps") consists of test step instructions as described in
 4804 Table 179. The XML Schema of the interface parameters for the FS-Master automated safety
 4805 layer test is illustrated in Figure 15. The tests described in this section are referred as SCL
 4806 Tests.

4807 NOTE The general concept of SCL protocol conformance testing is described in A.2.3. The automated safety layer
 4808 tester for FS-Masters is described in A.2.4.



4809

4810

Figure 15 – Schema of steps and parameters/attributes

4811 Table 179 defines the FS-Master interface parameters.

4812

Table 179 – FS-Master interface parameters/attributes

Test step instruction	Parameter	Value range
FSMasterSend_FSAppSend (FS-Master → Test System) (see Annex A.2.3, Figure A.9)	PDout	SD – Test System expects SD values (= 0) PD – Test System expects PD values (> 0)
	PortNum	valid – Test System expects configured Port number
	MCount	0 to 7
	setSD	0, 1
	ChFAckReq	0, 1

Test step instruction	Parameter	Value range
	CRC	valid – Test System expects correct CRC-Signature
	PDin_M	SD – Test System expects SD values (= 0) PD – Test System expects PD values (> 0)
	Bit 0: SDset_S	0, 1
	Bit 1: ChFAckReq_S	0, 1
	Bit 2: DCommErr_S	0, 1
	Bit 3: DTimeout_S	0, 1
	Bit 4: MCommErr_S	0, 1
	Bit 5: MTimeout_S	0, 1
FSMasterReceive_FSAppReceive (Test System → FS-Master)	PDin	PD – Test System sends PD values (> 0)
	PortNum	valid – Test System sends configured Port number invalid – Test System sends not configured Port number
	DCount	0 to 7
	SDset	0, 1
	DCommErr	0, 1
	DTimeout	0, 1
	CRC	valid – Test System sends correct CRC-Signature invalid – Test System sends incorrect CRC-Signature
	PDout_M	PD – Test System sends PD values (> 0)
	Bit 0: setSD_C	0, 1
	Bit 1: ChFAck_C	0, 1
Timeout (Test System → FS-Master)		Test System sends no new message within a time delay \geq MTime. See for example 12.2.3.
Transition (Tag)	SourceState	This parameter is informative and will be inserted only in test logging from test system
	TargetState	This parameter is informative and will be inserted only in test logging from test system

4813

4814 The test step instruction "FSMasterSend_FSAppSend" is used for messages sent by the FS-
4815 Master test object (EUT). Within these messages, the test data to the IO-Link communication
4816 port and to the FS-Master "processing" interface are specified in one test message. This
4817 approach has been chosen due to the special test setup not allowing explicit access for the test
4818 system to the "processing" port of the test object (in this case the FS-Master, see Figure A.7).

4819 The values of the parameters *PDout*, *PortNum*, *MCount*, *setSD*, *ChFAckReq* and *CRC* are
4820 defined for the IO-Link communication port, whereas the values of the parameters *PDin_M*,
4821 *SDset_S*, *ChFAckReq_S*, *DCommErr_S*, *DTimeout_S*, *MCommErr_S*, and *MTimeout_S* are
4822 defined for the "processing" interface.

4823 With the test step instruction "FSMasterReceive_FSAppReceive" the reception of test messa-
4824 ges by the FS master is specified. The test messages comprise also the IO-Link communication
4825 Port and the "processing" interface.

4826 The parameter values of *PDin*, *PortNum*, *DCount*, *SDset*, *DCommErr*, *DTimeout*, and *CRC* are
4827 determined for the IO-Link communication Port, whereas the values of the parameters *PDout_M*,
4828 *setSD_C*, and *ChFAck_C* are determined for the "processing" interface.

4829 The test step instruction "Timeout" specifies for how long the test system shall not update the
4830 response SPDU. This time shall be greater than the watchdog time of the EUT (MTime).

4831 The XML tag "Transition" is used for traceability of test messages with respect to the expected
 4832 transition of the state machine specified in [4]. This information is only descriptive and has no
 4833 impact on the test flow of the test tool.

4834 12.2 FS-Master SCL test suite

4835 12.2.1 Test script 1

4836 Table 180 defines the test conditions for this test case. The associated XML file contains steps
 4837 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 4838 DCommErr.

4839 **Table 180 – FS-Master test script 1**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0164
Name	FSTCM_SCLM_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_1.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4842

4843 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_1.xml":

```

4844 <?xml version="1.0" encoding="UTF-8"?>
4845 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4846 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_1" date="20.11.2018: 14:01:29.066">
4847   <FSMasterSciTestCaseSteps>
4848     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
4849     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
4850     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
4851     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4852     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
4853     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
4854     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
4855     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
4856     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4857     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="0" CRC="valid"
4858     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4859     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
4860     CRC="invalid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
4861     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4862     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4863     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4864     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChAckReq="0" CRC="valid"
4865     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>

```

```
4866 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
4867 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4868 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4869 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4870 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4871 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
4872 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4873 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="4" SDset="0" DCommErr="0" DTimeout="1"
4874 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4875 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4876 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4877 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4878 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFackReq="0" CRC="valid"
4879 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
4880 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0"
4881 CRC="invalid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4882 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4883 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4884 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4885 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="5" setSD="1" ChFackReq="1" CRC="valid"
4886 PDin_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4887 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
4888 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0"
4889 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
4890 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4891 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
4892 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4893 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFackReq="0" CRC="valid"
4894 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4895 <Transition SourceState="WaitOnResponse_5" TargetState="WaitOnResponse_5"/>
4896 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0"
4897 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4898 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4899 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4900 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4901 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFackReq="0" CRC="valid"
4902 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4903 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
4904 CRC="invalid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4905 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4906 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
4907 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4908 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
4909 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
4910 </FSMasterSciTestCasesSteps>
4911 </Testroot>
4912
```

4913 **12.2.2 Test script 2**

4914 Table 181 defines the test conditions for this test case. The associated XML file contains steps
 4915 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 4916 SDset.

4917 **Table 181 – FS-Master test script 2**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0165
Name	FSTCM_SCLM_FLOW_SETSD1MC0SDSET1
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_2.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4920

4921 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_2.xml":

```

4922 <?xml version="1.0" encoding="UTF-8"?>
4923 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4924 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_2" date="20.11.2018: 14:01:29.066">
4925   <FSMasterSciTestCaseSteps>
4926     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
4927     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
4928     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
4929     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4930     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="0" DTimeout="0"
4931     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4932     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
4933     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4934     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4935     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"
4936     PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4937     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0"
4938     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4939     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4940     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4941     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4942     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"
4943     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4944     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
4945     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4946     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4947     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4948     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>

```

```
4949 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"
4950 PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4951 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0"
4952 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4953 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4954 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4955 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4956 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"
4957 PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4958 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0"
4959 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4960 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4961 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4962 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4963 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"
4964 PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4965 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="1"
4966 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4967 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4968 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
4969 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4970 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFAckReq="0" CRC="valid"
4971 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
4972 </FSMasterSciTestCaseSteps>
4973 </Testroot>
4974
```


4975 **12.2.3 Test script 3**

4976 Table 182 defines the test conditions for this test case. The associated XML file contains steps
 4977 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 4978 ChannelFailureAck = 1.

4979 **Table 182 – FS-Master test script 3**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0166
Name	FSTCM_SCLM_FLOW_SETSD1MC0CFAC1
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_3.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

4982

4983 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_3.xml":

```

4984 <?xml version="1.0" encoding="UTF-8"?>
4985 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4986 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_3" date="20.11.2018: 14:01:29.067">
4987   <FSMasterSciTestCaseSteps>
4988     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
4989     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
4990     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFackReq="0" CRC="valid"
4991     PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4992     <Transition SourceState="WaitOnResponse_2" TargetState="WaitOnResponse_2"/>
4993     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0"
4994     CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="1"/>
4995     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
4996     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4997     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4998     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFackReq="0" CRC="valid"
4999     PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5000     <Timeout/>
5001     <Transition SourceState="WaitOnResponse_5" TargetState="PrepareSPDU_6"/>
5002     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5003     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFackReq="0" CRC="valid"
5004     PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="1"/>
5005     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="0" DTimeout="0"
5006     CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="1"/>
5007     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5008     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5009     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5010     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="1" CRC="valid"
5011     PDin_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>

```

```
5012 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5013 CRC="invalid" PDout_M="PD" setSD_C="0" ChFack_C="1"/>
5014 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5015 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5016 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5017 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFackReq="0" CRC="valid"
5018 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5019 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
5020 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="1"/>
5021 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5022 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5023 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5024 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
5025 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5026 <Timeout/>
5027 <Transition SourceState="WaitOnResponse_7" TargetState="PrepareSPDU_6"/>
5028 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5029 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFackReq="0" CRC="valid"
5030 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="1"/>
5031 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5032 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="1"/>
5033 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5034 </FSMasterSclTestCaseSteps>
5035 </Testroot>
5036
```

5037

5038 **12.2.4 Test script 4**

5039 Table 183 defines the test conditions for this test case. The associated XML file contains steps
 5040 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 5041 DCommErr.

5042 **Table 183 – FS-Master test script 4**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0167
Name	FSTCM_SCLM_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_4.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5045

5046 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_4.xml":

```

5047 <?xml version="1.0" encoding="UTF-8"?>
5048 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5049 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_4" date="20.11.2018: 14:01:29.067">
5050 <FSMasterSclTestCaseSteps>
5051 <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5052 <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5053 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5054 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5055 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5056 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5057 <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5058 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5059 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5060 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5061 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5062 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5063 CRC="invalid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5064 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5065 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5066 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5067 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="0" CRC="valid"
5068 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5069 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
5070 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5071 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5072 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5073 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>

```

```
5074 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
5075 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5076 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="4" SDset="0" DCommErr="0" DTimeout="1"
5077 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5078 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5079 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5080 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5081 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFackReq="0" CRC="valid"
5082 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5083 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="3" SDset="0" DCommErr="0" DTimeout="1"
5084 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5085 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5086 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5087 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5088 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="5" setSD="1" ChFackReq="0" CRC="valid"
5089 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5090 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="2" SDset="0" DCommErr="0" DTimeout="1"
5091 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5092 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5093 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5094 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5095 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFackReq="0" CRC="valid"
5096 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5097 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0"
5098 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5099 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5100 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5101 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5102 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="7" setSD="1" ChFackReq="1" CRC="valid"
5103 PDin_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5104 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5105 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5106 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5107 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5108 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5109 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5110 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
5111 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5112 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5113 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5114 <Transition SourceState="WaitOnResponse_5" TargetState="WaitOnResponse_5"/>
5115 </FSMasterScITestCasesSteps>
5116 </Testroot>

5117

5118
```

5119 **12.2.5 Test script 5**

5120 Table 184 defines the test conditions for this test case. The associated XML file contains steps
 5121 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 5122 DCommErr.

5123 **Table 184 – FS-Master test script 5**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0168
Name	FSTCM_SCLM_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_5.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5126

5127 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_5.xml":

```

5128 <?xml version="1.0" encoding="UTF-8"?>
5129 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5130 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_5" date="20.11.2018: 14:01:29.067">
5131   <FSMasterSclTestCaseSteps>
5132     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5133     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5134     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5135     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5136     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="1" DTimeout="0"
5137     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5138     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5139     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5140     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5141     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5142     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5143     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="0" DTimeout="0"
5144     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5145     <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5146   </FSMasterSclTestCaseSteps>
5147 </Testroot>
5148

```

5149 **12.2.6 Test script 6**

5150 Table 185 defines the test conditions for this test case. The associated XML file contains steps
 5151 and message parameters for the state flow check in case of setSD =1, MCount =0, and
 5152 DCommErr.

5153 **Table 185 – FS-Master test script 6**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0169
Name	FSTCM_SCLM_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_6.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5156

5157 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_6.xml":

```

5158 <?xml version="1.0" encoding="UTF-8"?>
5159 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5160 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_6" date="20.11.2018: 14:01:29.067">
5161   <FSMasterSclTestCaseSteps>
5162     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5163     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5164     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5165     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5166     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5167     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5168     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5169     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5170     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5171     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5172     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5173     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5174     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5175     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5176     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5177     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5178     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="1" CRC="valid"
5179     PDin_M="SD" SDset_S="1" ChFAckReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5180     <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5181     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
5182     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5183     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5184     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5185     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>

```

```
5186 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"
5187 PDin_M="PD" SDset_S="0" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5188 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5189 CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="1"/>
5190 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5191 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5192 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5193 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChAckReq="0" CRC="valid"
5194 PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5195 </FSMasterSciTestCaseSteps>
5196 </Testroot>
5197
```

5198 **12.2.7 Test script 7**

5199 Table 186 defines the test conditions for this test case. The associated XML file contains steps
 5200 and message parameters for the state flow check in case of setSD =1, MCount =0, and
 5201 DCommErr.

5202 **Table 186 – FS-Master test script 7**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0170
Name	FSTCM_SCLM_FLOW_SETSD1MC0DCE1
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_7.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5205

5206 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_7.xml":

```

5207 <?xml version="1.0" encoding="UTF-8"?>
5208 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5209 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_7" date="20.11.2018: 14:01:29.067">
5210 <FSMasterSclTestCaseSteps>
5211 <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5212 <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5213 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5214 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5215 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5216 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5217 <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5218 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5219 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5220 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5221 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5222 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5223 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5224 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5225 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5226 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5227 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="1" CRC="valid"
5228 PDin_M="SD" SDset_S="1" ChFAckReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5229 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5230 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
5231 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5232 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5233 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5234 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>

```



```
5235 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"
5236 PDin_M="PD" SDset_S="0" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5237 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5238 CRC="invalid" PDout_M="PD" setSD_C="0" ChAck_C="1"/>
5239 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5240 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5241 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5242 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChAckReq="0" CRC="valid"
5243 PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5244 </FSMasterSciTestCaseSteps>
5245 </Testroot>
5246
```

5247 **12.2.8 Test script 8**

5248 Table 187 defines the test conditions for this test case. The associated XML file contains steps
 5249 and message parameters for the state flow check in case of setSD =1, MCount =0, DCommErr,
 5250 and Portnumber error.

5251 **Table 187 – FS-Master test script 8**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0171
Name	FSTCM_SCLM_FLOW_SETSD1MC0DCE1PNERR
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_8.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5254

5255 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_8.xml":

```

5256 <?xml version="1.0" encoding="UTF-8"?>
5257 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5258 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_8" date="20.11.2018: 14:01:29.068">
5259   <FSMasterSclTestCaseSteps>
5260     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5261     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5262     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5263     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5264     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5265     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5266     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5267     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5268     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5269     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5270     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5271     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5272     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5273     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5274     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5275     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5276     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="1" CRC="valid"
5277     PDin_M="SD" SDset_S="1" ChFAckReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5278     <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5279     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
5280     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5281     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5282     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5283     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>

```

```
5284 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"
5285 PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5286 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5287 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5288 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5289 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5290 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5291 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFAckReq="0" CRC="valid"
5292 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5293 </FSMasterSciTestCaseSteps>
5294 </Testroot>
5295
```

5296 **12.2.9 Test script 9**

5297 Table 188 defines the test conditions for this test case. The associated XML file contains steps
5298 and message parameters for the state flow check in case of setSD =1 and MCount =0.

5299 **Table 188 – FS-Master test script 9**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0172
Name	FSTCM_SCLM_FLOW_SETSD1MC0
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_9.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5302

5303 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_9.xml":

```

5304 <?xml version="1.0" encoding="UTF-8"?>
5305 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5306 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_9" date="20.11.2018: 14:01:29.068">
5307   <FSMasterSciTestCaseSteps>
5308     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5309     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5310     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5311     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5312     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="0" DTimeout="0"
5313     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5314     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5315     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
5316     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5317     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"
5318     PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5319     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0"
5320     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5321     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5322     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
5323     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5324     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"
5325     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5326     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
5327     CRC="invalid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5328     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5329     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
5330     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5331     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"
5332     PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>

```

```
5333 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="0" SDset="0" DCommErr="0" DTimeout="1"
5334 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5335 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5336 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5337 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5338 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFAckReq="0" CRC="valid"
5339 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5340 </FSMasterSciTestCaseSteps>
5341 </Testroot>
5342
```

5343 **12.2.10 Test script 10**

5344 Table 189 defines the test conditions for this test case. The associated XML file contains steps
 5345 and message parameters for the state flow check in case of setSD =1, MCount =0, Port number
 5346 error, and CRC error.

5347 **Table 189 – FS-Master test script 10**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0173
Name	FSTCM_SCLM_FLOW_PNERRCRCERR
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_10.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5350

5351 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_10.xml":

```

5352 <?xml version="1.0" encoding="UTF-8"?>
5353 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5354 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_10" date="20.11.2018: 14:01:29.068">
5355   <FSMasterSciTestCaseSteps>
5356     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5357     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5358     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
5359     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5360     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5361     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5362     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5363     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5364     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5365     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="0" CRC="valid"
5366     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5367     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5368     CRC="invalid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5369     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5370     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5371     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5372     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChAckReq="0" CRC="valid"
5373     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5374     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
5375     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5376     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5377     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5378     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>

```

```
5379 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
5380 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5381 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="4" SDset="0" DCommErr="0" DTimeout="1"
5382 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5383 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5384 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5385 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5386 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFackReq="0" CRC="valid"
5387 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5388 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="3" SDset="0" DCommErr="0" DTimeout="1"
5389 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5390 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5391 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5392 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5393 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="5" setSD="1" ChFackReq="0" CRC="valid"
5394 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5395 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="2" SDset="0" DCommErr="0" DTimeout="1"
5396 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5397 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5398 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5399 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5400 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFackReq="0" CRC="valid"
5401 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5402 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0"
5403 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5404 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5405 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5406 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5407 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="7" setSD="1" ChFackReq="1" CRC="valid"
5408 PDin_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5409 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5410 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5411 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5412 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5413 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5414 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5415 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
5416 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5417 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="1" DTimeout="0"
5418 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5419 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5420 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5421 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5422 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFackReq="0" CRC="valid"
5423 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5424 </FSMasterScITestCasesSteps>
5425 </Testroot>
5426
```

5427 **12.2.11 Test script 11**

5428 Table 190 defines the test conditions for this test case. The associated XML file contains steps
 5429 and message parameters for the state flow check in case of setSD =1, MCount =0, Port number
 5430 error, and CRC error.

5431 **Table 190 – FS-Master test script 11**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0174
Name	FSTCM_SCLM_FLOW_PNERRCRCERR
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_11.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5434

5435 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_11.xml":

```

5436 <?xml version="1.0" encoding="UTF-8"?>
5437 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5438 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_11" date="20.11.2018: 14:01:29.068">
5439   <FSMasterSciTestCaseSteps>
5440     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5441     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5442     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
5443     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5444     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5445     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5446     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5447     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5448     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5449     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="0" CRC="valid"
5450     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5451     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5452     CRC="invalid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5453     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5454     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5455     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5456     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChAckReq="0" CRC="valid"
5457     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5458     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
5459     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5460     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5461     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5462     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>

```



```
5463 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
5464 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5465 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="4" SDset="0" DCommErr="0" DTimeout="1"
5466 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5467 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5468 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5469 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5470 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFackReq="0" CRC="valid"
5471 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5472 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="3" SDset="0" DCommErr="0" DTimeout="1"
5473 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5474 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5475 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5476 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5477 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="5" setSD="1" ChFackReq="0" CRC="valid"
5478 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5479 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="2" SDset="0" DCommErr="0" DTimeout="1"
5480 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5481 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5482 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5483 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5484 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFackReq="0" CRC="valid"
5485 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5486 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0"
5487 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5488 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5489 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5490 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5491 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="7" setSD="1" ChFackReq="1" CRC="valid"
5492 PDin_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5493 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5494 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5495 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5496 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5497 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5498 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5499 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
5500 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5501 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0"
5502 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5503 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5504 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5505 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5506 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFackReq="0" CRC="valid"
5507 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5508 </FSMasterScITestCasesSteps>
5509 </Testroot>
5510
```

5511 **12.2.12 Test script 12**

5512 Table 191 defines the test conditions for this test case. The associated XML file contains steps
 5513 and message parameters for the state flow check in case of a port number error and MCount
 5514 =0.

5515 **Table 191 – FS-Master test script 12**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0175
Name	FSTCM_SCLM_FLOW_PNERRMC0
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_12.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5518

5519 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_12.xml":

```

5520 <?xml version="1.0" encoding="UTF-8"?>
5521 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5522 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_12" date="20.11.2018: 14:01:29.068">
5523   <FSMasterSclTestCaseSteps>
5524     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5525     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5526     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
5527     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5528     <Transition SourceState="WaitOnResponse_2" TargetState="WaitOnResponse_2"/>
5529     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5530     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5531     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5532     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5533     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5534     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="0" CRC="valid"
5535     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5536   </FSMasterSclTestCaseSteps>
5537 </Testroot>

```

5538 **12.2.13 Test script 13**

5539 Table 192 defines the test conditions for this test case. The associated XML file contains steps
5540 and message parameters for the state flow check in case of CRC error and MCount =0.

5541 **Table 192 – FS-Master test script 13**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0176
Name	FSTCM_SCLM_FLOW_CRCERRMC0
Purpose (short)	
Equipment under test (EUT)	FS-Master
Test case version	1.0
Category / type	FS-Master automated SCL protocol test
Specification (clause)	[4] clause 11.3.2, Figure 40 (services); clause 11.5.2, Figure 45 (state chart)
Configuration / setup	See Table A.6
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Protocol flow in case of distinct error
Precondition	FS-Master to send first message
Procedure	See XML file "IO-Link-Safety_spec_master_final_testsuite_testcase_13.xml"
Test parameter	See Table 179 and XML file
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	Comparison of expected and received values according to the XML file
Test passed	Comparison OK
Test failed (examples)	Comparison not OK
Report	Printout of the automated SCL protocol tester <pass/fail>

5544

5545 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_13.xml":

```

5546 <?xml version="1.0" encoding="UTF-8"?>
5547 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5548 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_13" date="20.11.2018: 14:01:29.068">
5549   <FSMasterSclTestCaseSteps>
5550     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5551     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5552     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
5553     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5554     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5555     CRC="invalid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5556     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5557     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5558     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5559     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="0" CRC="valid"
5560     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5561   </FSMasterSclTestCaseSteps>
5562 </Testroot>
5563

```

5564 **13 FS-Master additional functional tests**5565 **13.1 Overview**

5566 The FS-Master with reference FS-Devices test comprise tests, where several approved FS-
5567 Devices as reference are available. Rules for reference systems are defined in A.2.7.

5568 An approved SMTU shall be used for the following test cases except for the basic reference
5569 test FSTCM_REFT_RD where reference Devices from regular automation environments must
5570 be used.

5571 The FS-Master in additional functional tests comprise tests of the splitter and composer for
5572 Process Data. Since tests for SR PD are already included in 12.2, the test cases here focus on
5573 the NSR PD part. They are followed by test cases for special SMI services for read back of the
5574 (safety) Port configuration and Port status and optionally by test cases for the correct Process
5575 Data in case of OSSDe (FS-DI) Port mode. In addition, Port Events are tested. Besides tests
5576 for the FS-Master SCL protocol watchdog, the aspects of Safety Function Response Time
5577 (SFRT) are covered.

5578 **13.2 Splitter/composer**5579 **13.2.1 Splitter in mixed PD mode (CRC32)**

5580 Table 193 defines the test conditions for this test case.

5581 **Table 193 – Splitter in mixed PD mode (CRC32)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0177
Name	FSTCM_FSOP_SPLITTERMIXPD32
Purpose (short)	Check whether NSR PD of an FS-Device (sensor) are transferred correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] 10.2, 10.3, 10.5
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether NSR PD of an FS-Device (sensor) are transferred correctly with the help of SMI_PDIn in case of CRC32 and in mixed mode.
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMTU_NSR_Set(NSR, PDValid) <i>;set NSR Process Data + PDValid</i> b) SMTU_SPDU_Change <i>;wait until SPDU has changed</i> c) SMI_PDIn <i>;return ArgBlock "PDIn"</i> d) Evaluate 1)
Test parameter	NSR[1] = {3}, PDValid = 1
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check (NSR) "PDIn"
Test passed	PDIn.InputDataLength = 1, PDIn.PDI0 = 3 PDIn.PQI = 1
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

5584

5585 **13.2.2 Splitter in mixed PD mode (CRC16)**

5586 Table 194 defines the test conditions for this test case.

5587 **Table 194 – Splitter in mixed PD mode (CRC16)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0179
Name	FSTCM_FSOP_SPLITTERMIXPD16
Purpose (short)	Check whether NSR PD of an FS-Device (sensor) are transferred correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] 10.2, 10.3, 10.5
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether NSR PD of an FS-Device (sensor) are transferred correctly with the help of SMI_PDIn in case of CRC16
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_16
Procedure	a) SMTU_NSR_Set(NSR, PDValid) <i>;set NSR Process Data + PDValid</i> b) SMTU_SPDU_Change <i>;wait until SPDU has changed</i> c) SMI_PDIn <i>;return ArgBlock "PDIn"</i> d) Evaluate 1)
Test parameter	NSR[4] = {3, 6, 9, 12}, PDValid = 1
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check (NSR) "PDIn"
Test passed	PDIn.InputDataLength = 4, PDIn.PDli [i = 0, ..., 3] = {3, 6, 9, 12}, PDIn.PQI = 1
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

5590

5591 **13.2.3 Composer in mixed PD mode (CRC32)**

5592 Table 195 defines the test conditions for this test case.

5593 **Table 195 – Composer in mixed PD mode (CRC32)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0181
Name	FSTCM_FSOP_COMPOSERMIXPD32
Purpose (short)	Check whether NSR PD to an FS-Device (actuator) are transferred correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] 10.2, 10.3, 10.5
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether NSR PD to an FS-Device (actuator) are transferred correctly via SMI_PDOut and checked via SMTU instruction case of CRC32.
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_PDOut(ABPS_PDOUT32<OutputDataLength=1>,<PDO=NSR>) b) STM_WAIT_TIMEOUT <i>;wait for FSP_Watchdog timeout</i> c) SMI_FSPDInOut <i>;returns "FSPDInOut"</i> d) Evaluate 1) e) SMTU_SPDU_Change <i>;wait until SPDU has changed</i> f) SMTU_MixData_Get <i>;returns "mixed PD"</i> g) Evaluate 2)
Test parameter	NSR[1] = {3}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check "FSPDInOut" 1) Check "mixed PD"
Test passed	FSPDInOut.PDO0 = 3, and NSR = {3}, OE = Valid
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

5596

5597 **13.2.4 Composer in mixed PD mode (CRC16)**

5598 Table 196 defines the test conditions for this test case.

5599 **Table 196 – Composer in mixed PD mode (CRC16)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0183
Name	FSTCM_FSOP_COMPOSERMIXPD16
Purpose (short)	Check whether NSR PD to an FS-Device (actuator) are transferred correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] 10.2, 10.3, 10.5
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether NSR PD are correctly transferred to an FS-Device (actuator) via SMI_PDOut and checked via SMTU instruction in case of CRC16
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_16
Procedure	a) SMI_PDOut(ABPS_PDOUT32<OutputDataLength=4>,<PDO=NSR>) b) STM_WAIT_TIMEOUT ;wait for FSP_Watchdog timeout c) SMI_FSPDInOut ;returns "FSPDInOut" d) Evaluate 1) e) SMTU_SPDU_Change ;wait until SPDU has changed f) SMTU_MixData_Get ;returns "mixed PD" g) Evaluate 2)
Test parameter	NSR[4] = {3, 6, 9, 12}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check "FSPDInOut" 2) Check "mixed PD"
Test passed	FSPDInOut.PDO0 = 3, FSPDInOut.PDO0 = 6, FSPDInOut.PDO0 = 9, FSPDInOut.PDO0 = 12, and NSR = {3, 6, 9, 12}, OE = Valid
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

5602

5603 **13.3 SMI service tests (safety)**5604 **13.3.1 Read back safety configuration**

5605 Table 197 defines the test conditions for this test case.

5606 **Table 197 – Read back safety configuration**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0185
Name	FSTCM_SMIS_READBACKCONFIG
Purpose (short)	Check whether safety configuration is read back correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.1
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether safety configuration is read back correctly with the help of SMI_ReadbackPortConfiguration using Argblock 0x8100
Precondition	EUT: PORT_POWER_OFF SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_PortConfiguration(ABPS_FSCONFIG_MIXEDCOM) b) SMI_ReadBackPortConfiguration(0x8100) ;returns ArgBlock "FSPortConfigList" c) Evaluation 1)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Compare ArgBlock "FSPortConfigList" with ABPS_FSCONFIG_MIXEDCOM
Test passed	All comparisons match
Test failed (examples)	Any mismatch at comparison
Report	Mismatches: <yes/no> <ok nok>

5609

5610 **13.3.2 Safety Port status**

5611 Table 198 defines the test conditions for this test case.

5612 **Table 198 – Safety Port status**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0186
Name	FSTCM_SMIS_FSPORTSTATUS
Purpose (short)	Check whether Port status is read back correctly and the PDoutValidity of NSR data is set to invalid
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.1
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4]10.3.5
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether the safety Port status can be read out using the SMI_PortStatus service and Argblock 0x9100. Check the output validity of the NSR PDout data that must be invalid before an PDOOut SMI service has been issued.
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_PortStatus(0x9100) ;returns ArgBlock "FSPortStatusList" b) Evaluation 1) c) SMI_PDOut(invalid) d) Wait(2*Watchdogtimeout) d) OE = SMTU_MixData_Get e) Evaluation 2) f) SMI_PDOut(valid) g) Wait(2*Watchdogtimeout) h) OE = SMTU_MixData_Get i) Evaluation 3)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Compare ArgBlock "FSPortStatusList" with assignments in "PORT_MIXFSCOM" 2) Check Value of OE and check if any FS related Event occurs (see [4] Table B.2) 3) Check Value of OE and check if any FS related Event occurs (see [4] Table B.2)
Test passed	1,2) PortStatusInfo = SCL_ENABLED PortQualityInfo.Bit0/1 = 0 ;all PD valid RevisionID = 0x11 TransmissionRate = COM2 MasterCycleTime ≥ 0x80 ;>33 ms InputDataLength = 0x20 ;PDInLength = 32 octets OutputDataLength = 0x20 ;PDOOutLength = 32 octets VendorID = 0xFDE8 ;IO-Link Community DeviceID = 0x002BD2 ;Tester NumberOfDiags = 0 DiagEntry0 = 0 DiagEntry1 = 0, and OE = invalid and no Event 3) OE = valid and no Event
Test failed (examples)	Any check deviating
Report	Values OK: <yes/no> <ok nok>

5615

5616 **13.4 Port with FS-DI/OSSDe (optional)**

5617 Testing of this functionality is covered by SDCI_FSTC_0008 in 5.4.1.

5618 **13.5 Events**5619 **13.5.1 Port specific Event**

5620 Table 199 defines the test conditions for this test case.

5621 **Table 199 – Port specific Event**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0187
Name	FSTCM_REFD_PORTEVENTCORRECT
Purpose (short)	Check whether Port Events are generated correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.1
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4] Table B.2
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether Port Event is generated correctly, e.g. a transmission Error (Timeout) occurred.
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32 <i>;no FST Parameter</i>
Procedure	a) SMI_PDOut(ABPS_PDOUT32<OutputDataLength=1>) b) SMTU_SPDU_Repetition (>WatchdogTimeout) ;Pause SCL on Device> WatchdogTimeout c) Wait on SMI_PortEvent ;returns ArgBlock "PortEvent" d) Evaluation 1)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check ArgBlock "PortEvent"
Test passed	EventCode = 0x2002 <i>;Transmission Error (Timeout)</i>
Test failed (examples)	No Event or EventCode incorrect
Report	Port Event OK: <yes/no> <ok nok>

5624

5625 **13.5.2 FS-Device Event**

5626 Table 200 defines the test conditions for this test case.

5627 **Table 200 – FS-Device Event**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0188
Name	FSTCM_REFD_FSDEVICEEVENTCORRECT
Purpose (short)	Check whether FS-Device Event is propagated correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Master-Tester-System
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether FS-Device Event is propagated correctly, e.g. unexpected authentication code (0xB003)
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32 ;no FST Parameter
Procedure	a) SMI_PortConfig (ABPS_FSCONFIG_SAFECOM<FSCP_Authenticity1=2>) b) Wait(1s + FSP-MinShutdownTime + FSP_TimeToReady) c) Wait on SMI_DeviceEvent ;returns ArgBlock "DeviceEvent" d) Evaluation 1)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check ArgBlock "DeviceEvent"
Test passed	EventCode = 0xB003 ;Unexpected authentication code
Test failed (examples)	No Event or EventCode incorrect
Report	FS-Device Event OK: <yes/no> <ok nok>

5630

5631 **13.6 Safety function response time**

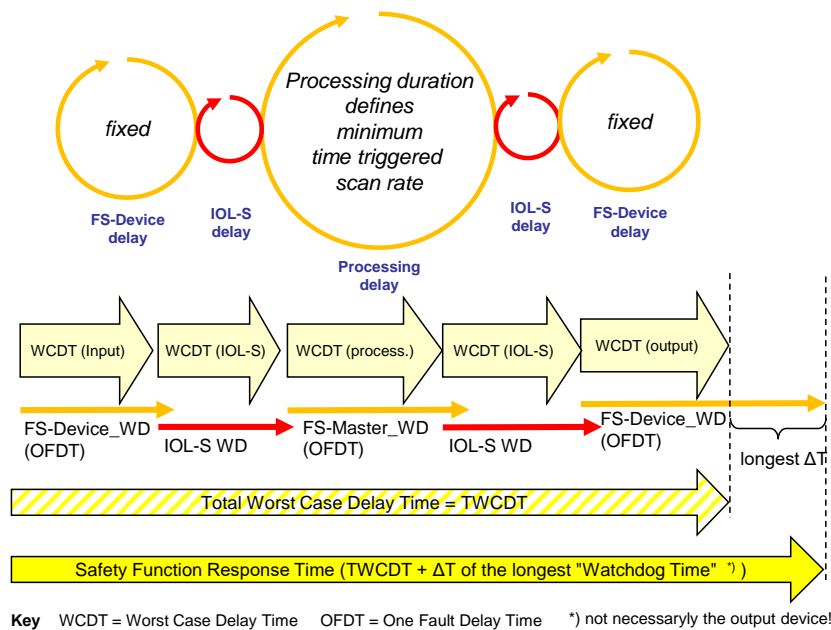
5632 **13.6.1 General concepts and accuracies**

5633 Figure 16 illustrates the effects of the worst-case delay times (WCDT) and one fault delay times
 5634 (OFDT) of the components involved in a safety function based on a pure FS-Master and FS-
 5635 Device system. see Annex H.6 in [4], which requires for a

- 5636 • a manufacturer/vendor of FS-Devices to provide the "worst-case delay time" (WCDT) value.
 5637 WCDT is defined as the time from triggering an FS-Device (sensor) until the output shows
 5638 a corresponding signal change or Process Data change. For an FS-Device (actuator) it is
 5639 the time from signal change or Process Data change to the actuator's safe state.
 5640
- 5641 • a manufacturer/vendor of FS-Devices to provide the "one fault delay time" (OFDT) value.
 5642 The definition of OFDT is similar to WCDT, however in case of a fault within the FS-Device
 5643 at the time of the measurement.

5644 Therefore, since it is mandatory for all components to provide WCDT and OFDT in user manuals,
 5645 FS-Master tools are enabled to provide values for the total worst case delay time (TWCDT) and
 5646 safety function response time.

5647 An FS-Master shall also provide values for FS-Master_WD (OFDT), usually derived from
 5648 program processing duration and for IOL-S WD for the output side.



5649

5650 **Figure 16 – SFRT of a stand-alone FS-Master with processing**

5651 Only one fault shall be assumed per trip. The watchdog time with the largest impact on the
 5652 safety function response time (SFRT) shall be considered for a safety function. For a machine
 5653 usually an overtravel measurement (usually at least 10 measurements) is performed.

5654 Table 201 shows the accuracies and tolerances to be used for timings.

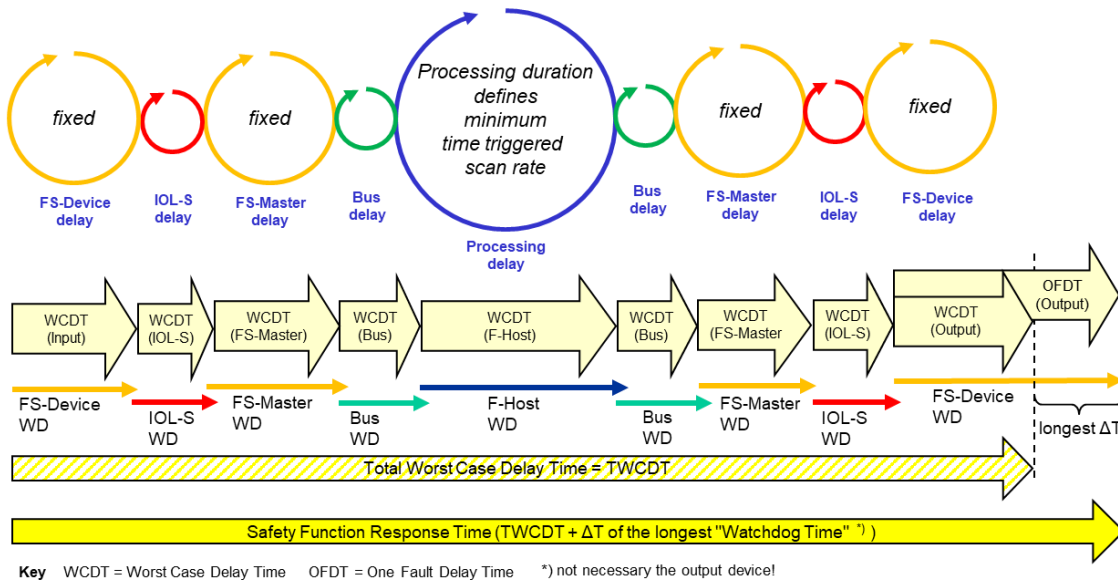
5655 **Table 201 – Accuracies and tolerances for timings**

Item	Accuracy	Remarks
Measurement accuracy	+/- 1 %	-
Permitted watchdog time tolerance	+/- 10 %	-

5656

5657 Figure 17 illustrates the effects of the worst-case delay times (WDCT) and one fault delay
 5658 times (OFDT) of the components involved in a safety function based on FS-Master and FS-

5659 Devices integrated in a fieldbus functional safety communication profile (FSCP), see for
 5660 example [11].

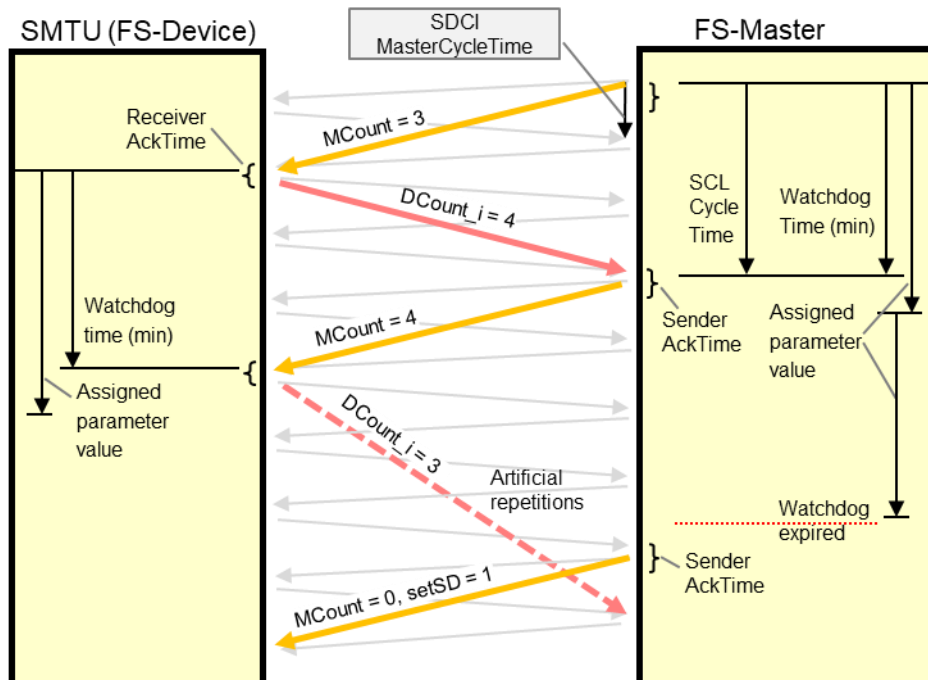


5661

5662 **Figure 17 – SFRT including IOL-S and FSCP**

5663 Figure 18 illustrates, how the watchdog timer of an FS-Master is tested. The Safety Master
 5664 Tester Unit (SMTU), playing the role of an FS-Device, is controlled in such a way that the
 5665 response SPDU ("DCount_i = 3") is delayed through artificial repetitions. For details see 13.6.2.

5666



5667

5668 **Figure 18 – Test of the FS-Master watchdog**

5668 The actual watchdog response time cannot be measured with IO-Link on-board equipment. This
 5669 shall be measured by the manufacturer using development tools or determined via software
 5670 analysis (safety assessment, see 8.3.3). It is however possible, to validate in a test case that
 5671 the FS-Watchdog timeout is within certain limits. The IO-Link Interface Specification [2],A.3.7
 5672 provides a definition of the MinCycleTime that is a property of the Device.

5673 The manufacturer of the IO-Link Device specifies the MinCycleTime of the Device.

$$5674 \quad \text{MinCycleTime} = t_{bc,min}$$

5675 In addition, the Manufacturer of the IO-Link FS-Device specifies the io-update time $t_{io,update}$,
 5676 (see [4] A.2.6). Based on the description in [4], the io-update time shall cover the processing
 5677 time of the SCL layer in the FS-Device plus the transmission time of the black channel including
 5678 all repetitions and some synchronization delay. Thus the IO-update time shall fulfill the following
 5679 requirement.

$$5680 \quad t_{io,update} \geq 6.6 t_{bc,min} + t_{scl,d}$$

5681 Where $t_{scl,d}$ is the processing time of the FS-Device, which is the time between the capturing of
 5682 an update of the SPDU-Out from the FS-Master by the SCL and the updating of the SPDU-IN
 5683 forwarded to the FS-Master. The io-update time is published in the IODD of the FS-Device as
 5684 Default value of the parameter FSP-Watchdog. With the Mastertool, the value $t_{io,update}$ is
 5685 extended by the processing time of the FS-Master $t_{scl,m}$ and the MinCycleTime $t_{bc,min}$, which is
 5686 replaced by the selected nominal master cycle time

$$5687 \quad t_{bc,nom} \geq t_{bc,min}$$

5688 The resulting Watchdog timeout t_{WD} is stored in the FSP-Watchdog parameter.

$$5693 \quad t_{WD} > 6.6 t_{bc,nom} + t_{scl,d} + t_{scl,m}$$

5694 The SCL Master cycle time $t_{scl,m}$ is a property of the FS-Master that must be made available by
 5695 the Manufacturer of the FS-Master to the Master tool and the FS-Master tester. The duration of
 5696 $t_{scl,m}$ covers the processing time between the capturing an SPDUIn from the FS-Device by the
 5697 SCL and the update of the SPDUOut by the FS-Master.

5695 For validating the FSWatchdog, the following assumptions are made:

- 5696 • The test is executed under controlled conditions, thus no repetitions occur during the test.
- 5697 • An update of the SCL state in the FS-Master is copied to SPDUOut within the effective IO-
 5698 Link cycle time t_{bc}

$$5699 \quad 0.99 t_{bc,nom} \leq t_{bc} \leq 1.1 t_{bc,nom}$$

- 5700 • An update of SPDUIN is copied to the SCL of the FS-Master within $t_{scl,m} \leq t_{WD}$.
- 5701 • The Watchdog Timeout t_{WD} shall be validated only by the SMTU.
- 5702 • The SMTU observes $PD_{In,Out}$ and/or $SPDU_{In,Out}$ discretized by the effective IO-Link cycle time
 5703 t_{bc} .
- 5704 • The watchdog timeout value can be reduced to

$$5705 \quad t_{WD,test} \geq 2.2 t_{bc,min} + t_{scl,m} + t_{scl,d}$$

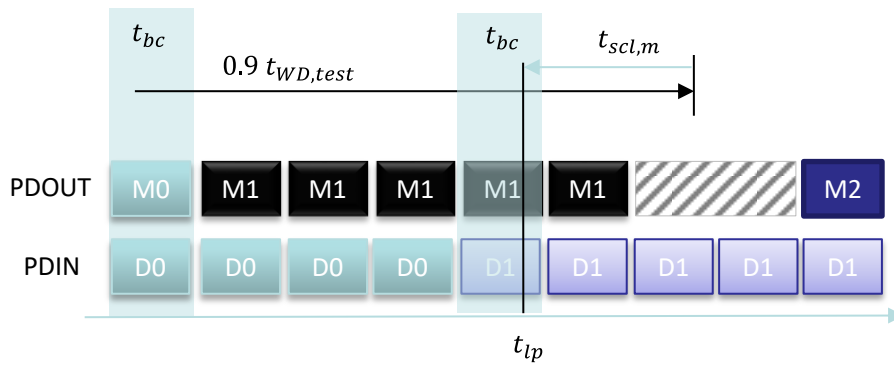
5706 The validation of the Watchdog timeout on the FS-Master is done by checking boundary
 5707 conditions. First, it is checked that a Watchdog timeout never occurs on the FS-Master, when
 5708 the SCL of the FS-Device responds within a time longestpass

$$5711 \quad t_{lp} \leq 0.9 t_{wd,test} - 2 t_{bc} - t_{scl,m}; \quad t_{lp} \geq 0$$

5712 Secondly, it is checked that a Watchdog timeout always occurs on the FS-Master, when the
 5713 SCL of the FS-Device responds at a time shortestfail

$$5714 \quad t_{sf} \geq 1.1 t_{WD,test} + 2 t_{bc} + t_{scl,m}$$

5715 The prefixes 0.9 and 1.1 are reflecting the tolerance of the Watchdog timeout.

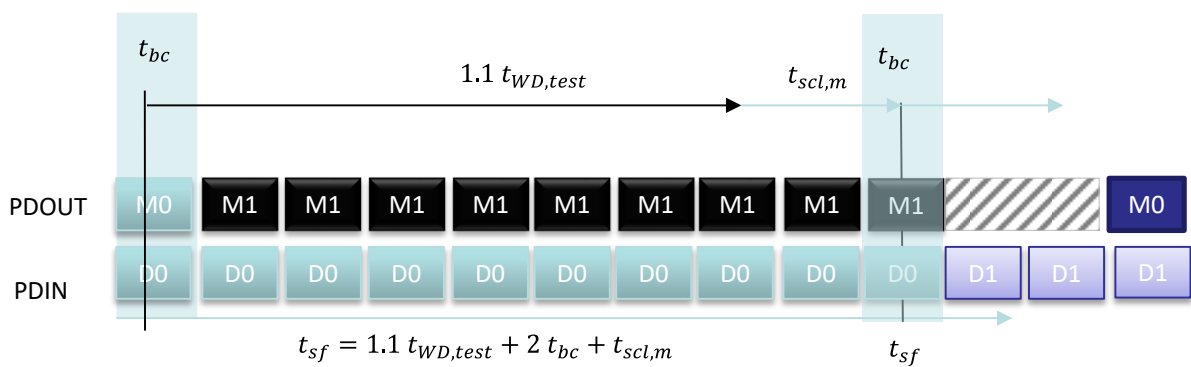


$$t_{lp} = 0.9 t_{WD,test} - 2 t_{bc} - t_{scl,m}$$

5716

5717 **Figure 19 Longest SCL response t_{lp} that never leads to an FSWatchdog Timeout**

5718



$$t_{sf} = 1.1 t_{WD,test} + 2 t_{bc} + t_{scl,m}$$

5719

5720 **Figure 20 Shortest response t_{sf} that always leads to an FSWatchdog Timeout**

5721 In Figure 19 and Figure 20, M0, M1 or M2 are indicating MCount in SPDUOut of the FS-Master.
 5722 D0 or D1 are indicating DCount in SPDUIn of the FS-Device.

5723 The times are shortened respectively prolonged by the 2 times the blackchannel jitter t_{bc} and
 5724 the SCL cycle time of the FS-Master as a second source of jitter due to the asynchronicity
 5725 between black channel and SCL.

5726 **13.6.2 FS-Master watchdog test**

5727 Table 202 defines the test conditions for this test case.

5728 **Table 202 – FS-Master watchdog test**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0189
Name	FSTCM_SCLM_WATCHDOGPRECISION
Purpose (short)	Check whether the watchdog timeout reaction of the FS-Master meets expected timing constraints.
Equipment under test (EUT)	FS-Master
Test case version	1.1
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4]
Configuration / setup	FS-Master-Tester-Unit (SMTU)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether FS-Master's safety reaction time upon watchdog timeout lies within the expected limits considering the SCL cycle time of the FS-Master and given properties of the SMTU.
Precondition	EUT: Port config DEACTIVATED; Transmission rate = COM2 SMTU: SMTU_STANDARD_STATE_32 FS Master SCL cycle time $t_{scl,m}$, SCL cycle time of SMTU $t_{scl,d} = 25.2\text{ ms}$
Procedure	a) Choose new Watchdog_value from first FSP_Watchdog in A) b) Update Verifyrecord with new Watchdog_value from A) c) Update longestpass (t_{ip}) and shortestfail (t_{sf}) with new valuse from A d) Perform ISDU-Write with Watchdog_value to FSP_Watchdog parameter e) Set PortConfig with current FSP_VerifyRecord e.g. via SMI_PortConfiguration using ArgBlock 0x8100 f) SMTU_DelaySPDU(t_{ip}) ;return M_COUNT g) Evaluation 1) h) Perform ISDU-Write with Watchdog_value to FSP_Watchdog parameter i) Set PortConfig with current FSP_VerifyRecord e.g. via SMI_PortConfiguration using ArgBlock 0x8100 j) SMTU_DelaySPDU(t_{sf}) ;return M_COUNT k) Evaluation 2) l) Repeat from c) 3 times m) Update watchdog_value with next FSP_Watchdog from A) n) Repeat from b)
Test parameter	A) FSP protocol parameter record: ;MinCycleTime = 25.2 ms FSP_Watchdog = { $t_{WD} = 90\text{ ms} + t_{scl,m}$, $t_{WD} = 140\text{ ms} + t_{scl,m}$ } $t_{ip} = 0.9 t_{WD} - t_{scl,m} - 55\text{ ms}$ $t_{sf} = 1.1 t_{WD} + t_{scl,m} + 55\text{ ms}$ FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = valid CRC signature ;responsibility of tester FSP_ProtParCRC = valid CRC signature ;responsibility of tester
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) get M_COUNT
Test passed	1) M_COUNT <> 0 2) M_COUNT = 0
Test failed (examples)	Any check incorrect
Report	For every repetition 1) M_COUNT = <value> <ok nok> 2) M_COUNT = <value> <ok nok>

5730

TEST CASE RESULTS	CHECK / REACTION

5731

5732 **13.6.3 Integration aspects**

5733 In 13.6.1, the general concepts are explained also for a more complex FS-Master integrated in
 5734 a fieldbus's functional safety communication profile (FSCP) according to the IEC 61784-3 series.
 5735 In this case, usually the FS-Master plays only the role of a mapper of Process Data from one
 5736 safety communication system to the other.

5737 The designer/manufacturer of such a mapping FS-Master/Gateway shall provide WCDT and
 5738 OFDT for the mapping part to enable computer-aided approximation of a safety function
 5739 response time. Integration specifications to FSCPs should comprise definitions and descriptions
 5740 how to achieve these values.

5741 **13.7 Test with Reference FS-Devices**5742 **13.7.1 Test in regular automation environments**

5743 Table 203 defines the test conditions for this test case.

5744 **Table 203 – Test of FS-Master with Reference FS-Devices**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0199
Name	FSTCM_REFT_RD
Purpose (short)	Basic test of FS_Master with Reference FS-Devices
Equipment under test (EUT)	FS-Master, Mastertool
Test case version	1.0
Category / type	Test of basic functionality of FS-Master and Master Tool with 3 reference FS-Devices
Specification (clause)	[4]
Configuration / setup	Standard setup of FS-Master System and Master Tool connected to 3 reference FS-Devices with IODDs and Dedicated Tools
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Test of basic functionality of the EUT together with 3 reference FS-Devices to show that the EUT is able to establish a safety communication also in regular automation environments
Precondition	Setup of FS- Master with Master Tool, Engineering and PLC connected to reference FS-Devices
Procedure	For each reference FS-Device: a) Install Dedicated Tool b) Evaluation 1) c) Start Dedicated Tool and configure FST parameters and return FSP_TechParCRC d) Evaluation 2) e) Configure Port to SAFETYCOM or MIXEDSAFETYCOM f) Evaluation 3) g) Execute optional additional tests h) Evaluation 4)
Test parameter	-
Post condition	-
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check installation result 2) Check FSP_TechParCRC 3) Check safety communication 4) Check results of additional tests
Test passed	1) Installation of Device Tool was successful 2) FSP_TechParCRC is not "0" 3) Safety communication has started 4) Tests show expected results
Test failed (examples)	At least one test shows unexpected results

TEST CASE RESULTS	CHECK / REACTION
Report	Values OK : <yes/no>

5747 **14 FS-Master Tool tests**5748 **14.1 IODD import**

5749 Table 204 defines the test conditions for this test case.

5750 **Table 204 – IODD import**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0190
Name	FSTCM_TOOL_IODDIMPORT
Purpose (short)	IODD of the SMTU can be imported into FS-Master Tool
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master Tool test, test-to-pass
Specification (clause)	[4]
Configuration / setup	EUT + IODD of SMTU (or any FS-Device)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether IODD of the SMTU can be imported into FS-Master Tool and FSP_ParamDescCRC is correct.
Precondition	–
Procedure	a) Import IODD b) Evaluation 1) c) Evaluation 2)
Test parameter	IODD of SMTU
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check import status (CRC signature, Display) 2) Check FSP_ParamDescCRC
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

5753

5754 **14.2 IODD conventions (PD headlines coloring)**

5755 Table 205 defines the test conditions for this test case.

5756 **Table 205 – IODD conventions (PD headlines coloring)**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0191
Name	FSTCM_TOOL_IODDCONVENTIONS
Purpose (short)	IODD of the SMTU is displayed according to IODD rules
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master Tool test, test-to-pass
Specification (clause)	[4]
Configuration / setup	EUT + IODD of SMTU
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether IODD of the SMTU is displayed according to IODD rules, e.g. headers of Process Data and FS parameters in yellow color
Precondition	–
Procedure	a) Import and open IODD of the SMTU b) Evaluation 1)
Test parameter	FS parameter in user manual
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check display
Test passed	Headers of Process Data and FS parameters in yellow color according to IODD rules
Test failed (examples)	Display not according to IODD rules
Report	Values OK: <yes/no> <ok nok>

5759

5760 **14.3 FS parameters visible completely**

5761 Table 206 defines the test conditions for this test case.

5762 **Table 206 – FS parameters visible completely**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0192
Name	FSTCM_TOOL_IODDDISPLAYCOMPLETE
Purpose (short)	IODD FS parameter of the SMTU are displayed completely and appropriately
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master Tool test, test-to-pass
Specification (clause)	[4]
Configuration / setup	EUT + IODD of SMTU (or any FS-Device) + user manual
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	IODD FS parameter of the SMTU are displayed completely and appropriately
Precondition	–
Procedure	a) Import and open IODD of the SMTU b) Display all FSP parameters c) Evaluation 1) d) Display all FST parameters e) Evaluation 2)
Test parameter	FS parameter in user manual
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Compare all FSP parameters with user manual 2) Compare all FST parameters with user manual
Test passed	All comparisons correct or tolerable (no misunderstandings)
Test failed (examples)	Any comparison incorrect
Report	Comparisons OK: <yes/no> <ok nok>

5765

5766 **14.4 FS-Device parameterization**

5767 Table 207 defines the test conditions for this test case.

5768 **Table 207 – FS-Device parameterization**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0193
Name	FSTCM_TOOL_FSTPARAMETERS
Purpose (short)	FST parameterization is possible
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master Tool test, test-to-pass
Specification (clause)	[4]
Configuration / setup	EUT + IODD of SMTU (or any FS-Device)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	FS-parameterization is possible
Precondition	–
Procedure	a) Import IODD b) Establish communication with SMTU c) Modify FS parameter d) Evaluation 1)
Test parameter	FST parameter in user manual
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Compare SMTU behavior with description in SMTU user manual
Test passed	All checks correct or tolerable (no misunderstandings)
Test failed (examples)	Any check incorrect
Report	Behavior OK: <yes/no> <ok nok>

5771

5772 **14.5 Dedicated Tool operation**

5773 Table 208 defines the test conditions for this test case.

5774 **Table 208 – Dedicated Tool operation**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0194
Name	FSTCM_TOOL_COMMDEDITool
Purpose (short)	Dedicated Tool of the SMTU can communicate with Master Tool
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4]
Configuration / setup	EUT + IODD of SMTU + Dedicated Tool from SMTU
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	FS-Master Tool invokes Dedicated Tool and passes over FST parameter via TPF. Subsequently, calculation of TechParCRC upon parameter changes takes place. Parameter values and TechParCRC are returned to FS-Master Tool via TBF ("Back Channel"). After parameter changes in FS-Master Tool, an update of the parameter values in the Dedicated Tool shall not occur automatically but only upon invocation of the Dedicated Tool. Check whether Dedicated Tool of the SMTU can communicate with FS-Master Tool.
Precondition	–
Procedure	a) Launch/invoke Dedicated Tool b) Evaluation 1) c) Try changing parameter values in FS-Master Tool d) Evaluation 2) e) Close Dedicated Tool f) Evaluation 3) g) Modify FST parameter values in FS-Master Tool h) Relaunch Dedicated Tool i) Evaluation 4) j) Evaluation 5) k) Perform commissioning of SMTU l) Evaluation 6)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check availability of TechParCRC display (decimal value) in Dedicated Tool (memorize CRC value) 2) Editing of values in FS-Master Tool shall be blocked 3) Check identical TechParCRC display (decimal value) in FS-Master Tool (see 1)) 4) Compare parameter values in displays of Dedicated Tool and FS-Master Tool (parameter values shall match) 5) Compare FST_TechParCRC on FS-Master Tool with TechParCRC of Dedicated Tool (CRC values should differ due to parameter changes) 6) Check behavior of FS-Master system with connected SMTU
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

5777

5778 **14.6 DDO exchange**

5779 Table 209 defines the test conditions for this test case.

5780 **Table 209 – DDO exchange**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0195
Name	FSTCM_TOOL_DDOEXCHANGE
Purpose (short)	Device Data Objects (DDOs) can be exchanged between tools
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
Category / type	FS-Master test, test-to-pass
Specification (clause)	[4]
Configuration / setup	–
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Check whether Device Data Objects (DDOs) can be exchanged with the Master Tool
Precondition	–
Procedure	a) Import Test-DDO into FS_Master Tool b) Evaluation 1) c) Create a DDO in FS-Master Tool d) Import the DDO into FS-Master Tester or FS-Device Tester Tool. e) Evaluation 2)
Test parameter	Test-DDO
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check whether FS-Master Tool display matches imported Test-DDO 2) Check whether display of Tester Tool matches exported DDO of FS-Master Tool
Test passed	All checks correct
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

5783

5784 **15 Environmental tests**

5785 **15.1 General**

5786 Annex H in [2] defines the basic EMC tests for the SDCI communication part of an FS-
5787 Master/FS-Device system. Clause 5.4.2 in [2] specifies environmental conditions (e.g. electrical
5788 safety) especially for FS-Master with Port Class B.

5789 It depends on the technology of an FS-Device and the countries of deployment, whether addi-
5790 tional EMC tests or environmental tests are required to achieve for example a CE mark in
5791 Europe.

5792 **15.2 Product specific standards**

5793 Usually, the sector specific EMC standard IEC 61326-3-1 or the generic EMC standard 61000-
5794 6-7 are relevant for FS-Master.

5795 For FS-Devices, there are several EMC standards, including but not limited to:

- 5796 • Product standard IEC 61496-1 (Electro-sensitive protective equipment)
- 5797 • Product standard IEC 60947-5-3 (Proximity switches)
- 5798 • Sector standard IEC 61326-3-1 (Factory automation)
- 5799 • Generic standard IEC 61000-6-7 (in case of no sector or product standard, such as in case
5800 of drives)

5801 The following rule applies: Product standards shall be observed if available, otherwise sector
5802 standard or then generic standard.

5803 **15.3 EMC tests**

5804 EMC tests in respect of a particular phenomenon are defined in the IEC 61000-4-x series.
5805 Details for the respective test set-ups are described in Annex H.1.6 in [2] and in 4.4.

5806 **15.4 Test report templates**

5807 Tests are required for the following phenomena:

- 5808 • Electrostatic discharge (ESD: IEC 61000-4-2)
- 5809 • Electromagnetic field (HF: IEC 61000-4-3)
- 5810 • Fast transients (Burst: IEC 61000-4-4)
- 5811 • Surge protection (Surge: IEC 61000-4-5): optional, depending on deployment
- 5812 • Conducted radio frequency (CRF: IEC 61000-4-6)

5813

5814 Usually, the test levels and durations exceed the values of NSR devices. A special performance
5815 criterion "DS" allows the devices to enter a Defined State at these extended "stress" tests,
5816 which is supposed to be safe in safety functions.

5817 A passed EMC test is a precondition for a Manufacturer Declaration of Conformity. It shall
5818 comprise statements on the results of the above EMC tests. The forms in [9] may be used if
5819 they contain the appropriate information.

5820
5821
5822
5823

Annex A
(normative)

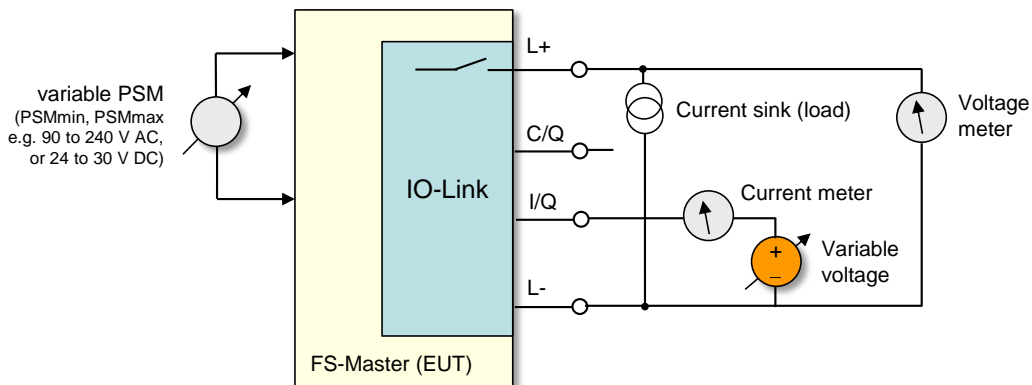
Test configurations, principles, and tools

5824 Tolerances of test signal generators and measurement equipment shall be considered to assure
5825 that min- and max values are reached.

5826 **A.1 Measurement circuits / setups**

5827 **A.1.1 Measurement circuits for static FS-Master parameter tests**

5828 Figure A.1 illustrates the measurement circuits for static FS-Master parameter tests in 5.2.

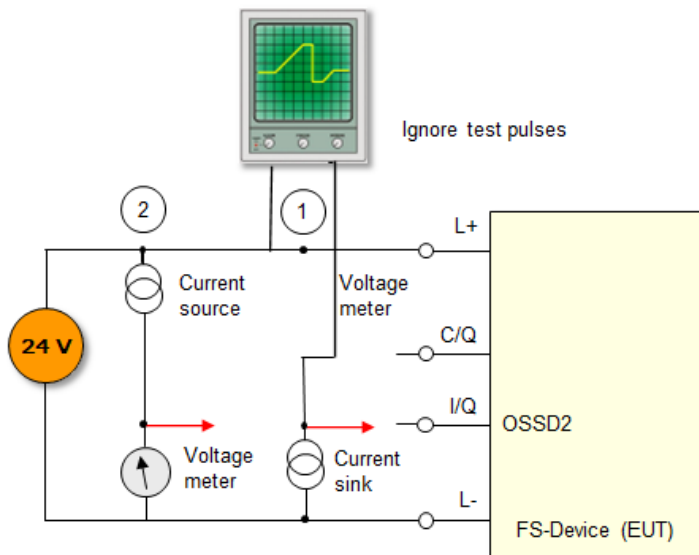


5829
5830

Figure A.1 – Measurement circuits for static FS-Master parameter tests

5831 **A.1.2 Measurement circuits for static FS-Device parameter tests**

5832 Figure A.2 illustrates the measurement circuits for static FS-Device parameter tests in 5.3.
5833 Method ① or ② can be applied.

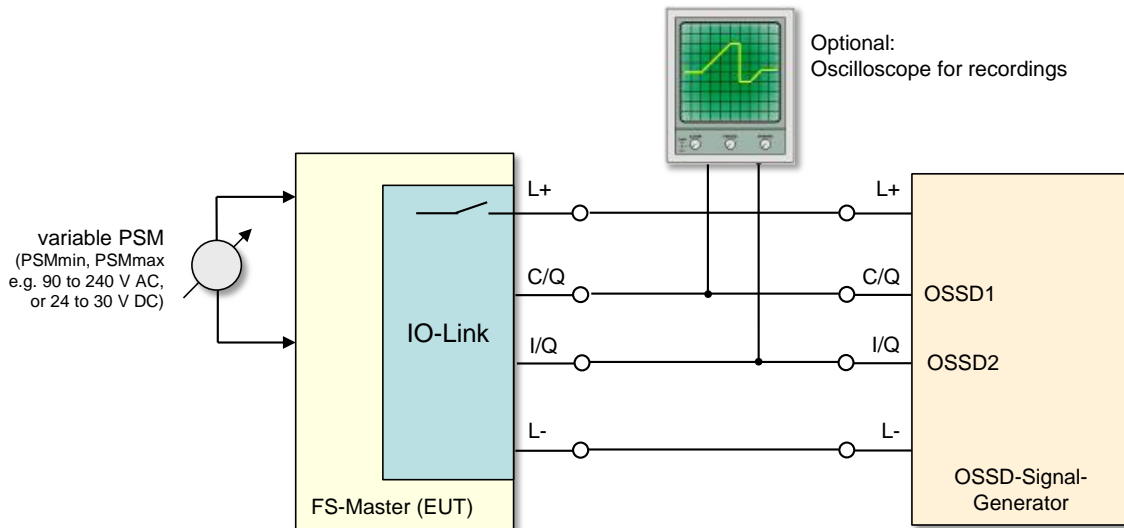


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5835

Figure A.2 – Measurement circuits for static FS-Device parameter tests

5836 **A.1.3 Measurement circuits for dynamic FS-Master parameter tests**

5837 Figure A.3 illustrates the measurement circuits for dynamic FS-Master parameter tests in 5.4



5838

Figure A.3 – Measurement circuits for dynamic FS-Master parameter tests

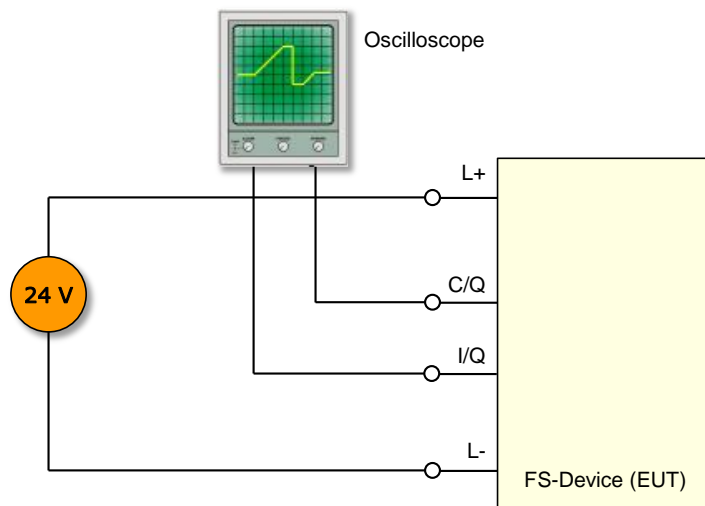
5839

A.1.4 Measurement circuits for dynamic FS-Device parameter tests

5840

Figure A.4 illustrates the measurement circuits for dynamic FS-Device parameter tests in 5.5.

5841



5842

Figure A.4 – Measurement circuits for dynamic FS-Device parameter tests

5843

5844

A.2 Test tools

5845

A.2.1 Overview

5846

Seven tools have been identified supporting the performance of the test cases in this document:

5847

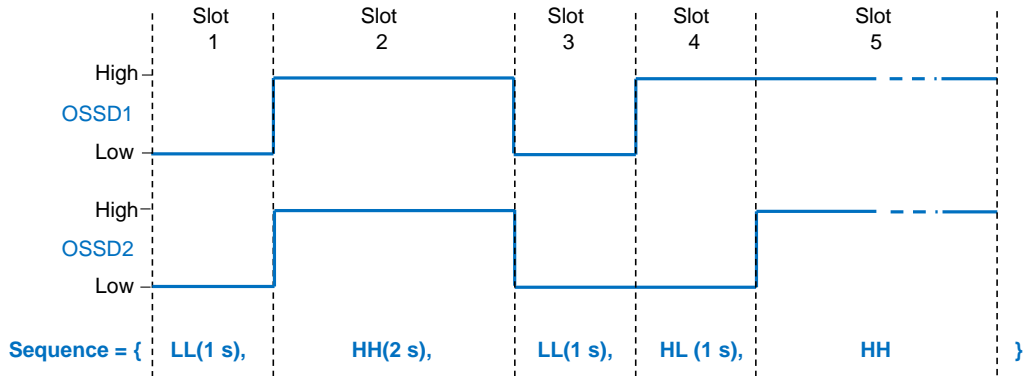
- 5848 • "OSSD Signal Generator", see A.2.2
- 5849 • "Upper-Tester" (UT) for SCL protocol conformance testing, see A.2.3
- 5850 • "FS-Master tester system" including the "Safety Master Tester Unit" (SMTU), see A.2.4
- 5851 • "FS-Device tester" (FSDT), see A.2.5
- 5852 • "IODD Checker Tool", see A.2.6
- 5853 • Reference FS-Master/Tool and FS-Devices, see A.2.7
- 5854 • "EMC-Test tool" (optional)

5855

5856 **A.2.2 OSSD signal generator**

5857 Several test cases require complex correlated signal sequences on both OSSD channels, which
 5858 cannot be stimulated by a reference off-the-shelf FS-Device. An OSSD signal generator, acting
 5859 as a controllable FS-Device, which is connected to an FS-Master, can provide the required
 5860 OSSD signals and the superimposed OSSD test pulses (see Figure A.3).

5861 Figure A.5 shows an example of an OSSD signal sequence and its description.



5862

5863 **Figure A.5 – Example of an OSSD signal sequence description**

5864 The OSSD signal sequences are specified by the symbols "H" and "L", describing the OSSD
 5865 signal levels during a time slot. Unless otherwise noted, the duration of a slot is longer than
 5866 required for the detection of any possible signal combination.

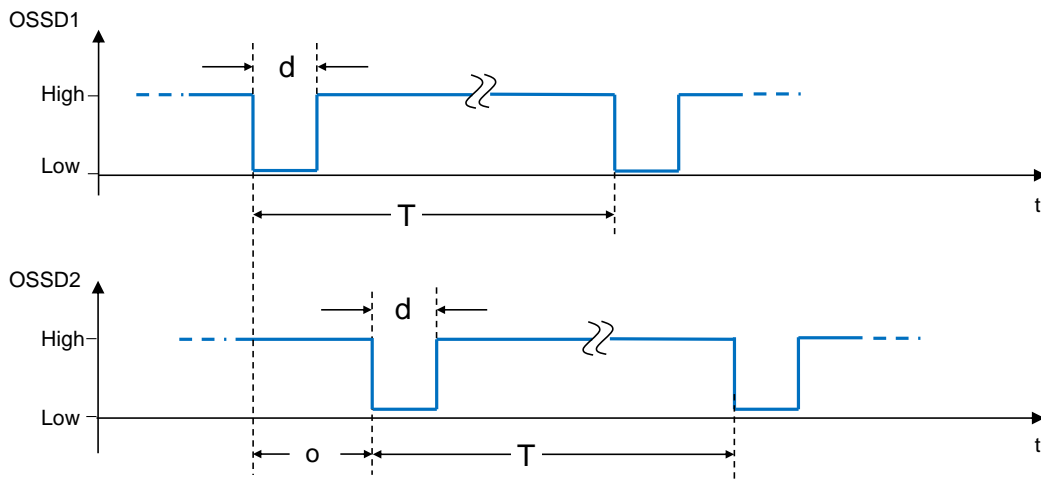
5867 The combined symbols for the description of OSSD sequences are defined in Table A.1.

5868 **Table A.1 – Description means for OSSD signal sequences**

Combined symbol	OSSD1 level	OSSD2 level	Duration of time slot
HH(d)	High	High	d
HL(d)	High	Low	d
LH(d)	Low	High	d
LL(d)	Low	Low	d

5869

5870 Figure A.6 shows means to describe OSSD test pulses for the FS-Device output testing (see
 5871 [4] 5.3.2.3). Parameters are "T" for period, "d" for duration of the test pulse, and "o"
 5872 for the offset between test pulse train1 and train2.



5873

5874 **Figure A.6 – OSSD test pulses**

5875 The OSSD test pulses are specified by test pulse symbol pairs, like the OSSD signal sequence
 5876 in curly brackets.

5877 **Table A.2 – Test pulse symbols**

Test pulse symbol	Definition
p(T, d)	Train1 of low pulses with repetition period "T" and duration "d"
p(T, d, o)	Train2 of low pulses with repetition period "T", duration "d", and offset "o" to train1

5878
 5879 A complete OSSD signal can be described by the combination of an OSSD signal sequence
 5880 and a test pulse symbol pair. The test pulses are only affecting the OSSD signal when the signal
 5881 shows a "high" level.

5882 **A.2.3 Principles of SCL protocol conformance testing**

5883 In case of IO-Link Safety, the conformance test is a black box test verifying the IUT
 5884 (Implementation Under Test) against the specification [4] at defined PCO (Point of Control and
 5885 Observation).

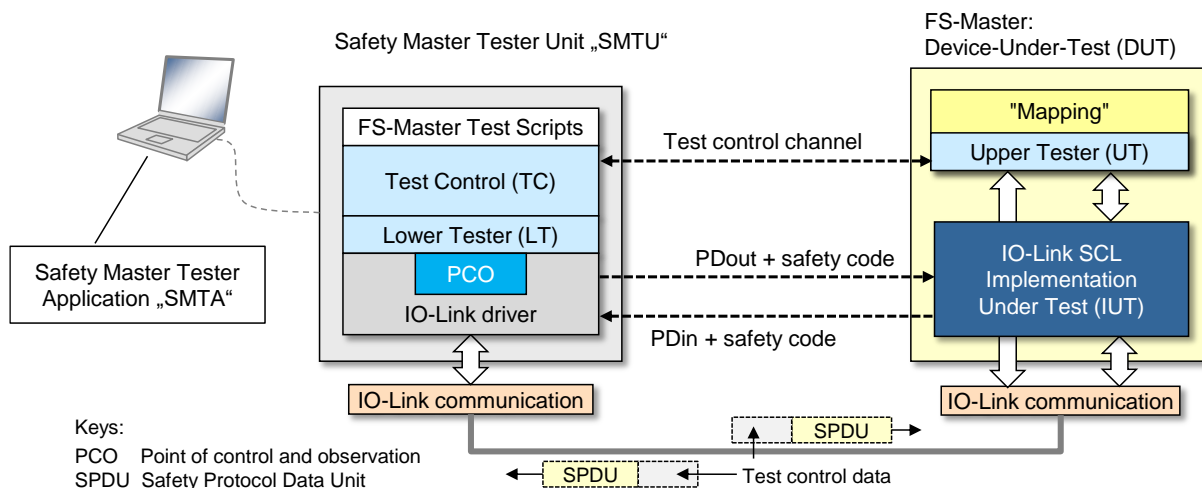
5886 The IUT for IO-Link-Safety is the FS-Master state machine or the FS-Device state machine. It
 5887 is embedded in the DUT (Device Under Test) and has the following interfaces:

- 5888 • IO-Link communication interface (SPDU)
- 5889 • IO-Link SCL interface to "Mapping" (FS-Master) or "Technology" (FS-Device)

5890 In order to test the "Mapping/Technology" interface, a special "test application" would normally
 5891 be required at the DUT. This "test application" is supposed to apply and check test patterns at
 5892 the SCL interface inputs/outputs and thus requires control by the tester performing the test
 5893 scripts.

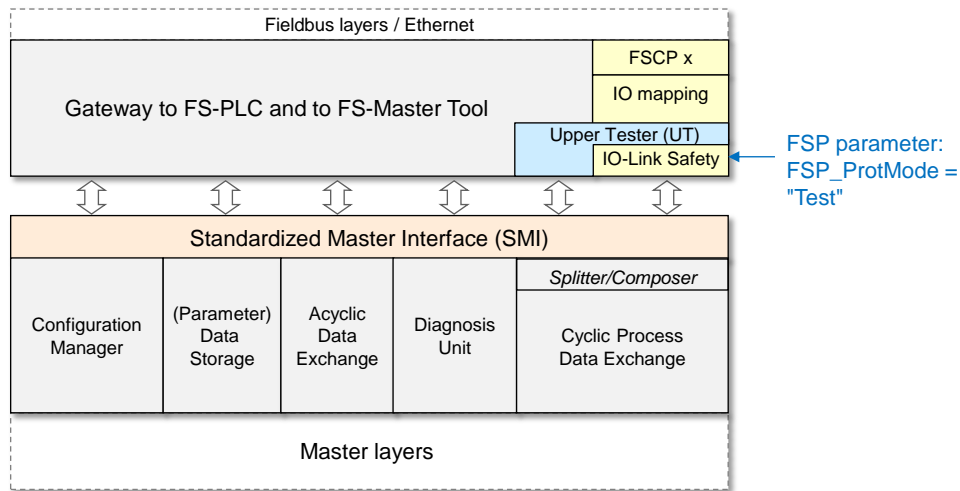
5894 For the sake of simplicity, IO-Link Safety uses the non-safety part of IO-Link messages as "test
 5895 control channel" in order to remotely access the "test application" as shown in Figure A.7. In
 5896 this case "the test application" is called "Upper Tester" (UT).

5897



5898
 5899 **Figure A.7 – Principle of FS-Master SCL testing**

5900 The UT is embedded in the IO mapping part of the safety gateway to an FSCP as shown in
 5901 Figure A.8. It is only active during testing and controlled by certain values of the FSP parameter
 5902 "FSP_ProtMode" (see [4] Annex A.2.5). These values are not visible in the IODD of an FS-
 5903 Device and cannot be set by an FS-Master Tool. Solely the FS-Master Tester system is enabled.

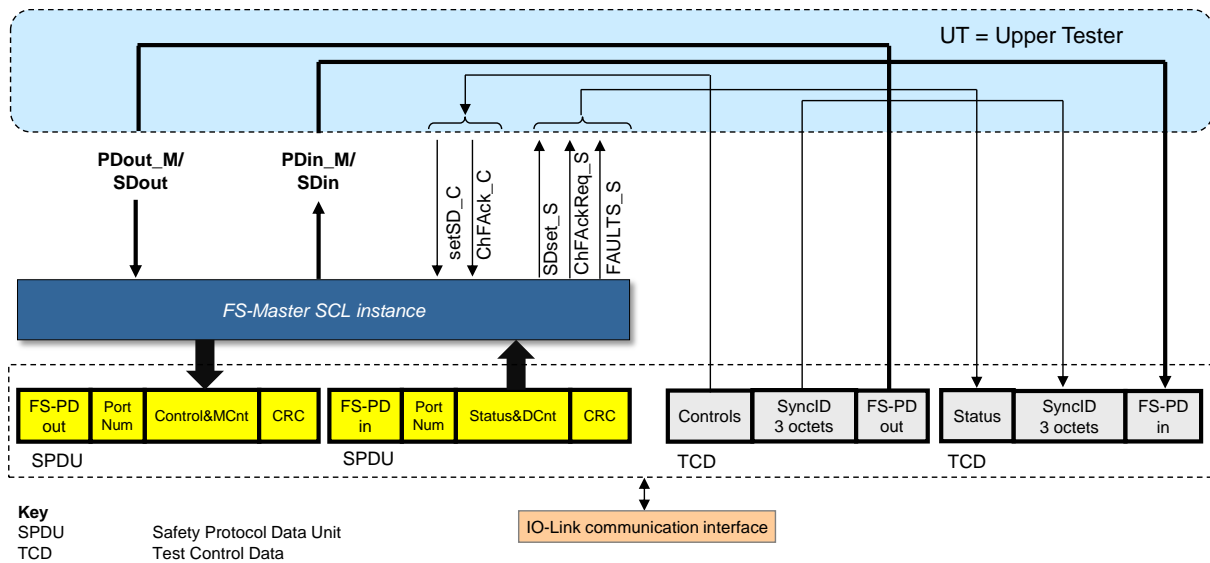


5904

5905

Figure A.8 – Remote Upper Tester (UT) as "test application"

5906 This allows for a quite simple "test application" by just copying data between the safety and
 5907 non-safety transmission parts as shown in detail in Figure A.9. Thus, the test patterns ("FS-
 5908 Master Test Scripts") for the FS-Master set and check all safety process data and signals of
 5909 the communication interface (SPDU) as well as all safety process data and signals of the
 5910 "Mapping" interface.



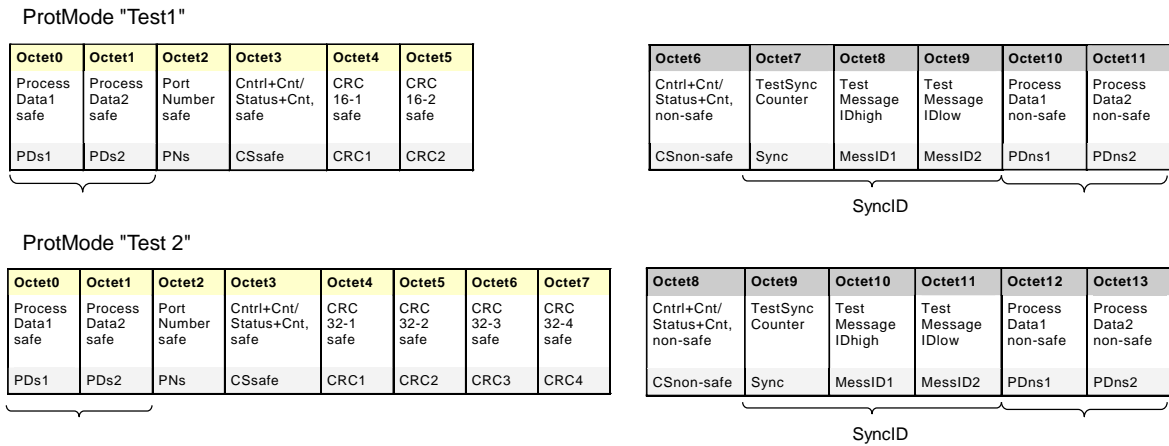
5911

5912

Figure A.9 – Upper Tester logic operations (copy)

5913 Figure A.10 shows how synchronization check of data (test patterns) is achieved through an 8
 5914 bit counter (TestSyncCounter) within the "test control channel" in case of "FSP_ProtMode" =
 5915 "Test1" (16 bit CRC) and "Test2" (32 bit CRC) (see Table 179).

5916 The Octets for test message identifications "TestMessageIdhigh" and "TestMessageIdlow"
 5917 shall be treated as "reserved".



5918

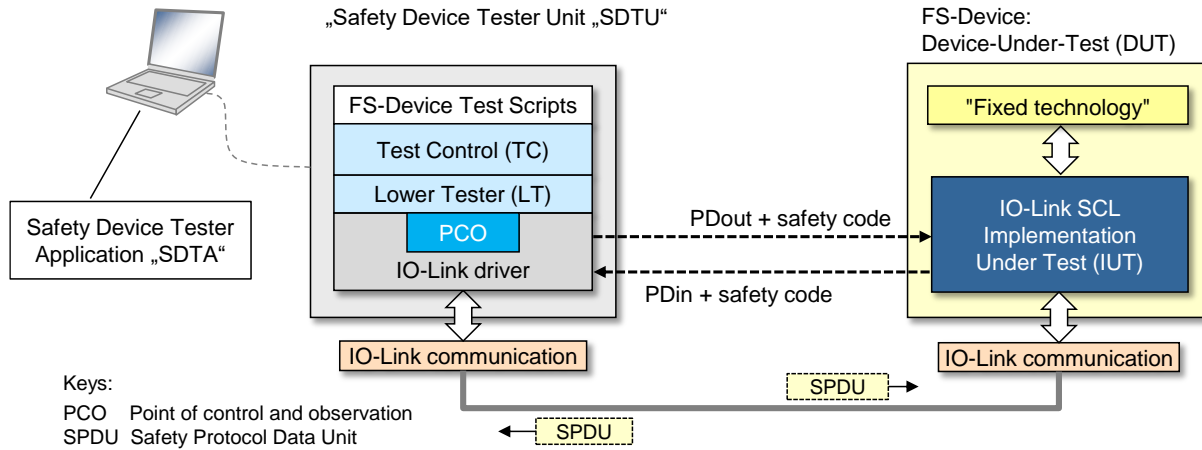
5919 **Figure A.10 – Data transfer in safety and test control channel**

5920 Details are defined for the actual FS-Master SCL protocol tester tool in A.2.4.

5921 Many FS-Device DUTs have a fixed technology application and limited resources such that no
 5922 test control channel and no remote Upper Tester can be established. Thus, a simplified FS-
 5923 Device SCL testing has been chosen as shown Figure A.11. It results in the following
 5924 restrictions for the test creation and performance.

5925 The test scripts for the FS-Device set and check all safety process data and signals of the
 5926 communication interface (SPDU). A static configuration with safety process data >0 and
 5927 SDset_DS =0 is defined for the parameters of the "Fixed technology" interface. An FS-Device
 5928 shall always provide valid process data values for the test.

5929



5930

5931 **Figure A.11 – Principle of FS-Device SCL testing**

5932 **A.2.4 FS-Master tester system**

5933 Figure A.12 shows the possible configurations for an FS-Master tester system including SCL
 5934 testing. This configuration can be used for all test cases such as VerifyRecord, FS-Master/FS-
 5935 Device configuration, and SCL protocol test scripts, but not for physical layer tests.

5987 MTU/SMTU-Instructions. Flow control expressions such as "wait until", "repeat from", etc. can
 5988 supplement these macros. They shall be named intuitively and shall be preceded by the prefix
 5989 "STM_" for safety test macro.

5990 A.4.2 EUT preconditions (FS-Master Port)

5991 Table A.3 shows preconditions of the EUT in addition to the preconditions for NSR testing
 5992 defined in [9]. They can represent a description of a state or a sequence of activities to reach
 5993 a certain state of the EUT. Parameters are listed in Table A.7.

5994

Table A.3 – Preconditions of the EUT

Identifier	Description of state or activities to reach state
PORT_OSSDe	Port is in OSSDe Mode <i>;SML_FSPortConfiguration</i>
PORT_FSCOM	Port is in SAFETYCOM Mode <i>;pure FS-PD exchange</i>
PORT_MIXFSCOM	Port is in MIXEDSAFETYCOM Mode <i>;FS-PD and PD exchange</i>
PORT_POWER_OFF	Port Power L+ switched off <i>;SML_PortPowerOffOn</i>
PORT_FSP_PARAMETERS	FSP-Parameters are stored in FS-Master for VerifyRecord <i>;SML_FSPortConfiguration</i>

5995

5996 A.4.3 SMTU preconditions

5997 Table A.4 shows macros of preconditions of the SMTU playing the role of a controllable and
 5998 observable FS-Device. They describe values (instances) of parameters of a state or a sequence
 5999 of activities to reach a certain state of the SMTU.

6000

Table A.4 – Preconditions of the SMTU

Identifier	Description of state or activity to reach state
SMTU_STANDARD_STATE_16	Change/expand the MTU_STANDARD_STATE in [9] to: DPP1(M-sequenceCapability) = 0x1F <i>;PREOPERATE = TYPE1_2, ;OPERATE = TYPE_2_V ;ISDU supported</i> DPP1(ProcessDataIn) = 0x8A <i>;PDIn = 88 bit</i> DPP1(ProcessDataOut) = 0x8A <i>;PDOOut = 88 bit</i> DPP1(DeviceID) = 0x002BD3 NOTE 1 <i>;DID = 11219</i> DPP1(MinCycleTime)=0x56 <i>;15.2 ms</i> Mandatory Indices: Index 0x0012 (ProductName) = "SMTU" <i>;UTF8 coding</i> Index 0x4200 (Authenticity record): FSCP_Authenticity = xxx(non-zero) NOTE 4 <i>;"Armed"</i> FSP_Port = yyy (non-zero) NOTE 4 <i>;valid Port Number</i> FSP_AuthentCRC = CRC-16 <i>;valid signature for Authenticity</i> Index 0x4201 (Protocol record): FSP_ProtVersion = 0x01 <i>;current protocol version</i> FSP_ProtMode = 0x01 <i>;3 octets FS-PD maximum</i> FSP_Watchdog = yyy NOTE 2 <i>;reasonable time value!</i> FSP_IO_StructCRC = CRC-16 <i>;valid signature for IO_Struct</i> FSP_TechParCRC = CRC-32 <i>;valid signature for no FST-</i> <i>Param.</i> FSP_PortParCRC = CRC-16 <i>;valid signature for Protocol</i> <i>record</i> FSP-MinShutdownTime = 100 <i>;1 second</i> FSP_TimeToReady = 500 <i>;5 seconds</i> Index 0x4212 (FSP_ParamDescCRC) = CRC-32 <i>;from IODD</i>
SMTU_STANDARD_STATE_32	Same as SMTU_STANDARD_STATE_16, except for: DPP1(ProcessDataIn) = 0x9F <i>;PDIn = 32 octets</i> DPP1(ProcessDataOut) = 0x9F <i>;PDOOut = 32 octets</i> DPP1(MinCycleTime) = 0x6F; <i>;25.2 ms</i> Mandatory Indices: Index 0x4201 (Protocol record): FSP_ProtMode = 0x02 <i>;25 octets FS-PD maximum</i>
NOTE 1 Only this ID can be overwritten by FS-Master for compatibility tests (see clause 8.5 in [9]). It differs from the ID value in [9].	

Identifier	Description of state or activity to reach state
	NOTE 2 A reasonable value should be chosen allowing watchdog tests without long test durations (<< 1 min)
	NOTE 3 The SMTU shall issue Events within 1 second after its occurrence.
	NOTE 4 To be preconfigured based on the Authentication of the FS-Master and the target Port.

6001

6002 **A.4.4 SafetyTestMacros (STM) of the FS-Master-Tester-Program**6003 Table A.5 shows SafetyTestMacros of the Safety-Master-Tester-Program for both EUT (FS-
6004 Master) and SMTU. All STMs shall return after ≤ 30 s (default Test_Timeout).6005 **Table A.5 – SafetyTestMacros of the FS-Master-Tester-Program**

STM identifier	Variable	Test Service Action to enter mode	Comment
STM_SCL_START16	–	Set FS-Master to SCL state "wait on SPDU" and set SMTU to SCL state "not ready"	–
STM_SCL_START32	–	Set FS-Master to SCL state "wait on SPDU" and set SMTU to SCL state "not ready"	–
STM_WAIT_TIMEOUT	–	Wait for FSP_Watchdog timeout	–
STM_WAIT	Timeout	FS Master Tester pauses for the indicated duration	in ms

6006

6007 **A.4.5 SMI Event handling**

6008 The Safety-Master-Tester-Program uses the mechanisms as specified in Annex A.4.5 in [9].

6009 **A.4.6 SMI ArgBlock parameter sets (ABPS)**6010 The ArgBlock parameter sets (ABPS) defined in Annex A.4.6 in [9] are supplemented for safety.
6011 The same rules apply.6012 **Table A.6 – ArgBlock Parameter Sets (ABPS) for safety**

ABPS	ArgBlock	Element	Type	Value
ABPS_FSCONFIG_MIXEDCOM	FSPortConfigList	ArgBlockID	Unsigned16	0x8001
		PortMode	Unsigned8	50 (MIXSAFETYCOM)
		Validation&Backup	Unsigned8	3 ("V1.1", B+R)
		I/Q Behavior	Unsigned8	0 (not supported)
		PortCycleTime	Unsigned8	0 (AFAP)
		VendorID	Unsigned16	0xFDE8
		DeviceID	Unsigned32	0x002BD3 (different)
		InputDataLength	Unsigned8	31 (total)
		OutputDataLength	Unsigned8	31 (total)
		FSCP_Authenticity1	Unsigned32	1
		FSCP_Authenticity2	Unsigned32	1
		FSP_Port	Unsigned8	1 (default)
		FSP_AuthentCRC	Unsigned16	64191 (0xFABF)
		FSP_ProtVersion	Unsigned8	0x01
		FSP_ProtMode	Unsigned8	0xF9 (32 bit CRC) ("upper tester")
		FSP_WatchdogTime	Unsigned16	1000 ms (0x03E8)
		FSP_IO_StructCRC	Unsigned16	39137 (0x98E1)

ABPS	ArgBlock	Element	Type	Value
		FSP_TechParCRC	Unsigned32	1 (0x00000001)
		FSP_ProtParCRC	Unsigned16	62167 (0xF2D7)
		IO_DescVersion	Unsigned8	1 (Version 1)
		SPDUInLength	Unsigned8	8
		TotalOfInBits	Unsigned8	0
		TotalOfInOctets	Unsigned8	0
		TotalOfInInt16	Unsigned8	1
		TotalOfInInt32	Unsigned8	0
		SPDUOutLength	Unsigned8	8
		TotalOfOutBits	Unsigned8	0
		TotalOfOutOctets	Unsigned8	0
		TotalOfOutInt16	Unsigned8	1
		TotalOfOutInt32	Unsigned8	0
		FSP-MinShutdownTime	Unsigned16	100 (Unit 10 ms)
		FSP_TimeToReady	Unsigned16	500 (Unit 10 ms)
ABPS_FSCONFIG_OSSDE	FSPortConfigList	ArgBlockID	Unsigned16	0x8100
		PortMode	Unsigned8	51 (OSSDE)
		Don't care (≠ 0)
		SPDUInLength	Unsigned8	1 octet (fixed)
		Don't care (≠ 0)
		FSP-MinShutdownTime	Unsigned16	100 (Unit 10 ms)
		FSP_TimeToReady	Unsigned16	500 (Unit 10 ms)
ABPS_FSCONFIG_SAFECOM	FSPortConfigList	ArgBlockID	Unsigned16	0x8100
		PortMode	Unsigned8	49 (SAFETYCOM)
		Validation&Backup	Unsigned8	3 ("V1.1", B+R)
		I/Q Behavior	Unsigned 8	0 (not supported)
		PortCycleTime	Unsigned8	0 (AFAP)
		VendorID	Unsigned16	0xFDE8
		DeviceID	Unsigned32	0x002BD3 (different)
		InputDataLength	Unsigned8	31 (total)
		OutputDataLength	Unsigned8	31 (total)
		FSCP_Authenticity1	Unsigned32	1
		FSCP_Authenticity2	Unsigned32	1
		FSP_Port	Unsigned8	1 (default)
		FSP_AuthentCRC	Unsigned16	64191 (0xFABF)
		FSP_ProtVersion	Unsigned8	0x01
		FSP_ProtMode	Unsigned8	0xF9 (32 bit CRC) ("upper tester")
		FSP_WatchdogTime	Unsigned16	1000 ms (0x03E8)
		FSP_IO_StructCRC	Unsigned16	39137 (0x98E1)
		FSP_TechParCRC	Unsigned32	1 (0x00000001)
		FSP_ProtParCRC	Unsigned16	62167 (0xF2D7)

ABPS	ArgBlock	Element	Type	Value
		IO_DescVersion	Unsigned8	1 (Version 1)
		SPDUInLength	Unsigned8	8
		TotalOfInBits	Unsigned8	0
		TotalOfInOctets	Unsigned8	0
		TotalOfInInt16	Unsigned8	1
		TotalOfInInt32	Unsigned8	0
		SPDUOutLength	Unsigned8	8
		TotalOfOutBits	Unsigned8	0
		TotalOfOutOctets	Unsigned8	0
		TotalOfOutInt16	Unsigned8	1
		TotalOfOutInt32	Unsigned8	0
		FSP-MinShutdownTime	Unsigned16	100 (Unit 10 ms)
		FSP_TimeToReady	Unsigned16	500 (Unit 10 ms)
ABPS_PDOUT6	PDOOUT	ArgBlockID	Unsigned16	0x1002
	OE		Unsigned8	1
	OutputDataLength		Unsigned8	6
	PDO0		Unsigned8	11
	PDO1		Unsigned8	22
	PDO2		Unsigned8	33
	PDO3		Unsigned8	44
	PDO4		Unsigned8	55
	PDO5		Unsigned8	66
ABPS_PDOUT32	PDOOut	ArgBlockID	Unsigned16	0x1002
	OE		Unsigned8	1
	OutputDataLength		Unsigned8	32
	PDOOut [i=0...31]		Unsigned8	3*(i+1)
ABPS_PORT_OFF	PortPowerOffOn	ArgBlockID	Unsigned16	0x7003
	PortPowerMode		Unsigned8	1 (OFF permanent)
	PortPowerOffTime		Unsigned16	0
ABPS_PORT_ON	PortPowerOffOn	ArgBlockID	Unsigned16	0x7003
	PortPowerMode		Unsigned8	2 (ON permanent)
	PortPowerOffTime		Unsigned16	0
ABPS_POWER_CYCLE	PortPowerOffOn	ArgBlockID	Unsigned16	0x7003
	PortPowerMode		Unsigned8	0 (OFF-ON cycle)
	PortPowerOffTime		Unsigned16	0x01F4 (~ 1 s)

6013

6014

A.4.7 SMTU instructions

6015 Instructions of the Master-Tester-Program for the MTU specified in Annex A.4.7 in [9] are
6016 supplemented for safety. Table A.7 shows (fixed) instructions of the Safety-Master-Tester-
6017 Program for the SMTU (Safety-Master-Tester-Unit). Every SMTU instruction returns the speci-
6018 fied parameters defined in "Return value".

6019

Table A.7 – SMTU instructions

Name	Parameter	Return value	Definition
SMTU_Authent_Set	Authent1, Authent2, Port, CRC	–	Set deviating values
SMTU_PowerState_Get	–	1= Power On 0= Power Off	Returns current state of L+ power
SMTU_PowerOffTime_Start	–	–	Starts measurement of the PowerOffOn time
SMTU_PowerOffTime_Get	–	PowerOffTime	Returns measured PowerOffTime in ms after a PowerOffOn cycle
SMTU_Delay_SPDU	delay in ms	M_COUNT	SMTU to check Watchdog timeout 1) Keep SPDUIN DCount unchanged for delay if MCount gets 1 2) update DCount with first cycle after delay 3) Return when M_Count changes or $2.2 \cdot \text{FSP_Watchdog}$ after MCount got 1
SMTU_MixData_Get	–	SR, NSR, OE	Readback mixed Process Data from SMTU
SMTU_NSR_Set	NSR, PQI	–	Sets NSR Process Data in SMTU
SMTU_Pause	Pause time in seconds	–	SMTU does not respond during pause
SMTU_Ready_Wait	t2R, tRP	–	Start-up of FS-Device
SMTU_SPDU_Repetition	Time in seconds	–	Artificially repeat SPDU
SMTU_SPDU_Change	–	–	SMTU to wait until SPDU changed. Usually this is an MCount or DCount value.
SMTU_VerifyRecord_Get	–	VerifyRecord	Returns entire VerifyRecord

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A.4.8 Fictive IODD for SMTU6021 The FS-Master tester system provides a fictive IODD for the SMTU.
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Annex B (normative)

Assessment and certification

6027 **B.1 General**

6028 In case of safety for machinery, a manufacturer declaration is only sufficient for a product to be
6029 launched, if the manufacturer fulfils certain preconditions. Otherwise, functional safety
6030 assessments by assessment bodies are required based on international standards such as IEC
6031 61508, IEC 62061, or ISO 13849. There are three types of assessment objects in IO-Link Safety:

- 6032 • Specification (see [4]),
- 6033 • SCL-stacks and software tools,
- 6034 • Functional safety products such as FS-Device and FS-Master including Master-Tools.

6035 The actual assessment of IO-Link Safety can only comprise a concept approval of the
6036 specification ([4]) and companion documents as a precondition for the conformity of
6037 implementations (see B.4).

6038 Since it is possible to implement the safety communication layers (SCL) of IO-Link Safety in a
6039 completely hardware-independent manner, manufacturers can save quite some effort and time
6040 if pre-certified SCL-stacks and software tools are available on the market. Preconditions are
6041 described in B.5.2.

6042 Procedures and constraints for functional safety products are described in detail in B.5.

6043 **B.2 Safety policy**

6044 In order to prevent and protect the manufacturers and vendors of FS-Masters and FS-Devices
6045 from possibly misleading understandings or wrong expectations and negligence actions regard-
6046 ing safety-related developments and applications the following shall be observed and ex-
6047 plained in each training, seminar, workshop and consultancy.

- 6048 • Any non-safety-related device automatically will not be applicable for safety-related appli-
6049 cations just by using fieldbus or IO-Link communication and a safety communication layer.
6050 The safety technology part of a safety device shall be approved for a Safety Integrity Level
6051 (SIL) or Performance Level (PL) suitable for the intended safety functions. The IO-Link
6052 Safety part shall be implemented and approved for the same SIL/PL or better.
- 6053 • In order to enable a product for safety-related applications, appropriate development
6054 processes according to safety standards shall be observed (see IEC 61508, IEC 62061, ISO
6055 13849) and an assessment from a competent assessment body or authorized manufacturer
6056 department shall be achieved.
- 6057 • The manufacturer/vendor of a safety product is responsible for the correct implementation
6058 of the safety communication layer technology, the correctness and completeness of the
6059 product documentation and information.
- 6060 • Supplemental safety-related information to the regular specification in [4] shall be observed
6061 for implementation, test and assessment if applicable. Normally, this information is provided
6062 by the working group as response to a change request (CR) within the CR-database that is
6063 in state "implementation" and approved by an assessment body. The working group can
6064 decide to publish these CRs through a separate "Corrigendum" document for download on
6065 the IO-Link website.

6066 **B.3 Obligations for international business**

6067 As a rule, the international safety standards are accepted (ratified) globally. However, since
6068 safety technology in automation is relevant to occupational safety and the concomitant
6069 insurance risks in a country, recognition of the rules pointed out here is still a sovereign right.
6070 The national "Authorities" decide on the recognition of assessment reports. The observation of
6071 additional national regulations may be required.

6072 B.4 Concept approval of IO-Link Safety

6073 For the approval of the safety concepts of IO-Link Safety the following has been provided by
6074 the community:

- 6075 • Specification of IO-Link Safety ([4])
- 6076 • Documentation of the modelling, the model checking, and the simulation including fault
6077 injection of the IO-Link safety communication layer (SCL)
- 6078 • Document "Safety considerations" with Functional Safety Management, calculation of
6079 relevant Residual Error Rates, and software tool chain FMEA
- 6080 • Document "Document Management and Working Group rules"

6081

6082 B.5 Product assessment and certification

6083 B.5.1 Overview

6084 Products within the domain of IO-Link Safety can be pre-certified software stacks or safety
6085 devices.

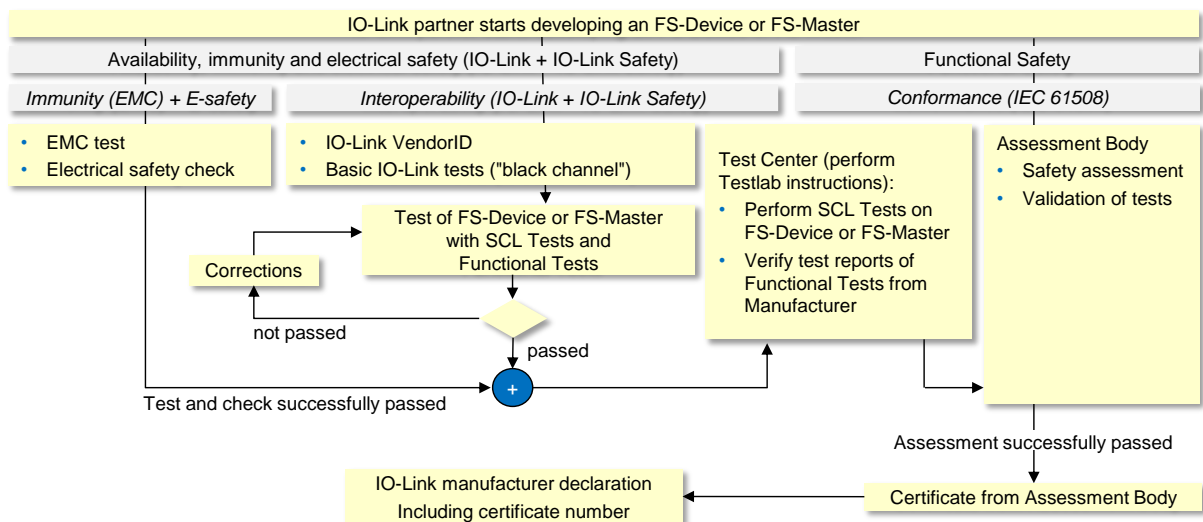
6086 B.5.2 Pre-certified software stacks

6087 Software shall be valid for the architecture required by the certain SIL or PL, for example
6088 redundancy in case of SIL3 or PL_e. The requirements for compliant items according to IEC
6089 61508-3 shall be observed for the assessment of a pre-certified SCL-stack.

6090 Software shall be "sealed" to protect it from unintended changes. The user is only permitted to
6091 adapt the interfaces and keep the core part of the software untouched in order to keep the
6092 certificate.

6093 B.5.3 Certified FS-Devices and FS-Masters

6094 Figure B.1 below illustrates the assessment procedures of FS-Device and FS-Master.



6095

6096

Figure B.1 – Assessment of FS-Device and FS-Master

6097 Test, assessment, and certification of FS-Devices and FS-Masters comprise three aspects:

- 6098 • Conformity with regulations, for example European Directives such as Electromagnetic
6099 Compatibility (EMC – IEC 61000-6-7) and Low Voltage Directive (electrical safety – IEC
6100 61010-2-201) with possibly deviating issues depending on the standards to be considered
6101 (generic, domain, or product),

- 6102 • IO-Link Interoperability, that means conformity of the FS-Device with the IO-Link
6103 specifications: The IO-Link community arranged for Functional Tests (test tool suite) based
6104 on this document and supported by Technology Providers,
- 6105 • Conformance of functional safety development process with IEC 61508 (due to
6106 software/firmware involvement).

6107

6108 NOTE Usually, from a fieldbus/FSCP point-of-view, the FS-Master is a fieldbus device and shall be developed,
6109 tested, and assessed according to the interoperability/conformity rules of the individual fieldbus/FSCP. The result is
6110 a certificate of the fieldbus organization.

6111

6112 **B.5.4 Usage of Functional Tests and SCL Tests**

6113 In Figure B.1 Functional Tests and SCL Tests are mentioned. The Test Systems for FS-Device
6114 and FS-Master may implement both kinds of tests, however separated from each other in order
6115 and under different conditions.

6116 SCL Tests are safety-related and thus safety assessed and certified. The SCL Tests shall be
6117 embedded in the tester software without changing the semantics of the SCL test scripts. The
6118 corresponding tests check whether the protocol software of an FS-Device or FS-Master is
6119 performed as specified in [4]. General requirements for test tools are given in A.3. With respect
6120 to the SCL Tests, the test tools shall in particular fulfil the following requirements:

- 6121 • Testlab Instructions, created by the IO-Link Community, describing the behavior and
6122 handling of the test tools and their constraints as well as a configuration management.
- 6123 • Prove that each and every test case of the SCL Tests has been performed in accordance
6124 with the SCL test scripts.
- 6125 • Prove that each deviation of the FS-Master or FS-Device responses from the expected
6126 responses as given by the SCL test scripts is detected by the test system.
- 6127 • SCL Tests are fixed, versioned and "locked/sealed" by signature (e.g. CRC) and must not
6128 be changed during an update of the test system.

6129

6130 Functional Tests can be variable to a certain extent and be adjusted to customer requirements.
6131 The corresponding test cases are specified in this document. An update of the Functional Tests
6132 and the corresponding test system is possible without safety assessment as long as the SCL
6133 Tests keep untouched.

6134 While developers can perform tests during development to ensure a high degree of
6135 conformity/interoperability with IO-Link and IO-Link Safety, this is not enough for functional
6136 safety. Additional requirements are given below.

6137

6138 Four parties are involved in the procedure of test and assessment:

- 6139 • The manufacturer of an IO-Link product, responsible for performing conformance tests with
6140 test tools (Functional Tests),
- 6141 • The FS-Test-Center, responsible for verification and approval of tests. FS-Test-Centers are
6142 accredited by the IO-Link Community and audited periodically. They are performing tests
6143 and checks according to "Test Lab Instructions" approved by the IO-Link Community.
- 6144 • The Assessment Body, verifying and validating the product and its development.
- 6145 • The IO-Link business office, managing the manufacturer declarations of conformity.

6146

6147

6148 The procedure of test and assessment consists of the following steps:

- 6149 1) Manufacturer performs basic IO-Link Tests (“Black Channel”) during and at the end of
6150 development, based on IO-Link Test specification, V1.1.3. if applicable for FS-Masters or
6151 FS-Devices.
- 6152 2) Manufacturer performs additional safety tests (“FS-Device or FS-Master”) as well as some
6153 “Black Channel” extensions such as Ready Pulse, VerifyRecord, etc., during and at the end
6154 of development, based on IO-Link Safety Test & Assessment specification, V1.1.
- 6155 3) Manufacturer cares for Physical Layer testing, EMC-testing according to the IO-Link V1.1.3
6156 specification and an electrical safety check before handing over to the FS-Test Center, to
6157 protect its personnel.
- 6158 4) Manufacturer contracts an FS-Test-Center and hands over the FS-Device or FS-Master
6159 including Device Tools, IODD, Engineering, etc., together with the test reports.
- 6160 5) FS-Test-Center verifies test reports of Functional Tests and performs SCL Tests.
- 6161 6) FS-Test Center returns an “FS-Test Report” based on the results of its verification work to
6162 the Manufacturer.
- 6163 7) Manufacturer provides this “FS Test Report” to the Assessment Body as prerequisite for the
6164 assessment procedure.
- 6165 8) The Assessment Body checks additional safety related parameters like additional safety
6166 related EMC-Tests, electrical safety checks etc., required for the safety certificate that is
6167 handed over to the Manufacturer.
- 6168 9) Finally, the Manufacturer completes the manufacturer's declaration referencing the safety
6169 certificate based on a standardized template which might be forwarded to the IO-Link
6170 Business Office to be published in the approved component list (ACL).

6171

6172 **B.6 Grandfathering rules**

6173 In future releases of this document, grandfathering rules will be necessary once the "black
6174 channel", i.e. the IO-Link layer stack is changed in an FS-Master or in an FS-Device.

6175 Same is true for SCL stack changes in an FS-Master or in an FS-Device.

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Annex C
(informative)

**Information on testing
of FS-Devices and FS-Master/Tools**

6181 Information about test laboratories, which test and validate the conformity of IO-Link Safety
6182 products such as FS-Masters and FS-Devices with IO-Link specifications can be obtained from
6183 the following organization:

6184 IO-Link Community
6185 c/o PROFIBUS Nutzerorganisation e.V.
6186 Haid-und-Neu-Str. 7
6187 76131 Karlsruhe
6188 GERMANY
6189 Phone: +49 721 9658 590
6190 Fax: +49 721 9658 589
6191 E-Mail: info@io-link.com
6192 URL: www.io-link.com

6193
6194
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Annex D
(normative)

Manufacturer declaration for safety devices

6197 A dedicated manufacturer declaration for FS-Devices and FS-Masters can be downloaded from
6198 the download area in www.io-link.com.

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6200
6201

Annex E (informative) Listing of FS test cases

6202 E.1 Listing of FS test cases sorted by IDs

6203 Table E.1 shows the Test cases and its references.

6204

Table E.1 – FS test cases sorted by IDs

FSTC ID	FSTC Name	Reference
FSTC_0001	FSTCM_PHYL_PWR1_SWITCHABLE	Table 12
FSTC_0002	FSTCM_PHYL_OSSD_HIGHVIMIQ	Table 13
FSTC_0003	FSTCM_PHYL_OSSD_LOWVIMIQ	Table 14
FSTC_0004	FSTCM_PHYL_OSSD_VHYSMCI	Table 15
FSTC_0005	FSTCM_PHYL_OSSD_LOADIQ	Table 16
FSTC_0006	FSTCD_PHYL_OSSD_HSRESVOLT	Table 17
FSTC_0007	FSTCD_PHYL_OSSD_LSRESVOLT	Table 18
FSTC_0008	FSTCM_PHYL_INTF_OSSDSENS	Table 19
FSTC_0009	FSTCM_PHYL_INTF_DISCREPANCY	Table 20
FSTC_0010	FSTCM_PHYL_INTF_TESTPULSERES	Table 21
FSTC_0011	FSTCM_PHYL_INTF_READYDETECT	Table 22
FSTC_0012	FSTCM_PHYL_INTF_WAKEUPTOREADYDELAY	Table 23
FSTC_0013	FSTCD_PHYL_OSSD_DISCREP	Table 24
FSTC_0014	FSTCD_PHYL_INTF_TESTPULSPERIOD	Removed
FSTC_0015	FSTCD_PHYL_INTF_TESTPULSDURATION	Table 25
FSTC_0016	FSTCD_PHYL_INTF_READYPULSDUR	Table 26
FSTC_0017	FSTCD_PHYL_INTF_READY2OSSD	Table 27
FSTC_0018	FSTCI_IODD_FSPD_IODDPARAMDESCCRC	Table 29
FSTC_0019	FSTCI_IODD_FSPD_DEDICTOOL	Table 30
FSTC_0020	FSTCD_CONF_INFO_DOCUMENTS	Table 31
FSTC_0021	FSTCD_CONF_INFO_CONNECTCABLE	Table 32
FSTC_0022	FSTCD_CONF_INFO_DEFAULTBEHAVIOR	Table 33
FSTC_0023	FSTCD_CONF_FSPD_PORTINVAL	Table 34
FSTC_0024	FSTCD_CONF_FSPD_AUTHENTCRCINVAL	Table 35
FSTC_0025	FSTCD_CONF_FSPD_PROTVINVAL	Table 36
FSTC_0026	FSTCD_CONF_FSPD_PMODEINVAL	Table 37
FSTC_0027	FSTCD_CONF_FSPD_WDOGRANGE	Table 38
FSTC_0028	FSTCD_CONF_FSPD_PRCRCINVAL	Table 39
FSTC_0029	FSTCD_CONF_DEFAULTFST	Table 40
FSTC_0030	FSTCD_CONF_IODDFSTPAR	Table 41
FSTC_0031	FSTCD_CONF_CRCDEEDTOOL	Table 42
FSTC_0032	FSTCD_CONF_SWTOOSSD	Table 43
FSTC_0033	FSTCD_CONF_SETUPCOMMI	Table 44
FSTC_0034	FSTCD_CONF_SETUPARMED	Table 45
FSTC_0035	FSTCD_PARM_VRFY_ARMED	Table 46
FSTC_0036	FSTCD_PARM_VRFY_COMMISTEST	Table 47

FSTC_0037	FSTCD_PARM_VRFY_ARMEDNOVFY	Table 48
FSTC_0038	FSTCD_PARM_VRFY_TESTNOVFY	Table 49
FSTC_0039	FSTCD_PARM_VRFY_TECHPARN0	Table 50
FSTC_0040	FSTCD_PARM_VRFY_TECHPAR0	Table 51
FSTC_0041	FSTCD_PARM_VRFY_AUTH1WRONG	Table 52
FSTC_0042	FSTCD_PARM_VRFY_AUTH2WRONG	Table 53
FSTC_0043	FSTCD_PARM_VRFY_PORTWRONG	Table 54
FSTC_0044	FSTCD_PARM_VRFY_AUTHCRCWRG	Table 55
FSTC_0045	FSTCD_PARM_VRFY_PPARCRCWRG	Table 56
FSTC_0046	FSTCD_PARM_VRFY_TPARCRCWRG	Table 57
FSTC_0047	FSTCD_PARM_VRFY_IOSTCRCWRG	Table 58
FSTC_0048	FSTCD_PARM_VRFY_WDTIMEINVL	Table 59
FSTC_0049	FSTCD_PARM_VRFY_PVERSINVL	Table 60
FSTC_0050	FSTCD_PARM_VRFY_PMODEINVL	Table 61
FSTC_0051	FSTCD_SCLD_WATCHDOGANDIODD	Table 62
FSTC_0052	FSTCD_SCLD_FLOW_NOERRMC1TO	Table 64
FSTC_0053	FSTCD_SCLD_FLOW_SETSD1MC0	Table 65
FSTC_0054	FSTCD_SCLD_FLOW_SETSD0MC5TO	Table 66
FSTC_0055	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 67
FSTC_0056	FSTCD_SCLD_FLOW_SETSD1MC0	Table 68
FSTC_0057	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 69
FSTC_0058	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 70
FSTC_0059	FSTCD_SCLD_FLOW_SETSD0MC7TO	Table 71
FSTC_0060	FSTCD_SCLD_FLOW_CRC1MC0TO	Table 72
FSTC_0061	FSTCD_SCLD_FLOW_SETSD1MC0TO	Table 73
FSTC_0062	FSTCD_SCLD_FLOW_SETSD1MC0	Table 74
FSTC_0063	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 75
FSTC_0064	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 76
FSTC_0065	FSTCD_SCLD_FLOW_SETSD0MC2DCE1	Table 77
FSTC_0066	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 78
FSTC_0067	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 79
FSTC_0068	FSTCD_SCLD_FLOW_PNERRMC0	Table 80
FSTC_0069	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 81
FSTC_0070	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 82
FSTC_0071	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 83
FSTC_0072	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 84
FSTC_0073	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 85
FSTC_0074	FSTCD_SCLD_FLOW_SETSD1MC1DCE1	Table 86
FSTC_0075	FSTCD_SCLD_FLOW_SETSD1MC1DCE1	Table 87
FSTC_0076	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 88
FSTC_0077	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 89
FSTC_0078	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 90
FSTC_0079	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 91
FSTC_0080	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 92
FSTC_0081	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 93

FSTC_0082	FSTCD_SCLD_FLOW_SETSD0MC3TO	Table 94
FSTC_0083	FSTCD_SCLD_FLOW_SETSD0MC3TO	Table 95
FSTC_0084	FSTCD_SCLD_FLOW_SETSD0MC3TO	Table 96
FSTC_0085	FSTCD_SCLD_FLOW_SETSD0MC4TO	Table 97
FSTC_0086	FSTCD_SCLD_FLOW_SETSD0MC4TO	Table 98
FSTC_0087	FSTCD_SCLD_FLOW_SETSD0MC4TO	Table 99
FSTC_0088	FSTCD_SCLD_FLOW_SETSD0MC5TO	Table 100
FSTC_0089	FSTCD_SCLD_FLOW_SETSD0MC5TO	Table 101
FSTC_0090	FSTCD_SCLD_FLOW_SETSD0MC5TO	Table 102
FSTC_0091	FSTCD_SCLD_FLOW_SETSD0MC6TO	Table 103
FSTC_0092	FSTCD_SCLD_FLOW_SETSD0MC6TO	Table 104
FSTC_0093	FSTCD_SCLD_FLOW_SETSD0MC7TO	Table 105
FSTC_0094	FSTCD_SCLD_FLOW_SETSD0MC7TO	Table 106
FSTC_0095	FSTCD_SCLD_FLOW_SETSD0MC7TO	Table 107
FSTC_0096	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 108
FSTC_0097	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 109
FSTC_0098	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 110
FSTC_0099	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 111
FSTC_0100	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 112
FSTC_0101	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 113
FSTC_0102	FSTCD_SCLD_FLOW_SETSD0MC2DCE1	Table 114
FSTC_0103	FSTCD_SCLD_FLOW_SETSD0MC3TO	Table 115
FSTC_0104	FSTCD_SCLD_FLOW_SETSD0MC3TO	Table 116
FSTC_0105	FSTCD_SCLD_FLOW_SETSD0MC4TO	Table 117
FSTC_0106	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 118
FSTC_0107	FSTCD_SCLD_FLOW_SETSD1MC0	Table 119
FSTC_0108	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 120
FSTC_0109	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 121
FSTC_0110	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 122
FSTC_0111	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 123
FSTC_0112	FSTCD_SCLD_FLOW_SETSD1MC0	Table 124
FSTC_0113	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 125
FSTC_0114	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 126
FSTC_0115	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 127
FSTC_0116	FSTCD_SCLD_FLOW_SETSD1MC0	Table 128
FSTC_0117	FSTCD_SCLD_FLOW_SETSD1MC0	Table 129
FSTC_0118	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 130
FSTC_0119	FSTCD_SCLD_FLOW_SETSD1MC0	Table 131
FSTC_0120	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 132
FSTC_0121	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 133
FSTC_0122	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 134
FSTC_0123	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 135
FSTC_0124	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 136
FSTC_0125	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 137
FSTC_0126	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 138

FSTC_0127	FSTCD_SCLD_FLOW_SETSD1MC0	Table 139
FSTC_0128	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 140
FSTC_0129	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 141
FSTC_0130	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 142
FSTC_0131	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 143
FSTC_0132	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 144
FSTC_0133	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 145
FSTC_0134	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 146
FSTC_0135	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 147
FSTC_0136	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 148
FSTC_0137	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 149
FSTC_0138	FSTCD_SCLD_FLOW_SETSD0MC3TO	Table 150
FSTC_0139	FSTCD_SCLD_FLOW_SETSD0MC3TO	Table 151
FSTC_0140	FSTCD_SCLD_FLOW_SETSD1MC0DCE1	Table 152
FSTC_0141	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 153
FSTC_0142	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 154
FSTC_0143	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 155
FSTC_0144	FSTCD_SCLD_FLOW_SETSD0MC3	Table 156
FSTC_0145	FSTCD_SCLD_FLOW_SETSD0MC1TO	Table 157
FSTC_0146	FSTCD_SCLD_FLOW_SETSD0MC3TO	Table 158
FSTC_0147	FSTCD_SCLD_FLOW_SETSD0MC2TO	Table 159
FSTC_0148	FSTCD_REFT_INVOKEDEDITOOL	Table 160
FSTC_0149	FSTCD_REFT_CALCDEEDITOOL	Table 161
FSTC_0150	FSTCD_REFT_BACKDEEDITOOL	Table 162
FSTC_0151	FSTCD_REFT_COMMDEDITOOL	Table 163
FSTC_0152	FSTCD_REFT_CORRECTFSTVALUES	Table 164
FSTC_0153	FSTCD_REFT_INCORRECTFSPVALUES	Table 165
FSTC_0154	FSTCD_REFT_COMMINTERRUPT	Table 167
FSTC_0155	FSTCM_INFO_DOCUMENTS	Table 169
FSTC_0156	FSTCM_CONF_INFO_CONNECTCABLE	Table 170
FSTC_0157	FSTCM_CONF_INFO_DEFAULTPARAM	Table 171
FSTC_0158	FSTCM_INFO_FSMIDENT	Table 172
FSTC_0159	FSTCM_INFO_FSMAUTHENT	Table 173
FSTC_0160	FSTCM_FSOP_PORTPOWOFFON	Removed
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Bibliography

- 6207 [1] IEC 61131-9:2022³, *Programmable controllers – Part 9: Single-drop digital communi-*
6208 *cation interface for small sensors and actuators (SDCI)*, www.iec.ch
- 6209 [2] IO-Link Community, *IO-Link Interface and System*, V1.1.3, June 2019, Order No. 10.002
- 6210 [3] IO-Link Community, *IO-Link Corrigendum & Package 2020*, January 2021, Order No.
6211 10.122
- 6212 [4] IO-Link Community, *IO-Link Safety System Extensions*, V1.1.3, March 2022, Order No.
6213 10.092
- 6214 [5] IO-Link Community, *IO Device Description (IODD)*, V1.1.3, January 2021, Order No.
6215 10.012
- 6216 [6] IO-Link Community, *Common Profile*, V 1.1, December 2021, Order No. 10.072
- 6217 [7] ISO/IEC 19505-2:2012, *Information technology – OMG Unified Modeling Language*
6218 *(OMG UML)*, Revision 2
- 6219 [8] ZVEI-Recommendation
6220 https://www.zvei.org/fileadmin/user_upload/Presse_und_Medien/Publikationen/2021/Ju
6221 [ni/ZVEI_Empfehlung_Klassifizierung_Binaerer_24-V-Schnittstellen/24V-](https://www.zvei.org/fileadmin/user_upload/Presse_und_Medien/Publikationen/2021/Ju)
6222 [Schnittstellen_final.pdf](https://www.zvei.org/fileadmin/user_upload/Presse_und_Medien/Publikationen/2021/Ju)
- 6223 [9] IO-Link Community, *IO-Link Test*, V1.1.3, January 2021, Order No. 10.032
- 6224 [10] IO-Link Community, *IO-Link Exceptions*, V1.0, January 2020, Order No. 10.232
- 6225 [11] PI Profile Specification, *IO-Link Safety Integration in PROFIsafe*, V1.0, Februar 2022,
6226 Order No. 3.312

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