

IO-Link Safety – Test & Assessment

Specification

Related to
**IO-Link Safety – System Extensions
Specification V1.1.3**
and
**IO-Link Test
Specification V1.1.3**

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This version 1.1 of the IO-Link Safety – Test & Assessment specification has been prepared by the IO-Link Safety test team. It covers automated SCL test cases (tier1) and functional test cases (tier2).

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Table 108 – FS-Device test script 45 147

Table 109 – FS-Device test script 46 148

Table 110 – FS-Device test script 47 149

Table 111 – FS-Device test script 48 150

Table 112 – FS-Device test script 49 151

Table 113 – FS-Device test script 50 152

Table 114 – FS-Device test script 51 153

Table 115 – FS-Device test script 52 154

Table 116 – FS-Device test script 53 155

Table 117 – FS-Device test script 54 156

Table 118 – FS-Device test script 55 157

Table 119 – FS-Device test script 56 158

Table 120 – FS-Device test script 57 159

Table 121 – FS-Device test script 58 160

Table 122 – FS-Device test script 59 161

Table 123 – FS-Device test script 60 162

Table 124 – FS-Device test script 61 163

Table 125 – FS-Device test script 62 164

Table 126 – FS-Device test script 63 165

Table 127 – FS-Device test script 64 166

Table 128 – FS-Device test script 65 167

Table 129 – FS-Device test script 66 168

Table 130 – FS-Device test script 67 170

Table 131 – FS-Device test script 68 172

Table 132 – FS-Device test script 69 173

Table 133 – FS-Device test script 70 175

Table 134 – FS-Device test script 71 177

Table 135 – FS-Device test script 72 179

Table 136 – FS-Device test script 73 181

Table 137 – FS-Device test script 74 183

Table 138 – FS-Device test script 75 185

Table 139 – FS-Device test script 76 187

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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 191-05-01 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

312 **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 (+)	
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	
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	

313

314 **3.4 Conventions**315 **3.4.1 Test case template**

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

318

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

319

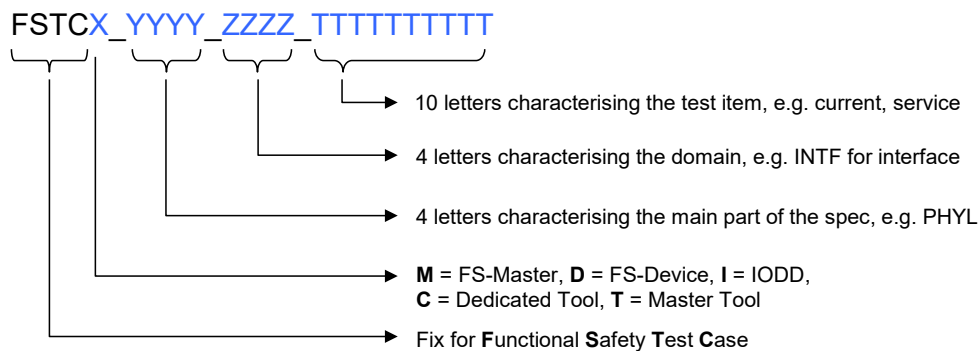
320

TEST CASE	CONDITIONS / PERFORMANCE
	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	- 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).

321

322 **3.4.2 Naming of test cases**

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



324

325 **Figure 1 – Structure of the test case name**

326 **3.4.3 Categories and types of test cases**

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

328

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)

Category	Definition
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

329

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

331

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.

332

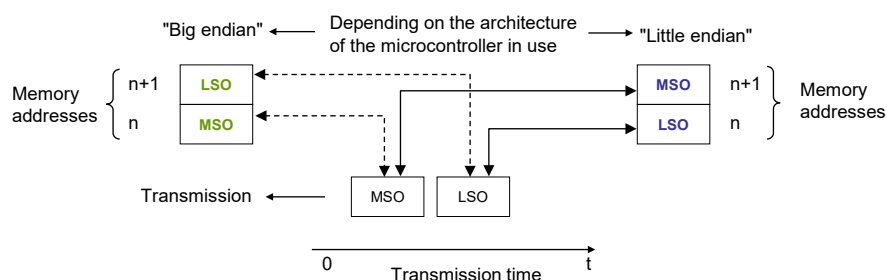
333 **3.4.4 Naming of variables**

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

337 **3.4.5 Memory and transmission octet order**

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

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



343

344

Figure 2 – Memory and transmission octet order

345 **3.4.6 Behavioral descriptions**

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

347 **4 Strategy for testing IO-Link Safety devices**

348 **4.1 Purpose of this test specification**

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

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

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

358 **4.2 Structure of this document**

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

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

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

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

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

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

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

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

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

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

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

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

386 **4.3 Conformity classes**

387 **4.3.1 Overview**

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

389 **4.3.2 FS-Devices with OSSDe**

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

396 **4.3.3 FS-Devices without OSSDe**

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

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

402 **4.3.4 FS-Master**

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

405 **4.3.5 FS-Master with FS-DI/OSSDe support**

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

408 **4.3.6 FS-Master with Port Class B**

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

411 **4.4 Test of FS-Devices**

412 **4.4.1 General**

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

414 **4.4.2 Compatibility with non-safety Master (tester) Ports**

415 **4.4.2.1 Device properties for the analysis of the test behavior**

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

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

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

425 **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

427 Table 5 shows possible conflicts and references the remedies.

428 **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

429

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

432 **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)

433

434 4.4.3 Physical Layer tests

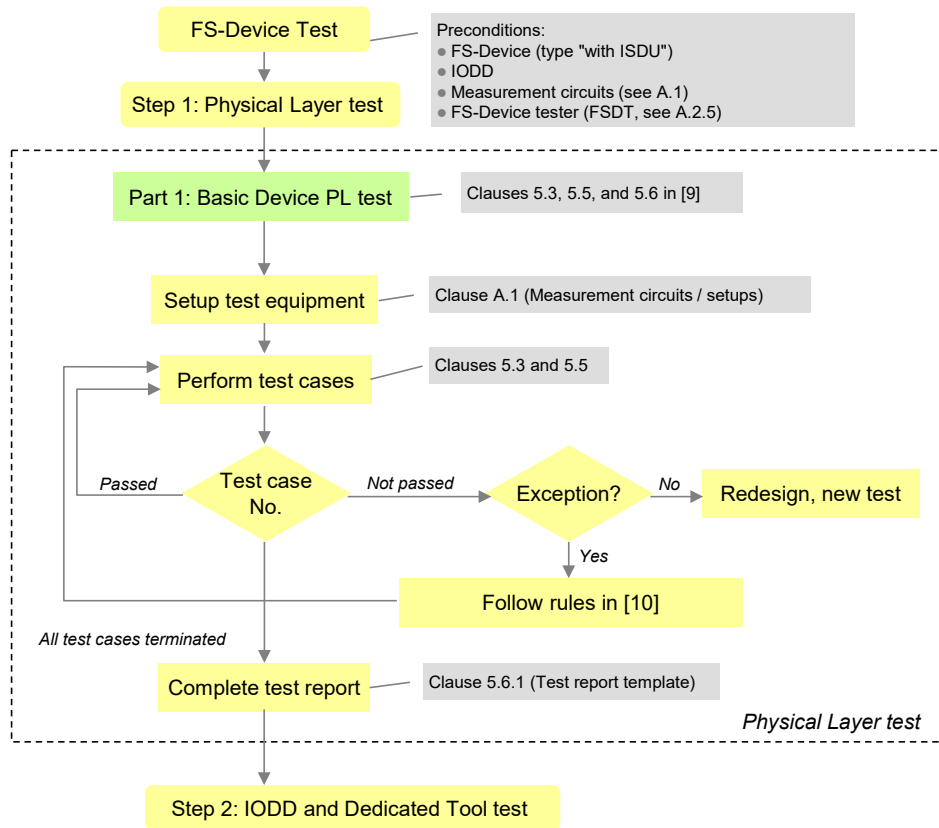
435 Figure 3 shows the workflow for physical layer tests. They mainly comprise measurements of
436 the I/Q connection, which is necessary for OSSDe.

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

439 **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

440



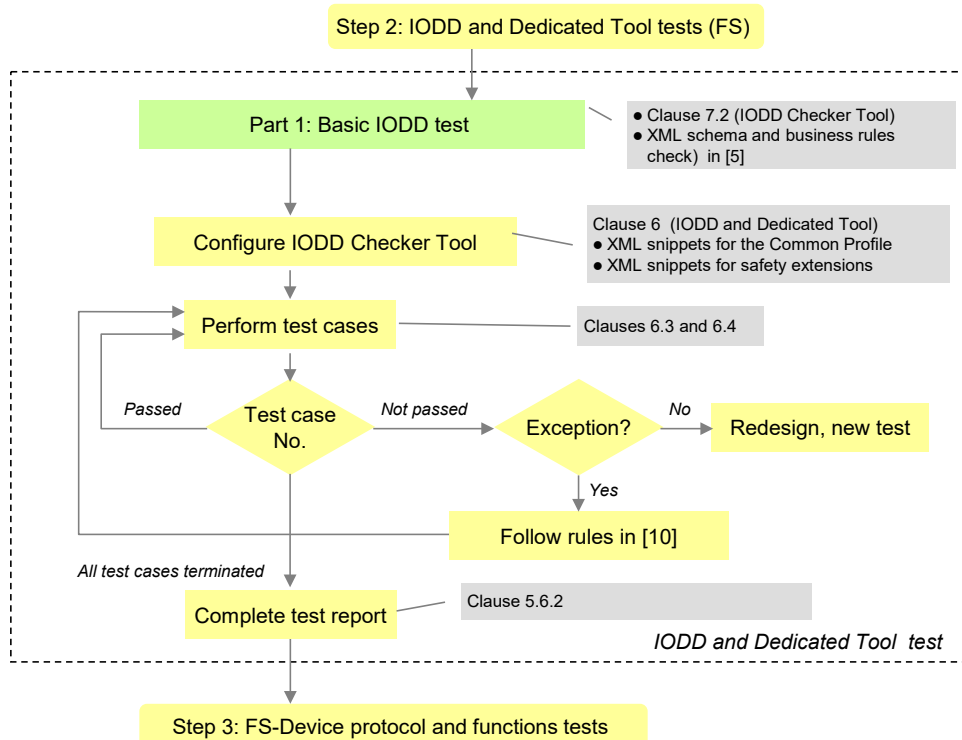
441

442

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

443 4.4.4 IODD and Dedicated Tool tests

444 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].
 445



446

447

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

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

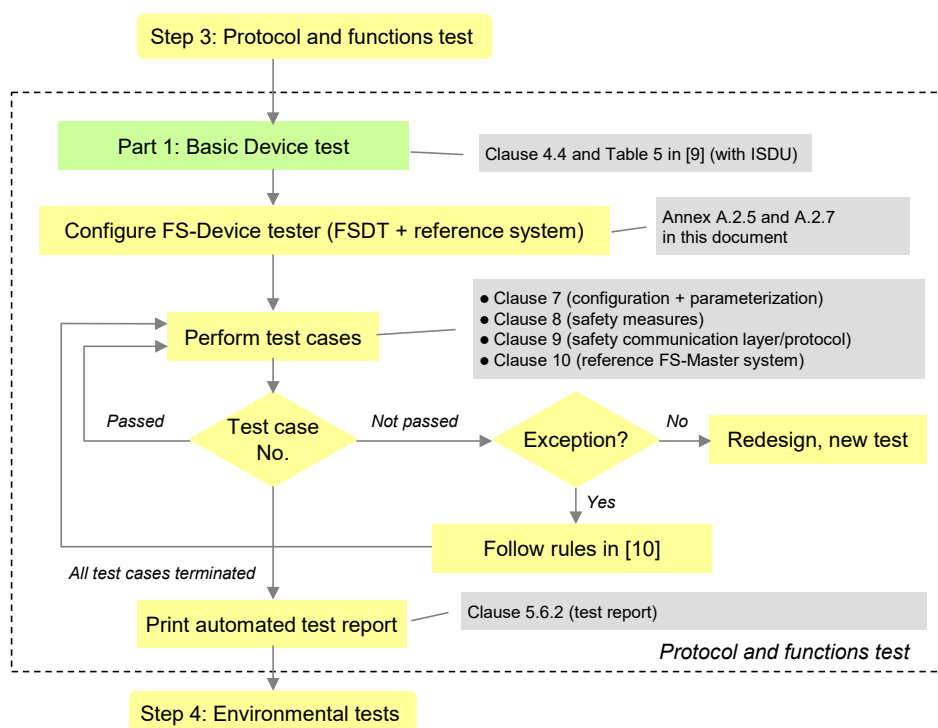
450 **Table 8 – IODD and Dedicated Tool of FS-Device**

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

451

452 **4.4.5 FS-Device protocol and functions tests**

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



455

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

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

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

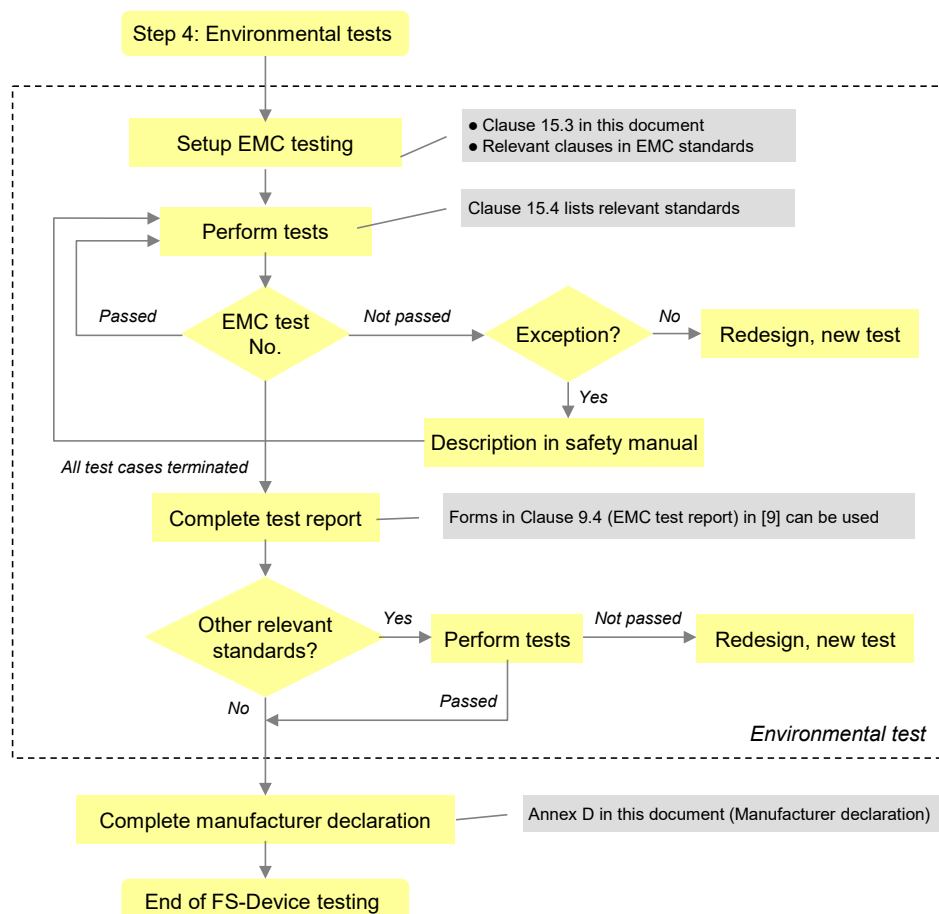
Major feature	Test cases	Remarks
STARTUP	See 6.2 in [9]	-
PREOPERATE	See 6.3 in [9]	-
OPERATE	See 6.4 in [9]	For SDCI_TC_0312 and SDCI_TC_0313 see Table 6
ISDU	See 6.5 in [9]	-
Events	See 6.6 in [9]	For SDCI_TC_0072 see Table 6
Data Storage	See 6.7 in [9]	-
Direct Parameter page 1	See 6.9 in [9]	-

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

461

462 **4.4.6 Environment**

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



467

468

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

469 **4.5 Test of FS-Masters**

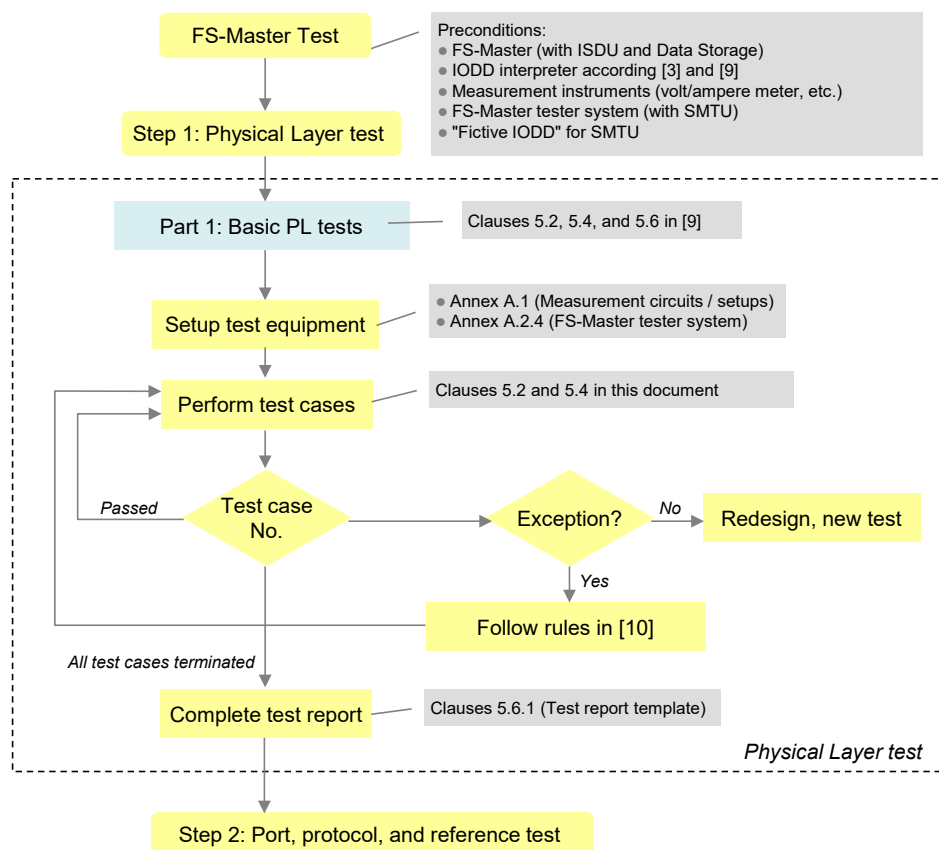
470 **4.5.1 General**

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

474 **4.5.2 Physical Layer tests**

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

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



480

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

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

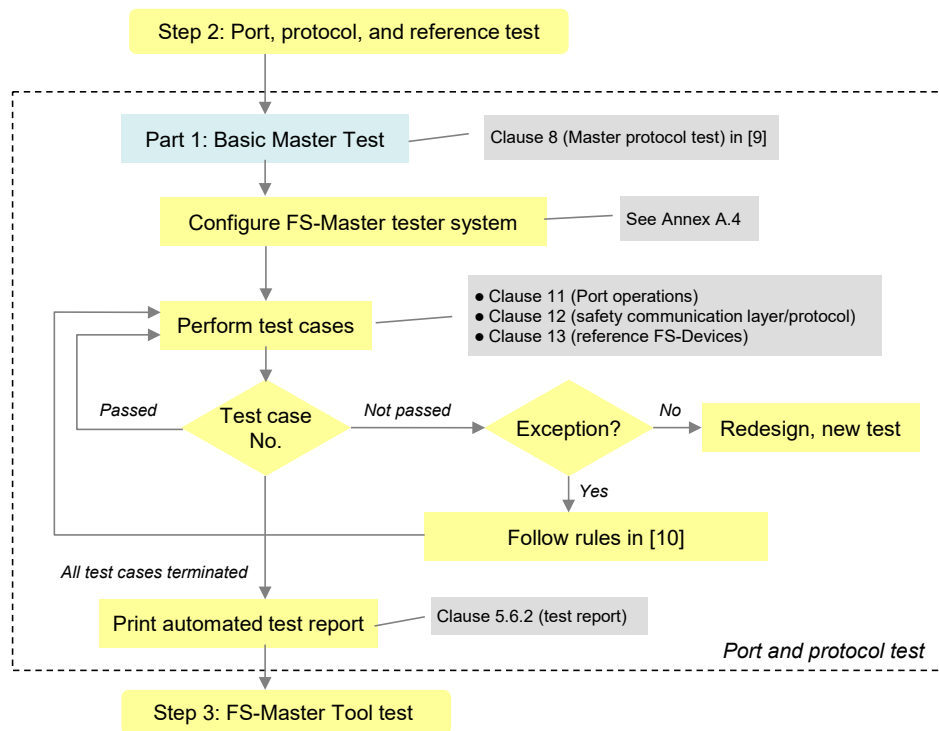
484 **Table 10 – Physical layer tests**

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

485

486 **4.5.3 Port operations, protocol, and reference tests**

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



488

489

Figure 8 – Step 2 of the FS-Master test sequence (Protocol)490 Table 11 lists the FS-Master Port operations and protocol tests. It contains the non-safety test
491 cases in its first part and the safety-specific test cases within its second part.

492

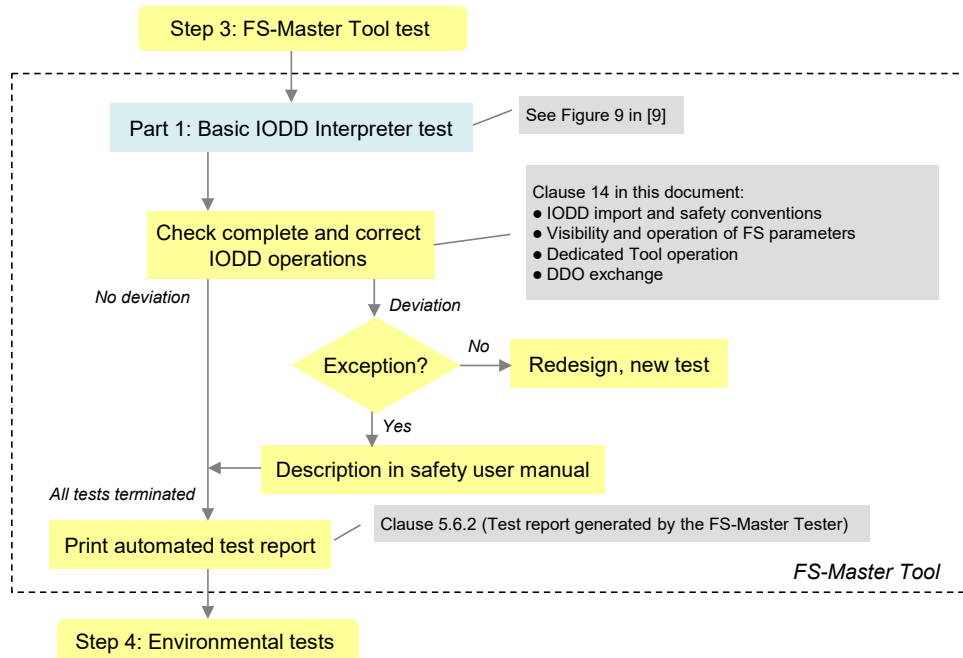
Table 11 – FS-Master protocol tests

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	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

493

494 **4.5.4 FS-Master Tool**

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

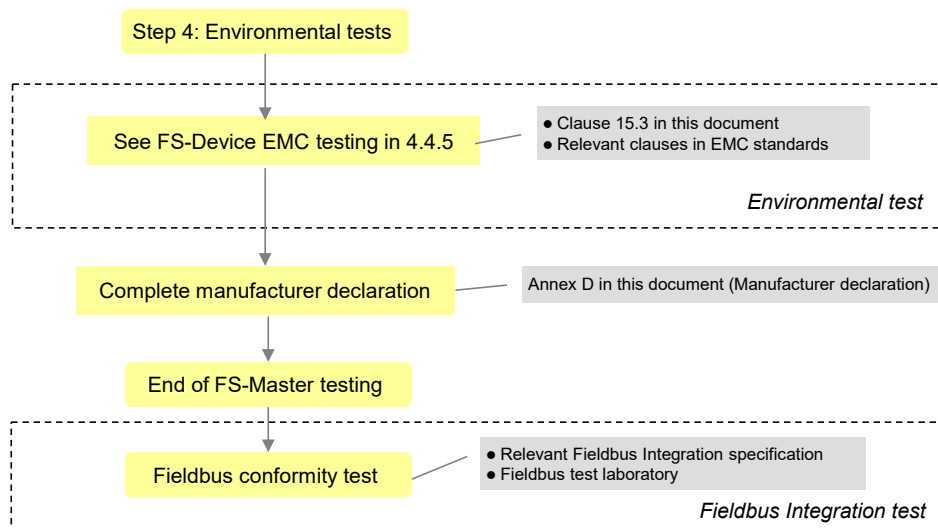


499

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

501 **4.5.5 Environment**

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



506

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

508

509 **5 Physical Layer (PL) tests**

510 **5.1 General**

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

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

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

521 **5.2 Static characteristics of the FS-Master interface (FS-DI)**522 **5.2.1 Power1 switchable OFF/ON**

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

524 **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, 10.3.2, Figure 9, [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 <i>;see field "Test parameter"</i> b) Select first PSM and ISM value <i>;see field "Test parameter"</i> c) Apply PSM value to Master <i>;see field "Test parameter"</i> d) Adjust current sink to ISM value <i>;see field "Test parameter"</i> 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} <i>;according to user manual</i> ISM = {ISMmax, 0 mA} <i>;ISMmax according to user manual</i>
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 <i>;1 V is reasonable practical value</i> Minimum value of VSM ≥ 20 V in ON state
Test failed	Maximum value of VSM > 1 V in OFF state, or <i>;1 V is reasonable practical value</i> Minimum value of VSM < 20 V in ON state
Report	Maximum VSM (ON state): <value> <ok nok> Minimum VSM (OFF state): <value> <ok nok>

527

528 **5.2.2 High-level input threshold voltage at I/Q**

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

530 **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
Test case version	1.0
Category / type	FS-Master PL test, test to pass
Specification (clause)	[4], 5.3.2.2, Table 5; [2], 11.2.17, 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_PDIn 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>

533

534 **5.2.3 Low-level input threshold voltage at I/Q**

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

536 **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
Test case version	1.0
Category / type	FS-Master PL test, test to pass
Specification (clause)	[4], 5.3.2.2, Table 5; [2], 11.2.17, 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_PDIn 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>

539

540 **5.2.4 Input hysteresis voltage at I/Q**

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

542 **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
Test case version	1.0
Category / type	FS-Master PL test, test to pass
Specification (clause)	[4], 5.3.2.2, Table 5
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>

545

546 **5.2.5 Load current at I/Q**

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

548 **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
Test case version	1.0
Category / type	FS-Master PL test, test to pass
Specification (clause)	[4], 5.3.2.3, Table 6
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>

551

552 **5.3 Static characteristics of the FS-Device interface**553 **5.3.1 General**

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

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

557 **5.3.2 High-side residual voltage at FS-Device OSSD2**

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

560 **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
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>

563

564 **5.3.3 Low-side residual voltage at FS-Device OSSD2**565 Table 18 defines the test conditions for this test case. It is only applicable for Devices with
566 OSSD.567 **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
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 ; <i>Test parameter</i> 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>

570

571 **5.4 Dynamic characteristics of the FS-Master interface**572 **5.4.1 FS-DI and OSSD sensor with and without READY pulse**

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

574 **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>	

577

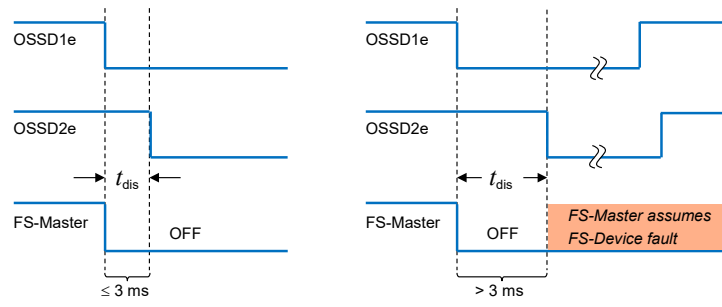
578 **5.4.2 FS-DI and discrepancy evaluation**

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

580 **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 5.4, Table 7
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 = 4 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 = {0 ms, 2,5 ms, 4 ms}
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Argblock "FSPDInOut.SPDUIn0" 2) Check ArgBlock "PortEvent"
Test passed	Expected "Low" or "High" without Port Event, and <i>;tdis = 0 ms</i> Expected "Low" or "High" without Port Event, and <i>;tdis = 2,5 ms</i> Expected "Low" with Port Event 0x20F0 <i>;tdis = 4 ms</i>
Test failed (examples)	Any incorrect detection(s) during evaluation
Report	"Low" detected: <yes/no> <i><ok nok></i> "Low" detected: <yes/no> <i><ok nok></i> Correct Port Event detected: <yes/no> <i><ok nok></i>

583



584

585

Figure 11 – Discrepancy behavior

586 **5.4.3 Test pulse resilience**

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

588 **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, 5.4, Table 7
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_FSPDUIn service d) Evaluation 1) e) Repeat from b) with next value of tc
Test parameter	<p style="text-align: right;"><i>;Test parameter</i> <i>;at OSSD signal "high"</i> <i>;returns ArgBlock</i> <i>"FSPDUIn"</i></p> <p style="text-align: right;"><i>;Test parameter</i></p>
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check Argblock "FSPDUIn.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>

591

592 **5.4.4 READY pulse detection**

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

594 **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 <i>;Test parameter</i> b) Perform SMTU_Ready_Wait(t2R, tRP) <i>;see A.4.7</i> c) Power ON cycle of FS-Device d) TM_AWAIT (t2R) <i>;before and beyond Ready pulse</i> e) Read SR Process Data via SMI_FSPDInOut service <i>;returns ArgBlock "FSPDInOut"</i> 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}, <i>;optional: value from IODD instead of default = 5 s</i> 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 <i>;t2R = 5 s</i> Safety communication did not start (timeout) <i>;t2R = (5+1) s</i>
Test failed (examples)	Safety communication did not start, and/or <i>;t2R = 5 s</i> Safety communication started <i>;t2R = (5+1) s</i>
Report	Safety communication: <yes/no> <ok nok>

597

598 **5.4.5 Wake-up delay after Ready pulse**

599 Table 22 defines the test conditions for this test case

600 **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>

603

604 **5.5 Dynamic characteristics of the FS-Device interface**605 **5.5.1 Equivalent switching and discrepancy time**

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

607 **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)	

610

611 **5.5.2 Test pulse duration**

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

613 **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 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 T_{i1max} 2) Check duration of test pulse and memorize maximum value T_{i2max}
Test passed	$T_{i1max} \leq 1 \text{ ms}$, and $T_{i2max} \leq 1 \text{ ms}$
Test failed (examples)	$T_{i1max} > 1 \text{ ms}$, or $T_{i2max} > 1 \text{ ms}$
Report	Maximum duration of test pulses at OSSDe1: <value> <ok nok> Maximum duration of test pulses at OSSDe2: <value> <ok nok>

616

617 **5.5.3 Ready pulse duration**

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

619 **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 tRP between rising and falling edge of Ready pulse on OSSDe1 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 tRP @ PSD = 18 V and 30 V
Test passed	For both supply voltages: 500 µs ≤ tRP ≤ 1000 µs
Test failed (examples)	Any of the values of tRP < 500 µs or > 1000 µs
Report	tRP @ 18V: <value> tRP @ 30V: <value>
	<ok nok> <ok nok>

622

623 **5.5.4 End of Ready pulse to OSSD**

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

625 **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 ≥ 700 μs
Test failed (examples)	tRO < 700 μs
Report	tRO: <value> <ok nok>

628

629 **5.6 Test report templates**630 **5.6.1 Template for the test report of PL tests**

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

632 **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>		

633

634 **5.6.2 Test report summaries of automated test cases**635 Templates are defined by the particular tester equipments. The complete test reports shall
636 present at least the information of the report fields of the test cases.

637 **6 IODD and Dedicated Tool tests**

638 **6.1 Overview**

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

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

647 IODD test cases are specified in 6.3.

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

652 Dedicated Tool test cases are specified in 10.2.

653

654 **6.2 Requirements for the IODD Checker (expanded schema test for safety)**

655 **6.2.1 Basic requirements and business rules for FS-Devices**

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

658 **6.2.2 XML snippets for the Common Profile**

659 The XML snippets for the Common Profile are contained in its .zip file downloadable from the
660 website indicated in Annex C. The name of the corresponding draft XML file is *IODD-*
661 *CommonProfile_Snippets_V0.99.000.xml*.

662 **6.2.3 XML snippets for safety extensions**

663 The XML snippets for safety extensions are specified in [4] and contained in an extra file named
664 *IODD-SafetyProfile_Snippets0.90.xml*. Both can be downloaded in a .zip file from the website
665 indicated in Annex C.

666 **6.3 IODD test via Checker Tool (conformity and CRC signatures)**

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

668 **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 extended test on Common Profile parameters using the file " <i>IODD-CommonProfile_Snippets_V1.1.0.xml</i> " d) Evaluation 2) e) Perform extended test on Safety parameters using the file " <i>IODD-SafetyProfile-Snippets1.1.3.xml</i> " f) Evaluation 3) g) Perform extended 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
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>

671

672 **6.4 Availability of the Dedicated Tool**

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

674 **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>

677

678

679 **7 FS-Device configuration and parameterization tests**680 **7.1 Overview**

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

685 **7.2 FS-Device meta data**686 **7.2.1 Manuals and safety assessment certificate**

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

688 **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
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>

691

692 **7.2.2 Connector and cable information**

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

694 **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>

697

698 **7.2.3 FS-Device default behavior**

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

700 **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>

703

704 **7.3 FSP parameter range limits and invalid values**705 **7.3.1 Invalid value of parameter "FSP_Port"**

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

707 **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 0x8030, 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>

710

711 **7.3.2 Invalid value of signature "FSP_AuthentCRC"**

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

713 **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 0x8030, 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>

716

717 **7.3.3 Invalid value of parameter "FSP_ProtVersion"**

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

719 **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>

722

723 **7.3.4 Invalid value of parameter "FSP_ProtMode"**

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

725 **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 <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) g) Write FSP protocol parameter record (0x4201), e.g. via SMI_DeviceWrite <i>;see field test parameter with D)</i> 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), <i>;see values at the end of field</i> FSP_Watchdog = defaultValue in IODD, FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC <i>;values for case A), B), C) or D)</i> 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>

728

729 **7.3.5 Invalid range of parameter "FSP_Watchdog"**

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

731 **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 ;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)
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), ;see values at the end of field FSP_IOStructCRC = defaultValue in IODD, FSP_TechParCRC = 0, FSP_ProtParCRC = valid CRC ;values for case A), B), C) or D) A) FSP_Watchdog = 0 B) FSP_Watchdog = lowerValue in IODD - 1 C) FSP_Watchdog = upperValue in IODD + 1 ;only if upperValue in IODD < 65535
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): 0x8030 (out of range) 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>

734

735 **7.3.6 Invalid value of signature "FSP_ProtParCRC"**

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

737 **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 pass
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 0x8030, 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>

740

741 **7.4 FST parameterization**742 **7.4.1 Default FST parameter (for OSSDe operation)**

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

744 **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>

747

748 **7.4.2 IODD versus FST parameters in FS-Device**

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

750 **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>

753

754 **7.4.3 TechParCRC via Dedicated Tool**

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

756 **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	1.0
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_TechParCR ;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) 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	–
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>

759

760 **7.4.4 Switch to OSSDe operation after parameterization**

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

762 **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>

765

766 **7.5 Setup operational modes (Annex G)**767 **7.5.1 Setup "commissioning test"**

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

769 **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 described in Annex G
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 (FSDT)
TEST CASE	CONDITIONS / PERFORMANCE
Purpose (detailed)	Setup "commissioning test" as described in Annex G
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>

772

773 **7.5.2 Setup "armed"**

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

775 **Table 45 – Setup "armed"**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0034
Name	FSTCD_CONF_SETUPARMED
Purpose (short)	Setup "armed" as described in Annex G
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)	Setup "armed" as described in Annex G
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>

778

779 **8 FS-Device safety measure tests**780 **8.1 Overview**

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

785 **8.2 Verification (VerifyRecord)**786 **8.2.1 Correct VerifyRecord and FSP_TechParCRC ("armed")**

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

790 **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 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 <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 change
Test passed	No <timeout>
Test failed (examples)	<timeout>
Report	SPDU exchange: <negative/positive> <ok nok>

793

794 **8.2.2 Correct VerifyRecord and FSP_TechParCRC ("commissioning")**

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

798 **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>

801

802 **8.2.3 Missing VerifyRecord at start-up ("armed")**

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

806 **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-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 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>

809

810 **8.2.4 Missing VerifyRecord at start-up ("commissioning")**

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

814 **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-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 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>

817

818 **8.2.5 Incorrect FSP_TechParCRC ("commissioning")**

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

822 **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-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 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>

825

826

827 **8.2.6 Incorrect FSP_TechParCRC ("armed")**

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

831 **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-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 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>

834

835

836 **8.2.7 Unexpected authenticity 1 ("armed")**

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

841 **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-pass
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>

844

845

846 **8.2.8 Unexpected authenticity 2 ("armed")**

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

851 **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-pass
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>

854

855 **8.2.9 Unexpected Port ("armed")**

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

860 **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-pass
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>

863

864 **8.2.10 Incorrect authenticity CRC signature ("armed")**

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

868 **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-pass
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>

871

872 **8.2.11 Incorrect protocol parameter CRC signature ("armed")**

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

876 **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-pass
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>

879

880 **8.2.12 Incorrect technology parameter CRC signature ("armed")**

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

884 **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-pass
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>

887

888 **8.2.13 Incorrect IO structure CRC signature ("armed")**

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

892 **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-pass
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>

895

896 **8.2.14 Invalid watchdog time ("armed")**

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

900 **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-pass
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>

903

904 **8.2.15 Invalid protocol version ("armed")**

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

908 **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-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 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 <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 + 1, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = defaultValue in IODD, <i>;responsibility of tester</i> 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
Test passed	Port state is "OPERATE"
Test failed (examples)	Any check incorrect
Report	Port state OPERATE: <negative/positive> <ok nok>

911

912 **8.2.16 Invalid protocol mode ("armed")**

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

916 **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-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 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 <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 + 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>

919

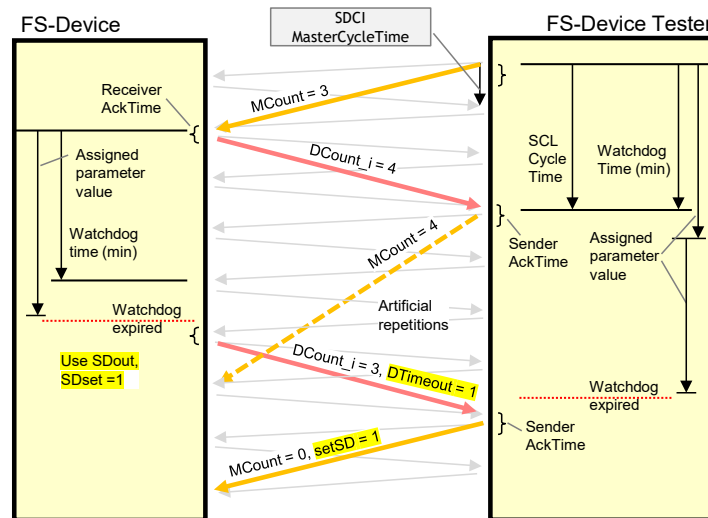
920 **8.3 Special SCL tests**

921 **8.3.1 Principle of FS-Device watchdog timer test**

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

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

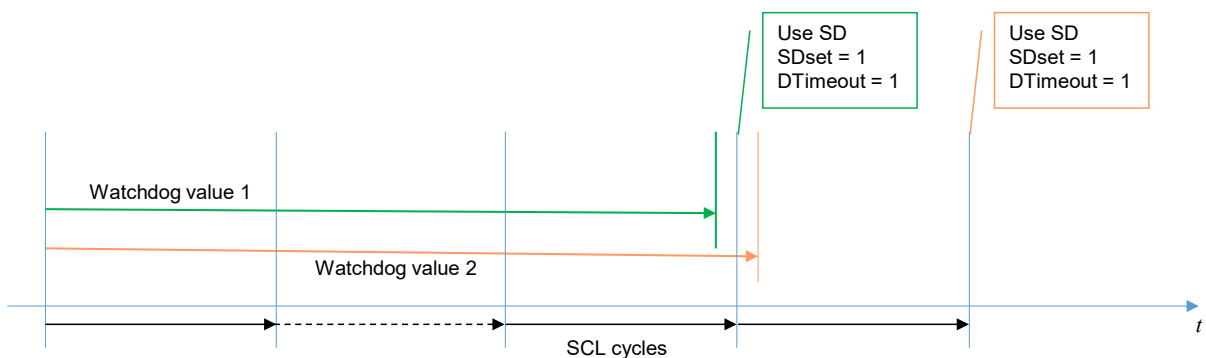
928



929

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

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



934

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

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

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

940 **8.3.2 FS-Device watchdog timer test**941 Table 62 defines the test conditions for this test case. The base protocol watchdog function of
942 the SCL is tested in 9.2.943 **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	1.0
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.
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) Line monitor to measure timeouts for 1 min (Status Bit0 = 0, DTimeout) c) Evaluation 1) d) Reduce FSP_Watchdog value by 10 % and set PortConfig again e) Line monitor to measure timeouts for 1 min (Status Bit0 = 0, DTimeout) f) 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 timeouts (default) 2) Check timeouts (- 10 %)
Test passed	No timeouts occurred, and Timeouts can occur
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

946

947 **8.3.3 Watchdog retrigger and CRC exception (0 →1)**

948 8.3.1 defines the conditions for this test case. Some critical safety features cannot be tested by
949 IO-Link on-board equipment and shall be assessed during the development process via
950 verification and validation activities according to appropriate clauses in IEC 61508-3 as also
951 mentioned in 13.6.1.

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

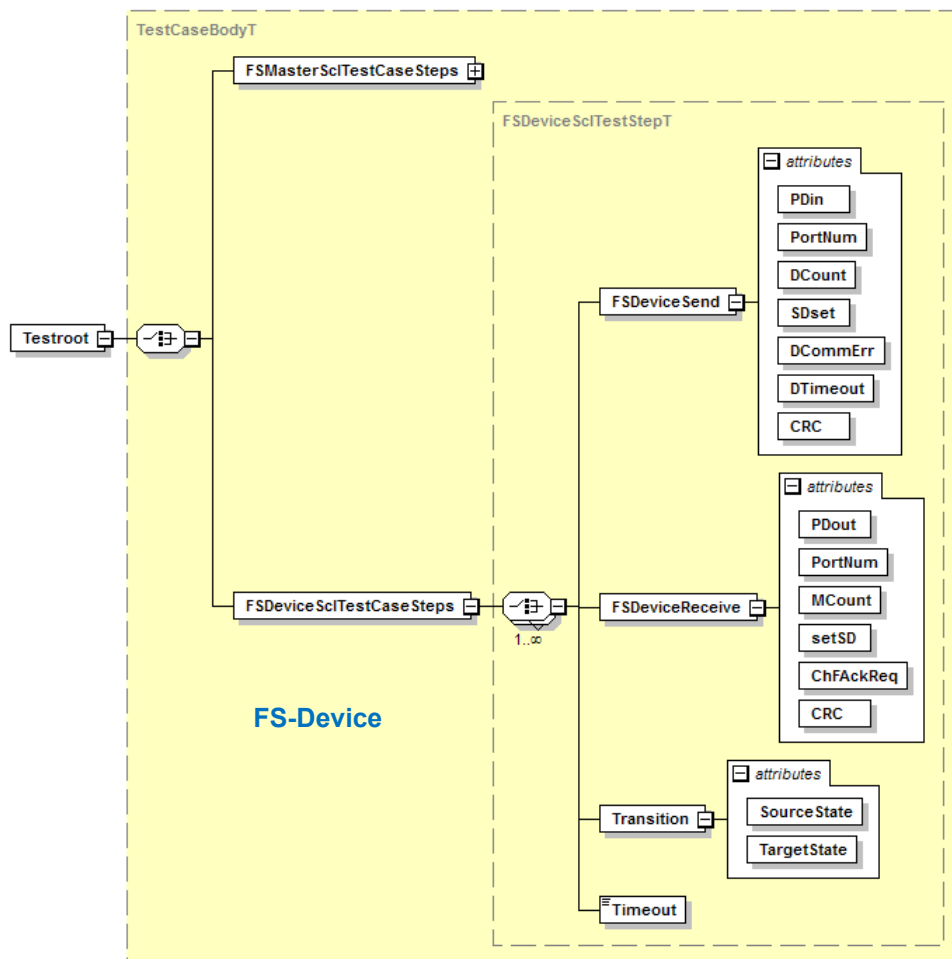
954 **9 FS-Device safety communication layer tests**

955 **9.1 Interface for the FS-Device SCL test scripts**

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

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

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



966

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

968 Table 63 defines the FS-Device interface parameters.

969 **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

970

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

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

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

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

982 **9.2 FS-Device SCL test suite**983 **9.2.1 Test script 1**

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

986 **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 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_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>

987

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

```

991 <?xml version="1.0" encoding="UTF-8"?>
992 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
993 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_1" date="20.11.2018: 14:01:13.942">
994   <FSDeviceSclTestCaseSteps>
995     <Transition SourceState="Init" TargetState="SystemStart_20"/>
996     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
997     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
998     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
999     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1000     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1001     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1002     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1003     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1004     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1005     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1006     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1007     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1008     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1009     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1010     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1011     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1012     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
1013     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1014     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1015     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1016     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1017     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
1018     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>

```

```
1019 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
1020 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1021 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1022 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="1" ChFAckReq="0" CRC="valid"/>
1023 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1024 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1025 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1026 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1027 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1028 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1029 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1030 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1031 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1032 </FSDeviceSciTestCaseSteps>
1033 </Testroot>
1034
1035
```

1036 **9.2.2 Test script 2**

1037 Table 65 defines the test conditions for this test case. The associated XML file contains steps
1038 and message parameters for the state flow check in case of a setSD error and MCount = 0.

1039 **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>

1042

1043 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_2.xml":

```

1044 <?xml version="1.0" encoding="UTF-8"?>
1045 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1046 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_2" date="20.11.2018: 14:01:13.942">
1047 <FSDeviceSciTestCaseSteps>
1048 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1049 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1050 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1051 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1052 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1053 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1054 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1055 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1056 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1057 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1058 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1059 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1060 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1061 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1062 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1063 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1064 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1065 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1066 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1067 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1068 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1069 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1070 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
1071 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1072 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1073 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```



```
1074 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1075 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
1076 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1077 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1078 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1079 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1080 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1081 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1082 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1083 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1084 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1085 </FSDeviceSciTestCaseSteps>
1086 </Testroot>
1087
```

1088 **9.2.3 Test script 3**

1089 Table 66 defines the test conditions for this test case. The associated XML file contains steps
1090 and message parameters for the state flow check in case of no error, MCount = 5, and Timeout.

1091 **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>

1094

1095 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_3.xml":

```

1096 <?xml version="1.0" encoding="UTF-8"?>
1097 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1098 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_3" date="20.11.2018: 14:01:13.942">
1099   <FSDeviceSciTestCaseSteps>
1100     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1101     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1102     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
1103     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1104     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1105     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1106     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1107     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
1108     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1109     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1110     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1111     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1112     <Timeout/>
1113     <Transition SourceState="WaitOnSPDU_26" TargetState="PrepareResponse_25"/>
1114     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1115     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1116     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
1117     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1118     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1119     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1120     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="0" DTimeout="1" CRC="valid"/>
1121     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1122     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1123     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1124     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1125     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>

```

```
1126 </FSDeviceSciTestCaseSteps>
1127 </Testroot>
1128
1129
```

1130 **9.2.4 Test script 4**

1131 Table 67 defines the test conditions for this test case. The associated XML file contains steps
 1132 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1133 **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>

1136

1137 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_4.xml":

```

1138 <?xml version="1.0" encoding="UTF-8"?>
1139 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1140 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_4" date="20.11.2018: 14:01:13.942">
1141   <FSDeviceSciTestCaseSteps>
1142     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1143     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1144     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1145     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1146     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1147     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1148     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1149     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1150     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1151     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1152     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1153     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1154     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1155     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1156     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1157     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1158     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1159     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1160     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1161     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1162     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1163     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1164     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1165     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1166     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1167     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>

```

```
1168     <FSDeviceSend PDIn="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1169     </FSDeviceSclTestCaseSteps>
1170 </Testroot>
1171
1172
```

1173 **9.2.5 Test script 5**

1174 Table 68 defines the test conditions for this test case. The associated XML file contains steps
1175 and message parameters for the state flow check in case of a setSD error and MCount = 0.

1176 **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>

1179

1180 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_5.xml":

```

1181 <?xml version="1.0" encoding="UTF-8"?>
1182 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1183 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_5" date="20.11.2018: 14:01:13.943">
1184   <FSDeviceSclTestCaseSteps>
1185     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1186     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1187     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1188     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1189     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1190     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1191     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1192     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="invalid"/>
1193     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1194     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1195     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1196     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1197     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1198     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1199     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1200     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1201   </FSDeviceSclTestCaseSteps>
1202 </Testroot>
1203

```

1204 **9.2.6 Test script 6**

1205 Table 69 defines the test conditions for this test case. The associated XML file contains steps
 1206 and message parameters for the state flow check in case of a setSD error, MCount = 2, and
 1207 Timeout.

1208 **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>

1211

1212 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_6.xml":

```

1213 <?xml version="1.0" encoding="UTF-8"?>
1214 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1215 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_6" date="20.11.2018: 14:01:13.943">
1216 <FSDeviceSclTestCaseSteps>
1217 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1218 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1219 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChAckReq="0" CRC="valid"/>
1220 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1221 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1222 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1223 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1224 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"/>
1225 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1226 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1227 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1228 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1229 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChAckReq="0" CRC="valid"/>
1230 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1231 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1232 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1233 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1234 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChAckReq="0" CRC="valid"/>
1235 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1236 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1237 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1238 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1239 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChAckReq="0" CRC="valid"/>
1240 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>

```

```
1241 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
1242 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1243 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1244 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="1" ChFAckReq="0" CRC="valid"/>
1245 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1246 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1247 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1248 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1249 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
1250 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1251 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1252 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1253 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1254 </FSDeviceSciTestCaseSteps>
1255 </Testroot>
1256
```


1257 **9.2.7 Test script 7**

1258 Table 70 defines the test conditions for this test case. The associated XML file contains steps
 1259 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1260 **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>

1263

1264 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_7.xml":

```

1265 <?xml version="1.0" encoding="UTF-8"?>
1266 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1267 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_7" date="20.11.2018: 14:01:13.943">
1268   <FSDeviceSclTestCaseSteps>
1269     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1270     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1271     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1272     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1273     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1274     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1275     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1276     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1277     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1278     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1279     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1280     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1281     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
1282     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1283     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1284     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1285     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1286   </FSDeviceSclTestCaseSteps>
1287 </Testroot>
1288

```

1289

1290 **9.2.8 Test script 8**

1291 Table 71 defines the test conditions for this test case. The associated XML file contains steps
 1292 and message parameters for the state flow check in case of no error, MCount = 7, and Timeout.

1293 **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>

1296

1297 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_8.xml":

```

1298 <?xml version="1.0" encoding="UTF-8"?>
1299 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1300 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_8" date="20.11.2018: 14:01:13.943">
1301 <FSDeviceSclTestCaseSteps>
1302 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1303 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1304 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
1305 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1306 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1307 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1308 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1309 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1310 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1311 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1312 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1313 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1314 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
1315 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1316 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1317 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1318 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1319 </FSDeviceSclTestCaseSteps>
1320 </Testroot>
1321

```

1322

1323

1324 **9.2.9 Test script 9**

1325 Table 72 defines the test conditions for this test case. The associated XML file contains steps
 1326 and message parameters for the state flow check in case of a CRC error and MCount = 0, and
 1327 Timeout.

1328 **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>

1331

1332 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_9.xml":

```

1333 <?xml version="1.0" encoding="UTF-8"?>
1334 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1335 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_9" date="20.11.2018: 14:01:13.943">
1336 <FSDeviceSclTestCaseSteps>
1337 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1338 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1339 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1340 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1341 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1342 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1343 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1344 <Timeout/>
1345 <Transition SourceState="WaitOnSPDU_26" TargetState="PrepareResponse_25"/>
1346 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1347 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1348 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
1349 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1350 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1351 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1352 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1353 </FSDeviceSclTestCaseSteps>
1354 </Testroot>
1355

```

1356

1357 **9.2.10 Test script 10**

1358 Table 73 defines the test conditions for this test case. The associated XML file contains steps
 1359 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1360 Timeout.

1361 **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>

1364

1365 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_10.xml":

```

1366 <?xml version="1.0" encoding="UTF-8"?>
1367 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1368 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_10" date="20.11.2018: 14:01:13.943">
1369   <FSDeviceSclTestCaseSteps>
1370     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1371     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1372     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1373     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1374     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1375     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1376     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1377     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1378     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1379     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1380     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1381     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1382     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1383     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1384     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1385     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1386     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1387     <Timeout/>
1388     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1389     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1390     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="1" CRC="valid"/>
1391     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
1392     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1393     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>

```

```
1394     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1395     <FSDeviceSend PDIn="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1396     </FSDeviceSciTestCaseSteps>
1397 </Testroot>
1398
```

1399 **9.2.11 Test script 11**

1400 Table 74 defines the test conditions for this test case. The associated XML file contains steps
1401 and message parameters for the state flow check in case of a setSD error and MCount = 0.

1402 **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>

1405

1406 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_11.xml":

```

1407 <?xml version="1.0" encoding="UTF-8"?>
1408 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1409 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_11" date="20.11.2018: 14:01:13.944">
1410 <FSDeviceSciTestCaseSteps>
1411 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1412 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1413 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1414 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1415 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1416 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1417 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1418 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1419 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1420 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1421 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1422 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1423 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1424 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1425 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1426 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1427 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1428 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1429 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1430 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1431 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1432 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1433 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1434 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1435 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1436 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
1437 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1438 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1439 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1440 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1441 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1442 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1443 </FSDeviceSciTestCaseSteps>
1444 </Testroot>
1445
1446
```

1447 **9.2.12 Test script 12**

1448 Table 75 defines the test conditions for this test case. The associated XML file contains steps
 1449 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1450 DCommErr.

1451 **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>

1454

1455 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_12.xml":

```

1456 <?xml version="1.0" encoding="UTF-8"?>
1457 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1458 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_12" date="20.11.2018: 14:01:13.944">
1459   <FSDeviceSclTestCaseSteps>
1460     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1461     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1462     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1463     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1464     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1465     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1466     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1467     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
1468     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1469     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1470     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1471     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1472     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1473     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1474     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1475     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1476   </FSDeviceSclTestCaseSteps>
1477 </Testroot>
1478

```

1479

1480 **9.2.13 Test script 13**

1481 Table 76 defines the test conditions for this test case. The associated XML file contains steps
 1482 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1483 DCommErr.

1484 **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>

1487

1488 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_13.xml":

```

1489 <?xml version="1.0" encoding="UTF-8"?>
1490 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1491 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_13" date="20.11.2018: 14:01:13.944">
1492 <FSDeviceSclTestCaseSteps>
1493 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1494 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1495 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1496 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1497 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1498 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1499 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1500 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
1501 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1502 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1503 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1504 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1505 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1506 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1507 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1508 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1509 </FSDeviceSclTestCaseSteps>
1510 </Testroot>
1511

```

1512 **9.2.14 Test script 14**

1513 Table 77 defines the test conditions for this test case. The associated XML file contains steps
 1514 and message parameters for the state flow check in case of no error, MCount = 2, and
 1515 DCommErr.

1516 **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>

1519

1520 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_14.xml":

```

1521 <?xml version="1.0" encoding="UTF-8"?>
1522 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1523 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_14" date="20.11.2018: 14:01:13.944">
1524 <FSDeviceSclTestCaseSteps>
1525 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1526 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1527 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1528 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1529 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1530 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1531 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1532 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1533 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1534 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1535 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1536 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1537 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1538 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1539 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1540 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1541 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1542 </FSDeviceSclTestCaseSteps>
1543 </Testroot>
1544

```

1545

1546 **9.2.15 Test script 15**

1547 Table 78 defines the test conditions for this test case. The associated XML file contains steps
 1548 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1549 DCommErr.

1550 **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>

1553

1554 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_15.xml":

```

1555 <?xml version="1.0" encoding="UTF-8"?>
1556 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1557 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_15" date="20.11.2018: 14:01:13.944">
1558 <FSDeviceSclTestCaseSteps>
1559 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1560 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1561 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"/>
1562 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1563 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1564 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1565 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1566 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChAckReq="0" CRC="valid"/>
1567 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1568 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1569 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1570 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1571 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChAckReq="0" CRC="valid"/>
1572 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1573 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1574 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1575 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1576 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"/>
1577 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1578 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1579 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1580 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1581 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChAckReq="0" CRC="valid"/>
1582 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
1583     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1584     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1585     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1586     </FSDeviceSclTestCaseSteps>
1587 </Testroot>
1588
```

1589 **9.2.16 Test script 16**

1590 Table 79 defines the test conditions for this test case. The associated XML file contains steps
 1591 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1592 DCommErr.

1593 **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>

1596

1597 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_16.xml":

```

1598 <?xml version="1.0" encoding="UTF-8"?>
1599 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1600 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_16" date="20.11.2018: 14:01:13.944">
1601 <FSDeviceSclTestCaseSteps>
1602 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1603 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1604 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"/>
1605 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1606 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1607 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1608 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1609 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChAckReq="0" CRC="valid"/>
1610 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1611 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1612 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1613 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1614 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChAckReq="0" CRC="valid"/>
1615 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1616 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1617 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1618 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1619 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"/>
1620 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1621 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1622 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1623 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1624 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChAckReq="0" CRC="valid"/>
1625 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
1626 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1627 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1628 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
1629 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1630 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
1631 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1632 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1633 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1634 </FSDeviceSciTestCaseSteps>
1635 </Testroot>
```

1636 **9.2.17 Test script 17**

1637 Table 80 defines the test conditions for this test case. The associated XML file contains steps
 1638 and message parameters for the state flow check in case of a PortNum error and MCount = 0.

1639 **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>

1642

1643 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_17.xml":

```

1644 <?xml version="1.0" encoding="UTF-8"?>
1645 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1646 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_17" date="20.11.2018: 14:01:13.944">
1647   <FSDeviceSclTestCaseSteps>
1648     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1649     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1650     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="0" setSD="0" ChAckReq="0" CRC="valid"/>
1651     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1652     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1653     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1654     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1655   </FSDeviceSclTestCaseSteps>
1656 </Testroot>
1657

```

1658

1659 **9.2.18 Test script 18**

1660 Table 81 defines the test conditions for this test case. The associated XML file contains steps
 1661 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

1662 **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>

1665

1666 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_18.xml":

```

1667 <?xml version="1.0" encoding="UTF-8"?>
1668 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1669 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_18" date="20.11.2018: 14:01:13.944">
1670   <FSDeviceSclTestCaseSteps>
1671     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1672     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1673     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1674     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1675     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1676     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1677     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1678     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1679     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1680     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1681     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1682     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1683   </FSDeviceSclTestCaseSteps>
1684 </Testroot>
1685
1686

```


1687 **9.2.19 Test script 19**

1688 Table 82 defines the test conditions for this test case. The associated XML file contains steps
 1689 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1690 DCommErr.

1691 **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>

1694

1695 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_19.xml":

```

1696 <?xml version="1.0" encoding="UTF-8"?>
1697 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1698 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_19" date="20.11.2018: 14:01:13.944">
1699   <FSDeviceSclTestCaseSteps>
1700     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1701     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1702     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1703     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1704     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1705     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1706     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1707     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
1708     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1709     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1710     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1711     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
1712     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1713     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1714     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1715     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1716   </FSDeviceSclTestCaseSteps>
1717 </Testroot>
1718

```

1719 **9.2.20 Test script 20**

1720 Table 83 defines the test conditions for this test case. The associated XML file contains steps
 1721 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1722 DCommErr.

1723 **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>

1726

1727 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_20.xml":

```

1728 <?xml version="1.0" encoding="UTF-8"?>
1729 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1730 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_20" date="20.11.2018: 14:01:13.944">
1731   <FSDeviceSclTestCaseSteps>
1732     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1733     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1734     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1735     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1736     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1737     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1738     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1739     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="invalid"/>
1740     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1741     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1742     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1743     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1744     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1745     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1746     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1747     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1748   </FSDeviceSclTestCaseSteps>
1749 </Testroot>
1750

```

1751 **9.2.21 Test script 21**

1752 Table 84 defines the test conditions for this test case. The associated XML file contains steps
 1753 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1754 DCommErr.

1755 **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>

1758

1759 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_21.xml":

```

1760 <?xml version="1.0" encoding="UTF-8"?>
1761 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1762 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_21" date="20.11.2018: 14:01:13.944">
1763   <FSDeviceSclTestCaseSteps>
1764     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1765     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1766     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1767     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1768     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1769     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1770     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1771     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="invalid"/>
1772     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1773     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1774     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1775     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
1776     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1777     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1778     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1779     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1780   </FSDeviceSclTestCaseSteps>
1781 </Testroot>
1782

```

1783

1784 **9.2.22 Test script 22**

1785 Table 85 defines the test conditions for this test case. The associated XML file contains steps
 1786 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 1787 DCommErr.

1788 **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>

1791

1792 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_22.xml":

```

1793 <?xml version="1.0" encoding="UTF-8"?>
1794 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1795 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_22" date="20.11.2018: 14:01:13.945">
1796   <FSDeviceSclTestCaseSteps>
1797     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1798     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1799     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
1800     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1801     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
1802     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
1803     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
1804     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
1805     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
1806     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1807     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1808     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
1809     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1810     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1811     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1812     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1813   </FSDeviceSclTestCaseSteps>
1814 </Testroot>
1815
1816

```

1817 **9.2.23 Test script 23**

1818 Table 86 defines the test conditions for this test case. The associated XML file contains steps
 1819 and message parameters for the state flow check in case of a setSD error, MCount = 1, and
 1820 DCommErr.

1821 **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>

1824

1825 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_23.xml":

```

1826 <?xml version="1.0" encoding="UTF-8"?>
1827 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1828 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_23" date="20.11.2018: 14:01:13.945">
1829   <FSDeviceSclTestCaseSteps>
1830     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1831     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1832     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1833     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1834     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1835     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1836     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1837     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1838     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1839     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1840     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1841     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1842     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1843     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
1844   </FSDeviceSclTestCaseSteps>
1845 </Testroot>
1846

```

1847 **9.2.24 Test script 24**

1848 Table 87 defines the test conditions for this test case. The associated XML file contains steps
 1849 and message parameters for the state flow check in case of a setSD error, MCount = 1, and
 1850 DCommErr.

1851 **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>

1854

1855 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_24.xml":

```

1856 <?xml version="1.0" encoding="UTF-8"?>
1857 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1858 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_24" date="20.11.2018: 14:01:13.945">
1859 <FSDeviceSclTestCaseSteps>
1860 <Transition SourceState="Init" TargetState="SystemStart_20"/>
1861 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1862 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1863 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1864 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1865 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1866 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1867 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1868 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1869 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1870 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1871 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1872 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1873 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1874 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1875 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1876 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1877 </FSDeviceSclTestCaseSteps>
1878 </Testroot>
1879

```

1880

1881 **9.2.25 Test script 25**

1882 Table 88 defines the test conditions for this test case. The associated XML file contains steps
1883 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1884 **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>

1887

1888 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_25.xml":

```

1889 <?xml version="1.0" encoding="UTF-8"?>
1890 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1891 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_25" date="20.11.2018: 14:01:13.945">
1892   <FSDeviceSclTestCaseSteps>
1893     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1894     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1895     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1896     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1897     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1898     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1899     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1900     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1901     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1902     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1903     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1904     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1905     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1906     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
1907   </FSDeviceSclTestCaseSteps>
1908 </Testroot>
1909

```

1910

1911 **9.2.26 Test script 26**

1912 Table 89 defines the test conditions for this test case. The associated XML file contains steps
 1913 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1914 **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>

1917

1918 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_26.xml":

```

1919 <?xml version="1.0" encoding="UTF-8"?>
1920 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1921 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_26" date="20.11.2018: 14:01:13.945">
1922   <FSDeviceSclTestCaseSteps>
1923     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1924     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1925     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1926     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1927     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1928     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1929     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1930     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1931     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1932     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1933     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1934     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1935     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
1936     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1937     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1938     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1939     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1940   </FSDeviceSclTestCaseSteps>
1941 </Testroot>

```

1942

1943

1944 **9.2.27 Test script 27**

1945 Table 90 defines the test conditions for this test case. The associated XML file contains steps
1946 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

1947 **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>

1950

1951 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_27.xml":

```

1952 <?xml version="1.0" encoding="UTF-8"?>
1953 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1954 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_27" date="20.11.2018: 14:01:13.945">
1955   <FSDeviceSclTestCaseSteps>
1956     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1957     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1958     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
1959     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1960     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1961     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1962     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1963     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1964     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1965     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1966     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1967     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1968     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1969     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1970     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1971     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1972     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
1973   </FSDeviceSclTestCaseSteps>
1974 </Testroot>

```

1975

1976

1977 **9.2.28 Test script 28**

1978 Table 91 defines the test conditions for this test case. The associated XML file contains steps
 1979 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

1980 **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>

1983

1984 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_28.xml":

```

1985 <?xml version="1.0" encoding="UTF-8"?>
1986 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
1987 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_28" date="20.11.2018: 14:01:13.945">
1988   <FSDeviceSciTestCaseSteps>
1989     <Transition SourceState="Init" TargetState="SystemStart_20"/>
1990     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
1991     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
1992     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
1993     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
1994     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
1995     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
1996     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
1997     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
1998     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
1999     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2000     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2001     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2002     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2003   </FSDeviceSciTestCaseSteps>
2004 </Testroot>
2005

```

2006

2007 **9.2.29 Test script 29**

2008 Table 92 defines the test conditions for this test case. The associated XML file contains steps
 2009 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

2010 **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>

2013

2014 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_29.xml":

```

2015 <?xml version="1.0" encoding="UTF-8"?>
2016 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2017 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_29" date="20.11.2018: 14:01:13.945">
2018 <FSDeviceSclTestCaseSteps>
2019 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2020 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2021 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2022 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2023 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2024 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2025 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2026 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2027 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2028 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2029 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2030 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2031 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2032 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2033 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2034 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2035 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2036 </FSDeviceSclTestCaseSteps>
2037 </Testroot>
2038

```

2039

2040 **9.2.30 Test script 30**

2041 Table 92 defines the test conditions for this test case. The associated XML file contains steps
2042 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

2043 **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>

2046

2047 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_30.xml":

```

2048 <?xml version="1.0" encoding="UTF-8"?>
2049 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2050 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_30" date="20.11.2018: 14:01:13.945">
2051   <FSDeviceSclTestCaseSteps>
2052     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2053     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2054     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2055     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2056     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2057     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2058     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2059     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2060     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2061     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2062     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2063     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2064     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2065     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2066     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2067     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2068     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2069   </FSDeviceSclTestCaseSteps>
2070 </Testroot>
2071

```

2072

2073 **9.2.31 Test script 31**

2074 Table 94 defines the test conditions for this test case. The associated XML file contains steps
2075 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2076 **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>

2079

2080 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_31.xml":

```

2081 <?xml version="1.0" encoding="UTF-8"?>
2082 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2083 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_31" date="20.11.2018: 14:01:13.945">
2084   <FSDeviceSclTestCaseSteps>
2085     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2086     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2087     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2088     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2089     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2090     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2091     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2092     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2093     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2094     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2095     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2096     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2097     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2098     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2099   </FSDeviceSclTestCaseSteps>
2100 </Testroot>
2101

```

2102

2103 **9.2.32 Test script 32**

2104 Table 95 defines the test conditions for this test case. The associated XML file contains steps
2105 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2106 **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>

2109

2110 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_32.xml":

```

2111 <?xml version="1.0" encoding="UTF-8"?>
2112 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2113 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_32" date="20.11.2018: 14:01:13.945">
2114 <FSDeviceSclTestCaseSteps>
2115 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2116 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2117 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2118 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2119 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2120 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2121 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2122 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2123 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2124 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2125 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2126 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2127 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2128 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2129 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2130 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2131 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2132 </FSDeviceSclTestCaseSteps>
2133 </Testroot>
2134

```

2135

2136 **9.2.33 Test script 33**

2137 Table 96 defines the test conditions for this test case. The associated XML file contains steps
2138 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2139 **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>

2142

2143 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_33.xml":

```

2144 <?xml version="1.0" encoding="UTF-8"?>
2145 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2146 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_33" date="20.11.2018: 14:01:13.945">
2147   <FSDeviceSclTestCaseSteps>
2148     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2149     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2150     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2151     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2152     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2153     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2154     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2155     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2156     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2157     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2158     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2159     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2160     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2161     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2162     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2163     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2164     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2165   </FSDeviceSclTestCaseSteps>
2166 </Testroot>
2167

```

2168 **9.2.34 Test script 34**

2169 Table 97 defines the test conditions for this test case. The associated XML file contains steps
2170 and message parameters for the state flow check in case of no error, MCount = 4, and Timeout.

2171 **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>

2174

2175 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_34.xml":

```

2176 <?xml version="1.0" encoding="UTF-8"?>
2177 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2178 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_34" date="20.11.2018: 14:01:13.945">
2179   <FSDeviceSciTestCaseSteps>
2180     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2181     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2182     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2183     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2184     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2185     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2186     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2187     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2188     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2189     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2190     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2191     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2192     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2193     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2194   </FSDeviceSciTestCaseSteps>
2195 </Testroot>
2196

```


2197 **9.2.35 Test script 35**

2198 Table 98 defines the test conditions for this test case. The associated XML file contains steps
 2199 and message parameters for the state flow check in case of no error, MCount = 4, and Timeout.

2200 **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>

2203

2204 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_35.xml":

```

2205 <?xml version="1.0" encoding="UTF-8"?>
2206 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2207 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_35" date="20.11.2018: 14:01:13.946">
2208   <FSDeviceSclTestCaseSteps>
2209     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2210     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2211     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2212     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2213     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2214     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2215     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2216     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2217     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2218     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2219     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2220     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2221     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2222     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2223     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2224     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2225     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2226   </FSDeviceSclTestCaseSteps>
2227 </Testroot>
2228

```

2229 **9.2.36 Test script 36**

2230 Table 99 defines the test conditions for this test case. The associated XML file contains steps
2231 and message parameters for the state flow check in case of no error, MCount = 4, and Timeout.

2232 **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>

2235

2236 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_36.xml":

```

2237 <?xml version="1.0" encoding="UTF-8"?>
2238 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2239 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_36" date="20.11.2018: 14:01:13.946">
2240   <FSDeviceSclTestCaseSteps>
2241     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2242     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2243     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2244     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2245     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2246     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2247     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2248     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2249     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2250     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2251     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2252     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2253     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2254     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2255     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2256     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2257     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2258   </FSDeviceSclTestCaseSteps>
2259 </Testroot>
2260

```

2261 **9.2.37 Test script 37**

2262 Table 100 defines the test conditions for this test case. The associated XML file contains steps
2263 and message parameters for the state flow check in case of no error, MCount = 5, and Timeout.

2264 **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>

2267

2268 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_37.xml":

```

2269 <?xml version="1.0" encoding="UTF-8"?>
2270 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2271 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_37" date="20.11.2018: 14:01:13.946">
2272   <FSDeviceSciTestCaseSteps>
2273     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2274     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2275     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2276     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2277     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2278     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2279     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2280     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2281     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2282     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2283     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2284     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2285     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2286     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2287   </FSDeviceSciTestCaseSteps>
2288 </Testroot>
2289

```

2290 **9.2.38 Test script 38**

2291 Table 101 defines the test conditions for this test case. The associated XML file contains steps
2292 and message parameters for the state flow check in case of no error, MCount = 5, and Timeout.

2293 **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>

2296

2297 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_38.xml":

```

2298 <?xml version="1.0" encoding="UTF-8"?>
2299 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2300 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_38" date="20.11.2018: 14:01:13.946">
2301   <FSDeviceSclTestCaseSteps>
2302     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2303     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2304     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2305     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2306     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2307     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2308     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2309     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2310     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2311     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2312     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2313     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2314     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2315     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2316     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2317     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2318     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2319   </FSDeviceSclTestCaseSteps>
2320 </Testroot>
2321

```

2322 **9.2.39 Test script 39**

2323 Table 102 defines the test conditions for this test case. The associated XML file contains steps
2324 and message parameters for the state flow check in case of no error, MCount = 5, and Timeout.

2325 **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>

2328

2329 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_39.xml":

```

2330 <?xml version="1.0" encoding="UTF-8"?>
2331 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2332 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_39" date="20.11.2018: 14:01:13.946">
2333 <FSDeviceSclTestCaseSteps>
2334 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2335 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2336 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2337 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2338 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2339 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2340 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2341 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2342 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2343 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2344 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2345 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2346 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2347 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2348 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2349 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2350 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2351 </FSDeviceSclTestCaseSteps>
2352 </Testroot>
2353

```

2354

2355 **9.2.40 Test script 40**

2356 Table 103 defines the test conditions for this test case. The associated XML file contains steps
 2357 and message parameters for the state flow check in case of no error, MCount = 6, and Timeout.

2358 **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>

2361

2362 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_40.xml":

```

2363 <?xml version="1.0" encoding="UTF-8"?>
2364 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2365 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_40" date="20.11.2018: 14:01:13.946">
2366   <FSDeviceSciTestCaseSteps>
2367     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2368     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2369     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2370     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2371     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2372     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2373     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2374     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2375     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2376     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2377     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2378     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2379     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2380     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2381   </FSDeviceSciTestCaseSteps>
2382 </Testroot>
2383

```

2384 **9.2.41 Test script 41**

2385 Table 104 defines the test conditions for this test case. The associated XML file contains steps
2386 and message parameters for the state flow check in case of no error, MCount = 6, and Timeout.

2387 **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>

2390

2391 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_41.xml":

```

2392 <?xml version="1.0" encoding="UTF-8"?>
2393 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2394 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_41" date="20.11.2018: 14:01:13.946">
2395   <FSDeviceSclTestCaseSteps>
2396     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2397     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2398     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2399     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2400     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2401     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2402     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2403     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2404     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2405     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2406     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2407     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2408     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2409     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2410     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2411     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2412     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2413   </FSDeviceSclTestCaseSteps>
2414 </Testroot>
2415

```

2416 **9.2.42 Test script 42**

2417 Table 105 defines the test conditions for this test case. The associated XML file contains steps
 2418 and message parameters for the state flow check in case of no error, MCount = 7, and Timeout.

2419 **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>

2422

2423 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_42.xml":

```

2424 <?xml version="1.0" encoding="UTF-8"?>
2425 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2426 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_42" date="20.11.2018: 14:01:13.946">
2427   <FSDeviceSciTestCaseSteps>
2428     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2429     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2430     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2431     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2432     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2433     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2434     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2435     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2436     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2437     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2438     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2439     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2440     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2441     <Transition SourceState="WaitOnSPDU_26" TargetState="WaitOnSPDU_26"/>
2442   </FSDeviceSciTestCaseSteps>
2443 </Testroot>
2444

```


2445 **9.2.43 Test script 43**

2446 Table 106 defines the test conditions for this test case. The associated XML file contains steps
2447 and message parameters for the state flow check in case of no error, MCount = 7, and Timeout.

2448 **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>

2451

2452 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_43.xml":

```

2453 <?xml version="1.0" encoding="UTF-8"?>
2454 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2455 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_43" date="20.11.2018: 14:01:13.946">
2456 <FSDeviceSclTestCaseSteps>
2457 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2458 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2459 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2460 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2461 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2462 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2463 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2464 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2465 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2466 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2467 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2468 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2469 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
2470 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2471 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2472 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2473 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2474 </FSDeviceSclTestCaseSteps>
2475 </Testroot>
2476

```

2477 **9.2.44 Test script 44**

2478 Table 107 defines the test conditions for this test case. The associated XML file contains steps
2479 and message parameters for the state flow check in case of no error, MCount = 7, and Timeout.

2480 **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>

2483

2484 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_44.xml":

```

2485 <?xml version="1.0" encoding="UTF-8"?>
2486 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2487 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_44" date="20.11.2018: 14:01:13.946">
2488   <FSDeviceSclTestCaseSteps>
2489     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2490     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2491     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2492     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2493     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2494     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2495     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2496     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2497     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2498     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2499     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2500     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2501     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2502     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2503     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2504     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2505     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2506   </FSDeviceSclTestCaseSteps>
2507 </Testroot>
2508

```

2509 **9.2.45 Test script 45**

2510 Table 108 defines the test conditions for this test case. The associated XML file contains steps
 2511 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 2512 DCommErr.

2513 **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>

2516

2517 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_45.xml":

```

2518 <?xml version="1.0" encoding="UTF-8"?>
2519 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2520 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_45" date="20.11.2018: 14:01:13.946">
2521 <FSDeviceSclTestCaseSteps>
2522 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2523 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2524 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2525 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2526 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2527 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2528 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2529 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="invalid"/>
2530 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2531 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2532 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2533 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2534 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2535 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2536 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2537 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2538 </FSDeviceSclTestCaseSteps>
2539 </Testroot>
2540

```

2541 **9.2.46 Test script 46**

2542 Table 109 defines the test conditions for this test case. The associated XML file contains steps
 2543 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 2544 DCommErr.

2545 **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>

2548

2549 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_46.xml":

```

2550 <?xml version="1.0" encoding="UTF-8"?>
2551 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2552 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_46" date="20.11.2018: 14:01:13.946">
2553 <FSDeviceSclTestCaseSteps>
2554 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2555 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2556 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2557 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2558 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2559 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2560 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2561 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="invalid"/>
2562 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2563 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2564 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2565 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2566 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2567 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2568 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2569 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2570 </FSDeviceSclTestCaseSteps>
2571 </Testroot>
2572

```

2573 **9.2.47 Test script 47**

2574 Table 110 defines the test conditions for this test case. The associated XML file contains steps
 2575 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 2576 DCommErr.

2577 **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>

2580

2581 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_47.xml":

```

2582 <?xml version="1.0" encoding="UTF-8"?>
2583 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2584 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_47" date="20.11.2018: 14:01:13.946">
2585   <FSDeviceSclTestCaseSteps>
2586     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2587     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2588     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2589     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2590     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2591     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2592     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2593     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="invalid"/>
2594     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2595     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2596     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2597     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2598     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2599     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2600     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2601     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2602   </FSDeviceSclTestCaseSteps>
2603 </Testroot>
2604

```

2605 **9.2.48 Test script 48**

2606 Table 111 defines the test conditions for this test case. The associated XML file contains steps
 2607 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2608 DCommErr.

2609 **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>

2612

2613 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_48.xml":

```

2614 <?xml version="1.0" encoding="UTF-8"?>
2615 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2616 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_48" date="20.11.2018: 14:01:13.947">
2617   <FSDeviceSclTestCaseSteps>
2618     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2619     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2620     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2621     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2622     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2623     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2624     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2625     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
2626     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2627     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2628     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2629     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
2630     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2631     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2632     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2633     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2634   </FSDeviceSclTestCaseSteps>
2635 </Testroot>
2636

```

2637 **9.2.49 Test script 49**

2638 Table 112 defines the test conditions for this test case. The associated XML file contains steps
 2639 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2640 DCommErr.

2641 **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>

2644

2645 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_49.xml":

```

2646 <?xml version="1.0" encoding="UTF-8"?>
2647 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2648 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_49" date="20.11.2018: 14:01:13.947">
2649   <FSDeviceSclTestCaseSteps>
2650     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2651     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2652     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2653     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2654     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2655     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2656     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2657     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
2658     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2659     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2660     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2661     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
2662     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2663     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2664     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2665     <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2666   </FSDeviceSclTestCaseSteps>
2667 </Testroot>
2668

```

2669 **9.2.50 Test script 50**

2670 Table 113 defines the test conditions for this test case. The associated XML file contains steps
2671 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

2672 **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>

2675

2676 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_50.xml":

```

2677 <?xml version="1.0" encoding="UTF-8"?>
2678 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2679 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_50" date="20.11.2018: 14:01:13.947">
2680 <FSDeviceSclTestCaseSteps>
2681 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2682 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2683 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2684 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2685 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2686 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2687 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2688 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2689 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2690 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2691 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2692 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2693 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
2694 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2695 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2696 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2697 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2698 </FSDeviceSclTestCaseSteps>
2699 </Testroot>
2700

```


2701 **9.2.51 Test script 51**

2702 Table 114 defines the test conditions for this test case. The associated XML file contains steps
 2703 and message parameters for the state flow check in case of no error, MCount = 2, and
 2704 DCommErr.

2705 **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>

2708

2709 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_51.xml":

```

2710 <?xml version="1.0" encoding="UTF-8"?>
2711 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2712 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_51" date="20.11.2018: 14:01:13.947">
2713 <FSDeviceSclTestCaseSteps>
2714 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2715 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2716 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2717 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2718 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2719 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2720 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2721 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2722 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2723 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2724 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2725 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2726 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
2727 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2728 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2729 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2730 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2731 </FSDeviceSclTestCaseSteps>
2732 </Testroot>
2733

```

2734 **9.2.52 Test script 52**

2735 Table 115 defines the test conditions for this test case. The associated XML file contains steps
2736 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2737 **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>

2740

2741 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_52.xml":

```

2742 <?xml version="1.0" encoding="UTF-8"?>
2743 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2744 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_52" date="20.11.2018: 14:01:13.947">
2745   <FSDeviceSclTestCaseSteps>
2746     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2747     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2748     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2749     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2750     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2751     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2752     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2753     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2754     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2755     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2756     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2757     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2758     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
2759     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2760     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2761     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2762     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2763   </FSDeviceSclTestCaseSteps>
2764 </Testroot>
2765

```

2766 **9.2.53 Test script 53**

2767 Table 116 defines the test conditions for this test case. The associated XML file contains steps
2768 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

2769 **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>

2772

2773 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_53.xml":

```

2774 <?xml version="1.0" encoding="UTF-8"?>
2775 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2776 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_53" date="20.11.2018: 14:01:13.947">
2777   <FSDeviceSclTestCaseSteps>
2778     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2779     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2780     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2781     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2782     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2783     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2784     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2785     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2786     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2787     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2788     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2789     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2790     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2791     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2792     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2793     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2794   </FSDeviceSclTestCaseSteps>
2795 </Testroot>
2796
2797

```

2798 **9.2.54 Test script 54**

2799 Table 117 defines the test conditions for this test case. The associated XML file contains steps
2800 and message parameters for the state flow check in case of no error, MCount = 4, and Timeout.

2801 **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>

2804

2805 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_54.xml":

```

2806 <?xml version="1.0" encoding="UTF-8"?>
2807 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2808 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_54" date="20.11.2018: 14:01:13.947">
2809   <FSDeviceSclTestCaseSteps>
2810     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2811     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2812     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
2813     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2814     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2815     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2816     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
2817     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
2818     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2819     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2820     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2821     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2822     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
2823     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
2824     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
2825     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2826     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2827   </FSDeviceSclTestCaseSteps>
2828 </Testroot>
2829

```

2830 **9.2.55 Test script 55**

2831 Table 118 defines the test conditions for this test case. The associated XML file contains steps
 2832 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2833 DCommErr.

2834 **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>

2837

2838 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_55.xml":

```

2839 <?xml version="1.0" encoding="UTF-8"?>
2840 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2841 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_55" date="20.11.2018: 14:01:13.947">
2842 <FSDeviceSclTestCaseSteps>
2843 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2844 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2845 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2846 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2847 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2848 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2849 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2850 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2851 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2852 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2853 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2854 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2855 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2856 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2857 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
2858 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2859 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2860 </FSDeviceSclTestCaseSteps>
2861 </Testroot>
2862

```

2863 **9.2.56 Test script 56**

2864 Table 119 defines the test conditions for this test case. The associated XML file contains steps
2865 and message parameters for the state flow check in case of setSD error and MCount = 0.

2866 **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>

2869

2870 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_56.xml":

```

2871 <?xml version="1.0" encoding="UTF-8"?>
2872 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2873 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_56" date="20.11.2018: 14:01:13.947">
2874   <FSDeviceSclTestCaseSteps>
2875     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2876     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2877     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2878     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2879     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2880     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2881     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2882     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2883     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2884     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2885     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2886     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2887     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2888     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2889     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2890     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2891     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2892     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2893     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
2894   </FSDeviceSclTestCaseSteps>
2895 </Testroot>
2896

```

2897 **9.2.57 Test script 57**

2898 Table 120 defines the test conditions for this test case. The associated XML file contains steps
 2899 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2900 DCommErr.

2901 **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>

2904

2905 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_57.xml":

```

2906 <?xml version="1.0" encoding="UTF-8"?>
2907 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2908 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_57" date="20.11.2018: 14:01:13.947">
2909   <FSDeviceSclTestCaseSteps>
2910     <Transition SourceState="Init" TargetState="SystemStart_20"/>
2911     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2912     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2913     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2914     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2915     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2916     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2917     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2918     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2919     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2920     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2921     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2922     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2923     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2924     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2925     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2926     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2927     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2928     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2929     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2930     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2931   </FSDeviceSclTestCaseSteps>
2932 </Testroot>
2933

```

2934 **9.2.58 Test script 58**

2935 Table 121 defines the test conditions for this test case. The associated XML file contains steps
 2936 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2937 DCommErr.

2938 **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>

2941

2942 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_58.xml":

```

2943 <?xml version="1.0" encoding="UTF-8"?>
2944 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2945 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_58" date="20.11.2018: 14:01:13.947">
2946 <FSDeviceSclTestCaseSteps>
2947 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2948 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2949 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2950 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2951 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2952 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2953 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2954 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2955 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2956 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2957 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2958 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2959 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
2960 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2961 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2962 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2963 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2964 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
2965 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
2966 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
2967 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
2968 </FSDeviceSclTestCaseSteps>
2969 </Testroot>
2970

```


2971 **9.2.59 Test script 59**

2972 Table 122 defines the test conditions for this test case. The associated XML file contains steps
 2973 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 2974 DCommErr.

2975 **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>

2978

2979 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_59.xml":

```

2980 <?xml version="1.0" encoding="UTF-8"?>
2981 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
2982 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_59" date="20.11.2018: 14:01:13.947">
2983 <FSDeviceSclTestCaseSteps>
2984 <Transition SourceState="Init" TargetState="SystemStart_20"/>
2985 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
2986 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
2987 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
2988 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2989 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2990 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2991 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
2992 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2993 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2994 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
2995 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
2996 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="0" CRC="valid"/>
2997 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
2998 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
2999 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3000 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3001 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="invalid"/>
3002 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3003 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3004 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3005 </FSDeviceSclTestCaseSteps>
3006 </Testroot>
3007

```

3008 **9.2.60 Test script 60**

3009 Table 123 defines the test conditions for this test case. The associated XML file contains steps
 3010 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3011 DCommErr.

3012 **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>

3015

3016 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_60.xml":

```

3017 <?xml version="1.0" encoding="UTF-8"?>
3018 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3019 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_60" date="20.11.2018: 14:01:13.948">
3020 <FSDeviceSclTestCaseSteps>
3021 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3022 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3023 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3024 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3025 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3026 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3027 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3028 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3029 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3030 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3031 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3032 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3033 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="0" CRC="valid"/>
3034 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3035 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3036 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3037 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3038 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="invalid"/>
3039 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3040 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3041 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3042 </FSDeviceSclTestCaseSteps>
3043 </Testroot>
3044

```

3045 **9.2.61 Test script 61**

3046 Table 124 defines the test conditions for this test case. The associated XML file contains steps
3047 and message parameters for the state flow check in case of setSD error and MCount = 0.

3048 **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>

3051

3052 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_61.xml":

```

3053 <?xml version="1.0" encoding="UTF-8"?>
3054 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3055 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_61" date="20.11.2018: 14:01:13.948">
3056 <FSDeviceSclTestCaseSteps>
3057 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3058 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3059 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3060 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3061 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3062 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3063 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3064 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3065 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3066 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3067 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3068 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3069 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3070 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3071 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3072 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3073 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3074 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3075 <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3076 </FSDeviceSclTestCaseSteps>
3077 </Testroot>
3078

```

3079 **9.2.62 Test script 62**

3080 Table 124 defines the test conditions for this test case. The associated XML file contains steps
 3081 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3082 DCommErr.

3083 **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>

3086

3087 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_62.xml":

```

3088 <?xml version="1.0" encoding="UTF-8"?>
3089 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3090 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_62" date="20.11.2018: 14:01:13.948">
3091 <FSDeviceSclTestCaseSteps>
3092 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3093 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3094 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3095 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3096 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3097 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3098 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3099 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3100 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3101 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3102 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3103 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3104 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3105 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3106 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3107 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3108 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3109 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3110 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3111 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3112 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3113 </FSDeviceSclTestCaseSteps>
3114 </Testroot>
3115

```

3116 **9.2.63 Test script 63**

3117 Table 126 defines the test conditions for this test case. The associated XML file contains steps
 3118 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3119 DCommErr.

3120 **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>

3123

3124 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_63.xml":

```

3125 <?xml version="1.0" encoding="UTF-8"?>
3126 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3127 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_63" date="20.11.2018: 14:01:13.948">
3128 <FSDeviceSciTestCaseSteps>
3129 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3130 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3131 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3132 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3133 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3134 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3135 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3136 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3137 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3138 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3139 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3140 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3141 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3142 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3143 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3144 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3145 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3146 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3147 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3148 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3149 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3150 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3151 </FSDeviceSciTestCaseSteps>
3152 </Testroot>

```

3153 **9.2.64 Test script 64**

3154 Table 127 defines the test conditions for this test case. The associated XML file contains steps
 3155 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3156 DCommErr.

3157 **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>

3160

3161 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_64.xml":

```

3162 <?xml version="1.0" encoding="UTF-8"?>
3163 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3164 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_64" date="20.11.2018: 14:01:13.948">
3165 <FSDeviceSciTestCaseSteps>
3166 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3167 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3168 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3169 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3170 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3171 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3172 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3173 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3174 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3175 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3176 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3177 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3178 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3179 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3180 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3181 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3182 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3183 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3184 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3185 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3186 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3187 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3188 </FSDeviceSciTestCaseSteps>
3189 </Testroot>

```

3190 **9.2.65 Test script 65**

3191 Table 128 defines the test conditions for this test case. The associated XML file contains steps
3192 and message parameters for the state flow check in case of setSD error and MCount = 0.

3193 **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>

3196

3197 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_65.xml":

```

3198 <?xml version="1.0" encoding="UTF-8"?>
3199 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3200 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_65" date="20.11.2018: 14:01:13.948">
3201   <FSDeviceSciTestCaseSteps>
3202     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3203     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3204     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3205     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3206     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3207     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3208     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3209     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3210     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3211     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3212     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3213     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3214     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3215     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3216     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3217     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3218     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3219     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3220     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3221     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3222     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3223     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3224     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3225     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3226   </FSDeviceSciTestCaseSteps>
3227 </Testroot>

```

3228 **9.2.66 Test script 66**

3229 Table 129 defines the test conditions for this test case. The associated XML file contains steps
3230 and message parameters for the state flow check in case of setSD error and MCount = 0.

3231 **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>

3234

3235 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_66.xml":

```

3236 <?xml version="1.0" encoding="UTF-8"?>
3237 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3238 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_66" date="20.11.2018: 14:01:13.948">
3239   <FSDeviceSciTestCaseSteps>
3240     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3241     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3242     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3243     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3244     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3245     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3246     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3247     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3248     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3249     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3250     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3251     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3252     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3253     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3254     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3255     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3256     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3257     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3258     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3259     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3260     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3261     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3262     <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3263     <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3264     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3265     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>

```



```
3266 </FSDeviceSciTestCaseSteps>  
3267 </Testroot>  
3268
```

3269 **9.2.67 Test script 67**

3270 Table 130 defines the test conditions for this test case. The associated XML file contains steps
 3271 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3272 DCommErr.

3273 **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>

3276

3277 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_67.xml":

```

3278 <?xml version="1.0" encoding="UTF-8"?>
3279 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3280 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_67" date="20.11.2018: 14:01:13.948">
3281 <FSDeviceSclTestCaseSteps>
3282 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3283 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3284 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3285 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3286 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3287 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3288 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3289 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3290 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3291 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3292 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3293 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3294 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3295 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3296 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3297 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3298 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3299 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3300 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3301 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3302 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3303 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3304 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3305 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3306     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3307     <FSDeviceSend PDIn="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3308     </FSDeviceSciTestCaseSteps>
3309 </Testroot>
3310
```

3311 **9.2.68 Test script 68**

3312 Table 131 defines the test conditions for this test case. The associated XML file contains steps
3313 and message parameters for the state flow check in case of setSD error and MCount = 0.

3314 **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>

3317

3318 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_68.xml":

```

3319 <?xml version="1.0" encoding="UTF-8"?>
3320 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3321 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_68" date="20.11.2018: 14:01:13.948">
3322   <FSDeviceSciTestCaseSteps>
3323     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3324     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3325     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3326     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3327     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3328     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3329     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3330     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3331     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3332     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3333     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3334     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3335     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3336     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3337     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3338     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3339     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3340     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3341     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3342     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3343     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3344     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3345     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3346     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3347   </FSDeviceSciTestCaseSteps>
3348 </Testroot>

```

3349 **9.2.69 Test script 69**

3350 Table 132 defines the test conditions for this test case. The associated XML file contains steps
 3351 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3352 DCommErr.

3353 **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>

3356

3357 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_69.xml":

```

3358 <?xml version="1.0" encoding="UTF-8"?>
3359 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3360 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_69" date="20.11.2018: 14:01:13.948">
3361 <FSDeviceSclTestCaseSteps>
3362 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3363 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3364 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3365 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3366 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3367 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3368 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3369 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3370 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3371 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3372 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3373 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3374 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3375 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3376 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3377 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3378 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3379 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3380 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3381 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3382 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3383 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3384 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3385 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3386     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3387     <FSDeviceSend PDIn="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3388     </FSDeviceSciTestCaseSteps>
3389 </Testroot>
3390
```

3391 **9.2.70 Test script 70**

3392 Table 133 defines the test conditions for this test case. The associated XML file contains steps
3393 and message parameters for the state flow check in case of setSD error, MCount = 0, and
3394 DCommErr.

3395 **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>

3398

3399 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_70.xml":

```

3400 <?xml version="1.0" encoding="UTF-8"?>
3401 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3402 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_70" date="20.11.2018: 14:01:13.949">
3403 <FSDeviceSclTestCaseSteps>
3404 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3405 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3406 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3407 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3408 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3409 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3410 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3411 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3412 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3413 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3414 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3415 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3416 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3417 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3418 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3419 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3420 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3421 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3422 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3423 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3424 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3425 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3426 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3427 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3428     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3429     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3430     </FSDeviceSciTestCaseSteps>
3431 </Testroot>
3432
```


3433 **9.2.71 Test script 71**

3434 Table 134 defines the test conditions for this test case. The associated XML file contains steps
 3435 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3436 DCommErr.

3437 **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>

3440

3441 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_71.xml":

```

3442 <?xml version="1.0" encoding="UTF-8"?>
3443 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3444 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_71" date="20.11.2018: 14:01:13.949">
3445 <FSDeviceSclTestCaseSteps>
3446 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3447 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3448 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3449 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3450 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3451 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3452 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3453 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3454 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3455 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3456 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3457 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3458 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3459 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3460 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3461 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3462 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3463 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3464 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3465 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3466 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3467 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3468 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
3469 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3470     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3471     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3472     </FSDeviceSciTestCaseSteps>
3473 </Testroot>
3474
```

3475 **9.2.72 Test script 72**

3476 Table 135 defines the test conditions for this test case. The associated XML file contains steps
 3477 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3478 DCommErr.

3479 **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>

3482

3483 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_72.xml":

```

3484 <?xml version="1.0" encoding="UTF-8"?>
3485 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3486 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_72" date="20.11.2018: 14:01:13.949">
3487 <FSDeviceSclTestCaseSteps>
3488 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3489 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3490 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3491 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3492 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3493 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3494 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3495 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3496 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3497 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3498 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3499 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3500 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="valid"/>
3501 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3502 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3503 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3504 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3505 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3506 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3507 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3508 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3509 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3510 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="invalid"/>
3511 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3512     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3513     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3514     </FSDeviceSciTestCaseSteps>
3515 </Testroot>
3516
```

3517 **9.2.73 Test script 73**

3518 Table 136 defines the test conditions for this test case. The associated XML file contains steps
 3519 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3520 DCommErr.

3521 **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>

3524

3525 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_73.xml":

```

3526 <?xml version="1.0" encoding="UTF-8"?>
3527 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3528 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_73" date="20.11.2018: 14:01:13.949">
3529 <FSDeviceSclTestCaseSteps>
3530 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3531 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3532 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3533 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3534 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3535 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3536 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3537 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3538 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3539 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3540 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3541 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3542 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3543 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3544 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3545 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3546 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3547 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3548 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3549 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3550 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3551 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3552 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3553 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3554     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3555     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3556     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3557     </FSDeviceSclTestCaseSteps>
3558 </Testroot>
3559
```

3560 **9.2.74 Test script 74**

3561 Table 137 defines the test conditions for this test case. The associated XML file contains steps
 3562 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3563 DCommErr.

3564 **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>

3567

3568 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_74.xml":

```

3569 <?xml version="1.0" encoding="UTF-8"?>
3570 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3571 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_73" date="20.11.2018: 14:01:13.949">
3572 <FSDeviceSclTestCaseSteps>
3573 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3574 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3575 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3576 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3577 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3578 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3579 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3580 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3581 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3582 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3583 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3584 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3585 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3586 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3587 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3588 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3589 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3590 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3591 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3592 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3593 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3594 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3595 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3596 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3597     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3598     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3599     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3600 </FSDeviceSclTestCaseSteps>
3601 </Testroot>
3602
3603
```


3604 **9.2.75 Test script 75**

3605 Table 138 defines the test conditions for this test case. The associated XML file contains steps
 3606 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3607 DCommErr.

3608 **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>

3611

3612 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_75.xml":

```

3613 <?xml version="1.0" encoding="UTF-8"?>
3614 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3615 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_75" date="20.11.2018: 14:01:13.950">
3616 <FSDeviceSclTestCaseSteps>
3617 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3618 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3619 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3620 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3621 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3622 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3623 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3624 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3625 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3626 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3627 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3628 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3629 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3630 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3631 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3632 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3633 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3634 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3635 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3636 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3637 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3638 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3639 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="invalid"/>
3640 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>

```

```
3641     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3642     <FSDeviceSend PDIn="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3643     </FSDeviceSciTestCaseSteps>
3644 </Testroot>
3645
```

```
3646
```

3647 **9.2.76 Test script 76**

3648 Table 139 defines the test conditions for this test case. The associated XML file contains steps
3649 and message parameters for the state flow check in case of setSD error and MCount = 0.

3650 **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>

3653

3654 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_76.xml":

```

3655 <?xml version="1.0" encoding="UTF-8"?>
3656 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3657 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_76" date="20.11.2018: 14:01:13.950">
3658   <FSDeviceSciTestCaseSteps>
3659     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3660     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3661     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3662     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3663     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3664     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3665     <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3666     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3667     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3668     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3669     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3670     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3671     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3672     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3673     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3674     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3675     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3676     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3677     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3678     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3679     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3680     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3681     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3682     <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3683     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3684     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
3685     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3686     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3687     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3688 </FSDeviceSclTestCaseSteps>
3689 </Testroot>
3690
```

```
3691
```

3692 **9.2.77 Test script 77**

3693 Table 140 defines the test conditions for this test case. The associated XML file contains steps
 3694 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3695 DCommErr.

3696 **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>

3699

3700 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_77.xml":

```

3701 <?xml version="1.0" encoding="UTF-8"?>
3702 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3703 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_77" date="20.11.2018: 14:01:13.950">
3704 <FSDeviceSclTestCaseSteps>
3705 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3706 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3707 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"/>
3708 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3709 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3710 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3711 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3712 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChAckReq="0" CRC="valid"/>
3713 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3714 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3715 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3716 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3717 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChAckReq="0" CRC="valid"/>
3718 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3719 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3720 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3721 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3722 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"/>
3723 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3724 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3725 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3726 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3727 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChAckReq="0" CRC="valid"/>
3728 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3729 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3730 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3731 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3732 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3733 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3734 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3735 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3736 </FSDeviceSclTestCaseSteps>
3737 </Testroot>
3738
3739
```

3740 **9.2.78 Test script 78**

3741 Table 141 defines the test conditions for this test case. The associated XML file contains steps
 3742 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3743 DCommErr.

3744 **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>

3747

3748 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_78.xml":

```

3749 <?xml version="1.0" encoding="UTF-8"?>
3750 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3751 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_78" date="20.11.2018: 14:01:13.950">
3752 <FSDeviceSclTestCaseSteps>
3753 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3754 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3755 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3756 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3757 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3758 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3759 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3760 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3761 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3762 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3763 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3764 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3765 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3766 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3767 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3768 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3769 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3770 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3771 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3772 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3773 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3774 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3775 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3776 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3777 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3778 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3779 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3780 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3781 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3782 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3783 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3784 </FSDeviceSclTestCaseSteps>
3785 </Testroot>
3786
3787
```


3788 **9.2.79 Test script 79**

3789 Table 142 defines the test conditions for this test case. The associated XML file contains steps
 3790 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3791 DCommErr.

3792 **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>

3795

3796 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_79.xml":

```

3797 <?xml version="1.0" encoding="UTF-8"?>
3798 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3799 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_79" date="20.11.2018: 14:01:13.951">
3800 <FSDeviceSclTestCaseSteps>
3801 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3802 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3803 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"/>
3804 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3805 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3806 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3807 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3808 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChAckReq="0" CRC="valid"/>
3809 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3810 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3811 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3812 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3813 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChAckReq="0" CRC="valid"/>
3814 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3815 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3816 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3817 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3818 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"/>
3819 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3820 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3821 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3822 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3823 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChAckReq="0" CRC="valid"/>
3824 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3825 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3826 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3827 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3828 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
3829 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3830 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3831 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3832 </FSDeviceSclTestCaseSteps>
3833 </Testroot>
3834
3835
```

3836 **9.2.80 Test script 80**

3837 Table 143 defines the test conditions for this test case. The associated XML file contains steps
 3838 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 3839 DCommErr.

3840 **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>

3843

3844 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_80.xml":

```

3845 <?xml version="1.0" encoding="UTF-8"?>
3846 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3847 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_80" date="20.11.2018: 14:01:13.951">
3848 <FSDeviceSclTestCaseSteps>
3849 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3850 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3851 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
3852 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3853 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3854 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3855 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3856 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3857 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3858 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3859 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3860 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3861 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3862 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3863 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3864 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3865 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3866 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3867 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
3868 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3869 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3870 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3871 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3872 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
3873 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
3874 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
3875 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3876 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="invalid"/>
3877 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3878 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3879 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3880 </FSDeviceSclTestCaseSteps>
3881 </Testroot>
3882
3883
```

3884 **9.2.81 Test script 81**

3885 Table 144 defines the test conditions for this test case. The associated XML file contains steps
3886 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

3887 **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>

3890

3891 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_81.xml":

```

3892 <?xml version="1.0" encoding="UTF-8"?>
3893 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3894 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_81" date="20.11.2018: 14:01:13.951">
3895   <FSDeviceSciTestCaseSteps>
3896     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3897     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3898     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3899     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3900     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3901     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3902     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
3903     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3904     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3905     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3906     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3907     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3908     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3909     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3910     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3911     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3912     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3913     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3914     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3915     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3916     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3917     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3918     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3919     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3920     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
3921     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
3922 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3923 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3924 <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
3925 </FSDeviceSclTestCaseSteps>
3926 </Testroot>
3927
3928
```

3929 **9.2.82 Test script 82**

3930 Table 145 defines the test conditions for this test case. The associated XML file contains steps
3931 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

3932 **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>

3935

3936 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_82.xml":

```

3937 <?xml version="1.0" encoding="UTF-8"?>
3938 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3939 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_82" date="20.11.2018: 14:01:13.951">
3940 <FSDeviceSciTestCaseSteps>
3941 <Transition SourceState="Init" TargetState="SystemStart_20"/>
3942 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3943 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3944 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3945 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3946 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3947 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
3948 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3949 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3950 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3951 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3952 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3953 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
3954 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3955 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3956 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3957 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3958 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
3959 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3960 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3961 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3962 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
3963 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
3964 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3965 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
3966 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
3967 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
3968 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3969 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
3970 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3971 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
3972 </FSDeviceSclTestCaseSteps>
3973 </Testroot>
3974
3975
```


3976 **9.2.83 Test script 83**

3977 Table 146 defines the test conditions for this test case. The associated XML file contains steps
3978 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

3979 **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>

3982

3983 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_83.xml":

```

3984 <?xml version="1.0" encoding="UTF-8"?>
3985 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
3986 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_83" date="20.11.2018: 14:01:13.952">
3987   <FSDeviceSciTestCaseSteps>
3988     <Transition SourceState="Init" TargetState="SystemStart_20"/>
3989     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
3990     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
3991     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
3992     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
3993     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3994     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
3995     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
3996     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
3997     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
3998     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
3999     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4000     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4001     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4002     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4003     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4004     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4005     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4006     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4007     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4008     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4009     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4010     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4011     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4012     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4013     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4014 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4015 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4016 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4017 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4018 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4019 </FSDeviceSclTestCaseSteps>
4020 </Testroot>
4021
4022
```

4023 **9.2.84 Test script 84**

4024 Table 147 defines the test conditions for this test case. The associated XML file contains steps
4025 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4026 **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>

4029

4030 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_84.xml":

```

4031 <?xml version="1.0" encoding="UTF-8"?>
4032 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4033 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_84" date="20.11.2018: 14:01:13.952">
4034 <FSDeviceSciTestCaseSteps>
4035 <Transition SourceState="Init" TargetState="SystemStart_20"/>
4036 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4037 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4038 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4039 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4040 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4041 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4042 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4043 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4044 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4045 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4046 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4047 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4048 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4049 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4050 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4051 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4052 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4053 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4054 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4055 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4056 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4057 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4058 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4059 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4060 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4061     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4062     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4063     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
4064 </FSDeviceSclTestCaseSteps>
4065 </Testroot>
4066
4067
```

4068 **9.2.85 Test script 85**

4069 Table 148 defines the test conditions for this test case. The associated XML file contains steps
4070 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4071 **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>

4074

4075 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_85.xml":

```

4076 <?xml version="1.0" encoding="UTF-8"?>
4077 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4078 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_85" date="20.11.2018: 14:01:13.952">
4079   <FSDeviceSciTestCaseSteps>
4080     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4081     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4082     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4083     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4084     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4085     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4086     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4087     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4088     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4089     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4090     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4091     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4092     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4093     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4094     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4095     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4096     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4097     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4098     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4099     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4100     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4101     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4102     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4103     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4104     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4105     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4106 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4107 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4108 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4109 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4110 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4111 </FSDeviceSclTestCaseSteps>
4112 </Testroot>
4113
4114
```

4115 **9.2.86 Test script 86**

4116 Table 149 defines the test conditions for this test case. The associated XML file contains steps
4117 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4118 **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>

4121

4122 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_86.xml":

```

4123 <?xml version="1.0" encoding="UTF-8"?>
4124 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4125 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_86" date="20.11.2018: 14:01:13.952">
4126   <FSDeviceSciTestCaseSteps>
4127     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4128     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4129     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4130     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4131     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4132     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4133     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4134     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4135     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4136     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4137     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4138     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4139     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4140     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4141     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4142     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4143     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4144     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4145     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4146     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4147     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4148     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4149     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4150     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4151     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4152     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4153 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4154 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4155 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4156 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4157 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4158 </FSDeviceSclTestCaseSteps>
4159 </Testroot>
4160
4161
```


4162 **9.2.87 Test script 87**

4163 Table 150 defines the test conditions for this test case. The associated XML file contains steps
4164 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

4165 **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>

4168

4169 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_87.xml":

```

4170 <?xml version="1.0" encoding="UTF-8"?>
4171 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4172 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_87" date="20.11.2018: 14:01:13.952">
4173   <FSDeviceSciTestCaseSteps>
4174     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4175     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4176     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4177     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4178     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4179     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4180     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4181     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4182     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4183     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4184     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4185     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4186     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4187     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4188     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4189     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4190     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4191     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4192     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4193     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4194     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4195     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4196     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4197     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4198     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4199     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4200     <FSDeviceSend PDIn="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4201     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4202     <Transition SourceState="WaitOnSPDU_24" TargetState="WaitOnSPDU_24"/>
4203     </FSDeviceSclTestCaseSteps>
4204 </Testroot>
4205
4206
```

4207 **9.2.88 Test script 88**

4208 Table 151 defines the test conditions for this test case. The associated XML file contains steps
4209 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

4210 **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>

4213

4214 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_88.xml":

```

4215 <?xml version="1.0" encoding="UTF-8"?>
4216 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4217 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_88" date="20.11.2018: 14:01:13.953">
4218   <FSDeviceSciTestCaseSteps>
4219     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4220     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4221     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4222     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4223     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4224     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4225     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4226     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4227     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4228     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4229     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4230     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4231     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4232     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4233     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4234     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4235     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4236     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4237     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4238     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4239     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4240     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4241     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4242     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4243     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4244     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4245 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4246 <FSDeviceReceive PDout="PD" PortNum="invalid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4247 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4248 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4249 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4250 </FSDeviceSclTestCaseSteps>
4251 </Testroot>
4252
4253
```

4254 **9.2.89 Test script 89**

4255 Table 152 defines the test conditions for this test case. The associated XML file contains steps
 4256 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 4257 DCommErr.

4258 **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>

4261

4262 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_89.xml":

```

4263 <?xml version="1.0" encoding="UTF-8"?>
4264 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4265 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_89" date="20.11.2018: 14:01:13.953">
4266 <FSDeviceSclTestCaseSteps>
4267 <Transition SourceState="Init" TargetState="SystemStart_20"/>
4268 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4269 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"/>
4270 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4271 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4272 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4273 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4274 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4275 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4276 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4277 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4278 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4279 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4280 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4281 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4282 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4283 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4284 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4285 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4286 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4287 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4288 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4289 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4290 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>

```

```
4291 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4292 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4293 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4294 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4295 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4296 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4297 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4298 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4299 </FSDeviceSciTestCaseSteps>
4300 </Testroot>
4301
4302
```

4303 **9.2.90 Test script 90**

4304 Table 153 defines the test conditions for this test case. The associated XML file contains steps
4305 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4306 **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>

4309

4310 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_90.xml":

```

4311 <?xml version="1.0" encoding="UTF-8"?>
4312 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4313 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_90" date="20.11.2018: 14:01:13.953">
4314 <FSDeviceSciTestCaseSteps>
4315 <Transition SourceState="Init" TargetState="SystemStart_20"/>
4316 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4317 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4318 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4319 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4320 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4321 <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4322 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4323 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4324 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4325 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4326 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4327 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4328 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4329 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4330 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4331 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4332 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4333 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4334 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4335 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4336 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4337 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4338 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4339 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4340 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4341 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4342 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
4343 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4344 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4345 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4346 </FSDeviceSclTestCaseSteps>
4347 </Testroot>
4348
4349
```


4350 **9.2.91 Test script 91**

4351 Table 154 defines the test conditions for this test case. The associated XML file contains steps
4352 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

4353 **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>

4356

4357 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_91.xml":

```

4358 <?xml version="1.0" encoding="UTF-8"?>
4359 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4360 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_91" date="20.11.2018: 14:01:13.954">
4361   <FSDeviceSciTestCaseSteps>
4362     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4363     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4364     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4365     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4366     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4367     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4368     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4369     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4370     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4371     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4372     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4373     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4374     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4375     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4376     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4377     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4378     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4379     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4380     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4381     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4382     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4383     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4384     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4385     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4386     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4387     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4388 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4389 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
4390 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4391 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4392 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4393 </FSDeviceSclTestCaseSteps>
4394 </Testroot>
4395
4396
```

4397 **9.2.92 Test script 92**

4398 Table 155 defines the test conditions for this test case. The associated XML file contains steps
4399 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

4400 **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>

4403

4404 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_92.xml":

```

4405 <?xml version="1.0" encoding="UTF-8"?>
4406 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4407 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_92" date="20.11.2018: 14:01:13.954">
4408   <FSDeviceSciTestCaseSteps>
4409     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4410     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4411     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4412     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4413     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4414     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4415     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4416     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4417     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4418     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4419     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4420     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4421     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4422     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4423     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4424     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4425     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4426     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4427     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4428     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4429     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4430     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4431     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4432     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4433     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4434     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4435 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4436 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="invalid"/>
4437 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4438 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4439 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4440 </FSDeviceSclTestCaseSteps>
4441 </Testroot>
4442
4443
```

4444 **9.2.93 Test script 93**

4445 Table 156 defines the test conditions for this test case. The associated XML file contains steps
4446 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

4447 **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>

4450

4451 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_93.xml":

```

4452 <?xml version="1.0" encoding="UTF-8"?>
4453 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4454 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_93" date="20.11.2018: 14:01:13.954">
4455   <FSDeviceSciTestCaseSteps>
4456     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4457     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4458     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4459     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4460     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4461     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4462     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4463     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4464     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4465     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4466     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4467     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4468     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4469     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4470     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4471     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4472     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4473     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4474     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4475     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4476     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4477     <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4478     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4479     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4480     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4481     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4482 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4483 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4484 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4485 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_23"/>
4486 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>
4487 <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4488 </FSDeviceSciTestCaseSteps>
4489 </Testroot>
4490
4491
```

4492 **9.2.94 Test script 94**

4493 Table 157 defines the test conditions for this test case. The associated XML file contains steps
4494 and message parameters for the state flow check in case of no error, MCount = 1, and Timeout.

4495 **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>

4498

4499 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_94.xml":

```

4500 <?xml version="1.0" encoding="UTF-8"?>
4501 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4502 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_94" date="20.11.2018: 14:01:13.954">
4503   <FSDeviceSciTestCaseSteps>
4504     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4505     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4506     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"/>
4507     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4508     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4509     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4510     <FSDeviceSend PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4511     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4512     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4513     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4514     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4515     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4516     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4517     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4518     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4519     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4520     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4521     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4522     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4523     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4524     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4525     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4526     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4527     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4528     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4529     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4530 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4531 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4532 <Transition SourceState="WaitOnSPDU_24" TargetState="CheckSPDU_22"/>
4533 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4534 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4535 <FSDeviceSend PDIn="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4536 </FSDeviceSciTestCaseSteps>
4537 </Testroot>
4538
4539
```


4540 **9.2.95 Test script 95**

4541 Table 158 defines the test conditions for this test case. The associated XML file contains steps
4542 and message parameters for the state flow check in case of no error, MCount = 3, and Timeout.

4543 **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>

4546

4547 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_95.xml":

```

4548 <?xml version="1.0" encoding="UTF-8"?>
4549 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4550 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_95" date="20.11.2018: 14:01:13.954">
4551 <FSDeviceSciTestCaseSteps>
4552 <Transition SourceState="Init" TargetState="SystemStart_20"/>
4553 <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4554 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4555 <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4556 <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4557 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4558 <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4559 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4560 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4561 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4562 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4563 <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4564 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4565 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4566 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4567 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4568 <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4569 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4570 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4571 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4572 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4573 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4574 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="valid"/>
4575 <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4576 <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4577 <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4578 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4579 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="0" setSD="0" ChFAckReq="0" CRC="invalid"/>
4580 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4581 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4582 <FSDeviceSend PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4583 </FSDeviceSclTestCaseSteps>
4584 </Testroot>
4585
4586
```

4587 **9.2.96 Test script 96**

4588 Table 159 defines the test conditions for this test case. The associated XML file contains steps
4589 and message parameters for the state flow check in case of no error, MCount = 2, and Timeout.

4590 **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>

4593

4594 Content of file "IO-Link-Safety_spec_device_final_testsuite_testcase_96.xml":

```

4595 <?xml version="1.0" encoding="UTF-8"?>
4596 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4597 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_96" date="20.11.2018: 14:01:13.955">
4598   <FSDeviceSciTestCaseSteps>
4599     <Transition SourceState="Init" TargetState="SystemStart_20"/>
4600     <Transition SourceState="SystemStart_20" TargetState="WaitOnSPDU_21"/>
4601     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"/>
4602     <Transition SourceState="WaitOnSPDU_21" TargetState="CheckSPDU_22"/>
4603     <Transition SourceState="CheckSPDU_22" TargetState="PrepareResponse_25"/>
4604     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4605     <FSDeviceSend PDin="PD" PortNum="valid" DCount="5" SDset="1" DCommErr="1" DTimeout="1" CRC="valid"/>
4606     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"/>
4607     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4608     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4609     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4610     <FSDeviceSend PDin="PD" PortNum="valid" DCount="4" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4611     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"/>
4612     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4613     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4614     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4615     <FSDeviceSend PDin="PD" PortNum="valid" DCount="3" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4616     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"/>
4617     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4618     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_25"/>
4619     <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4620     <FSDeviceSend PDin="PD" PortNum="valid" DCount="2" SDset="1" DCommErr="0" DTimeout="0" CRC="valid"/>
4621     <FSDeviceReceive PDout="PD" PortNum="valid" MCount="6" setSD="0" ChFAckReq="0" CRC="valid"/>
4622     <Transition SourceState="WaitOnSPDU_26" TargetState="CheckSPDU_27"/>
4623     <Transition SourceState="CheckSPDU_27" TargetState="PrepareResponse_23"/>
4624     <Transition SourceState="PrepareResponse_23" TargetState="WaitOnSPDU_24"/>

```

```
4625 <FSDeviceSend PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0" CRC="valid"/>
4626 <FSDeviceReceive PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFAckReq="0" CRC="invalid"/>
4627 <Transition SourceState="WaitOnSPDU_24" TargetState="PrepareResponse_25"/>
4628 <Transition SourceState="PrepareResponse_25" TargetState="WaitOnSPDU_26"/>
4629 <FSDeviceSend PDin="PD" PortNum="valid" DCount="0" SDset="1" DCommErr="1" DTimeout="0" CRC="valid"/>
4630 </FSDeviceSclTestCaseSteps>
4631 </Testroot>
4632
4633
```

4634 **10 FS-Device in reference system tests**

4635 **10.1 Overview and reference systems**

4636 The FS-Device in reference system tests comprise tests, where a complete (DTI) and approved
4637 FS-Master reference system including FS-Master Tool is available. Rules for reference systems
4638 are defined in A.2.7.

4639 IODD testing is specified in Clause 6 and therefore interoperability of the particular IODD of an
4640 FS-Device with the reference FS-Master system can be assumed. In case, an IODD tested with
4641 the help of the Checker Tool cannot be imported, the testing of the FS-Device shall be continued
4642 as far as possible, and in parallel, the manufacturer of the reference system shall be contacted
4643 for clarification.

4644 The availability of the Dedicated Tool has been checked in Clause 6.4. It is not necessary,

- 4645
- if an FS-Device has no parameters for its particular technology (no FST parameter), or
 - if the manufacturer of an FS-Device provides CRC signature values (TechParCRC) for any
4646 FST parameter combination (e.g. via user manual), which can be entered into the
4647 FSP_TechParCRC field of the FS-Master Tool.
- 4648

4649

4650 The FS-Device in reference system tests comprise tests of the Dedicated Tool, behavior of the
4651 FS-Device in case of correct or incorrect FSP protocol parameter, and test of Events that are
4652 not covered by other test cases anyway.

4653 **10.2 Dedicated Tool**4654 **10.2.1 Invokability via registry**

4655 Table 160 defines the test conditions for this test case.

4656 **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>

4659

4660 **10.2.2 Calculation of TechParCRC**

4661 Table 161 defines the test conditions for this test case.

4662 **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>

4665

4666 **10.2.3 DTI communication/Back Channel**

4667 Table 162 defines the test conditions for this test case. This test is optional.

4668 **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>

4671

4672 **10.2.4 DTI communication to FS-Device**

4673 Table 163 defines the test conditions for this test case. This test is optional.

4674 **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>

4677

4678 **10.3 FS-Device replacement**4679 **10.3.1 General**

4680 Preparation of FS-Device?

4681 **10.3.2 Correct FSP parameter values (Out-of-box)**

4682 Table 164 defines the test conditions for this test case.

4683 **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>

4686

4687 **10.3.3 Incorrect FSP parameter values**

4688 Table 165 defines the test conditions for this test case.

4689 **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 pass
Specification (clause)	[4],
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>

4692

4693 **10.4 Events**4694 **10.4.1 Overview**

4695 Most of the FS-Device Events are already covered within the context of other test cases. Table
4696 166 contains a list of Clauses and the concerned EventCodes.

4697 **Table 166 – List of FS-Device Events in other test cases**

Clause	EventCode	Description
7.3.1, 8.2.7, 8.2.8, 11.3.6, 13.5.2	0xB003	Unexpected authentication code
7.3.2, 8.2.10	0xB005	Incorrect FSP_AuthentCRC
7.3.5, 10.3.3, 8.2.14	0xB009	Watchdog time out of specification (e.g. "0")
7.3.6, 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

4698

4699 Remaining Events are tested in 10.4.2.

4700 **10.4.2 Events@communication**

4701 Table 167 defines the test conditions for this test case.

4702 **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>

4705

4706

4707 **11 FS-Master Port operations tests**4708 **11.1 Overview**

4709 The FS-Master Port operations test cases comprise the necessary information about the
 4710 product to test, the basic FS-Master operations such as identification, authorization, and FSCP
 4711 authenticity from an upper-level FSCP system. Other test cases deal with Port power OFF/ON,
 4712 VerifyRecord for verification, detection of misconnection, and safe FS-Device replacement.

4713 **11.2 FS-Master meta data**4714 **11.2.1 User manual and safety assessment certificate**

4715 "Highly recommended" feature exceptions.

4716 Table 168 defines the test conditions for this test case.

4717 **Table 168 – 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>

4720

4721 **11.2.2 Connector and cable information**

4722 Table 169 defines the test conditions for this test case.

4723 **Table 169 – 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>

4726

4727 **11.2.3 Default behavior (Power, OSSDe, configurations)**

4728 Table 33 defines the test conditions for this test case.

4729 **Table 170 – 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>

4732

4733 **11.3 FS-Master operations**4734 **11.3.1 Overview**

4735

4736 **11.3.2 FS-Master identification**

4737 Table 171 defines the test conditions for this test case.

4738 **Table 171 – 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)	[4], E.2
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>

4741

4742

4743 **11.3.3 FS-Master access and authenticity**

4744 Table 172 defines the test conditions for this test case.

4745 **Table 172 – 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],
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>

4748

4749 **11.3.4 Port power off/on**

4750 Table 173 defines the test conditions for this test case.

4751 **Table 173 – Port power off/on**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0160
Name	FSTCM_FSOP_PORTPOWOFFON
Purpose (short)	Check whether Power power off/on is possible
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 all three Port power off/on modes are possible with the help of SMI_PortPowerOffOn
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_PortPowerOffOn(ABPS_PORT_POWER_OFF) b) STM_WAIT_TIMEOUT c) SMTU_PowerState_Get ;returns "Power" d) Evaluation 1) e) SMI_PortPowerOffOn(ABPS_PORT_POWER_ON) f) STM_WAIT_TIMEOUT g) SMTU_PowerState_Get ;returns "Power" h) Evaluation 2) i) SMTU_PowerOffTime_Start j) SMI_PortPowerOffOn(ABPS_POWER_CYCLE<PowerOffTime=500>) k) SMTU_PowerOffTime_Get ;returns "PowerOffTime" l) Evaluation 3) m) SMTU_PowerOffTime_Start n) SMI_PortPowerOffOn(ABPS_POWER_CYCLE<PowerOffTime=65535>) o) SMTU_PowerOffTime_Get ;returns "PowerOffTime" p) Evaluation 4)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check "Power" 2) Check "Power" 3) Check "PowerOffTime" 4) Check "PowerOffTime"
Test passed	"Power" = Off, and "Power" = Off, and 490 < "PowerOffTime" < 510, and 65000 < "PowerOffTime" < 66000
Test failed (examples)	Any check incorrect
Report	Values OK: <yes/no> <ok nok>

4754

- 4755 **11.3.5 PREOPERATE – verification**
 4756 VerifyRecord available, power cycle, (no safety check)
 4757 Table 174 defines the test conditions for this test case.

4758 **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	1.0
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 VerifyRecord is sent to FS-Device
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_PortConfig (ABPS_FSCONFIG_SAFECOM) b) SMTU_PowerOffTime_Start ;measurement starts c) SMI_PortPowerOffOn(ABPS_POWER_CYCLE<PowerOffTime=1000>) d) STM_WAIT(2000) e) SMTU_VerifyRecord_Get ;returns "VerifyRecord" f) 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>

4761

4762 **11.3.6 PREOPERATE – misconnection**

4763 Authenticity check

4764 Table 175 defines the test conditions for this test case.

4765 **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	1.0
Category / type	FS-Master test, test to pass
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) SMI_PortPowerOffOn(ABPS_PORT_OFF) b) SMTU_Authent_Set(Authent1=2, CRC=???) ;change FSCP_Authenticity1 c) SMI_PortPowerOffOn(ABPS_PORT_ON) d) Wait 3 s ;self test time = 2 s e) SMI_PortStatus(ArgBlock = 0x9100) ;returns ArgBlock "FSPortStatusList" f) Evaluation 1) g) Wait on SMI_DeviceEvent ;returns ArgBlock "DeviceEvent" h) Evaluation 2)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check ArgBlock "FSPortStatusList" 2) Check ArgBlock "DeviceEvent"
Test passed	FSPortStatusList.PortStatusInfo = 4, and ;OPERATE 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>

4768

4769 **11.3.7 PREOPERATE – replacement**

4770 Table 176 defines the test conditions for this test case.

4771 **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> <i><ok nok></i>

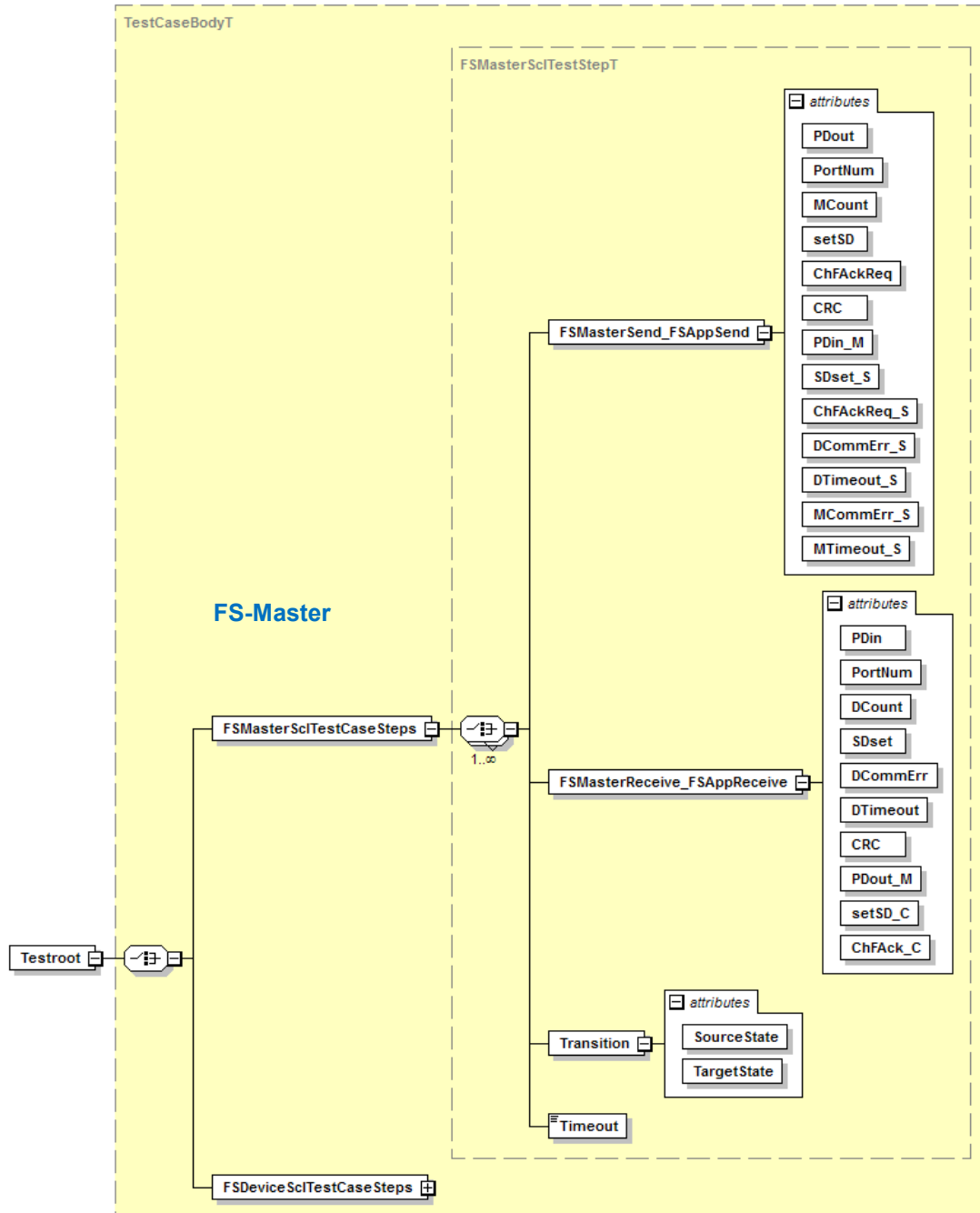
4774

4775 **12 FS-Master safety communication layer tests**

4776 **12.1 Interface for the FS-Master SCL test scripts**

4777 The test scripts for the automated safety layer tests are encoded as XML files. Each and every
 4778 test script ("FSMasterSciTestCaseSteps") consists of test step instructions as described in
 4779 Table 177. The XML Schema of the interface parameters for the FS-Master automated safety
 4780 layer test is illustrated in Figure 15.

4781 NOTE The general concept of SCL protocol conformance testing is described in A.2.3. The automated safety layer
 4782 tester for FS-Masters is described in A.2.4.



4783

4784

Figure 15 – Schema of steps and parameters/attributes

4785

Table 177 defines the FS-Master interface parameters.

4786

Table 177 – FS-Master interface parameters/attributes

Test step instruction	Parameter	Value range
FSMasterSend_FSAppSend (FS-Master → Test System) (see	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
	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

4787

4788 The test step instruction "FSMasterSend_FSAppSend" is used for messages sent by the FS-
4789 Master test object (EUT). Within these messages, the test data to the IO-Link communication
4790 port and to the FS-Master "processing" interface are specified in one test message. This
4791 approach has been chosen due to the special test setup not allowing explicit access for the test
4792 system to the "processing" port of the test object (in this case the FS-Master, see Figure A.7).

4793 The values of the parameters *PDout*, *PortNum*, *MCount*, *setSD*, *ChFAckReq* and *CRC* are
4794 defined for the IO-Link communication port, whereas the values of the parameters *PDin_M*,
4795 *SDset_S*, *ChFAckReq_S*, *DCommErr_S*, *DTimeout_S*, *MCommErr_S*, and *MTimeout_S* are
4796 defined for the "processing" interface.

4797 With the test step instruction "FSMasterReceive_FSAppReceive" the reception of test messages by the FS master is specified. The test messages comprise also the IO-Link communication Port and the "processing" interface.
4798
4799

4800 The parameter values of *PDin*, *PortNum*, *DCount*, *SDset*, *DCommErr*, *DTimeout*, and *CRC* are determined for the IO-Link communication Port, whereas the values of the parameters *PDout_M*, *setSD_C*, and *ChFack_C* are determined for the "processing" interface.
4801
4802

4803 The test step instruction "Timeout" specifies for how long the test system shall not send a response. This time shall be greater than the watchdog time of the EUT (MTime).
4804

4805 The XML tag "Transition" is used for traceability of test messages with respect to the expected transition of the state machine specified in [4]. This information is only descriptive and has no impact on the test flow of the test tool.
4806
4807

4808 12.2 FS-Master SCL test suite

4809 12.2.1 Test script 1

4810 Table 178 defines the test conditions for this test case. The associated XML file contains steps and message parameters for the state flow check in case of a setSD error, MCount = 0, and DCommErr.
4811
4812

4813 **Table 178 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

4816
4817 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_1.xml":

```
4818 <?xml version="1.0" encoding="UTF-8"?>
4819 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4820 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_1" date="20.11.2018: 14:01:29.066">
4821   <FSMasterSclTestCaseSteps>
4822     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
4823     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
4824     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFackReq="0" CRC="valid"
4825     PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
```

```
4826 <FSMasterReceive_FSAppReceive PDIn="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
4827 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4828 <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
4829 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
4830 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4831 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
4832 PDIn_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4833 <FSMasterReceive_FSAppReceive PDIn="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
4834 CRC="invalid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4835 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4836 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4837 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4838 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFackReq="0" CRC="valid"
4839 PDIn_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
4840 <FSMasterReceive_FSAppReceive PDIn="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
4841 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4842 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4843 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4844 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4845 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
4846 PDIn_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4847 <FSMasterReceive_FSAppReceive PDIn="PD" PortNum="invalid" DCount="4" SDset="0" DCommErr="0" DTimeout="1"
4848 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4849 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4850 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4851 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4852 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFackReq="0" CRC="valid"
4853 PDIn_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
4854 <FSMasterReceive_FSAppReceive PDIn="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0"
4855 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4856 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4857 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4858 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4859 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="5" setSD="1" ChFackReq="1" CRC="valid"
4860 PDIn_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4861 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
4862 <FSMasterReceive_FSAppReceive PDIn="PD" PortNum="valid" DCount="2" SDset="0" DCommErr="0" DTimeout="0"
4863 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
4864 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4865 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
4866 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4867 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFackReq="0" CRC="valid"
4868 PDIn_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4869 <Transition SourceState="WaitOnResponse_5" TargetState="WaitOnResponse_5"/>
4870 <FSMasterReceive_FSAppReceive PDIn="PD" PortNum="valid" DCount="1" SDset="1" DCommErr="0" DTimeout="0"
4871 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4872 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4873 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4874 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4875 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="7" setSD="0" ChFackReq="0" CRC="valid"
4876 PDIn_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4877 <FSMasterReceive_FSAppReceive PDIn="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
4878 CRC="invalid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
4879 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4880 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
4881 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4882 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
4883 PDIn_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
4884 </FSMasterSciTestCasesSteps>
4885 </Testroot>
4886
```

4887 **12.2.2 Test script 2**

4888 Table 179 defines the test conditions for this test case. The associated XML file contains steps
 4889 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 4890 SDset.

4891 **Table 179 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

4894

4895 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_2.xml":

```

4896 <?xml version="1.0" encoding="UTF-8"?>
4897 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4898 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_2" date="20.11.2018: 14:01:29.066">
4899   <FSMasterSciTestCaseSteps>
4900     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
4901     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
4902     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
4903     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4904     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="0" DTimeout="0"
4905     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
4906     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
4907     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4908     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4909     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="1" setSD="0" ChAckReq="0" CRC="valid"
4910     PDin_M="PD" SDset_S="0" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4911     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0"
4912     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
4913     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4914     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4915     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4916     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="2" setSD="0" ChAckReq="0" CRC="valid"
4917     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4918     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
4919     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
4920     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4921     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4922     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>

```

```
4923 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"
4924 PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4925 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="4" SDset="0" DCommErr="0" DTimeout="0"
4926 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4927 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4928 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4929 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4930 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="4" setSD="0" ChFAckReq="0" CRC="valid"
4931 PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4932 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="3" SDset="0" DCommErr="0" DTimeout="0"
4933 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4934 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4935 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4936 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4937 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="5" setSD="0" ChFAckReq="0" CRC="valid"
4938 PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4939 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="1"
4940 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
4941 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
4942 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
4943 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4944 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFAckReq="0" CRC="valid"
4945 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
4946 </FSMasterSciTestCaseSteps>
4947 </Testroot>
4948
```

4949 **12.2.3 Test script 3**

4950 Table 180 defines the test conditions for this test case. The associated XML file contains steps
 4951 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 4952 ChannelFailureAck = 1.

4953 **Table 180 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

4956

4957 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_3.xml":

```

4958 <?xml version="1.0" encoding="UTF-8"?>
4959 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
4960 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_3" date="20.11.2018: 14:01:29.067">
4961   <FSMasterSclTestCaseSteps>
4962     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
4963     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
4964     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
4965     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4966     <Transition SourceState="WaitOnResponse_2" TargetState="WaitOnResponse_2"/>
4967     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="1" DCommErr="0" DTimeout="0"
4968     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="1"/>
4969     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
4970     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
4971     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
4972     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="1" setSD="0" ChAckReq="0" CRC="valid"
4973     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
4974     <Timeout/>
4975     <Transition SourceState="WaitOnResponse_5" TargetState="PrepareSPDU_6"/>
4976     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4977     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
4978     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="1"/>
4979     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="0" DTimeout="0"
4980     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="1"/>
4981     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4982     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4983     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4984     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="1" CRC="valid"
4985     PDin_M="SD" SDset_S="1" ChAckReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>

```

```
4986 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
4987 CRC="invalid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
4988 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4989 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4990 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4991 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="0" CRC="valid"
4992 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
4993 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
4994 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
4995 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
4996 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
4997 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
4998 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFAckReq="0" CRC="valid"
4999 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5000 <Timeout/>
5001 <Transition SourceState="WaitOnResponse_7" 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="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="1"/>
5005 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5006 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5007 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5008 </FSMasterSclTestCaseSteps>
5009 </Testroot>
5010
5011
```

5012 **12.2.4 Test script 4**

5013 Table 181 defines the test conditions for this test case. The associated XML file contains steps
 5014 and message parameters for the state flow check in case of a setSD error, MCount = 0, and
 5015 DCommErr.

5016 **Table 181 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5019

5020 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_4.xml":

```

5021 <?xml version="1.0" encoding="UTF-8"?>
5022 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5023 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_4" date="20.11.2018: 14:01:29.067">
5024   <FSMasterSclTestCaseSteps>
5025     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5026     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5027     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5028     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5029     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5030     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5031     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5032     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5033     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5034     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5035     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5036     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5037     CRC="invalid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5038     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5039     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5040     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5041     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="0" CRC="valid"
5042     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5043     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
5044     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5045     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5046     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5047     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>

```

```
5048 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
5049 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5050 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="4" SDset="0" DCommErr="0" DTimeout="1"
5051 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5052 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5053 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5054 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5055 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFackReq="0" CRC="valid"
5056 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5057 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="3" SDset="0" DCommErr="0" DTimeout="1"
5058 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5059 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5060 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5061 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5062 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="5" setSD="1" ChFackReq="0" CRC="valid"
5063 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5064 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="2" SDset="0" DCommErr="0" DTimeout="1"
5065 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5066 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5067 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5068 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5069 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFackReq="0" CRC="valid"
5070 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5071 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0"
5072 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5073 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5074 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5075 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5076 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="7" setSD="1" ChFackReq="1" CRC="valid"
5077 PDin_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5078 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5079 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5080 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5081 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5082 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5083 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5084 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
5085 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5086 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5087 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5088 <Transition SourceState="WaitOnResponse_5" TargetState="WaitOnResponse_5"/>
5089 </FSMasterSciTestCasesSteps>
5090 </Testroot>
```

5091

5092

5093 **12.2.5 Test script 5**

5094 Table 182 defines the test conditions for this test case. The associated XML file contains steps
 5095 and message parameters for the state flow check in case of setSD error, MCount = 0, and
 5096 DCommErr.

5097 **Table 182 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5100

5101 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_5.xml":

```

5102 <?xml version="1.0" encoding="UTF-8"?>
5103 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5104 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_5" date="20.11.2018: 14:01:29.067">
5105   <FSMasterSclTestCaseSteps>
5106     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5107     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5108     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5109     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5110     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="1" DTimeout="0"
5111     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5112     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5113     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5114     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5115     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5116     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5117     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="0" DTimeout="0"
5118     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5119     <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5120   </FSMasterSclTestCaseSteps>
5121 </Testroot>
5122

```

5123 **12.2.6 Test script 6**

5124 Table 183 defines the test conditions for this test case. The associated XML file contains steps
5125 and message parameters for the state flow check in case of setSD =1, MCount =0, and
5126 DCommErr.

5127 **Table 183 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5130

5131 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_6.xml":

```

5132 <?xml version="1.0" encoding="UTF-8"?>
5133 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5134 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_6" date="20.11.2018: 14:01:29.067">
5135   <FSMasterSclTestCaseSteps>
5136     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5137     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5138     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5139     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5140     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5141     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5142     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5143     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5144     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5145     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5146     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5147     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5148     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5149     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5150     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5151     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5152     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="1" CRC="valid"
5153     PDin_M="SD" SDset_S="1" ChFAckReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5154     <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5155     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
5156     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5157     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5158     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5159     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>

```

```
5160 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"
5161 PDin_M="PD" SDset_S="0" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5162 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5163 CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="1"/>
5164 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5165 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5166 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5167 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChAckReq="0" CRC="valid"
5168 PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5169 </FSMasterSciTestCaseSteps>
5170 </Testroot>
5171
```

5172 **12.2.7 Test script 7**

5173 Table 184 defines the test conditions for this test case. The associated XML file contains steps
5174 and message parameters for the state flow check in case of setSD =1, MCount =0, and
5175 DCommErr.

5176 **Table 184 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5179

5180 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_7.xml":

```

5181 <?xml version="1.0" encoding="UTF-8"?>
5182 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5183 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_7" date="20.11.2018: 14:01:29.067">
5184   <FSMasterSclTestCaseSteps>
5185     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5186     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5187     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5188     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5189     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5190     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5191     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5192     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5193     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5194     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5195     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5196     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5197     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5198     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5199     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5200     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5201     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="1" CRC="valid"
5202     PDin_M="SD" SDset_S="1" ChFAckReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5203     <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5204     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
5205     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5206     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5207     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5208     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>

```

```
5209     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChAckReq="0" CRC="valid"
5210     PDin_M="PD" SDset_S="0" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5211     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5212     CRC="invalid" PDout_M="PD" setSD_C="0" ChAck_C="1"/>
5213     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5214     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5215     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5216     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChAckReq="0" CRC="valid"
5217     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5218     </FSMasterSciTestCaseSteps>
5219     </Testroot>
5220
```

5221 **12.2.8 Test script 8**

5222 Table 185 defines the test conditions for this test case. The associated XML file contains steps
 5223 and message parameters for the state flow check in case of setSD =1, MCount =0, DCommErr,
 5224 and Portnumber error.

5225 **Table 185 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5228

5229 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_8.xml":

```

5230 <?xml version="1.0" encoding="UTF-8"?>
5231 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5232 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_8" date="20.11.2018: 14:01:29.068">
5233   <FSMasterSclTestCaseSteps>
5234     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5235     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5236     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5237     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5238     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5239     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5240     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5241     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5242     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5243     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5244     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5245     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5246     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5247     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5248     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5249     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5250     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="1" CRC="valid"
5251     PDin_M="SD" SDset_S="1" ChFAckReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5252     <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5253     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
5254     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5255     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5256     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5257     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>

```

```
5258 <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"
5259 PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5260 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5261 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="1"/>
5262 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5263 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5264 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5265 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFAckReq="0" CRC="valid"
5266 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5267 </FSMasterSciTestCaseSteps>
5268 </Testroot>
5269
```

5270 **12.2.9 Test script 9**

5271 Table 186 defines the test conditions for this test case. The associated XML file contains steps
5272 and message parameters for the state flow check in case of setSD =1 and MCount =0.

5273 **Table 186 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5276

5277 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_9.xml":

```

5278 <?xml version="1.0" encoding="UTF-8"?>
5279 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5280 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_9" date="20.11.2018: 14:01:29.068">
5281   <FSMasterSciTestCaseSteps>
5282     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5283     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5284     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5285     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5286     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="0" DTimeout="0"
5287     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5288     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5289     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
5290     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5291     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="1" setSD="0" ChFAckReq="0" CRC="valid"
5292     PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5293     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="1" DCommErr="0" DTimeout="0"
5294     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5295     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5296     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
5297     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5298     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="2" setSD="0" ChFAckReq="0" CRC="valid"
5299     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5300     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="0" DTimeout="0"
5301     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5302     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5303     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_4"/>
5304     <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5305     <FSMasterSend_FSAppSend PDout="PD" PortNum="valid" MCount="3" setSD="0" ChFAckReq="0" CRC="valid"
5306     PDin_M="PD" SDset_S="0" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>

```



```
5307     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="0" SDset="0" DCommErr="0" DTimeout="1"
5308 CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5309     <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5310     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5311     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5312     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFAckReq="0" CRC="valid"
5313 PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5314     </FSMasterSciTestCaseSteps>
5315 </Testroot>
5316
```

5317 **12.2.10 Test script 10**

5318 Table 187 defines the test conditions for this test case. The associated XML file contains steps
 5319 and message parameters for the state flow check in case of setSD =1, MCount =0, Port number
 5320 error, and CRC error.

5321 **Table 187 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5324

5325 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_10.xml":

```

5326 <?xml version="1.0" encoding="UTF-8"?>
5327 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5328 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_10" date="20.11.2018: 14:01:29.068">
5329   <FSMasterSciTestCaseSteps>
5330     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5331     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5332     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
5333     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5334     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5335     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5336     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5337     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5338     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5339     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="0" CRC="valid"
5340     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5341     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5342     CRC="invalid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5343     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5344     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5345     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5346     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChAckReq="0" CRC="valid"
5347     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5348     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
5349     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5350     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5351     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5352     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>

```

```
5353 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
5354 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5355 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="4" SDset="0" DCommErr="0" DTimeout="1"
5356 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5357 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5358 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5359 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5360 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFackReq="0" CRC="valid"
5361 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5362 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="3" SDset="0" DCommErr="0" DTimeout="1"
5363 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5364 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5365 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5366 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5367 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="5" setSD="1" ChFackReq="0" CRC="valid"
5368 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5369 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="2" SDset="0" DCommErr="0" DTimeout="1"
5370 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5371 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5372 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5373 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5374 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFackReq="0" CRC="valid"
5375 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5376 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0"
5377 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5378 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5379 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5380 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5381 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="7" setSD="1" ChFackReq="1" CRC="valid"
5382 PDin_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5383 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5384 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5385 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5386 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5387 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5388 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5389 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
5390 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5391 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="1" DTimeout="0"
5392 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5393 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5394 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5395 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5396 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFackReq="0" CRC="valid"
5397 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5398 </FSMasterSclTestCaseSteps>
5399 </Testroot>
5400
```

5401 **12.2.11 Test script 11**

5402 Table 188 defines the test conditions for this test case. The associated XML file contains steps
 5403 and message parameters for the state flow check in case of setSD =1, MCount =0, Port number
 5404 error, and CRC error.

5405 **Table 188 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5408

5409 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_11.xml":

```

5410 <?xml version="1.0" encoding="UTF-8"?>
5411 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5412 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_11" date="20.11.2018: 14:01:29.068">
5413   <FSMasterSciTestCaseSteps>
5414     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5415     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5416     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChFAckReq="0" CRC="valid"
5417     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5418     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="7" SDset="0" DCommErr="1" DTimeout="0"
5419     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5420     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5421     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5422     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5423     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFAckReq="0" CRC="valid"
5424     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5425     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="6" SDset="0" DCommErr="0" DTimeout="0"
5426     CRC="invalid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5427     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5428     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5429     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5430     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFAckReq="0" CRC="valid"
5431     PDin_M="SD" SDset_S="1" ChFAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5432     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="5" SDset="0" DCommErr="1" DTimeout="0"
5433     CRC="valid" PDout_M="PD" setSD_C="0" ChFAck_C="0"/>
5434     <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5435     <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5436     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>

```

```
5437 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="3" setSD="1" ChFackReq="0" CRC="valid"
5438 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="1" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5439 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="4" SDset="0" DCommErr="0" DTimeout="1"
5440 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5441 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5442 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5443 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5444 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="4" setSD="1" ChFackReq="0" CRC="valid"
5445 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5446 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="3" SDset="0" DCommErr="0" DTimeout="1"
5447 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5448 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5449 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5450 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5451 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="5" setSD="1" ChFackReq="0" CRC="valid"
5452 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5453 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="2" SDset="0" DCommErr="0" DTimeout="1"
5454 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5455 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5456 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5457 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5458 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="6" setSD="1" ChFackReq="0" CRC="valid"
5459 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="1" MCommErr_S="1" MTimeout_S="0"/>
5460 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0"
5461 CRC="valid" PDout_M="PD" setSD_C="0" ChFack_C="0"/>
5462 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5463 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_6"/>
5464 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5465 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="7" setSD="1" ChFackReq="1" CRC="valid"
5466 PDin_M="SD" SDset_S="1" ChFackReq_S="1" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5467 <Transition SourceState="WaitOnResponse_7" TargetState="WaitOnResponse_7"/>
5468 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5469 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5470 <Transition SourceState="WaitOnResponse_7" TargetState="CheckSPDU_8"/>
5471 <Transition SourceState="CheckSPDU_8" TargetState="PrepareSPDU_4"/>
5472 <Transition SourceState="PrepareSPDU_4" TargetState="WaitOnResponse_5"/>
5473 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChFackReq="0" CRC="valid"
5474 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5475 <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="1" SDset="0" DCommErr="0" DTimeout="0"
5476 CRC="valid" PDout_M="PD" setSD_C="1" ChFack_C="1"/>
5477 <Transition SourceState="WaitOnResponse_5" TargetState="CheckSPDU_3"/>
5478 <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5479 <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5480 <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="2" setSD="1" ChFackReq="0" CRC="valid"
5481 PDin_M="SD" SDset_S="1" ChFackReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5482 </FSMasterScI TestCaseSteps>
5483 </Testroot>
5484
```

5485 **12.2.12 Test script 12**

5486 Table 189 defines the test conditions for this test case. The associated XML file contains steps
 5487 and message parameters for the state flow check in case of a port number error and MCount
 5488 =0.

5489 **Table 189 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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>

5492

5493 Content of file "IO-Link-Safety_spec_master_final_testsuite_testcase_12.xml":

```

5494 <?xml version="1.0" encoding="UTF-8"?>
5495 <Testroot xsi:noNamespaceSchemaLocation="IO-Link-Safety-Test-Procedure_Types_V1.0.xsd"
5496 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2" name="tc_12" date="20.11.2018: 14:01:29.068">
5497   <FSMasterSclTestCaseSteps>
5498     <Transition SourceState="Init" TargetState="PrepareSPDU_1"/>
5499     <Transition SourceState="PrepareSPDU_1" TargetState="WaitOnResponse_2"/>
5500     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="0" setSD="1" ChAckReq="0" CRC="valid"
5501     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="0" MTimeout_S="0"/>
5502     <Transition SourceState="WaitOnResponse_2" TargetState="WaitOnResponse_2"/>
5503     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="invalid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5504     CRC="valid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5505     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5506     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5507     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5508     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="0" CRC="valid"
5509     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5510   </FSMasterSclTestCaseSteps>
5511 </Testroot>

```

5512 **12.2.13 Test script 13**

5513 Table 190 defines the test conditions for this test case. The associated XML file contains steps
5514 and message parameters for the state flow check in case of CRC error and MCount =0.

5515 **Table 190 – 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 41 (services); clause 11.5.2, Figure 46 (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 177 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_13.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_13" 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     <FSMasterReceive_FSAppReceive PDin="PD" PortNum="valid" DCount="0" SDset="0" DCommErr="0" DTimeout="0"
5529     CRC="invalid" PDout_M="PD" setSD_C="0" ChAck_C="0"/>
5530     <Transition SourceState="WaitOnResponse_2" TargetState="CheckSPDU_3"/>
5531     <Transition SourceState="CheckSPDU_3" TargetState="PrepareSPDU_6"/>
5532     <Transition SourceState="PrepareSPDU_6" TargetState="WaitOnResponse_7"/>
5533     <FSMasterSend_FSAppSend PDout="SD" PortNum="valid" MCount="1" setSD="1" ChAckReq="0" CRC="valid"
5534     PDin_M="SD" SDset_S="1" ChAckReq_S="0" DCommErr_S="0" DTimeout_S="0" MCommErr_S="1" MTimeout_S="0"/>
5535   </FSMasterSclTestCaseSteps>
5536 </Testroot>
5537

```

5538 **13 FS-Master with reference FS-Devices tests**5539 **13.1 Overview**

5540 The FS-Master with reference FS-Devices test comprise tests, where several approved FS-
5541 Devices as reference are available. Rules for reference systems are defined in A.2.3.

5542 An approved SMTU can also be used as an approved FS-Device if an IODD exists.

5543 The FS-Master in reference tests comprise tests of the splitter and composer for Process Data.
5544 Since tests for SR PD are already included in 12.2, the test cases here focus on the NSR PD
5545 part. They are followed by test cases for special SMI services for read back of the (safety) Port
5546 configuration and Port status and optionally by test cases for the correct Process Data in case
5547 of OSSDe (FS-DI) Port mode. In addition, Port Events are tested. Besides tests for the FS-
5548 Master SCL protocol watchdog, the aspects of Safety Function Response Time (SFRT) are
5549 covered.

5550 **13.2 Splitter/composer**5551 **13.2.1 Splitter in mixed PD mode (CRC32)**

5552 Table 191 defines the test conditions for this test case.

5553 **Table 191 – 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>

5556

5557 **13.2.2 Splitter in mixed PD mode (CRC16)**

5558 Table 192 defines the test conditions for this test case.

5559 **Table 192 – 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>

5562

5563 **13.2.3 Composer in mixed PD mode (CRC32)**

5564 Table 193 defines the test conditions for this test case.

5565 **Table 193 – 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 ;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[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>

5568

5569 **13.2.4 Composer in mixed PD mode (CRC16)**

5570 Table 194 defines the test conditions for this test case.

5571 **Table 194 – 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 to an FS-Device (actuator) are transferred correctly 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>

5574

5575 **13.3 SMI service tests (safety)**5576 **13.3.1 Read back safety configuration**

5577 Table 195 defines the test conditions for this test case.

5578 **Table 195 – 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	1.0
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 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_PortPowerOffOn() b) Wait 3 s c) SMI_PortConfiguration(ABPS_FSCONFIG_MIXEDCOM) d) SMI_ReadBackPortConfiguration(0x8100) ;returns ArgBlock "FSPortConfigList" d) 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>

5581

5582 **13.3.2 Safety Port status**

5583 Table 196 defines the test conditions for this test case.

5584 **Table 196 – 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
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 the safety Port status can be read out using the SMI_PortStatus service and Argblock 0x9100.
Precondition	EUT: PORT_MIXFSCOM SMTU: SMTU_STANDARD_STATE_32
Procedure	a) SMI_PortStatus(0x9100) <i>;returns ArgBlock "FSPortStatusList"</i> b) Evaluation 1)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Compare ArgBlock "FSPortStatusList" with assignments in "PORT_MIXFSCOM"
Test passed	PortStatusInfo = SCL_ENABLED PortQualityInfo.Bit0/1 = 0 <i>;all PD valid</i> RevisionID = 0x11 TransmissionRate = COM2 MasterCycleTime = 0x28 <i>;4 ms</i> InputDataLength = 0x20 <i>;PDInLength = 32 octets</i> OutputDataLength = 0x20 <i>;PDOOutLength = 32 octets</i> VendorID = 0xFDE8 <i>;IO-Link Community</i> DeviceID = 0x002BD2 <i>;Tester</i> NumberOfDiags = 0 DiagEntry0 = 0 DiagEntry1 = 0
Test failed (examples)	Any check deviating
Report	Values OK: <yes/no> <ok nok>

5587

5588 **13.4 Port with FS-DI/OSSDe (optional)**

5589 Testing of this functionality is covered by SDCI_FSTC_0008 in 5.4.1.

5590 **13.5 Events**5591 **13.5.1 Port specific Event**

5592 Table 197 defines the test conditions for this test case.

5593 **Table 197 – Port specific Event**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0187
Name	FSTCM_REFD_PORTEVENTCORRECT
Purpose (short)	Check whether Port Event is generated correctly
Equipment under test (EUT)	FS-Master + Tool
Test case version	1.0
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) SMI_SPDUOut(ABPS_SPDUOUT25 <SPD[i]=0>) c) SMTU_SPDU_Repetition (3s); <i>Pause > WatchdogTimeout to trigger Timeout Error</i> d) SMI_SPDUOut(ABPS_SPDUOUT25 <SPD[i]=1>) e) Wait on SMI_PortEvent <i>;returns ArgBlock "PortEvent"</i> 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>

5596

5597 **13.5.2 FS-Device Event**

5598 Table 198 defines the test conditions for this test case.

5599 **Table 198 – 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 <i>;no FST Parameter</i>
Procedure	a) SMI_PortConfig (ABPS_FSCONFIG_SAFECOM<FSCP_Authenticity1=2>) b) Wait(1s) c) Wait on SMI_DeviceEvent <i>;returns ArgBlock "DeviceEvent"</i> d) Evaluation 1)
Test parameter	–
Post condition	–
TEST CASE RESULTS	CHECK / REACTION
Evaluation	1) Check ArgBlock "DeviceEvent"
Test passed	EventCode = 0xB003 <i>;Unexpected authentication code</i>
Test failed (examples)	No Event or EventCode incorrect
Report	FS-Device Event OK: <yes/no> <ok nok>

5602

5603 **13.6 Safety function response time**

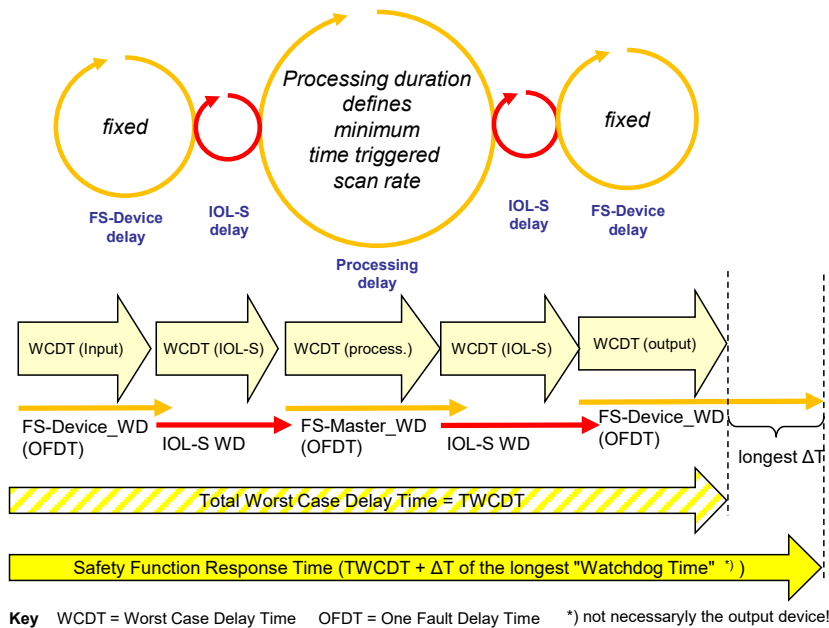
5604 **13.6.1 General concepts and accuracies**

5605 Figure 16 illustrates the effects of the worst-case delay times (WCDT) and one fault delay times
 5606 (OFDT) of the components involved in a safety function based on a pure FS-Master and FS-
 5607 Device system. see Annex H.6 in [4], which requires for a

- 5608 • a manufacturer/vendor of FS-Devices to provide the "worst-case delay time" (WCDT) value.
 5609 WCDT is defined as the time from triggering an FS-Device (sensor) until the output shows
 5610 a corresponding signal change or Process Data change. For an FS-Device (actuator) it is
 5611 the time from signal change or Process Data change to the actuator's safe state.
 5612
- 5613 • a manufacturer/vendor of FS-Devices to provide the "one fault delay time" (OFDT) value.
 5614 The definition of OFDT is similar to WCDT, however in case of a fault within the FS-Device
 5615 at the time of the measurement.

5616 Therefore, since it is mandatory for all components to provide WCDT and OFDT in user
 5617 manuals, FS-Master tools are enabled to provide values for the total worst case delay time
 5618 (TWCDT) and safety function response time.

5619 An FS-Master shall also provide values for FS-Master_WD (OFDT), usually derived from
 5620 program processing duration and for IOL-S WD for the output side.



5621

5622 **Figure 16 – SFRT of a stand-alone FS-Master with processing**

5623 Only one fault shall be assumed per trip. The watchdog time with the largest impact on the
 5624 safety function response time (SFRT) shall be considered for a safety function. For a machine
 5625 usually an overtravel measurement (usually at least 10 measurements) is performed.

5626 Table 199 shows the accuracies and tolerances to be used for timings.

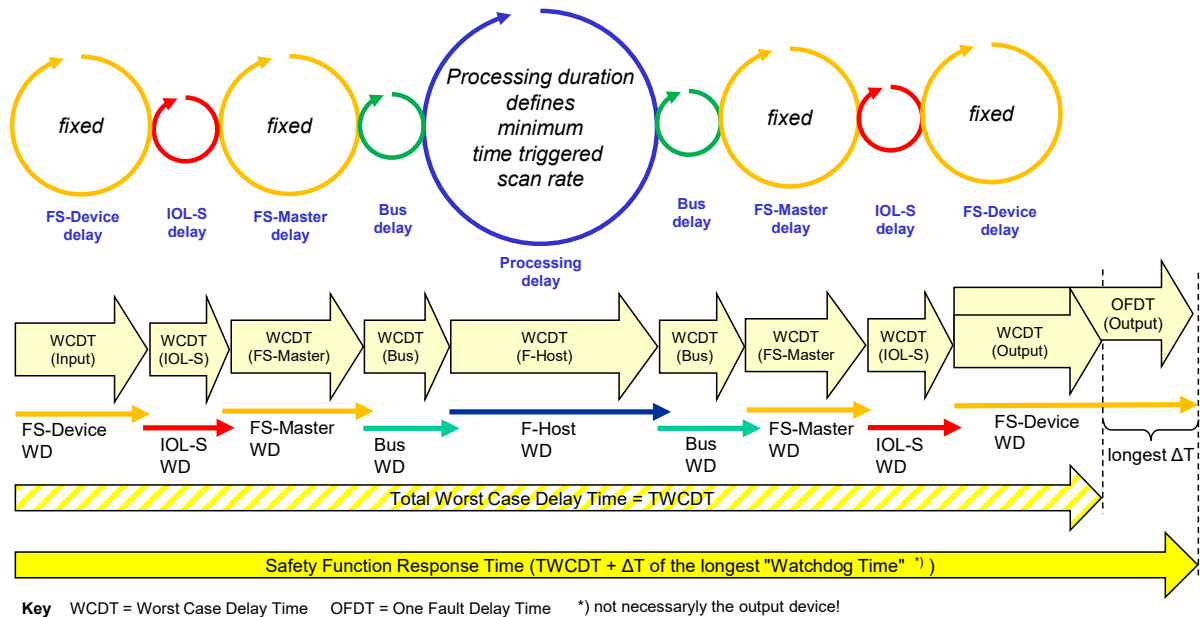
5627 **Table 199 – Accuracies and tolerances for timings**

Item	Accuracy	Remarks
Measurement accuracy	+/- 1 %	-
Permitted watchdog time tolerance	+/- 10 %	-

5628

5629 Figure 17 illustrates the effects of the worst-case delay times (WDCT) and one fault delay
 5630 times (OFDT) of the components involved in a safety function based on FS-Master and FS-

5631 Devices integrated in a fieldbus functional safety communication profile (FSCP), see for
 5632 example [11].

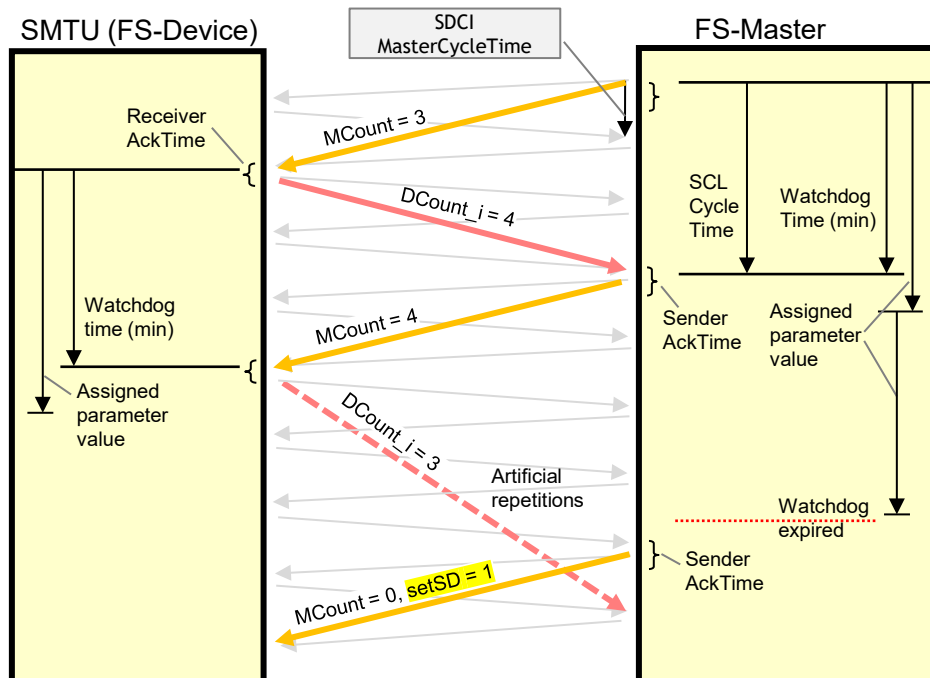


5633

5634

Figure 17 – SFRT including IOL-S and FSCP

5635 Figure 18 illustrates, how the watchdog timer of an FS-Master is tested. The Safety Master
 5636 Tester Unit (SMTU), playing the role of an FS-Devices, is controlled in such a way that the
 5637 response SPDU ("DCount_i = 3") is delayed through artificial repetitions. For details see
 5638 13.6.2.



5639

5640

Figure 18 – Test of the FS-Master watchdog

5641 The actual watchdog response time cannot be measured with IO-Link on-board equipment.
 5642 This shall be measured by the manufacturer using development tools or determined via
 5643 software analysis (safety assessment, see 8.3.3).

5644 **13.6.2 FS-Master watchdog test**

5645 Table 200 defines the test conditions for this test case.

5646 **Table 200 – FS-Master watchdog test**

TEST CASE ATTRIBUTES	IDENTIFICATION / REFERENCE
Identification (ID)	SDCI_FSTC_0189
Name	FSTCM_SCLM_WATCHDOGPRECISION
Purpose (short)	Check whether FS-Master watchdog timeout coincides with IODD value
Equipment under test (EUT)	FS-Master
Test case version	1.0
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 coincides with the FSP_Watchdog value in the IODD.
Precondition	EUT: Port config DEACTIVATED; Transmission rate = COM2 SMTU: Configured for armed operation ;see field test parameter
Procedure	a) Choose test parameter with first FSP_Watchdog value ;see field test parameter b) Set PortConfig with FSP_VerifyRecord with values of A) and B) e.g. via SMI_PortConfiguration using ArgBlock 0x8100 ;see field test parameter c) SMTU_Measure_WDtime ;returns "WD_time" f) Evaluation 1) g) Repeat from c) 3 times g) Choose test parameter with next FSP_Watchdog value h) Repeat from b)
Test parameter	A) FSP protocol parameter record: FSP_ProtVersion = defaultValue in IODD, FSP_ProtMode = defaultValue in IODD, FSP_Watchdog = {50 ms, 100 ms}, 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 "WD_time", memorize maximum WD_time and minimum WD_time
Test passed	Deviation of maximum/minimum WD_time less than 10 % @ 50 ms, and Deviation of maximum/minimum WD_time less than 10 % @ 100 ms
Test failed (examples)	Any check incorrect
Report	WD_time (min) @ 50 ms: <value> <ok nok> WD_time(max) @ 50 ms: <value> <ok nok> WD_time (min) @ 100 ms: <value> <ok nok> WD_time (max) @ 100 ms: <value> <ok nok>

5649

5650

5651

5652 13.6.3 Integration aspects

5653 In 13.6.1, the general concepts are explained also for a more complex FS-Master integrated in
5654 a fieldbus's functional safety communication profile (FSCP) according to the IEC 61784-3
5655 series. In this case, usually the FS-Master plays only the role of a mapper of Process Data from
5656 one safety communication system to the other.

5657 The designer/manufacture of such a mapping FS-Master/Gateway shall provide WCDT and
5658 OFDT for the mapping part to enable computer-aided approximation of a safety function
5659 response time. Integration specifications to FSCPs should comprise definitions and descriptions
5660 how to achieve these values.

5661

5662 **14 FS-Master Tool tests**5663 **14.1 IODD import**

5664 Table 201 defines the test conditions for this test case.

5665 **Table 201 – 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>

5668

5669 **14.2 IODD conventions (PD headlines coloring)**

5670 Table 202 defines the test conditions for this test case.

5671 **Table 202 – 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>

5674

5675 **14.3 FS parameters visible completely**

5676 Table 203 defines the test conditions for this test case.

5677 **Table 203 – 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>

5680

5681 **14.4 FS-Device parameterization**

5682 Table 204 defines the test conditions for this test case.

5683 **Table 204 – 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>

5686

5687 **14.5 Dedicated Tool operation**

5688 Table 205 defines the test conditions for this test case.

5689 **Table 205 – 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>

5692

5693 **14.6 DDO exchange**

5694 Table 206 defines the test conditions for this test case.

5695 **Table 206 – 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>

5698

5699 **15 Environmental tests**

5700 **15.1 General**

5701 Annex H in [2] defines the basic environmental tests (EMC) for the SDCI communication part
5702 of an FS-Master/FS-Device system. Clause 5.4.2 in [2] specifies environmental conditions (e.g.
5703 electrical safety) especially for FS-Master with Port Class B.

5704 It depends on the technology of an FS-Device and the countries of deployment, whether addi-
5705 tional environmental tests are required to achieve for example a CE mark in Europe.

5706 **15.2 Product specific standards**

5707 Usually, the sector specific EMC standard IEC 61326-3-1 or the generic EMC standard 61000-
5708 6-7 are relevant for FS-Master.

5709 For FS-Devices, there are several EMC standards, including but not limited to:

- 5710 • Product standard IEC 61496-1 (Electro-sensitive protective equipment)
- 5711 • Product standard IEC 60947-5-3 (Proximity switches)
- 5712 • Sector standard IEC 61326-3-1 (Factory automation)
- 5713 • Generic standard IEC 61000-6-7 (in case of no sector or product standard, such as in case
5714 of drives)

5715 The following rule applies: Product standards shall be observed if available, otherwise sector
5716 standard or then generic standard.

5717 **15.3 EMC tests**

5718 EMC tests in respect of a particular phenomenon are defined in the IEC 61000-4-x series.
5719 Details for the respective test set-ups are described in Annex H.1.6 in [2] and in 4.4 or 0.

5720 **15.4 Test report templates**

5721 Tests are required for the following phenomena:

- 5722 • Electrostatic discharge (ESD: IEC 61000-4-2)
- 5723 • Electromagnetic field (HF: IEC 61000-4-3)
- 5724 • Fast transients (Burst: IEC 61000-4-4)
- 5725 • Surge protection (Surge: IEC 61000-4-5): optional, depending on deployment
- 5726 • Conducted radio frequency (CRF: IEC 61000-4-6)

5727

5728 Usually, the test levels and durations exceed the values of NSR devices. A special performance
5729 criterion "DS" allows the devices to enter a Defined State at these extended "stress" tests,
5730 which is supposed to be safe in safety functions.

5731 A passed EMC test is a precondition for a Manufacturer Declaration of Conformity. It shall
5732 comprise statements on the results of the above EMC tests. The forms in [9] may be used if
5733 they contain the appropriate information.

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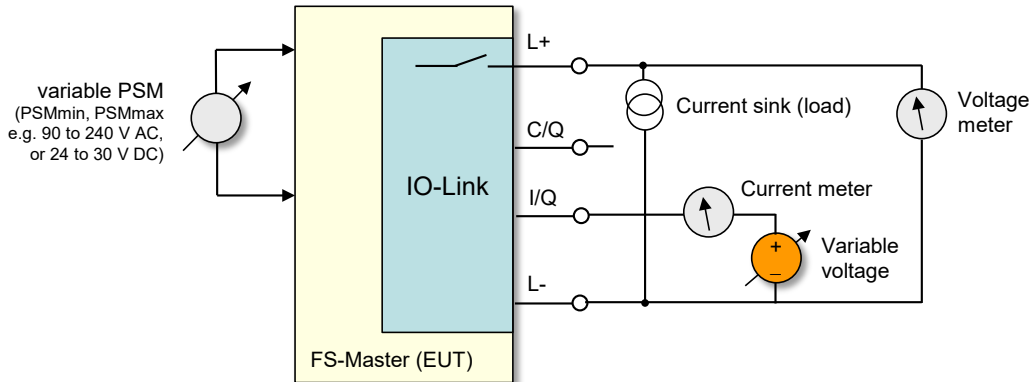
Annex A
(normative)

Test configurations, principles, and tools

A.1 Measurement circuits / setups

A.1.1 Measurement circuits for static FS-Master parameter tests

Figure A.1 illustrates the measurement circuits for static FS-Master parameter tests in 5.2.

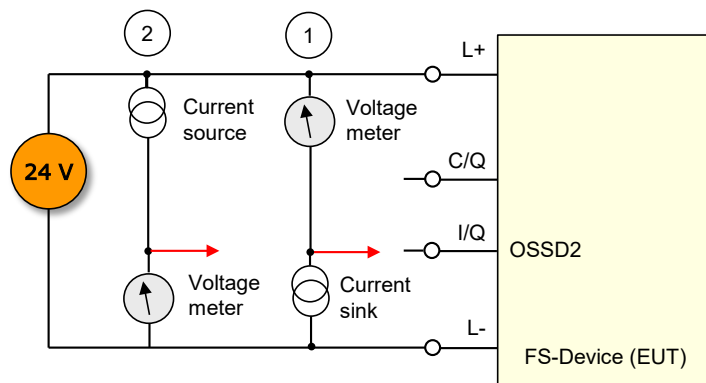


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Figure A.1 – Measurement circuits for static FS-Master parameter tests

A.1.2 Measurement circuits for static FS-Device parameter tests

Figure A.2 illustrates the measurement circuits for static FS-Device parameter tests in 5.3. Method ① or ② can be applied.



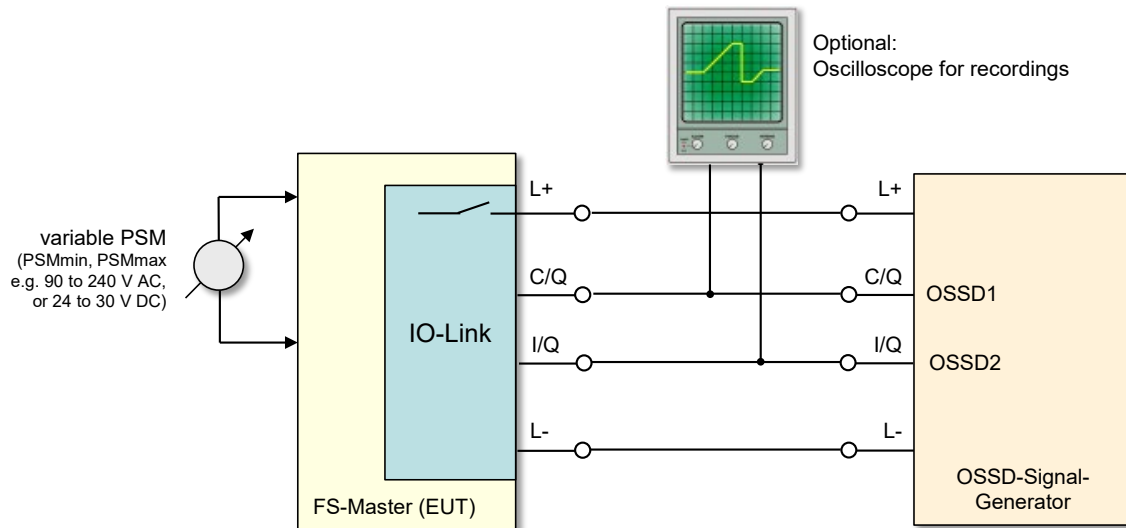
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Figure A.2 – Measurement circuits for static FS-Device parameter tests

A.1.3 Measurement circuits for dynamic FS-Master parameter tests

Figure A.3 illustrates the measurement circuits for dynamic FS-Master parameter tests in 5.4

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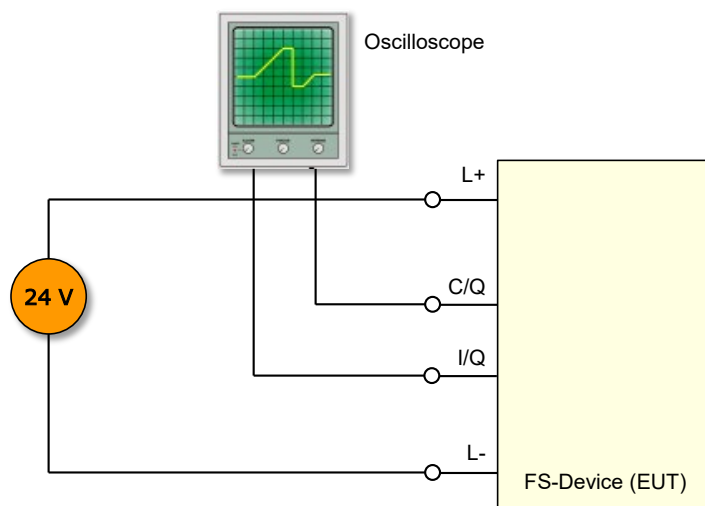
Figure A.3 – Measurement circuits for dynamic FS-Master parameter tests

5753

A.1.4 Measurement circuits for dynamic FS-Device parameter tests

5754

Figure A.4 illustrates the measurement circuits for dynamic FS-Device parameter tests in 5.5.



5755

5756

Figure A.4 – Measurement circuits for dynamic FS-Device parameter tests

5757

A.2 Test tools

A.2.1 Overview

Seven tools have been identified supporting the performance of the test cases in this document:

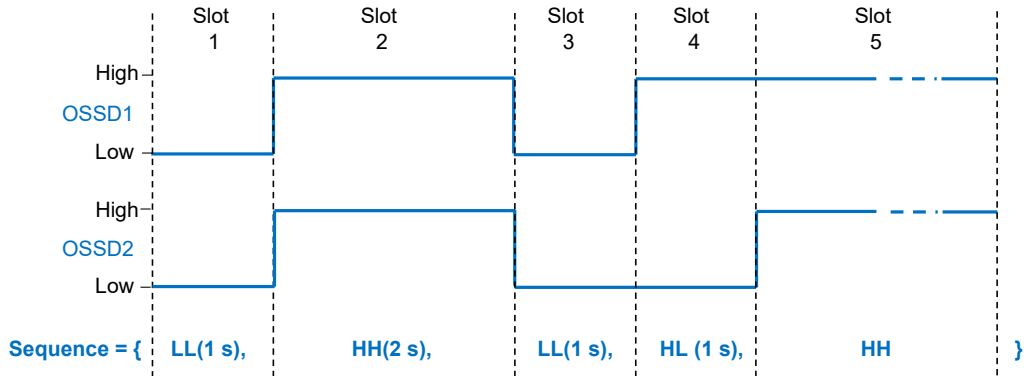
- 5761 • "OSSD Signal Generator", see A.2.2
- 5762 • "Upper-Tester" (UT) for SCL protocol conformance testing, see A.2.3
- 5763 • "FS-Master tester system" including the "Safety Master Tester Unit" (SMTU), see A.2.4
- 5764 • "FS-Device tester" (FSDT), see A.2.5
- 5765 • "IODD Checker Tool", see A.2.6
- 5766 • Reference FS-Master/Tool and FS-Devices, see A.2.7
- 5767 • "EMC-Test tool" (optional)

5768

5769 **A.2.2 OSSD signal generator**

5770 Several test cases require complex correlated signal sequences on both OSSD channels, which
 5771 cannot be stimulated by a reference off-the-shelf FS-Device. An OSSD signal generator, acting
 5772 as a controllable FS-Device, which is connected to an FS-Master, can provide the required
 5773 OSSD signals and the superimposed OSSD test pulses (see Figure A.3).

5774 Figure A.5 shows an example of an OSSD signal sequence and its description.



5775

5776

Figure A.5 – Example of an OSSD signal sequence description

5777 The OSSD signal sequences are specified by the symbols "H" and "L", describing the OSSD
 5778 signal levels during a time slot. Unless otherwise noted, the duration of a slot is longer than
 5779 required for the detection of any possible signal combination.

5780 The combined symbols for the description of OSSD sequences are defined in Table A.1.

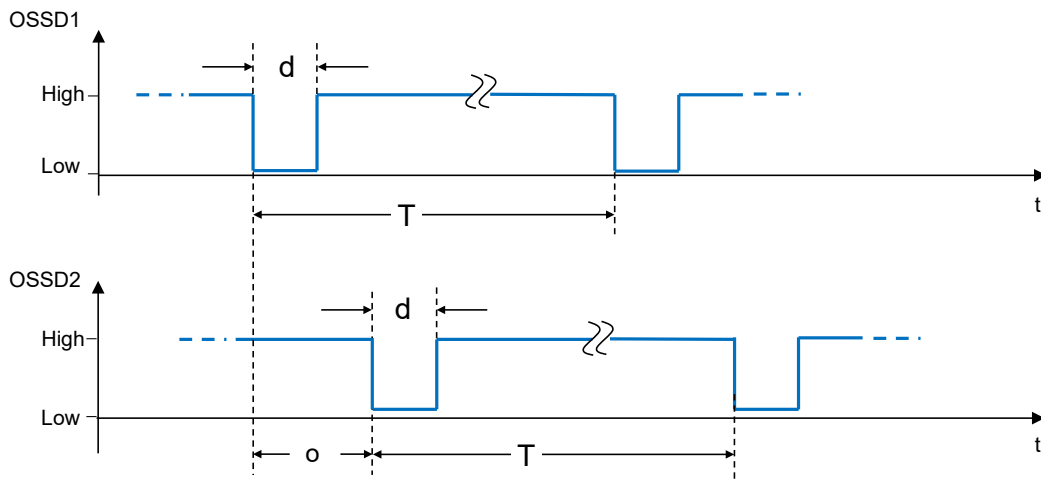
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Table A.1 – Description means for OSSD signal sequences

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

5782

5783 Figure A.6 shows means to describe OSSD test pulses for the FS-Device output testing (see
 5784 [4], 5.3.2.3). Parameters are "T" for period, "d" for duration of the test pulse, and "o"
 5785 for the offset between test pulse train1 and train2.



5786

5787

Figure A.6 – OSSD test pulses

5788 The OSSD test pulses are specified by test pulse symbol pairs, like the OSSD signal sequence
5789 in curly brackets.

5790 **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

5791

5792 A complete OSSD signal can be described by the combination of an OSSD signal sequence
5793 and a test pulse symbol pair. The test pulses are only affecting the OSSD signal when the signal
5794 shows a "high" level.

5795 A.2.3 Principles of SCL protocol conformance testing

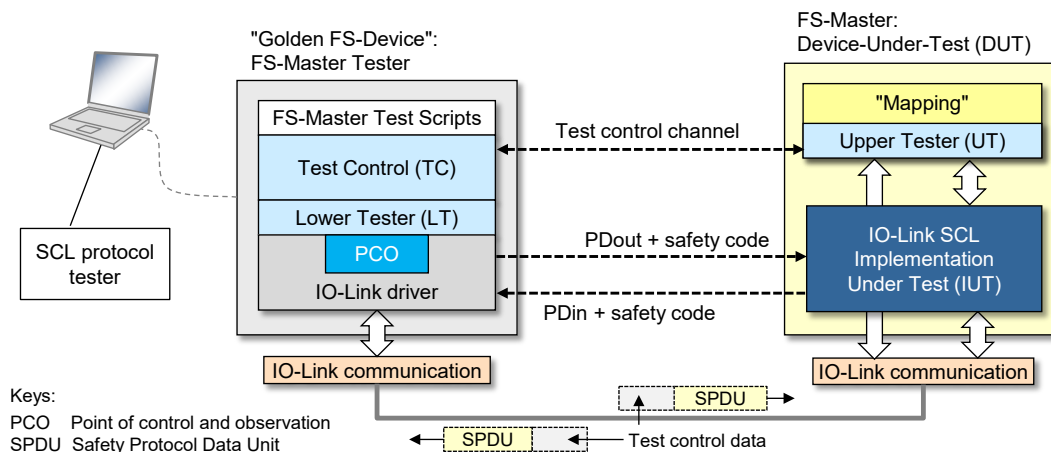
5796 In case of IO-Link Safety, the conformance test is a black box test verifying the IUT
5797 (Implementation Under Test) against the specification [4] at defined PCO (Point of Control and
5798 Observation).

5799 The IUT for IO-Link-Safety is the FS-Master state machine or the FS-Device state machine. It
5800 is embedded in the DUT (Device Under Test) and has the following interfaces:

- 5801 • IO-Link communication interface (SPDU)
- 5802 • IO-Link SCL interface to "Mapping" (FS-Master) or "Technology" (FS-Device)

5803 In order to test the "Mapping/Technology" interface, a special "test application" would normally
5804 be required at the DUT. This "test application" is supposed to apply and check test patterns at
5805 the SCL interface inputs/outputs and thus requires control by the tester performing the test
5806 scripts.

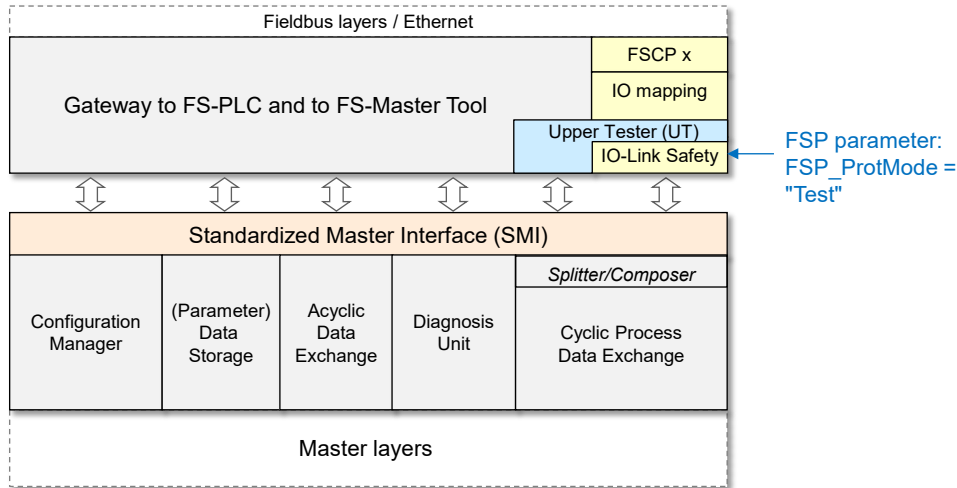
5807 For the sake of simplicity, IO-Link Safety uses the non-safety part of IO-Link messages as "test
5808 control channel" in order to remotely access the "test application" as shown in Figure A.7. In
5809 this case "the test application" is called "Upper Tester" (UT).



5810

5811 **Figure A.7 – Principle of FS-Master SCL testing**

5812 The UT is embedded in the IO mapping part of the safety gateway to an FSCP as shown in
5813 Figure A.8. It is only active during testing and controlled by certain values of the FSP parameter
5814 "FSP_ProtMode" (see [4], Annex A.2.5). These values are not visible in the IODD of an FS-
5815 Device and cannot be set by an FS-Master Tool. Solely the FS-Master Tester system is enabled.

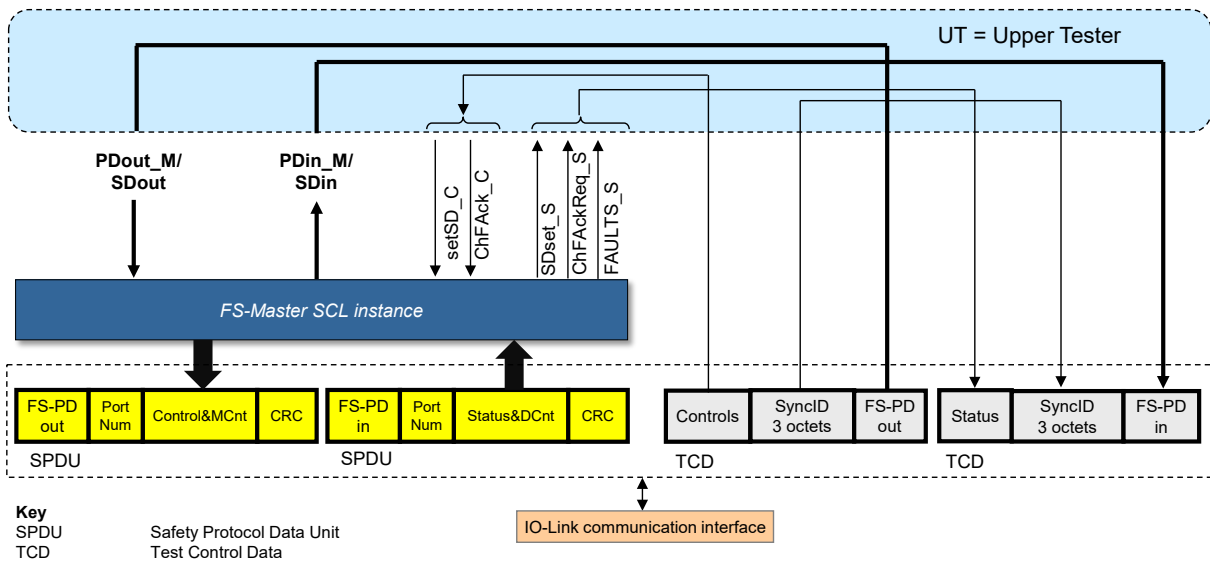


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Figure A.8 – Remote Upper Tester (UT) as "test application"

5818 This allows for a quite simple "test application" by just copying data between the safety and
 5819 non-safety transmission parts as shown in detail in Figure A.9. Thus, the test patterns ("FS-
 5820 Master Test Scripts") for the FS-Master set and check all safety process data and signals of
 5821 the communication interface (SPDU) as well as all safety process data and signals of the
 5822 "Mapping" interface.



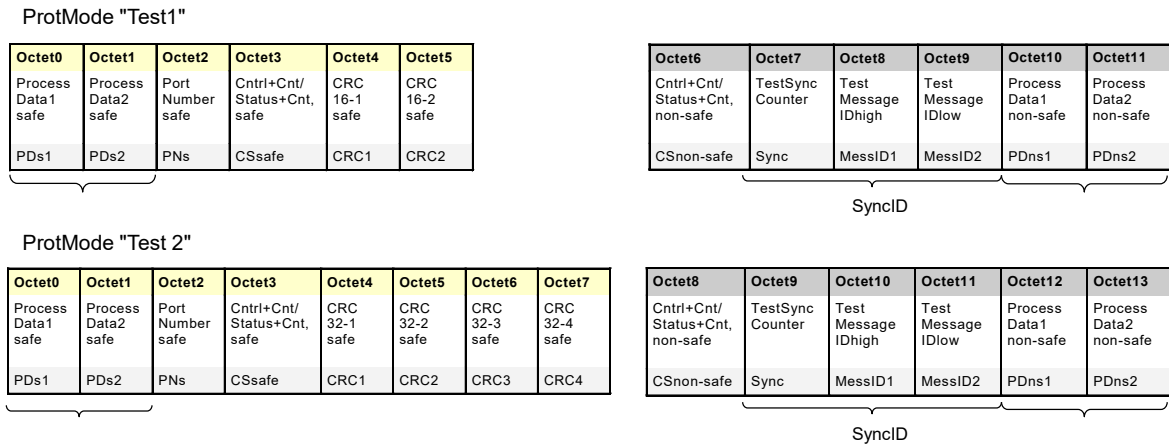
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Figure A.9 – Upper Tester logic operations (copy)

5825 Figure A.10 shows how synchronization check of data (test patterns) is achieved through an 8
 5826 bit counter (TestSyncCounter) within the "test control channel" in case of "FSP_ProtMode" =
 5827 "Test1" (16 bit CRC) and "Test2" (32 bit CRC).

5828 The Octets for test message identifications "TestMessageIdhigh" and "TestMessageIdlow"
 5829 shall be treated as "reserved".



5830

5831

Figure A.10 – Data transfer in safety and test control channel

5832

Details are defined for the actual FS-Master SCL protocol tester tool in A.2.4.

5833

Many FS-Device DUTs have a fixed technology application and limited resources such that no test control channel and no remote Upper Tester can be established. Thus, a simplified FS-Device SCL testing has been chosen as shown Figure A.11. It results in the following restrictions for the test creation and performance.

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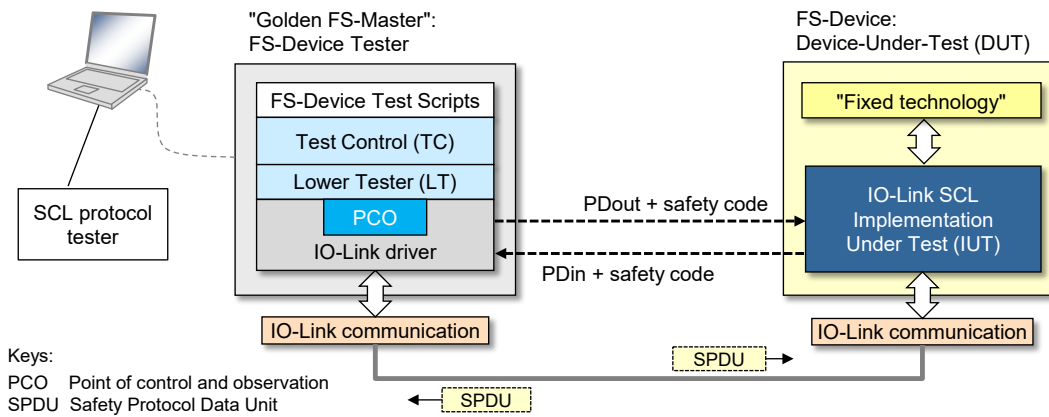
5837

The test scripts for the FS-Device set and check all safety process data and signals of the communication interface (SPDU). A static configuration with safety process data >0 and SDset_DS =0 is defined for the parameters of the "Fixed technology" interface. An FS-Device shall always provide valid process data values for the test.

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Figure A.11 – Principle of FS-Device SCL testing

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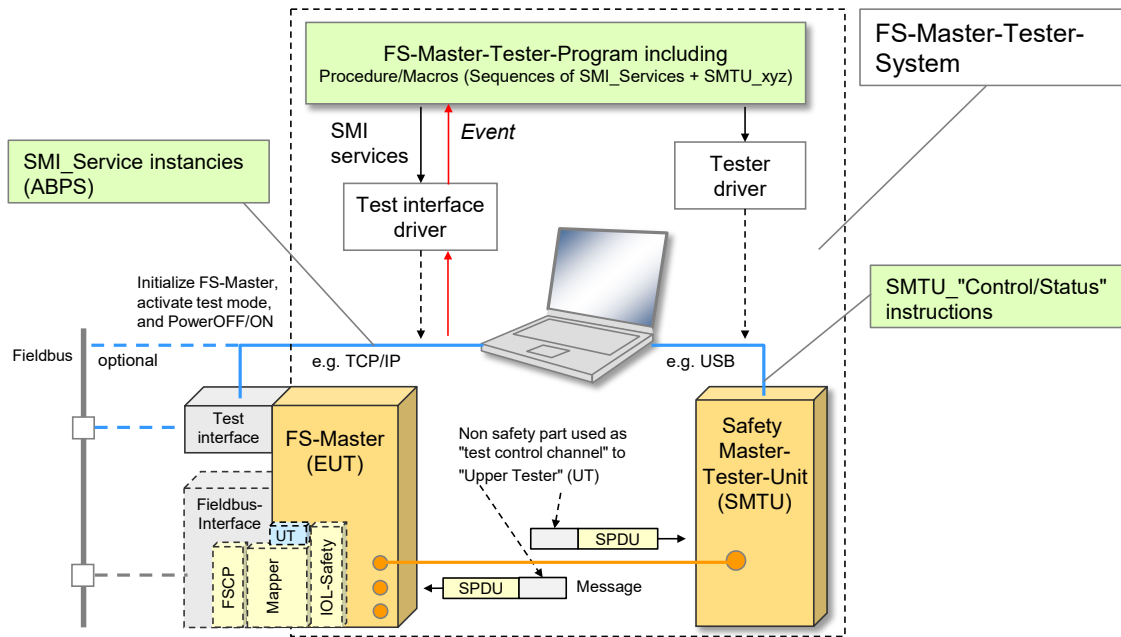
A.2.4 FS-Master tester system

5844

Figure A.12 shows the possible configurations for an FS-Master tester system including SCL testing. This configuration can be used for all test cases such as VerifyRecord, FS-Master/FS-Device configuration, and SCL protocol test scripts, but not for physical layer tests.

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Figure A.12 – FS-Master tester system

5849 Input for the FS-Master-Tester-Program are test scripts based on test cases in this document,
 5850 mainly coded in XML and secured for possible audits by assessment bodies. Test results
 5851 (verdict) shall be logged together with test scripts and versions of the FS-Master-Tester-
 5852 Program for later reproduction. Thus, versioning of testers is required.

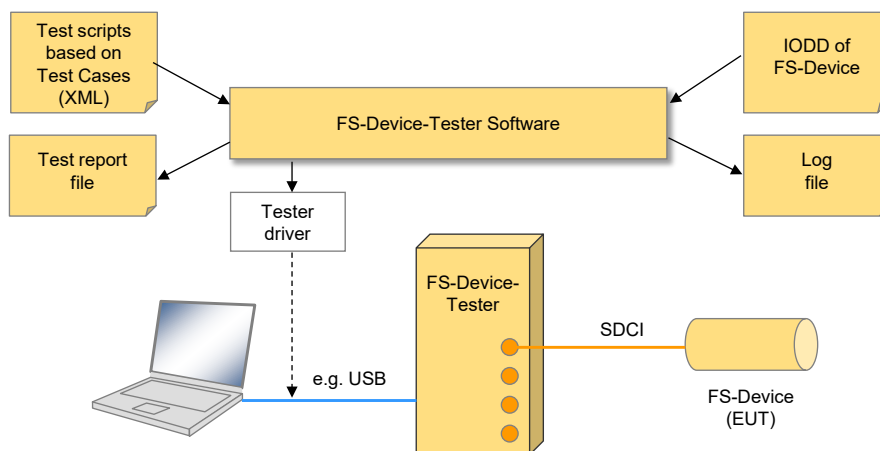
5853 In order to drive the tests, the FS-Master-Tester-Program uses SMI services defined in [2] and
 5854 specific SMI services defined in [4], as well as MTU instructions defined in [9] and SMTU
 5855 instructions defined in A.4.7.

5856 **A.2.5 FS-Device tester (FSDT)**

5857 Figure A.13 shows the possible configurations for an FS-Device tester (FSDT). With the help of
 5858 the IODD of the FS-Device, the test can be adjusted to the fixed IO data structures of the FS-
 5859 Device.

5860 Test results (verdict) shall be logged together with test scripts and versions of FS-Device Tester
 5861 Software for later reproduction. Thus, versioning of testers is required.

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5864

Figure A.13 – FS-Device SCL protocol tester

5865 **A.2.6 IODD Checker Tool**

5866 The existing Checker Tool for non-safety IODDs shall be augmented according to Clause 6.2.

5867 **A.2.7 Reference FS-Master/FS-Master Tool and FS-Devices**

5868 A number of test cases can only be performed in an economic manner by reference FS-
5869 Master/FS-Master Tool and FS-Devices. The IO-Link Community identifies such a reference
5870 based on suggestions of the IO-Link Safety working group. The working group can revise
5871 suggestions in case the reference does not meet specified requirements. After a start-up phase
5872 it is expected that at least 3 different reference FS-Devices are available.

5873 **A.2.8 Responsibility of test equipment manufacturers**

5874 A number of test cases are dealing with verification, configuration, and parameterization. Some
5875 of them can be performed automatically, some of them only manually. It is up to the
5876 manufacturers of test equipment whether they support all or some of these test cases in the
5877 particular test equipment. However, they are responsible for complete support of all test cases
5878 for either FS-Device or FS-Master including FS-Master Tool for the manufacturer declaration.
5879 For test cases not covered by the automated test equipment, manufacturers of test equipment
5880 shall provide instructions and auxiliary means, how the tests can be performed manually.

5881 **A.3 Assessment and audits of test equipment**

5882 There are no functional safety-related requirements on the hardware of the test equipment such
5883 as redundancy. However, tester software development shall observe the rules defined in IEC
5884 61508 or ISO 13849 for T2 level.

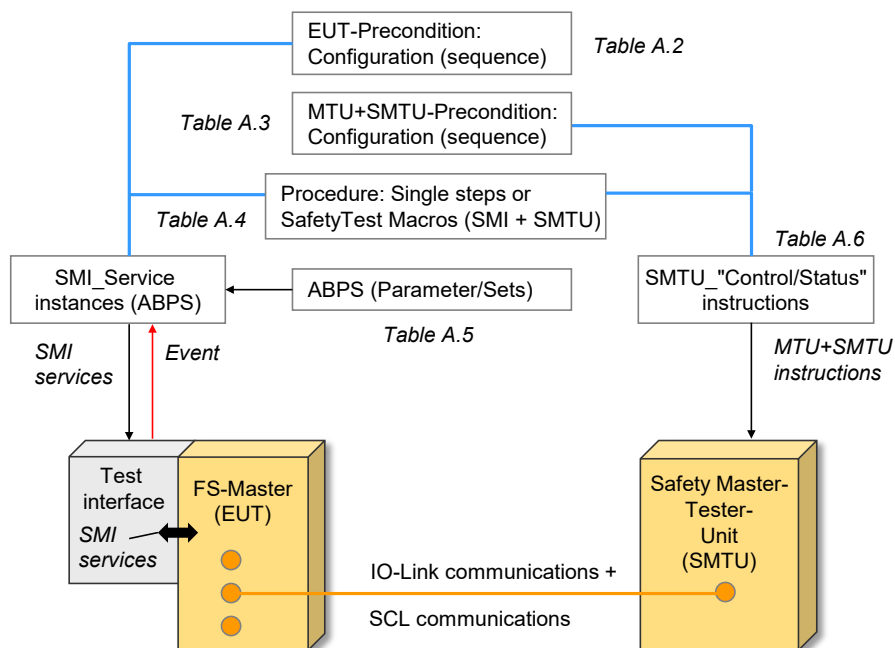
5885 Therefore, functional safety assessment by an accredited or recognized assessment body shall
5886 be performed for the equipment. The test scripts shall be "sealed" by CRC signature.

5887 If competence or test centers are established by the IO-Link Community, audits by the IO-Link
5888 Community and an assessment body are required for personal and test equipment.

5889 **A.4 Components of FS-Master test cases**

5890 **A.4.1 Overview**

5891 Figure A.14 provides an overview of the components of FS-Master test cases, comprising EUT-
5892 and SMTU-preconditions as well as safety test macros, ArgBlock parameter sets (ABPS) for
5893 SMI service instances, and SMTU instructions to control and monitor the SMTU.



5894

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Figure A.14 – Components of FS-Master test cases

5896 SMI service instances and MTU/SMTU instructions can be directly used to define test procedure
5897 steps. In certain cases, it is advantageous to use macros combining SMI service instances and

5898 MTU/SMTU-Instructions. Flow control expressions such as "wait until", "repeat from", etc. can
 5899 supplement these macros. They shall be named intuitively and shall be preceded by the prefix
 5900 "STM_" for safety test macro.

5901 A.4.2 EUT preconditions (FS-Master Port)

5902 Table A.3 shows preconditions of the EUT in addition to the preconditions for NSR testing
 5903 defined in [9]. They can represent a description of a state or a sequence of activities to reach
 5904 a certain state of the EUT. Parameters are listed in Table A.7.

5905 **Table A.3 – Preconditions of the EUT**

Identifier	Description of state or activities to reach state
PORT_OSSDe	Port is in OSSDe Mode ;SMI_FSPortConfiguration
PORT_FSCOM	Port is in SAFETYCOM Mode ;pure FS-PD exchange
PORT_MIXFSCOM	Port is in MIXEDSAFETYCOM Mode ;FS-PD and PD exchange
PORT_POWER_OFF	Port Power L+ switched off ;SMI_PortPowerOffOn
PORT_FSP_PARAMETERS	FSP-Parameters are stored in FS-Master for VerifyRecord ;SMI_FSPortConfiguration

5906

5907 A.4.3 SMTU preconditions

5908 Table A.4 shows macros of preconditions of the SMTU playing the role of a controllable and
 5909 observable FS-Device. They describe values (instances) of parameters of a state or a sequence
 5910 of activities to reach a certain state of the SMTU.

5911 **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 ;PREOPERATE = TYPE1_2, ;OPERATE = TYPE_2_V ;ISDU supported DPP1(ProcessDataIn) = 0x8A ;PDIn = 88 bit DPP1(ProcessDataOut) = 0x8A ;PDUOut = 88 bit DPP1(DeviceID) = 0x002BD3 NOTE 1 ;DID = 11219 Mandatory Indices: Index 0x0012 (ProductName) = "SMTU" ;UTF8 coding Index 0x4200 (Authenticity record): FSCP_Authenticity = xxx(non-zero) ;"Armed" FSP_Port = 1 ;Port number 1 FSP_AuthentCRC = CRC-16 ;valid signature for Authenticity Index 0x4201 (Protocol record): FSP_ProtVersion = 0x01 ;current protocol version FSP_ProtMode = 0x01 ;3 octets FS-PD maximum FSP_Watchdog = yyy NOTE 2 ;reasonable time value! FSP_IO_StructCRC = CRC-16 ;valid signature for IO_Struct FSP_TechParCRC = CRC-32 ;valid signature for no FST-Param. FSP_PortParCRC = CRC-16 ;valid signature for Protocol record Index 0x4212 (FSP_ParamDescCRC) = CRC-32 ;from IODD
SMTU_STANDARD_STATE_32	Same as SMTU_STANDARD_STATE_16, except for: DPP1(ProcessDataIn) = 0x9F ;PDIn = 32 octets DPP1(ProcessDataOut) = 0x9F ;PDUOut = 32 octets Mandatory Indices: Index 0x4201 (Protocol record): FSP_ProtMode = 0x02 ;25 octets FS-PD maximum
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].	
NOTE 2 A reasonable value should be chosen allowing watchdog tests without long test durations (<< 1 min)	

5912

5913 **A.4.4 SafetyTestMacros (STM) of the FS-Master-Tester-Program**

5914 Table A.5 shows SafetyTestMacros of the Safety-Master-Tester-Program for both EUT (FS-
5915 Master) and SMTU. All STMs shall return after ≤ 30 s (default Test_Timeout).

5916 **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

5917

5918 **A.4.5 SMI Event handling**

5919 The Safety-Master-Tester-Program uses the mechanisms as specified in Annex A.4.5 in [9].

5920 **A.4.6 SMI ArgBlock parameter sets (ABPS)**

5921 The ArgBlock parameter sets (ABPS) defined in Annex A.4.6 in [9] are supplemented for safety.
5922 The same rules apply.

5923

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)
		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		

ABPS	ArgBlock	Element	Type	Value
		TotalOfInInt16	Unsigned8	1
		TotalOfInInt32	Unsigned8	0
		SPDUOutLength	Unsigned8	8
		TotalOfOutBits	Unsigned8	0
		TotalOfOutOctets	Unsigned8	0
		TotalOfOutInt16	Unsigned8	1
		TotalOfOutInt32	Unsigned8	0
ABPS_FSCONFIG_OSSDE	FSPortConfigList	ArgBlockID	Unsigned16	0x8100
		PortMode	Unsigned8	51 (OSSDE)
		Don't care (≠ 0)
		SPDUInLength	Unsigned8	1 octet (fixed)
		Don't care (≠ 0)
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)
		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

ABPS	ArgBlock	Element	Type	Value
ABPS_PDOOUT6	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_PDOOUT32	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)
ABPS_SPDUOUT3	SPDUOut	ArgBlockID	Unsigned16	0x1102
		SPDUOut [i=0...2]	Unsigned8	3-i
ABPS_SPDUOUT25	SPDUOut	ArgBlockID	Unsigned16	0x1102
		SPDUOut [i=0...24]	Unsigned8	25-i

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A.4.7 SMTU instructions

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Instructions of the Master-Tester-Program for the MTU specified in Annex A.4.7 in [9] are supplemented for safety. Table A.7 shows (fixed) instructions of the Safety-Master-Tester-Program for the SMTU (Safety-Master-Tester-Unit). Every SMTU instruction returns the specified parameters defined in "Return value".

5930

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_Measure_WDtime	–	WD_time	1) SMTU to observe SPDU traffic ("MCount" and "Activate safe state" CB1) 2) Trigger SMTU to start measure-

Name	Parameter	Return value	Definition
			ment when MCount = 1 3) SMTU to insert artificial repetitions of the same SPDU with MCount = 1 (> FSP_Watchdog) 4) Stop measurement, when MCount = 0
SMTU_MixData_Get	–	SR, NSR, OE	Readback mixed Process Data in 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 record of VerifyRecord

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A.4.8 Fictive IODD for SMTU

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The FS-Master tester system provides a fictive IODD for the SMTU.

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Annex B (normative)

Assessment and certification

5938 **B.1 General**

5939 In case of safety for machinery, a manufacturer declaration is only sufficient for a product to be
5940 launched, if the manufacturer fulfils certain preconditions. Otherwise, functional safety
5941 assessments by assessment bodies are required based on international standards such as IEC
5942 61508, IEC 62061, or ISO 13849. There are three types of assessment objects in IO-Link
5943 Safety:

- 5944 • Specification (see [4]),
- 5945 • SCL-stacks and software tools,
- 5946 • Functional safety products such as FS-Device and FS-Master including Master-Tools.

5947 The actual assessment of IO-Link Safety can only comprise a concept approval of the
5948 specification ([4]) and companion documents as a precondition for the conformity of
5949 implementations (see B.4).

5950 Since it is possible to implement the safety communication layers (SCL) of IO-Link Safety in a
5951 completely hardware-independent manner, manufacturers can save quiet some effort and time
5952 if precertified SCL-stacks and software tools are available on the market. Preconditions are
5953 described in B.5.2.

5954 Procedures and constraints for functional safety products are described in detail in B.5.

5955 **B.2 Safety policy**

5956 In order to prevent and protect the manufacturers and vendors of FS-Masters and FS-Devices
5957 from possibly misleading understandings or wrong expectations and negligence actions regar-
5958 ding safety-related developments and applications the following shall be observed and ex-
5959 plained in each training, seminar, workshop and consultancy.

- 5960 • Any non-safety-related device automatically will not be applicable for safety-related appli-
5961 cations just by using fieldbus or IO-Link communication and a safety communication layer.
5962 The safety technology part of a safety device shall be approved for a Safety Integrity Level
5963 (SIL) or Performance Level (PL) suitable for the intended safety functions. The IO-Link
5964 Safety part shall be implemented and approved for the same SIL/PL or better.
- 5965 • In order to enable a product for safety-related applications, appropriate development
5966 processes according to safety standards shall be observed (see IEC 61508, IEC 62061, ISO
5967 13849) and an assessment from a competent assessment body or authorized manufacturer
5968 department shall be achieved.
- 5969 • The manufacturer/vendor of a safety product is responsible for the correct implementation
5970 of the safety communication layer technology, the correctness and completeness of the
5971 product documentation and information.
- 5972 • Supplemental safety-related information to the regular specification in [4] shall be observed
5973 for implementation, test and assessment if applicable. Normally, this information is provided
5974 by the working group as response to a change request (CR) within the CR-database that is
5975 in state "implementation" and approved by an assessment body. The working group can
5976 decide to publish these CRs through a separate "Corrigendum" document for download on
5977 the IO-Link website.

5978 **B.3 Obligations for international business**

5979 As a rule, the international safety standards are accepted (ratified) globally. However, since
5980 safety technology in automation is relevant to occupational safety and the concomitant
5981 insurance risks in a country, recognition of the rules pointed out here is still a sovereign right.

5982 The national "Authorities" decide on the recognition of assessment reports. The observation of
5983 additional national regulations may be required.

5984 **B.4 Concept approval of IO-Link Safety**

5985 For the approval of the safety concepts of IO-Link Safety the following has been provided by
5986 the community:

- 5987 • Specification of IO-Link Safety ([4])
- 5988 • Documentation of the modelling, the model checking, and the simulation including fault
5989 injection of the IO-Link safety communication layer (SCL)
- 5990 • Document "Safety considerations" with Functional Safety Management, calculation of
5991 relevant Residual Error Rates, and software tool chain FMEA
- 5992 • Document "Document Management and Working Group rules"

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5994 **B.5 Product assessment and certification**

5995 **B.5.1 Overview**

5996 Products within the domain of IO-Link Safety can be precertified software stacks or safety
5997 devices.

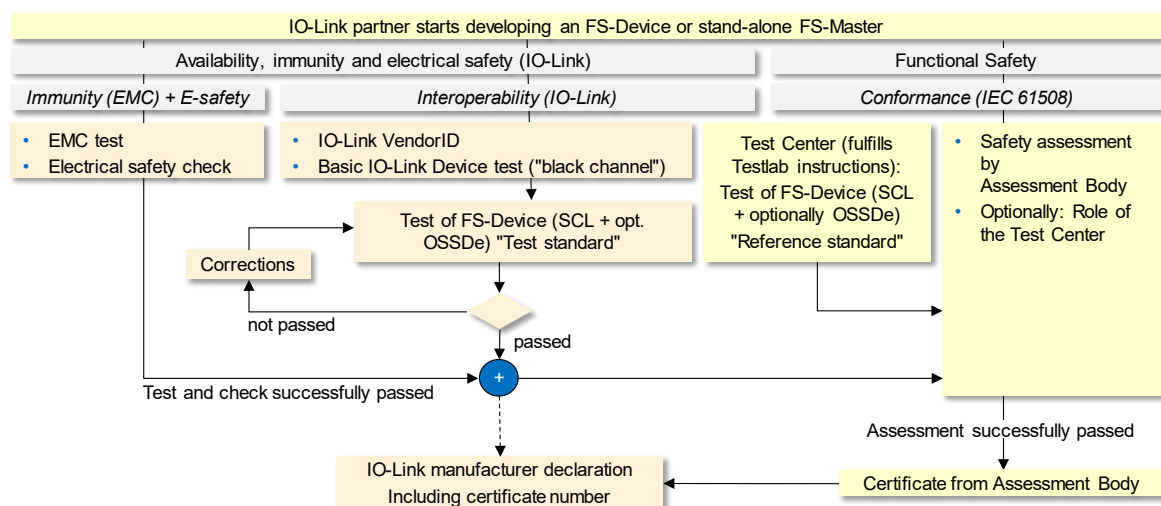
5998 **B.5.2 Precertified software stacks**

5999 Software shall be valid for the architecture required by the certain SIL or PL, for example
6000 redundancy in case of SIL3 or PL_e. The requirements for compliant items according to IEC
6001 61508-3 shall be observed for the assessment of a precertified SCL-stack.

6002 Software shall be "sealed" to protect it from unintended changes. The user is only permitted to
6003 adapt the interfaces and keep the core part of the software untouched in order to keep the
6004 certificate.

6005 **B.5.3 Certified FS-Devices and stand-alone FS-Master**

6006 Figure B.1 illustrates the assessment procedures of FS-Device and stand-alone FS-Master.



6007

6008 **Figure B.1 – Assessment of FS-Device and stand-alone FS-Master**

6009 Test, assessment, and certification of FS-Devices comprise three aspects:

- 6010 • Conformity with regulations, for example European Directives such as Electromagnetic
6011 Compatibility (EMC – IEC 61000-6-7) and Low Voltage Directive (electrical safety – IEC
6012 61010-2-201);

6013 • IO-Link Interoperability, that means conformity of the FS-Device with the IO-Link
 6014 specifications: The IO-Link community arranged for "Test standards" (test tool suite) based
 6015 on this document and supported by Technology Providers;

6016 • Conformance of functional safety development process with IEC 61508 (due to
 6017 software/firmware involvement).

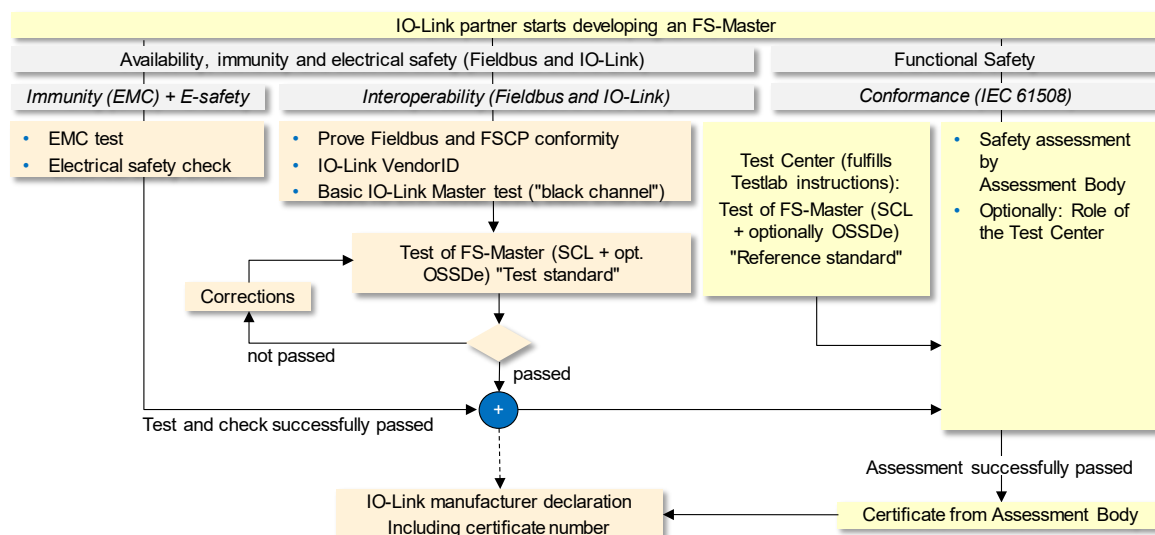
6018 While developers can use the IO-Link "Test Standards" during development to ensure a high
 6019 degree of conformity/interoperability with IO-Link and IO-Link Safety, this is not enough for
 6020 functional safety. IO-Link Safety requires Test Centers assessed by the IO-Link Community and
 6021 an assessment body and audited periodically. These Test Centers are performing tests and
 6022 checks according to approved "Test Lab Instructions" and using approved "Reference Stan-
 6023 dards". "Test Standards" and "Reference Standards" correspond to each other. However, while
 6024 the "Test Standards" can be variable to a certain extent and be adjusted to customer require-
 6025 ments, the "Reference Tests" are fixed and "locked/sealed" by signature.

6026 Safety assessment bodies can play the role of a Test Center on behalf of the IO-Link Communi-
 6027 ty, thus reducing time and effort.

6028 After the final certificate of the Assessment Body, the FS-Device manufacturer can issue the
 6029 IO-Link Safety Manufacturer declaration showing the certificate number of the assessment.

6030 B.5.4 Certified FS-Master integrated in FSCP

6031 Figure B.2 illustrates the assessment procedures of FS-Master on FSCP.



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Figure B.2 – Assessment of FS-Master on FSCP

6034 Assessment and certification of FS-Masters on fieldbus/FSCP follows a similar concept:

6035 • EMC tests and electrical safety issues can be different depending on the standards to be
 6036 considered (generic, domain, or product);

6037 • Usually, from a fieldbus/FSCP point-of-view, the FS-Master is a fieldbus device and shall
 6038 be developed, tested, and assessed according to the interoperability/conformity rules of the
 6039 particular fieldbus/FSCP. The result is a certificate of the fieldbus organization;

6040 • The remaining steps correspond to those of an FS-Device.

6041 B.6 Grandfathering rules

6042 In future releases of this document, grandfathering rules will be necessary once the "black
 6043 channel", i.e. the IO-Link layer stack is changed in an FS-Master or in an FS-Device.

6044 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**

6050 Information about test laboratories, which test and validate the conformity of IO-Link Safety
6051 products such as FS-Masters and FS-Devices with IO-Link specifications can be obtained from
6052 the following organization:

6053 IO-Link Community
6054 c/o PROFIBUS Nutzerorganisation e.V.
6055 Haid-und-Neu-Str. 7
6056 76131 Karlsruhe
6057 GERMANY
6058 Phone: +49 721 9658 590
6059 Fax: +49 721 9658 589
6060 E-Mail: info@io-link.com
6061 URL: www.io-link.com

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Annex D
(normative)

Manufacturer declaration for safety devices

6066 A dedicated manufacturer declaration for FS-Devices and FS-Masters can be downloaded from
6067 the download area in www.io-link.com.

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Annex E (informative) Listing of FS test cases

6071 E.1 Listing of FS test cases sorted by IDs

6072 Table E.1 shows the Test cases and its references.

6073

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
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