

ISO/TS 22133:2023-03 (E)

Road vehicles - Test object monitoring and control for active safety and automated/autonomous vehicle testing - Functional requirements, specifications and communication protocol

Contents	Page
Introduction.....	vii
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	1
4 Abbreviated terms	4
5 Test scenario illustration.....	5
6 General requirements and recommendations.....	6
6.1 Function overview.....	6
6.2 Test object coordinate system	6
6.2.1 Vehicle	6
6.2.2 Moveable test objects other than vehicle	7
6.3 Test scenario coordinate system	9
6.3.1 Background info: tectonic/continental plate drift.....	9
6.3.2 Coordinate system - Tests on proving ground	9
6.3.3 Coordinate system - Test on other test areas.....	10
6.4 Time requirements	10
6.4.1 General time requirements	10
6.4.2 Time representation	10
6.4.3 Absolute time	10
6.4.4 Relative time	11
6.4.5 Time resolution.....	11
6.4.6 Time accuracy (and precision).....	11
6.4.7 Time synchronization.....	11
6.4.8 Date synchronization.....	12
6.4.9 Network delay.....	12
6.5 Communication requirements and permissions	13
7 Safety and risk assessment requirements and recommendations.....	14
7.1 General	14
7.2 Local test object fence and global geofence	15
7.2.1 Common requirements and recommendations	15
7.2.2 Global geofence	15
7.2.3 Local test object fence.....	15
8 Communication security requirements	17
9 Architecture and interfaces	17
9.1 General	17
9.2 Control centre and test object states	18
9.2.1 General.....	18
9.2.2 Test objects state diagram	18
9.2.3 Test object state change conditions.....	20
9.2.4 Control centre state diagram	20
9.2.5 Control centre state change triggers	21
9.3 Communication setup	22

9.3.1	General	22
9.3.2	Test object discovery	22
9.3.3	TCP communication setup (control channel)	22
9.3.4	UDP communication setup (process channel).....	23
9.3.5	File transfer protocol (FTP).....	25
9.4	Control functionalities.....	25
9.4.1	Automated and non-automated drive.....	25
9.4.2	Remote-control manoeuvring	26
10	Trajectory and scenario-based testing.....	28
10.1	Introduction to trajectory and scenario-based testing	28
10.2	Static trajectories	28
10.3	Dynamic trajectories.....	28
10.4	Scenario-description languages.....	29
11	Functional requirements.....	29
11.1	Device interface description XML (DIDX).....	29
11.2	Control centre requirements and recommendations.....	30
11.3	Stationary test object requirements.....	30
11.4	Moveable test object requirements and recommendations.....	30
11.5	Functions with behaviour description	31
11.5.1	Arm and disarm test object.....	31
11.5.2	Start test.....	32
11.5.3	Emergency stop of test scenario (initiated by the CC)	33
11.5.4	Emergency stop of test scenario (upon request from test object).....	34
11.5.5	Normal stop of test scenario.....	35
11.5.6	Download static (pre planned) trajectories	36
11.5.7	Cyclic monitor and heartbeat.....	36
11.5.8	Adaptive synchronization point.....	36
11.5.9	Remote-control manoeuvring	39
11.5.10	Trigger and action	40
12	Interface requirements	41
12.1	General	41
12.2	Message.....	42
12.2.1	Message structure	42
12.2.2	Sequential byte order	42
12.2.3	Message header.....	43
12.2.4	Message content.....	44
12.2.5	Message footer.....	45
12.2.6	Protocol tunnel.....	45
12.2.7	Vendor-specific messages	46
12.3	Collective message overview.....	46
12.3.1	Trajectory object message - TRAJ (MsgID 0x0001).....	48
12.3.2	Object setting message - OSEM (MsgID 0x0002)	51
12.3.3	Object state change request message - OSTM (MsgID 0x0003)	58
12.3.4	Start message -STRT (MsgID 0x0004).....	58
12.3.5	Heartbeat message - HEAB (MsgID 0x0005).....	59
12.3.6	Monitor message - MONR (MsgID 0x0006).....	61
12.3.7	Monitor message 2 - MONR2 (MsgID 0x0007)	64
12.3.8	GPS second of week roll over message - SOWM (MsgID 0x0008).....	66
12.3.9	Synchronization point configuration message - SYPM (MsgID 0x000B)	67
12.3.10	Master time to synchronization point message -MTSP (MsgID 0x000C).....	68
12.3.11	Remote-control manoeuvring message - RCMM (MsgID 0x000A)	68
12.3.12	Remote-control manoeuvring message 2 - RCMM2 (MsgID 0x0016).....	71
12.3.13	Trigger configuration message - TRCM (MsgID 0x0021).....	73

12.3.14	Action configuration message - ACCM (MsgID 0x0022)	76
12.3.15	Trigger event occurred message - TREO (MsgID 0x0023)	78
12.3.16	Execute action message - EXAC (MsgID 0x0024)	79
12.3.17	Cancel or delete trigger and action - CADE (MsgID 0x0025)	80
12.3.18	Action performed message - APEM (MsgID 0x0026).....	80
12.3.19	Discovery request DREQ (MsgID 0x0010)	81
12.3.20	Discovery response DRES (MsgID 0x0011)	81
12.3.21	Parameter request message - PREQ (MsgID 0x0012)	82
12.3.22	Parameter response message PRES (MsgID 0x0013)	83
12.3.23	GeoFence message GEOF (MsgID 0x0009)	84
12.3.24	General data message - GEDM (MsgID 0x0017)	85
12.3.25	General response message - GREM (MsgID 0x0018).....	87
Annex A (normative) Trajectory file format.....		89
Annex B (informative) Message footer checksum calculation		92
Annex C (informative) Trigger and action.....		95
Annex D (normative) Device interface description XML (DIDX)		100
Bibliography		102