

SLOVENSKI STANDARD

SIST EN 61158-6-10:2015

01-marec-2015

Nadomešča:

SIST EN 61158-6-10:2012

Industrijska komunikacijska omrežja - Specifikacije za procesna vodila - 6-10. del: Specifikacija protokola na aplikacijski ravni - Elementi tipa 10 (IEC 61158-6-10:2014)

Industrial communication networks - Fieldbus specifications - Part 6-10: Application layer protocol specification - Type 10 elements (IEC 61158-6-10:2014)

iTeh STANDARD PREVIEW

Industrielle Kommunikationsnetze - Feldbusse - Teil 6-10: Protokollspezifikation des Application Layer (Anwendungsschicht) - Typ 10-Elemente (IEC 61158-6-10:2014)

[SIST EN 61158-6-10:2015](#)

Réseaux de communication industriels - Spécifications des bus de terrain - Partie 6-10: Spécification du protocole de la couche application - Elements de type 10 (CEI 61158-6-10:2014)

Ta slovenski standard je istoveten z: EN 61158-6-10:2014

ICS:

25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control
35.100.70	Uporabniški sloj	Application layer
35.110	Omreževanje	Networking

SIST EN 61158-6-10:2015

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 61158-6-10:2015](https://standards.iteh.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-90e3fbc17714/sist-en-61158-6-10-2015)

<https://standards.iteh.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-90e3fbc17714/sist-en-61158-6-10-2015>

EUROPEAN STANDARD

EN 61158-6-10

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2014

ICS 25.040.40; 35.100.70; 35.110

Supersedes EN 61158-6-10:2012

English Version

**Industrial communication networks - Fieldbus specifications -
Part 6-10: Application layer protocol specification - Type 10
elements
(IEC 61158-6-10:2014)**

Réseaux de communication industriels - Spécifications des
bus de terrain - Partie 6-10: Spécification du protocole de la
couche application - Eléments de type 10
(CEI 61158-6-10:2014)

Industrielle Kommunikationsnetze - Feldbusse - Teil 6-10:
Protokollspezifikation des Application Layer
(Anwendungsschicht) - Typ 10-Elemente
(IEC 61158-6-10:2014)

This European Standard was approved by CENELEC on 2014-09-23. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

[https://standards.iteh.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-](https://standards.iteh.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-90e3fbc17714/sist-en-61158-6-10-2015)

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 65C/764/FDIS, future edition 3 of IEC 61158-6-10, prepared by SC 65C "Industrial networks" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61158-6-10:2014.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-06-23
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-09-23

This document supersedes EN 61158-6-10:2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

iTeh STANDARD PREVIEW

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

[SIST EN 61158-6-10:2015](https://standards.iteh.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-90e311111111/sist-en-61158-6-10-2015)

<https://standards.iteh.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-90e311111111/sist-en-61158-6-10-2015>

Endorsement notice

The text of the International Standard IEC 61158-6-10:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61784-1	NOTE	Harmonized as EN 61784-1.
IEC 61784-2	NOTE	Harmonized as EN 61784-2.
IEC 61784-3-3	NOTE	Harmonized as EN 61784-3-3.
IEC 60793-2-30	NOTE	Harmonized as EN 60793-2-30.
IEC 60793-2-40	NOTE	Harmonized as EN 60793-2-40.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-1	2014	Industrial communication networks - Fieldbus specifications - Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series	EN 61158-1	2014
IEC 61158-2	2014	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	EN 61158-2	2014
IEC 61158-5-10	2014	Industrial communication networks - Fieldbus specifications - Part 5-10: Application layer service definition - Type 10 elements	EN 61158-5-10	2014
IEC 61158-6-3	2014	Industrial communication networks - Fieldbus specifications - Part 6-3: Application layer protocol specification - Type 3 elements	EN 61158-6-3	2014
IEC 61588	-	Precision clock synchronization protocol for networked measurement and control systems	-	-
IEC 62439-2	-	Industrial communication networks - High availability automation networks - Part 2: Media Redundancy Protocol (MRP)	EN 62439-2	-
ISO/IEC 646	1991	Information technology - ISO 7-bit coded character set for information interchange	-	-
ISO/IEC 7498-1	-	Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model	-	-
ISO/IEC 8822	-	Information technology - Open Systems Interconnection - Presentation service definition	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO/IEC 8824-1	-	Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation	-	-
ISO/IEC 9545	-	Information technology - Open Systems Interconnection - Application layer structure	-	-
ISO/IEC 10731	-	Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI services	-	-
ISO 8601	-	Data elements and interchange formats - Information interchange - Representation of dates and times	-	-
IEEE 754	-	IEEE Standard for Floating-Point Arithmetic	-	-
IEEE 802	-	IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture	-	-
IEEE 802.1AB	2005	IEEE Standard for Local and metropolitan area networks - Station and Media Access Control Connectivity Discovery	-	-
IEEE 802.1AS	-	IEEE Standard for Local and Metropolitan Area Networks - Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks	-	-
IEEE 802.1D	-	IEEE Standard for local and metropolitan area networks - Media Access Control (MAC) Bridges	-	-
IEEE 802.1Q	-	IEEE Standard for Local and metropolitan area networks - Media Access Control (MAC) Bridges and Virtual Bridged Local Area Networks	-	-
IEEE 802.3	-	IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications	-	-
IEEE 802.11	-	IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEEE 802.15.1	2005	IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 15.1: Wireless medium access control (MAC) and physical layer (PHY) specifications for wireless personal area networks (WPANs)	-	-
IETF RFC 768	-	User Datagram Protocol	-	-
IETF RFC 791	-	Internet Protocol	-	-
IETF RFC 792	-	Internet Control Message Protocol	-	-
IETF RFC 826	-	Ethernet Address Resolution Protocol: Or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware	-	-
IETF RFC 1034	-	Domain names - concepts and facilities	-	-
IETF RFC 1213	-	Management Information Base for Network Management of TCP/IP-based Internets: MIB-II	-	-
IETF RFC 2131	-	Dynamic Host Configuration Protocol	-	-
IETF RFC 2132	-	DHCP Options and BOOTP Vendor Extensions	-	-
IETF RFC 2236	-	Internet Group Management Protocol, Version 2	-	-
IETF RFC 2365	-	Administratively Scoped IP Multicast	-	-
IETF RFC 2474	-	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers	-	-
IETF RFC 2674	-	Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and Virtual LAN Extensions	-	-
IETF RFC 2863	-	The Interfaces Group MIB	-	-
IETF RFC 3418	-	Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)	-	-
IETF RFC 3621	-	Power Ethernet MIB	-	-
IETF RFC 4361	-	Node-specific Client Identifiers for Dynamic Host Configuration Protocol Version Four (DHCPv4)	-	-
IETF RFC 4363	-	Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering, and Virtual LAN Extensions	-	-
IETF RFC 4836	-	Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)	-	-
IETF RFC 5735	-	Special Use IPv4 Addresses	-	-

iTeH STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61158-6-10:2015
<https://standards.iteh.ai/catalog/standards/sist/61158-6-10-2015/61158-420e-4932-a33c-90e3fbc17714/sist-en-61158-6-10-2015>

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IETF RFC 5890	-	Internationalized Domain Names for Applications (IDNA): Definitions and Document Framework	-	-
The Open Group - Publication C706	-	Technical Standard DCE1.1: Remote Procedure Call	-	-

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 61158-6-10:2015](https://standards.iteh.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-90e3fbc17714/sist-en-61158-6-10-2015)

<https://standards.iteh.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-90e3fbc17714/sist-en-61158-6-10-2015>



IEC 61158-6-10

Edition 3.0 2014-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Industrial communication networks – Fieldbus specifications –
Part 6-10: Application layer protocol specification – Type 10 elements**

**Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 6-10: Spécification du protocole de la couche application – Eléments
de type 10**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE **XH**
CODE PRIX

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-1761-0

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	28
INTRODUCTION.....	31
1 Scope.....	33
1.1 General.....	33
1.2 Specifications.....	33
1.3 Conformance.....	34
2 Normative references.....	34
3 Terms, definitions, abbreviations, symbols and conventions.....	36
3.1 Referenced terms and definitions.....	36
3.2 Additional terms and definitions for decentralized periphery.....	37
3.3 Abbreviations and symbols.....	45
3.4 Conventions.....	48
4 Application layer protocol specification for common protocols.....	56
4.1 FAL syntax description.....	56
4.2 Transfer syntax.....	59
4.3 Discovery and basic configuration.....	71
4.4 Precision working time control.....	110
4.5 Time synchronization.....	185
4.6 Media redundancy.....	185
4.7 Real time cyclic.....	185
4.8 Real time acyclic.....	213
4.9 Fragmentation.....	231
4.10 Remote procedure call.....	247
4.11 Link layer discovery.....	265
4.12 MAC Bridges.....	276
4.13 Virtual bridges.....	305
4.14 IP suite.....	314
4.15 Domain name system.....	317
4.16 Dynamic host configuration.....	318
4.17 Simple network management.....	319
4.18 Common DLL Mapping Protocol Machines.....	320
5 Application layer protocol specification for decentralized periphery.....	325
5.1 FAL syntax description.....	325
5.2 Transfer syntax.....	343
5.3 FAL protocol state machines.....	522
5.4 AP-Context state machine.....	524
5.5 FAL Service Protocol Machines.....	524
5.6 Application Relationship Protocol Machines.....	544
5.7 DLL Mapping Protocol Machines.....	663
Annex A (normative) Unified establishing of an AR for all RT classes.....	664
Annex B (normative) Compatible establishing of an AR.....	670
Annex C (informative) Establishing of a device access AR.....	673
Annex D (informative) Establishing of an AR (accelerated procedure).....	674
Annex E (informative) Establishing of an AR (fast startup procedure).....	677
Annex F (informative) Example of the upload, storage and retrieval procedure.....	679

Annex G (informative) OSI reference model layers.....	682
Annex H (informative) Overview of the IO controller and the IO device state machines	683
Annex I (informative) Priority regeneration	685
Annex J (informative) Overview of the PTCP synchronization master hierarchy	687
Annex K (informative) Optimization of bandwidth usage.....	689
Annex L (informative) Time constraints for bandwidth allocation	691
Annex M (informative) Time constraints for the forwarding of a frame	693
Annex N (informative) Principle of dynamic frame packing	694
Annex O (informative) Principle of Fragmentation	697
Annex P (informative) MRPD – Principle of seamless media redundancy	700
Annex Q (normative) Principle of a RED_RELAY without forwarding information in PDIRFrameData	702
Annex R (informative) Optimization for fast startup without autonegotiation	704
Annex S (informative) TX-error handling	706
Annex T (informative) Example of a PrmBegin, PrmEnd and ApplRdy sequence	707
Annex U (informative) List of supported MIBs	708
Annex V (informative) Structure and content of BLOB	709
Annex W (normative) LLDP EXT MIB	710
Bibliography.....	727

iTeh STANDARD PREVIEW

(standards.iteh.ai)

Figure 1 – Common structure of specific fields.....	49
Figure 2 – Common structure of specific fields for octet 1 (high)	50
Figure 3 – Common structure of specific fields for octet 2 (low)	50
Figure 4 – Common structure of specific fields for octet 1 (high)	51
Figure 5 – Common structure of specific fields for octet 2	51
Figure 6 – Common structure of specific fields for octet 3	52
Figure 7 – Common structure of specific fields for octet 4 (low)	52
Figure 8 – Coding of the data type BinaryDate.....	61
Figure 9 – Encoding of TimeOfDay with date indication value	61
Figure 10 – Encoding of TimeOfDay without date indication value	62
Figure 11 – Encoding of TimeDifference with date indication value	62
Figure 12 – Encoding of TimeDifference without date indication value	62
Figure 13 – FastForwardingMulticastMACAdd.....	66
Figure 14 – State transition diagram of DCPUCS	95
Figure 15 – State transition diagram of DCPUCR.....	99
Figure 16 – State transition diagram of DCPMCS.....	102
Figure 17 – State transition diagram of DCPMCR	105
Figure 18 – State transition diagram of DCPHMCS	108
Figure 19 – State transition diagram of DCPHMCR	109
Figure 20 – PTCP_SequenceID value range	115
Figure 21 – Timescale correspondence between PTCP_Time and CycleCounter	118
Figure 22 – Message timestamp point.....	123

Figure 23 – Timer model	123
Figure 24 – Four message timestamps	124
Figure 25 – Line delay protocol with follow up	125
Figure 26 – Line delay protocol without follow up	125
Figure 27 – Line delay measurement	127
Figure 28 – Model parameter for GSDML usage	129
Figure 29 – Bridge delay measurement	130
Figure 30 – Delay accumulation	131
Figure 31 – Worst case accumulated time deviation of synchronization	132
Figure 32 – Scheme for measurement of deviation	132
Figure 33 – Measurement of deviation	132
Figure 34 – PTCP master sending Sync-Frame without Follow Up-Frame	133
Figure 35 – PTCP master sending Sync-Frame with FollowUp-Frame	134
Figure 36 – !FU Sync Slave Forwarding Sync-Frame	135
Figure 37 – FU Sync Slave Forwarding Sync- and FollowUp-Frame	136
Figure 38 – FU Sync Slave Forwarding Sync- and Generating FollowUp-Frame	137
Figure 39 – Principle of the monitoring of the line delay measurement	138
Figure 40 – State transition diagram of DELAY_REQ	140
Figure 41 – State transition diagram of DELAY_RSP	147
Figure 42 – Overview of PTCP	151
Figure 43 – State transition diagram of SYN_BMA	153
Figure 44 – State transition diagram of SYN_MPSM	163
Figure 45 – State transition diagram of SYN_SPSM	169
Figure 46 – State transition diagram of SYNC_RELAY	175
Figure 47 – State transition diagram of SCHEDULER	182
Figure 48 – CycleCounter value range	187
Figure 49 – Structure of the CycleCounter	188
Figure 50 – Optimized CycleCounter setting	189
Figure 51 – SFCRC16 generation rule	192
Figure 52 – SFCycleCounter value range	194
Figure 53 – Basic structure of a PPM with frame structure	196
Figure 54 – Basic structure of a PPM with subframe structure	197
Figure 55 – State transition diagram of PPM	199
Figure 56 – Basic structure of a CPM	203
Figure 57 – State transition diagram of CPM	205
Figure 58 – Addressing scheme of RTA	215
Figure 59 – Structure of the APM	218
Figure 60 – Structure of the APMS	219
Figure 61 – State transition diagram of APMS	221
Figure 62 – Structure of the APMR	226
Figure 63 – State transition diagram of APMR	228
Figure 64 – State transition diagram of FRAG_D	238
Figure 65 – State transition diagram of FRAG_S	241

Figure 66 – State transition diagram of DEFRAG	244
Figure 67 – State transition diagram of RTC3PSM	280
Figure 68 – State transition diagram for generating events	284
Figure 69 – State transition diagram of RED_RELAY	285
Figure 70 – Scheme of the DFP_RELAY	289
Figure 71 – Scheme of the DFP_INBOUND and DFP_STORAGE	290
Figure 72 – Scheme of the DFP_OUTBOUND	290
Figure 73 – State transition diagram of DFP_RELAY	291
Figure 74 – State transition diagram of DFP_RELAY_INBOUND	294
Figure 75 – State transition diagram of DFP_RELAY_IN_STORAGE	298
Figure 76 – State transition diagram of DFP_RELAY_OUTBOUND	302
Figure 77 – State transition diagram of MUX	306
Figure 78 – State transition diagram of DEMUX	311
Figure 79 – Structuring of the protocol machines within the DMPM (bridge)	321
Figure 80 – State transition diagram of LMPM	323
Figure 81 – AlarmSpecifier.SequenceNumber value range	357
Figure 82 – FrameSendOffset vs. duration of a cycle	393
Figure 83 – Severity classification of diagnosis, maintenance and qualified	436
Figure 84 – Calculation principle for a cycle	455
Figure 85 – Calculation principle for the minimum YellowTime	456
Figure 86 – Definition of the reserved interval	462
Figure 87 – Toplevel view to the PLL window	466
Figure 88 – Definition of PLL window	466
Figure 89 – Toplevel view to the time PLL window	469
Figure 90 – Definition of time PLL window	470
Figure 91 – Detection of dropped frames — appear	478
Figure 92 – Detection of dropped frames — disappear	478
Figure 93 – Detection of DFP late error — appear and disappear	485
Figure 94 – MediaRedundancyWatchDog expired — appear and disappear	486
Figure 95 – Relationship among Protocol Machines	523
Figure 96 – State transition diagram of ALPMI	546
Figure 97 – State transition diagram of ALPMR	550
Figure 98 – Scheme of the IO device CM	553
Figure 99 – State transition diagram of the IO device CM	555
Figure 100 – State transition diagram of CMDEV	559
Figure 101 – Scheme of the IO device CM – device access	563
Figure 102 – State transition diagram of CMDEV_DA	565
Figure 103 – State transition diagram of CMSU	569
Figure 104 – State transition diagram of CMIO	574
Figure 105 – State transition diagram of CMWRR	578
Figure 106 – State transition diagram of CMRDR	582
Figure 107 – State transition diagram of CMSM	584
Figure 108 – State transition diagram of CMPBE	588

Figure 109 – State transition diagram of CMDMC	593
Figure 110 – State transition diagram of CMINA	597
Figure 111 – State transition diagram of CMRPC	606
Figure 112 – Scheme of the IO controller CM	612
Figure 113 – State transition diagram of the IO controller CM	613
Figure 114 – State transition diagram of CMCTL	617
Figure 115 – State transition diagram of CTLSM	623
Figure 116 – State transition diagram of CTLIO	626
Figure 117 – State transition diagram of CTRLDI	629
Figure 118 – State transition diagram of CTRLDR	632
Figure 119 – State transition diagram of CTRLRPC	636
Figure 120 – State transition diagram of CTLSU	641
Figure 121 – State transition diagram of CTLWRI	646
Figure 122 – State transition diagram of CTLWRR	650
Figure 123 – State transition diagram of CTLPBE	653
Figure 124 – State transition diagram of CTLDINA	658
Figure 125 – Automatic NameOfStation assignment	663
Figure A.1 – Establishing of an AR using RT_CLASS_1, RT_CLASS_2 or RT_CLASS_3 (Initial connection monitoring w/o RT)	665
Figure A.2 – Establishing of an AR using RT_CLASS_1, RT_CLASS_2 or RT_CLASS_3 (Connection monitoring with RT)	666
Figure A.3 – Principle of the data evaluation during startup (RED channel establishment delayed)	667
Figure A.4 – Principle of the data evaluation during startup (RED channel establishment early)	668
Figure A.5 – Principle of the data evaluation during startup (Special case: Isochronous mode application)	669
Figure B.1 – Establishing of an AR using RT_CLASS_3 AR with startup mode “Legacy”	671
Figure B.2 – Establishing of an AR using RT_CLASS_1, 2 or UDP AR with startup mode “Legacy”	672
Figure C.1 – Establishing of a device access AR	673
Figure D.1 – Accelerated establishing of an IOAR without error	675
Figure D.2 – Accelerated establishing of an IOAR with “late” error	676
Figure E.1 – Establishing of an IOAR using fast startup	678
Figure F.1 – Example of upload with storage	680
Figure F.2 – Example of retrieval with storage	681
Figure G.1 – Assignment of the OSI reference model layers	682
Figure H.1 – Overview of the IO controller state machines	683
Figure H.2 – Overview of the IO device state machines	683
Figure H.3 – Overview of the common state machines	684
Figure J.1 – Level model for synchronization master hierarchy	687
Figure J.2 – Two level variant of the synchronization master hierarchy	688
Figure K.1 – Devices build up in a linear structure	689
Figure K.2 – Propagation of frames in linear transmit direction	689
Figure K.3 – Propagation of a frames in receive direction	690

Figure L.1 – Overview of time constraints for bandwidth allocation.....	691
Figure L.2 – Calculation of the length of a RED period.....	691
Figure L.3 – Calculation of the length of a GREEN period.....	692
Figure M.1 – Minimization of bridge delay.....	693
Figure N.1 – Dynamic frame packing.....	694
Figure N.2 – Dynamic frame packing – truncation of outputs.....	695
Figure N.3 – Dynamic frame packing – concatenation of inputs.....	695
Figure N.4 – End node mode.....	696
Figure N.5 – DFPFeed definition.....	696
Figure O.1 – Principle of fragmentation.....	697
Figure O.2 – Protocol elements of fragments.....	697
Figure O.3 – Bandwidth allocation using fragmentation.....	698
Figure O.4 – Guardian for a fragmentation domain.....	698
Figure P.1 – Principle of seamless media redundancy – I/OCR.....	700
Figure P.2 – Principle of seamless media redundancy – MCR.....	701
Figure P.3 – Principle of seamless media redundancy – Line.....	701
Figure Q.1 – Generating the FrameSendOffset for a RED_RELAY without forwarding information in PDIRFrameData.....	702
Figure R.1 – Scheme of a 2-port switch.....	704
Figure R.2 – Scheme of 2-ports.....	704
Figure T.1 – PrmBegin, PrmEnd and ApplRdy procedure.....	707
STANDARD PREVIEW (standards.itech.ai)	
<u>SIST EN 61158-6-10:2015</u> https://standards.itech.ai/catalog/standards/sist/91ebd9f0-420e-4932-a33c-90e3fbc17714/sist-en-61158-6-10-2015	
Table 1 – State machine description elements.....	53
Table 2 – Description of state machine elements.....	53
Table 3 – Conventions used in state machines.....	53
Table 4 – Conventions for services used in state machines.....	54
Table 5 – IEEE 802.3 DLPDU syntax.....	56
Table 6 – IEEE 802.11 DLPDU syntax.....	57
Table 7 – IEEE 802.15.1 DLPDU syntax.....	58
Table 8 – SourceAddress.....	63
Table 9 – DCP_MulticastMACAdd for Identify.....	64
Table 10 – DCP_MulticastMACAdd for Hello.....	64
Table 11 – DCP_MulticastMACAdd.....	64
Table 12 – PTCP_MulticastMACAdd range 1.....	64
Table 13 – PTCP_MulticastMACAdd range 2.....	64
Table 14 – PTCP_MulticastMACAdd range 3.....	65
Table 15 – PTCP_MulticastMACAdd range 4.....	65
Table 16 – PTCP_MulticastMACAdd range 5.....	65
Table 17 – PTCP_MulticastMACAdd range 6.....	65
Table 18 – PTCP_MulticastMACAdd range 7.....	65
Table 19 – PTCP_MulticastMACAdd range 8.....	66
Table 20 – RT_CLASS_3 destination multicast address.....	67
Table 21 – RT_CLASS_3 invalid frame multicast address.....	67