



IEC 61158-4-19

Edition 4.0 2019-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Industrial communication networks – Fieldbus specifications –
Part 4-19: Data-link layer protocol specification – Type 19 elements
([standards.iec.ch](https://standards.iec.ch/catalog/standards/sisv/c39396bb-dia3-4bd4-b7cc-a6bf6b704781/iec-61158-4-19-2019))

Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 4-19: Spécification de protocole de la couche liaison de données –
Eléments de Type 19





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email. <https://standards.itech.ai/catalog/standards?filter=6158419&view=grid&sort=404100>

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC 61584-4-19:2019

<https://standards.itech.ai/catalog/standards?filter=6158419&view=grid&sort=404100>

IEC online collection - oc.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 61158-4-19

Edition 4.0 2019-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Industrial communication networks – Fieldbus specifications –
Part 4-19: Data-link layer protocol specification – Type 19 elements
standards.iec.ch

Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 4-19: Spécification de protocole de la couche liaison de données –
Eléments de Type 19

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 25.040.40; 35.100.20; 35.110

ISBN 978-2-8322-9176-4

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	24
INTRODUCTION	26
1 Scope	28
1.1 General	28
1.2 Specifications	28
1.3 Procedures	28
1.4 Applicability	28
1.5 Conformance	29
2 Normative references	29
3 Terms, definitions, symbols, acronyms, abbreviations and conventions	29
3.1 Reference model terms and definitions	29
3.2 Additional Type 19 terms and definitions	30
3.3 Symbols	33
3.4 Acronyms and abbreviations	34
3.5 Additional conventions	35
4 DL-protocol overview	35
4.1 Overview	35
4.2 General DLPDU identification	37
4.2.1 Introduction	37
4.2.2 Destination address (Dest MAC)	37
4.2.3 Source address (Src MAC)	37
4.2.4 EtherType	IEC 61158-4-19:2019
4.3 General DLPDU structure	37
4.3.1 Introduction	a6bf6b704781/iec-61158-4-19-2019
4.3.2 DLPDU header	37
4.3.3 DLPDU payload	38
4.4 DLPDU header	38
4.4.1 Introduction	38
4.4.2 DLPDU type	38
4.5 MDT DLPDU	39
4.5.1 MDT MST field summary	39
4.5.2 Evaluation of MDT header in the slaves	39
4.5.3 MDT type	40
4.5.4 MDT phase	40
4.5.5 MDT CRC	40
4.5.6 MDT payload during initialization	40
4.5.7 MDT payload in normal operation (CP4)	44
4.6 AT DLPDU	51
4.6.1 AT header field summary	51
4.6.2 Evaluation of AT header in the slaves	51
4.6.3 AT type	52
4.6.4 AT phase	52
4.6.5 AT CRC	52
4.6.6 AT Payload during initialization	52
4.6.7 AT payload in CP4	56
4.7 Mechanisms of connections	62
4.7.1 Introduction	62

4.7.2	Configuration of connections	63
4.7.3	Connection control.....	64
4.7.4	Producer state machine	66
4.7.5	Consumer state machine	68
5	DL management	72
5.1	Overview	72
5.2	Initialization of cyclic communication.....	72
5.2.1	Introduction	72
5.2.2	Communication phases (CP)	73
5.2.3	Switching of communication phases (CPS)	86
5.2.4	Communication Version	98
5.2.5	Address allocation in the master and slave	99
5.3	Network topologies	101
5.3.1	Introduction	101
5.3.2	Ring topology	102
5.3.3	Line topology	102
5.3.4	Topology conditions of a slave device.....	103
5.3.5	Topology conditions of a multi-slave device	104
5.3.6	Topology state machine.....	108
5.3.7	States of Topology state machine of slave.....	109
5.3.8	Transitions of Topology state machine	110
5.4	Redundancy of RT communication with ring topology.....	112
5.4.1	Introduction	112
5.4.2	Sequence with ring break	112
5.4.3	Recovery of ring topology	113
5.4.4	Recovery of P channel	114
5.4.5	Recovery of S channel.....	115
5.5	Hot-plug procedure	115
5.5.1	Introduction	115
5.5.2	Hot-plug state machine	116
5.5.3	States of HP state machine	117
5.5.4	Transitions of HP state machine	121
5.6	Watchdog	122
5.7	Status procedures.....	122
6	Data transmission methods	123
6.1	Overview	123
6.2	Service channel (SVC).....	123
6.2.1	SVC handling	123
6.2.2	Opening and closing SVC	124
6.2.3	Selection of data block element	124
6.2.4	Changing of data block element.....	124
6.2.5	Transmission steps.....	125
6.2.6	SVC valid	126
6.2.7	Handshake bits.....	126
6.2.8	Read/Write	127
6.2.9	Busy bit	127
6.2.10	Service channel initialization	128
6.2.11	Reaction to SVC handshake timeout.....	128
6.2.12	Reaction to error messages in the service channel	128

6.2.13	Service channel error messages	128
6.2.14	Procedure command functions via the service channel	131
6.3	RT Channel	137
6.3.1	Introduction	137
6.3.2	Read_Cyclic (RDC)	137
6.3.3	Write_Cyclic (WRC)	137
6.3.4	Notify_Cyclic_Data (NCD)	137
6.4	Transmission and activation of Type 19 time	137
6.5	Multiplexing of real-time data with data containers	139
6.5.1	General	139
6.5.2	Functionality of standard data container	141
6.5.3	Functionality of extended data container (preferred function)	145
6.5.4	Data container diagnostic	150
6.6	Handling of Real-time bits	150
6.6.1	General	150
6.6.2	Real-time bits (RTB)	151
6.6.3	RTB word container	152
6.6.4	RTB list container	152
6.7	SMP	153
6.7.1	Definitions	153
6.7.2	Structure of the Session Control Header (SCH)	154
6.7.3	Evaluation sequence of session control header by the consumer	156
6.7.4	Multiplexing of two sessions (example)	157
6.7.5	Prioritization	157
6.7.6	Diagnosis of SMP	158
6.7.7	Definition of SMP containers	158
6.7.8	Example	158
6.8	Oversampling	159
6.8.1	Description	159
6.8.2	General	159
6.8.3	Constraints	159
6.8.4	Oversampling Input	159
6.8.5	Oversampling Output	160
6.8.6	Oversampling Identification	160
6.8.7	Oversampling Configuration	161
6.8.8	Application example	161
6.8.9	Oversampling State Machine	161
7	Telegram timing and DLPDU handling	163
7.1	Communication mechanisms	163
7.1.1	Cycle time	163
7.1.2	Medium access	166
7.1.3	Calculation of the Type 19 telegram length	168
7.1.4	Timing calculation of RT channel	168
7.1.5	Calculation of S-0-1006 AT0 transmission starting time (t1)	169
7.1.6	Timing calculation of UC channel	170
7.1.7	Telegram timing in CP0	171
7.1.8	Telegram timing in CP1 and CP2	172
7.1.9	Telegram timing in CP3 and CP4	174
7.1.10	Unified communication mechanisms	175

7.1.11	Internet Protocol Services (IPS).....	187
7.2	Synchronization	224
7.2.1	Network synchronization.....	224
7.2.2	Synchronization of producer cycles.....	232
7.3	Processing methods of connection data	233
7.3.1	General	233
7.3.2	Synchronous processing of application data in the slave	234
7.3.3	Cyclic processing of application data in the slave	235
7.3.4	Non-synchronous processing of application data in the slave	236
8	Communication Error handling and monitoring.....	236
8.1	Invalid telegrams	236
8.2	Response to MDT and AT telegram failure	237
8.3	Error counters in the slave	237
8.3.1	Error effects on communication phases	237
8.4	Status codes of Type 19 communication profile (SCP)	238
8.5	Priority of diagnosis classes.....	240
Annex A (normative)	IDN – Identification numbers	242
A.1	IDN specification.....	242
A.1.1	Introduction	242
A.1.2	Element 1: structure of IDN	242
A.1.3	Element 2: structure of name	243
A.1.4	Element 3: structure of attribute	244
A.1.5	Element 4: structure of unit.....	246
A.1.6	Element 5: structure of minimum value.....	247
A.1.7	Element 6: structure of maximum value.....	247
A.1.8	Element 7: structure of operation data	247
A.1.9	Structure of Data status	249
A.2	Identification numbers in numerical orders	250
A.3	Detailed specification of communication-related IDNs	254
A.3.1	IDN S-0-0014 Interface status	254
A.3.2	IDN S-0-0021 IDN-list of invalid operation data for CP2.....	255
A.3.3	IDN S-0-0022 IDN-list of invalid operation data for CP3.....	256
A.3.4	IDN S-0-0026 IDN allocation of producer RTB word container	257
A.3.5	IDN S-0-0027 IDN allocation of consumer RTB word container	257
A.3.6	IDN S-0-0127 CP3 transition check	258
A.3.7	IDN S-0-0128 CP4 transition check	259
A.3.8	IDN S-0-0144 Producer RTB word container.....	260
A.3.9	IDN S-0-0145 Consumer RTB word container	260
A.3.10	IDN S-0-0187 IDN-list of configurable data as producer.....	261
A.3.11	IDN S-0-0188 IDN-list of configurable data as consumer	261
A.3.12	IDN S-0-0328 Bit allocation of producer RTB word container	262
A.3.13	IDN S-0-0329 Bit allocation of consumer RTB word container	263
A.3.14	IDN S-0-0360 MDT data container A1.....	263
A.3.15	IDN S-0-0361 MDT data container B1.....	264
A.3.16	IDN S-0-0362 MDT data container A list index	265
A.3.17	IDN S-0-0363 MDT data container B list index	266
A.3.18	IDN S-0-0364 AT data container A1.....	267
A.3.19	IDN S-0-0365 AT data container B1.....	268
A.3.20	IDN S-0-0366 AT data container A list index	269

A.3.21	IDN S-0-0367 AT data container B list index	270
A.3.22	IDN S-0-0368 Data container A pointer.....	271
A.3.23	IDN S-0-0369 Data container B pointer.....	273
A.3.24	IDN S-0-0370 MDT data container A/B configuration list	274
A.3.25	IDN S-0-0371 AT data container A/B configuration list	275
A.3.26	IDN S-0-0394 List IDN	275
A.3.27	IDN S-0-0395 List index.....	276
A.3.28	IDN S-0-0396 Number of list elements.....	277
A.3.29	IDN S-0-0397 List segment.....	277
A.3.30	IDN S-0-0398 IDN list of configurable real-time bits as producer.....	278
A.3.31	IDN S-0-0399 IDN list of configurable real-time bits as consumer	279
A.3.32	IDN S-0-0444 IDN-list of configurable data in the AT data container	280
A.3.33	IDN S-0-0445 IDN-list of configurable data in the MDT data container	280
A.3.34	IDN S-0-0450 MDT data container A2	281
A.3.35	IDN S-0-0451 MDT data container A3.....	282
A.3.36	IDN S-0-0452 MDT data container A4.....	283
A.3.37	IDN S-0-0453 MDT data container A5.....	284
A.3.38	IDN S-0-0454 MDT data container A6	285
A.3.39	IDN S-0-0455 MDT data container A7	286
A.3.40	IDN S-0-0456 MDT data container A8	287
A.3.41	IDN S-0-0457 MDT data container A9	288
A.3.42	IDN S-0-0458 MDT data container A10	289
A.3.43	IDN S-0-0459 MDT data container B2	289
A.3.44	IDN S-0-0480 AT data container A2	290
A.3.45	IDN S-0-0481 AT data container A3	291
A.3.46	IDN S-0-0482 AT data container A4.....	292
A.3.47	IDN S-0-0483 AT data container A5	293
A.3.48	IDN S-0-0484 AT data container A6	294
A.3.49	IDN S-0-0485 AT data container A7	295
A.3.50	IDN S-0-0486 AT data container A8	296
A.3.51	IDN S-0-0487 AT data container A9	297
A.3.52	IDN S-0-0488 AT data container A10	298
A.3.53	IDN S-0-0489 AT data container B2	299
A.3.54	IDN S-0-0490 MDT data container A2 configuration list	300
A.3.55	IDN S-0-0491 MDT data container A3 configuration list	301
A.3.56	IDN S-0-0492 MDT data container A4 configuration list	302
A.3.57	IDN S-0-0493 MDT data container A5 configuration list	302
A.3.58	IDN S-0-0494 MDT data container A6 configuration list	303
A.3.59	IDN S-0-0495 MDT data container A7 configuration list	304
A.3.60	IDN S-0-0496 MDT data container A8 configuration list	304
A.3.61	IDN S-0-0497 MDT data container A9 configuration list	305
A.3.62	IDN S-0-0498 MDT data container A10 configuration list	306
A.3.63	IDN S-0-0500 AT data container A2 configuration list	306
A.3.64	IDN S-0-0501 AT data container A3 configuration list	307
A.3.65	IDN S-0-0502 AT data container A4 configuration list	308
A.3.66	IDN S-0-0503 AT data container A5 configuration list	308
A.3.67	IDN S-0-0504 AT data container A6 configuration list	309
A.3.68	IDN S-0-0505 AT data container A7 configuration list	310
A.3.69	IDN S-0-0506 AT data container A8 configuration list	310

A.3.70	IDN S-0-0507 AT data container A9 configuration list	311
A.3.71	IDN S-0-0508 AT data container A10 configuration list	312
A.3.72	IDN S-0-1000.0.0 List of SCP Classes & Version.....	312
A.3.73	IDN S-0-1000.0.1 Active SCP Classes.....	316
A.3.74	IDN S-0-1000.0.2 Communication compatible functions.....	316
A.3.75	IDN S-0-1002 Communication cycle time	317
A.3.76	IDN S-0-1003 Allowed MST losses in CP3/CP4	318
A.3.77	IDN S-0-1005 Minimum feedback processing time (t_5).....	319
A.3.78	IDN S-0-1006 AT transmission starting time (t_1)	320
A.3.79	IDN S-0-1007 Synchronization time (Tsync).....	320
A.3.80	IDN S-0-1008 Command value valid time (t_3)	322
A.3.81	IDN S-0-1009 Device Control (C-DEV) offset in MDT	322
A.3.82	IDN S-0-1010 Lengths of MDTs	323
A.3.83	IDN S-0-1011 Device Status (S-DEV) offset in AT	324
A.3.84	IDN S-0-1012 Lengths of ATs	325
A.3.85	IDN S-0-1013 SVC offset in MDT.....	327
A.3.86	IDN S-0-1014 SVC offset in AT.....	327
A.3.87	IDN S-0-1015 Ring delay	328
A.3.88	IDN S-0-1016 Slave delay (P/S)	329
A.3.89	IDN S-0-1017 UC channel transmission time	330
A.3.90	IDN S-0-1019 MAC address A.....	331
A.3.91	IDN S-0-1020.0.1 Current IP address	331
A.3.92	IDN S-0-1020 IP address	332
A.3.93	IDN S-0-1021.0.1 Current subnet mask	333
A.3.94	IDN S-0-1021 Subnet mask	333
A.3.95	IDN S-0-1022.0.1 Current gateway address	334
A.3.96	IDN S-0-1022 Gateway address.....	335
A.3.97	IDN S-0-1023 SYNC jitter	336
A.3.98	IDN S-0-1024 SYNC delay measuring procedure command	337
A.3.99	IDN S-0-1026 Version of communication hardware	338
A.3.100	IDN S-0-1027.0.1 Requested MTU.....	339
A.3.101	IDN S-0-1027.0.2 Effective MTU.....	340
A.3.102	IDN S-0-1028 Error counter MST-P/S	341
A.3.103	IDN S-0-1031 Test pin assignment Port 1 & Port 2	342
A.3.104	IDN S-0-1032 Communication control	343
A.3.105	IDN S-0-1034 PHY error counter Port 1 & Port 2	344
A.3.106	IDN S-0-1035.0.01 Error counter P&S	345
A.3.107	IDN S-0-1035.0.0 Error counter Port 1 & Port 2	346
A.3.108	IDN S-0-1036 Inter Frame Gap	348
A.3.109	IDN S-0-1037 Slave jitter	349
A.3.110	IDN S-0-1039.0.1 Current active hostname	350
A.3.111	IDN S-0-1039 Hostname	350
A.3.112	IDN S-0-1040 Sub-device address	351
A.3.113	IDN S-0-1041 AT Command value valid time (t9)	352
A.3.114	IDN S-0-1042 Topology index	353
A.3.115	IDN S-0-1044 Device Control (C-DEV).....	354
A.3.116	IDN S-0-1045 Device Status	356
A.3.117	IDN S-0-1046 List of device addresses in device	358
A.3.118	IDN S-0-1047 Maximum Consumer Activation Time (t11).....	359

A.3.119	IDN S-0-1048 Activate network settings	360
A.3.120	IDN S-0-1050.x.01 Connection setup	360
A.3.121	IDN S-0-1050.x.02 Connection Number	362
A.3.122	IDN S-0-1050.x.03 Telegram assignment	363
A.3.123	IDN S-0-1050.x.04 Max. Length of Connection	364
A.3.124	IDN S-0-1050.x.05 Current length of connection	365
A.3.125	IDN S-0-1050.x.06 Configuration List	365
A.3.126	IDN S-0-1050.x.07 Assigned connection capability	366
A.3.127	IDN S-0-1050.x.08 Connection Control	367
A.3.128	IDN S-0-1050.x.09 Connection state	367
A.3.129	IDN S-0-1050.x.10 Producer cycle time	368
A.3.130	IDN S-0-1050.x.11 Allowed Data Losses	369
A.3.131	IDN S-0-1050.x.12 Error Counter Data Losses	369
A.3.132	IDN S-0-1050.x.20 IDN Allocation of real-time bit	370
A.3.133	IDN S-0-1050.x.21 IDN Allocation of real-time bit	370
A.3.134	IDN S-0-1051 Image of connection setups	371
A.3.135	IDN S-0-1060.x.01 Default configuration	372
A.3.136	IDN S-0-1060.x.02 Configuration mask	372
A.3.137	IDN S-0-1060.x.03 Maximum quantity of this connection capability	373
A.3.138	IDN S-0-1060.x.04 Max. connection length of connection capability	373
A.3.139	IDN S-0-1060.x.06 Configurable IDNs of connection capability	374
A.3.140	IDN S-0-1060.x.07 Maximum processing time	375
A.3.141	IDN S-0-1060.x.10 Minimum producer cycle time	376
A.3.142	IDN S-0-1061 Maximum TSref-Counter	376
A.3.143	IDN S-0-1080.x.02 Producer RTB list container	377
A.3.144	IDN S-0-1080.x.03 IDN allocation of producer RTB list container	377
A.3.145	IDN S-0-1080.x.04 Bit allocation of producer RTB list container	378
A.3.146	IDN S-0-1081.x.02 Consumer RTB list container	379
A.3.147	IDN S-0-1081.x.03 IDN allocation of consumer RTB list container	379
A.3.148	IDN S-0-1081.x.04 Bit allocation of consumer RTB list container	380
A.3.149	IDN S-0-1099.0.1 Test-IDN Control for SCP Conformity Purpose	381
A.3.150	IDN S-0-1099.0.2 Test-IDN Container for SCP Conformity purpose	382
A.3.151	IDN S-0-1100.0.01 Diagnostic counter sent SMP fragments	382
A.3.152	IDN S-0-1100.0.02 Diagnostic counter received SMP fragments	383
A.3.153	IDN S-0-1100.0.03 Diagnostic counter discarded SMP fragments	383
A.3.154	IDN S-0-1101.x.01 SMP Container Data	384
A.3.155	IDN S-0-1101.x.02 List of session identifiers	385
A.3.156	IDN S-0-1101.x.03 List of session priorities	385
A.3.157	IDN S-0-1150.x.01 OVS Control (C-OVS)	386
A.3.158	IDN S-0-1150.x.02 OVS Status (S-OVS)	387
A.3.159	IDN S-0-1150.x.03 OVS Container	388
A.3.160	IDN S-0-1150.x.04 Sample time	389
A.3.161	IDN S-0-1150.x.05 Phase shift	390
A.3.162	IDN S-0-1150.x.06 Configuration List OVS – IDNs	390
A.3.163	IDN S-0-1150.x.07 Configuration List OVS – Offset	391
A.3.164	IDN S-0-1150.x.08 Configuration List OVS – Length	392
A.3.165	IDN S-0-1150.x.09 Assigned Oversampling Capability	392
A.3.166	IDN S-0-1150.x.10 Number of Samples	393
A.3.167	IDN S-0-1151.x.01 Maximum number of samples	394

A.3.168	IDN S-0-1151.x.02 Internal resolution	394
A.3.169	IDN S-0-1151.x.03 Maximum quantity of this oversampling capability	395
A.3.170	IDN S-0-1151.x.04 Minimum sample time	396
A.3.171	IDN S-0-1151.x.06 Configurable IDNs of OVS capability	396
A.3.172	IDN S-0-1151.x.07 Configurable IDNs of OVS Capability – Offset	397
A.3.173	IDN S-0-1151.x.08 Configurable IDNs of OVS Capability – Length	397
A.3.174	IDN S-0-1152 Amount of OVS Domains	398
Annex B (normative)	SCP– Classification	399
B.1	General concept of profiling	399
B.2	Function Groups related to the SCP	400
B.2.1	FG SCP Identification	400
B.2.2	FG Timing	400
B.2.3	FG Telegram Setup	400
B.2.4	FG Control	401
B.2.5	FG Bus-Diagnosis	401
B.2.6	FG Connection	401
B.2.7	FG NRT	402
B.2.8	FG MUX	402
B.2.9	FG SMP	403
B.2.10	FG RTB	404
B.3	Type 19 communication classes	404
B.3.1	General	404
B.3.2	SCP_FixCFG	404
B.3.3	SCP_FixCFG_0x02	406
B.3.4	SCP_FixCFG_0x03 IEC 61158-4-19:2019	406
B.3.5	SCP_VarCFG	406
B.3.6	SCP_VarCFG_0x02	407
B.3.7	SCP_VarCFG_0x03	408
B.3.8	SCP_Sync	408
B.3.9	SCP_Sync	408
B.3.10	SCP_Sync_0x02	409
B.3.11	SCP_Sync_0x03	409
B.3.12	SCP_WD	409
B.3.13	SCP_WD_0x02	409
B.3.14	SCP_Diag	410
B.3.15	SCP_RTB	410
B.3.16	SCP_HP	410
B.3.17	SCP_SMP	410
B.3.18	SCP_Mux	411
B.3.19	SCP_Ext_Mux	411
B.3.20	SCP_NRT	411
B.3.21	SCP_Sig	412
B.3.22	SCP_ListSeg	412
B.3.23	SCP_IPS	412
B.3.24	SCP_Cap	412
B.3.25	SCP_RTBLListProd	413
B.3.26	SCP_RTBLListCons	413
B.3.27	SCP_SysTime	413
B.3.28	SCP_RTBWordProd	413

B.3.29	SCP_RTBWordCons.....	413
B.3.30	SCP_SafetyCon.....	414
B.3.31	SCP_OvS_Basic.....	414
B.3.32	SCP_NRTPC.....	415
B.3.33	SCP_Cyc.....	415
Annex C (normative)	GDP (Generic Device Profile)	416
C.1	General.....	416
C.2	Function Groups	416
C.2.1	Function Group Diagnosis	416
C.2.2	Function Group Archiving	418
C.2.3	Function Group Administration.....	418
C.2.4	Function Group Identification	418
C.2.5	Function Group State machine.....	419
C.2.6	Function Group Time	423
C.2.7	Function Group Conformance Test GDP	424
C.3	Classification	424
C.3.1	General	424
C.3.2	GDP_Basic.....	424
C.3.3	GDP_DiagT	424
C.3.4	GDP_DiagTAdv	425
C.3.5	GDP_LNg	425
C.3.6	GDP_PWD	425
C.3.7	GDP_Id	425
C.3.8	GDP_Rev	425
C.3.9	GDP_QA	426
C.3.10	GDP_CKs	426
C.3.11	GDP_CKsUser.....	426
C.3.12	GDP_StM	426
C.3.13	GDP_BKP.....	426
C.3.14	GDP_BKPAAdv	427
C.3.15	GDP_RST.....	427
C.3.16	GDP_CIPSafetyDev.....	427
C.4	List of all GPD related IDNs	427
C.4.1	IDN specification	427
C.4.2	Identification numbers in numerical orders.....	427
C.4.3	Detailed specification of communication-related IDNs.....	429
C.5	GDP status codes	475
Bibliography.....		477
Figure 1 – Example of offsets within MDT payload	45	
Figure 2 – Example of Offsets within AT payload	57	
Figure 3 – Flow of application data	63	
Figure 4 – Telegram assignment and connection length.....	64	
Figure 5 – Connection control state machine producer.....	66	
Figure 6 – Connection control state machine consumer	69	
Figure 7 – Communication phase (CP) state machine	74	
Figure 8 – Sub-state machine of CP0.....	75	

Figure 9 – Sub-state machine of CP1.....	79
Figure 10 – CPSwitch state machine master	88
Figure 11 – CPSwitch state machine of the slave.....	93
Figure 12 – Address allocation with line	100
Figure 13 – Address allocation with ring.....	100
Figure 14 – Address allocation with interrupted ring	101
Figure 15 – Ring topology with P and S channel	102
Figure 16 – Line topology with P channel (as example).....	103
Figure 17 – Block diagram of a slave	103
Figure 18 – Topology states of a slave.....	104
Figure 19 – Addressing of multi-slave device	105
Figure 20 – Multi-slave device in ring topology or not last in line topology.....	106
Figure 21 – Multi-slave device as last in line topology.....	106
Figure 22 – Multi-slave device in line (left).....	108
Figure 23 – Multi-slave device in line (right).....	108
Figure 24 – Multi-slave device in ring.....	108
Figure 25 – Topology state machine of a slave	109
Figure 26 – Ring without break.....	112
Figure 27 – Ring break	113
Figure 28 – Ring break on master.....	113
Figure 29 – Recovery of P channel (1).....	114
Figure 30 – Recovery of P channel (2) <small>IEC 61158-4-19:2019 https://standards.iteh.ai/catalog/standards/sist/c39396bb-dfa5-4bd4-b1cc-add00704781/iec-61158-4-19-2019</small>	114
Figure 31 – Recovery of S channel (1).....	115
Figure 32 – Recovery of S channel (2).....	115
Figure 33 – Communication phase and hot-plug state machine.....	117
Figure 34 – Service channel handling diagram.....	124
Figure 35 – Communication step proceeding diagram	125
Figure 36 – State machine for procedure command execution	134
Figure 37 – Interaction of procedure command control and acknowledgement	135
Figure 38 – Procedure command execution without interrupt	136
Figure 39 – Procedure command execution with interrupt	136
Figure 40 – Procedure command execution with error message.....	137
Figure 41 – Type 19 Time Transmission	139
Figure 42 – Data container configuration without acknowledge (slave).....	143
Figure 43 – Data container configuration with acknowledge (slave).....	144
Figure 44 – Processing of list index in the MDT data.....	145
Figure 45 – Structure of extended data container.....	148
Figure 46 – Transport container	154
Figure 47 – UML Sequence Diagram: Multiplexing of two sessions (Example)	157
Figure 48 – Oversampling overview	159
Figure 49 – Oversampling timing input (producer).....	160
Figure 50 – Oversampling timing output (consumer)	160
Figure 51 – Oversampling state machine	162

Figure 52 – Synchronized cascaded networks.....	164
Figure 53 – Diagram of phase locked loop	165
Figure 54 – Synchronization process	166
Figure 55 – Telegram timing reference.....	167
Figure 56 – Calculation of telegram length.....	168
Figure 57 – Calculation of t1	169
Figure 58 – Determination of UC channel.....	171
Figure 59 – Timing diagram of CP0.....	171
Figure 60 – Timing diagram of CP1 and CP2 with 2 MDT, 2AT and UC channel.....	172
Figure 61 – Timing diagram of CP1 and CP2 with 4 MDT, 4 AT and UC channel.....	173
Figure 62 – Timing diagram of CP1 and CP2 with 2 MDT, UC channel and 2 AT.....	173
Figure 63 – Timing diagram of CP1 and CP2 with 4 MDT, UC channel and 4 AT.....	174
Figure 64 – Telegram sequence.....	175
Figure 65 – Time delay of store and forward	176
Figure 66 – Time delay of cut through.....	177
Figure 67 – The two defined positions of the UC channel.....	178
Figure 68 – First and last transmit during UC channel.....	179
Figure 69 – UC telegram with payload	180
Figure 70 – Activated and deactivated collision buffer.....	183
Figure 71 – Double line without slave in between.....	184
Figure 72 – Double line with one slave in between.....	185
Figure 73 – Double line with several slaves in between <small>IEC 61158-4-19:2019 https://standards.iteh.ai/catalog/standards/sist/c39396bb-dfa5-4bd4-b1cc-a6f6b704781/iec-61158-4-19-2019</small>	186
Figure 74 – S/IP busy response	191
Figure 75 – Client connection	192
Figure 76 – Server connection	193
Figure 77 – S/IP asynchronous request	194
Figure 78 – S/IP PDU	194
Figure 79 – S/IP error response	196
Figure 80 – UDP Browsing.....	201
Figure 81 – Sequence of setting a new network configuration on one device using UDP	204
Figure 82 – UDP Identification	209
Figure 83 – Usage UDP reset request.....	221
Figure 84 – Sequence for watchdog trigger service and client application timeout.....	222
Figure 85 – Synchronization timing	225
Figure 86 – Synchronization trigger	225
Figure 87 – Timing of TSref with ring and line	227
Figure 88 – Timing of TSref with interrupted ring	229
Figure 89 – Determination of the SYNC delay time	230
Figure 90 – Definition of TSref	231
Figure 91 – Timing with different cycle times	233
Figure 92 – Timing with the same cycle times	233
Figure 93 – Synchronous application data processing.....	235
Figure 94 – Cyclic application data processing.....	236

Figure 95 – Non-synchronous application data processing	236
Figure A.1 – IDN name structure	244
Figure A.2 – Unit structure	246
Figure A.3 – Structure of IDN operation data with variable length	248
Figure A.4 – Example of synchronization timing with different producer cycles	321
Figure A.5 – Definition of MDT length	324
Figure A.6 – Lengths of MDTs (example)	324
Figure A.7 – Definition of AT length	326
Figure A.8 – Lengths of ATs (example)	326
Figure A.9 – Structure of MAC address	331
Figure A.10 – Structure of IP address	333
Figure A.11 – Structure of subnet mask	334
Figure A.12 – Structure of gateway address	336
Figure A.13 – Structure of List of Sub-device addresses	359
Figure A.14 – Definition of connection length	365
Figure A.15 – Synchronization with ring	375
Figure A.16 – Configuration example	389
Figure B.1 – Technical Profiling in Type 19	399
Figure C.1 – State machine without class GDP_StM	420
Figure C.2 – State machine without class GDP_StM	422
Figure C.3 – Password State Machine	437
Figure C.4 – Structure of Date information	457
Figure C.5 – Structure of QA date information	458
Figure C.6 – Structure of Service date information	459
Figure C.7 – Structure of Calibration date information	460
Figure C.8 – Structure of Calibration due date information	461
Figure C.9 – Mapping of data into the InputData and OutputData container	465
Table 1 – Ethernet DLPDU identification	37
Table 2 – Data structure in a DLPDU	37
Table 3 – DLPDU payload header	38
Table 4 – DLPDU type	39
Table 5 – MDT header	39
Table 6 – MDT header to be considered by the slave	39
Table 7 – MDT phase	40
Table 8 – MDT0 structure in CP0	41
Table 9 – Communication version	41
Table 10 – MDT0 in CP1 and CP2 (topology indices 0 to 127)	42
Table 11 – MDT1 in CP1 and CP2 (topology indices 128 to 255)	43
Table 12 – MDT2 in CP1 and CP2 (topology indices 256 to 383)	43
Table 13 – MDT3 in CP1 and CP2 (topology indices 384 to 511)	44
Table 14 – MDT data field	45
Table 15 – MDT hot-plug field	46