INTERNATIONAL STANDARD

IEC 61784-1

First edition
2003-05

Digital data communications for measurement and control –

Part 1:
Profile sets for continuous and discrete manufacturing relative to fieldbus use in industrial control systems

Reference number
IEC 61784-1:2003(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**

- **Catalogue of IEC publications**

  The on-line catalogue on the IEC web site (http://www.iec.ch/searchpub/cur_fut.htm) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

  This summary of recently issued publications (http://www.iec.ch/online_news/justpub/jp_entry.htm) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

  If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

  Email: custserv@iec.ch
  Tel: +41 22 919 02 11
  Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC 61784-1

First edition
2003-05

Digital data communications for measurement and control –

Part 1:
Profile sets for continuous and discrete manufacturing relative to fieldbus use in industrial control systems

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

PRICE CODE XH

For price, see current catalogue

CONTENTS

FIGURES

TABLES

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

DIGITAL DATA COMMUNICATIONS FOR MEASUREMENT AND CONTROL –

Part 1: Profile sets for continuous and discrete manufacturing relative to fieldbus use in industrial control systems

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

The International Electrotechnical Commission (IEC) draws attention to the fact that use of this International Standard involves the use of IEC 61158 series, and so may involve the use of patents given in IEC 61158. Each of the parts of IEC 61158 lists patents that may apply to that part, and at least some of the protocol types defined or specified within that part to which those patents may apply. The IEC takes no position concerning the evidence, validity and scope of any of those patent rights.

The holders of the patent rights identified in IEC 61158 series have assured the IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with the IEC.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights other than those identified above. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61784-1 has been prepared by subcommittee 65C: Digital communications, of IEC technical committee 65: Industrial-process measurement and control.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65C/294/FDIS	65C/302/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2007. At that date this publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of July 2004 have been included in this copy.

INTRODUCTION

This part of IEC 61784 provides a set of communication profiles in the sense of ISO/IEC TR 10000-1. These answer the need of identifying the protocol families co-existing within the IEC 61158 series, as a result of the international harmonisation of fieldbus technologies available on the market. More specifically, these profiles help to correctly state the compliance to the IEC 61158 series, and to avoid the spreading of divergent implementations, which would limit its use, clearness and understanding. Additional profiles to address specific market concerns, such as functional safety or information security, may be addressed by future parts of this standard.

This standard contains several communication profile families, which specify one or more communication profiles. Such profiles identify, in a strict sense, protocol subsets of the IEC 61158 series via protocol specific communication profiles. They do not define device-type-specific communication profiles for the purpose of guiding manufacturers in feature set selection – for example, in selecting the minimum set of communication services and protocol to implement a specific class of devices, such as generic slaves or transmitters ("implementation profiles"). Neither do they define device profiles that specify communication profiles together with application functions needed to answer the need of a specific application ("application profiles").

It is agreed that these latter classes of profiles would help the use of the IEC 61158 series of standards; the profiles defined in this document are a necessary step to achieve that task.

It is also important to clarify that interoperability — defined as the ability of two or more network systems to exchange information and to make mutual use of the information that has been exchanged (see 3.2.1 of ISO/IEC TR 10000-1) — can be directly achieved on the same link only for those devices complying to the same communication profile.

Profiles contained in this International Standard are constructed of references to IEC 61158-2 through IEC 61158-6 and other IS, TS or worldwide-accepted standards, as appropriate[1]. Each profile is required to reference at least one part of IEC 61158-2 through IEC 61158-6.

Two or more Profiles, which are related to a common family, are specified within a "Communication Profile Family" (CPF).

---

1 International Standardised Profiles may contain normative references to specifications other than International Standards; see ISO/IEC JTC 1 N 4047.

DIGITAL DATA COMMUNICATIONS FOR MEASUREMENT AND CONTROL –

Part 1: Profile sets for continuous and discrete manufacturing relative to fieldbus use in industrial control systems

1 Scope

This part of IEC 61784 defines a set of protocol specific communication profiles based primarily on the IEC 61158 series, to be used in the design of devices involved in communications in factory manufacturing and process control.

Each profile selects specifications for the communications protocol stack at a device. It contains a minimal set of required services at the Application Layer and specification of options in intermediate layers defined through references. If no Application Layer is included, then a minimal set of required services at the Data Link Layer is specified. The appropriate references to the protocol specific types are given in each communication profile family or associated profiles.

NOTE All profiles are based on standards or draft standards or International Standards published by the IEC or from standards or International Standards established by other standards bodies or open standards processes.

The structure of communication profile families is specified in Figure 1.

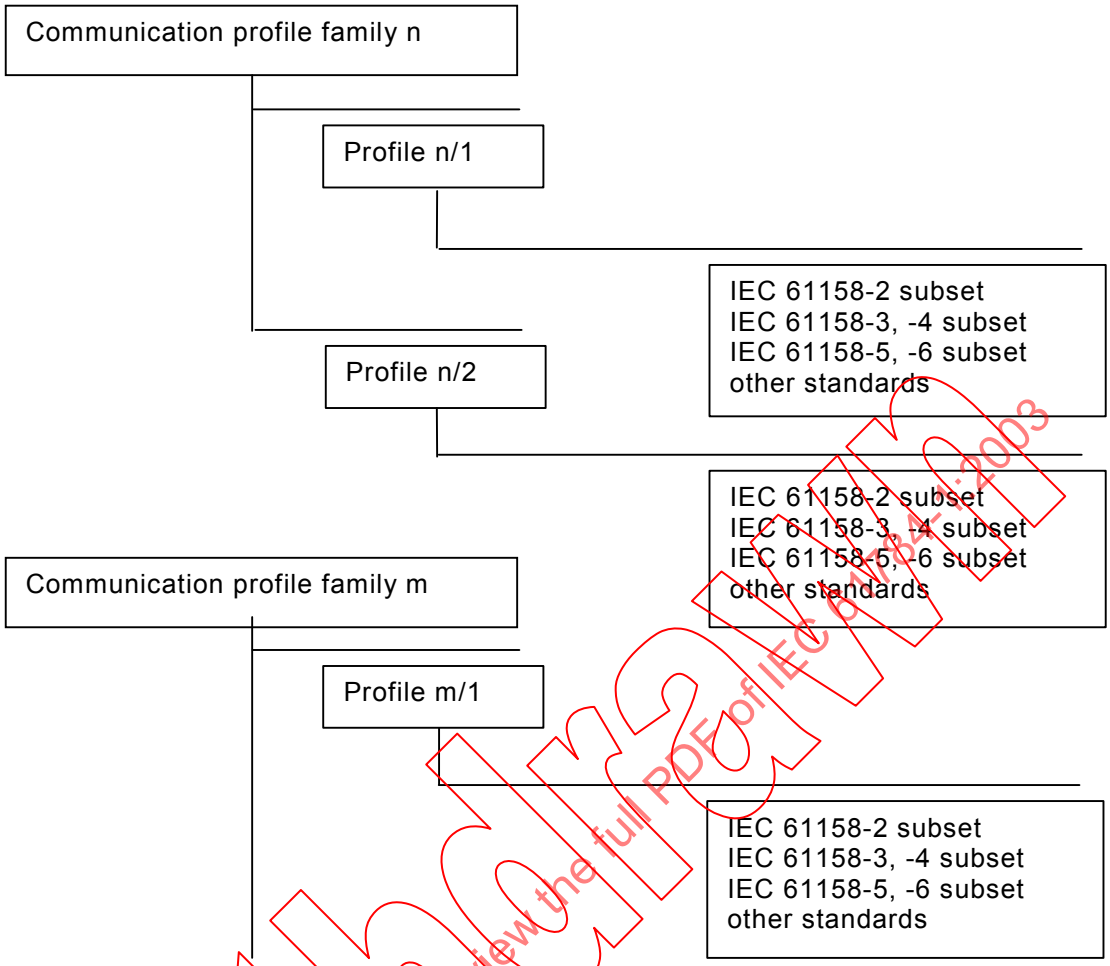

Figure 1 – Communication profile families and profiles

Each profile selects an appropriate consistent and compatible subset of services and protocols from the total available set that is defined and modelled in IEC 61158. For the selected subset of services and protocols, the profile also describes any possible or necessary constrains in parameter values.

Table 1 shows the communication profile families that are defined in this standard.

Table 1 – Relations of Communication Profile Families to type numbers

IEC 61784-1 contents			Corresponding IEC 61158 Types
CPF	**Clause**	**Communication Profile Families** (Note 1)	**Type**
1	5	FOUNDATION® Fieldbus	1, 5, 9 (Note 2)
2	6	ControlNet™	2
3	7	PROFIBUS	3, 10 (Note 3)
4	8	P-NET®	4
5	9	WorldFIP®	7
6	10	INTERBUS®	8
7	11	SwiftNet™	6

NOTE 1 See the specific CPF clauses for information on the respective trademark holders.
NOTE 2 CP 1/1 has a denigrated PhL device profile subclass, which uses a variant of a Type 3 PhL.
NOTE 3 CP 3/2 has a denigrated PhL device profile subclass, which uses a variant of a Type 1 PhL.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies.

For undated references to the IEC 61158 series, only the edition published contemporaneously with this edition of these profiles applies.[2] For all other undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60079-11:1999, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"*

IEC 60079-14:2002, *Electrical apparatus for explosive gas atmospheres – Part 14: Electrical installations in hazardous areas (other than mines)*

IEC 60079-25, *Electrical apparatus for explosive gas atmospheres – Part 25: Intrinsically safe systems* [3]

IEC 60079-27:2002, *Electrical apparatus for explosive gas atmospheres – Part 27: Fieldbus intrinsically safe concept (FISCO)*

IEC 61010 (all parts), *Safety requirements for electrical equipment for measurement, control and laboratory use*

IEC 61131-2:1992, *Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61158-2:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 2: Physical Layer specification and service definition*

IEC 61158-3:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 3: Data Link Service definition*

IEC 61158-4:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 4: Data Link Protocol specification*

IEC 61158-5:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 5: Application Layer Service definition*

IEC 61158-6:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 6: Application Layer protocol specification*

ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Basic Reference Model – Part 1: The Basic Model*

ISO/IEC 7498-2, *Information technology – Open Systems Interconnection – Basic Reference Model – Part 2: Security Architecture*

ISO/IEC 7498-3, *Information technology – Open Systems Interconnection – Basic Reference Model – Part 3: Naming and addressing*

ISO/IEC 8802-3:2001, *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*

ISO/DIS 15745-3, *Industrial automation systems and integration – Open systems application integration framework – Part 3: Reference description for IEC 61158-based control systems* [4]

ANSI TIA/EIA-232F:1997, *Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*

---

[2] This variance from the IEC editing rules was adopted because of the large number of references to the IEC 61158 series.

[3] To be published.

[4] To be published.

ANSI TIA/EIA 422-B:1994, *Electrical Characteristics of Balanced Voltage Digital Interface Circuits*

ANSI TIA/EIA-485-A:1998, *Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*

Internet Engineering Task Force (IETF), *Request for Comments (RFC):*

RFC 768, *User Datagram Protocol* (available at <http://www.ietf.org/rfc/rfc0768.txt>)

RFC 791, *Internet Protocol* (available at <http://www.ietf.org/rfc/rfc0791.txt>)

RFC 792, *Internet Control Message Protocol* (available at <http://www.ietf.org/rfc/rfc0792.txt>)

RFC 793, *Transmission Control Protocol* (available at <http://www.ietf.org/rfc/rfc0793.txt>)

RFC 826, *Ethernet Address Resolution Protocol* (available at <http://www.ietf.org/rfc/rfc0826.txt>)

RFC 894, *A standard for the Transmission of IP Datagrams over Ethernet Networks* (available at <http://www.ietf.org/rfc/rfc0894.txt>)

RFC 1112, *Host Extensions for IP Multicasting* (available at <http://www.ietf.org/rfc/rfc1112.txt>)

RFC 2236, *Internet Group Management Protocol, Version 2* (available at <http://www.ietf.org/rfc/rfc2236.txt>)

Open Software Foundation (OSF):

C706, *CAE Specification DCE11: Remote Procedure Call* (available at <http://www.opengroup.org/onlinepubs/9629399/toc.htm>)

3 Definitions

3.1 Terms and definitions

For the purposes of this document, all terms and definitions provided in the IEC 61158 series apply.

3.2 Abbreviations and symbols

3.2.1 IEC 61158 abbreviations and symbols

For the purposes of this profile, all abbreviations and symbols defined in the IEC 61158 series apply. The following abbreviations, found within the IEC 61158 series, are repeated here for use by those who wish to understand the general structure of this International Standard without referring to the IEC 61158 series.

AL	Application Layer
APDU	Application Protocol Data Unit
AR	Application Relationship
ASE	Application Service Element
DL-	Data Link Layer (as a prefix)
DLL	Data Link Layer
DLSDU	Data Link Service Data Unit
PhL	Physical Layer
TPDU	Transport Protocol Data Unit

3.2.2 Other abbreviations and symbols

CE	“Conformité Européene" which literaturely means "European Conformity”
CP	Communication Profile
CPF	Communication Profile Family
DP-V0	PROFIBUS DP Version 0
DP-V1	PROFIBUS DP Version 1
EMC	Electro-Magnetic-Compatibility
IP	Internet Protocol
IS	Intrinsically Safe (as an adjective) Intrinsic Safety (as a noun)
ISP	International Standardized Profiles
IV	Initialization Vector
PAS	Publically Available Specification
PPDU	Presentation Protocol Data Unit
TCP	Terminal Control Protocol
UDP	User Datagram Protocol

3.3 Conventions

3.3.1 Conventions common to all layers

3.3.1.1 (Sub)clause selection tables

(Sub)clause selection for all layers is defined in tables, as shown in Table 2 and Table 3. The selected base specifications are indicated just before the selection table(s). Selection is done at the highest (sub)clause level possible to define the profile selection unambiguously.

Table 2 – Layout of profile (sub)clause selection tables

Clause	Header	Presence	Constraints

Table 3 – Contents of (sub)clause selection tables

Column	Text	Meaning
Clause	<#>	(sub)clause number of the base specifications
Header	<text>	(sub)clause title of the base specifications
Presence	NO	This (sub)clause is not included in the profile
	YES	This (sub)clause is fully (100%) included in the profile in this case no further detail is given
	—	Presence is defined in the following subclauses
	Partial	Parts of this (sub)clause is included in the profile
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text table footnotes or table notes may be used

If sequences of (sub)clauses do not match the profile, then the numbers are concatenated.

EXAMPLE concatenated subclauses

3.4 – 3.7	—	NO	—

3.3.1.2 Service selection tables

If selection of services is defined in a table the format of Table 4 is used. The table identifies the selected services and includes service constraints, as explained in Table 5.

Table 4 – Layout of service selection tables

Service ref.	Service name	Usage	Constraint

Table 5 – Contents of service selection tables

Column	Text	Meaning
Service ref.	<#>	(sub)clause number of the base specifications where the service is defined
	—	Not applicable
Service name	<text>	The name of the service
Usage	M	Mandatory
	O	Optional
	—	Service is never used
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text table footnotes or table notes may be used

If selection of service parameters is defined in a table the format of Table 6 is used. Each table identifies the selected parameters and includes parameter constraints, as explained in Table 7.

Table 6 – Layout of parameter selection tables

Parameter ref.	Parameter name	Usage	Constraint

Table 7 – Contents of parameter selection tables

Column	Text	Meaning
Parameter ref.	<#>	(sub)clause number of the base specifications where the service is defined
	—	Not applicable
Parameter name	<text>	The name of the service parameter
Usage	M	Mandatory
	O	Optional
	—	Attribute is never present
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text table footnotes or table notes may be used

3.3.2 Physical Layer

No additional conventions are defined.

3.3.3 Data Link Layer

3.3.3.1 Service profile conventions

No additional conventions are defined.

3.3.3.2 Service and parameter selections

These are described using the common conventions, see 3.3.1.2.

3.3.4 Application Layer

3.3.4.1 Service profile conventions

ASE and class selection is described using (sub)clause selection tables, see 3.3.1.1. If the usage of selected ASE and classes is further constrained this is specified in the profile (e.g. an optional item of the base standard is mandatory in the profile).

If selection of class attributes is defined in a table the format of Table 8 is used. The table identifies the selected class attributes and includes their constraints, as explained in Table 9.

Table 8 – Layout of class attribute selection tables

Attribute	Attribute Name	Usage	Constraint

Table 9 – Contents of class attribute selection tables

Column	Text	Meaning
Attribute	<#>	Attribute number of the base specification class
	—	Not applicable
Attribute Name	<text>	The name of the attribute
Usage	M	Mandatory
	O	Optional
	—	Attribute is never present
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text table footnotes or table notes may be used

3.3.4.2 Service and parameter selections

These are described using the common conventions, see 3.3.1.2.

4 Conformance to communication profiles

Each communication profile within this International Standard includes part of the IEC 61158 series Edition 3.0 (Ed.3.0). It may also include parts of other standards or international specifications.

A statement of compliance to a Communication Profile Family (CPF) of this International Standard shall be stated[5] as either

Compliance to IEC 61784-1:2003[6] CPF n <Type>

or

Compliance to IEC 61784-1 (Ed.1.0) CPF n <Type>

and a statement of compliance to a Communication Profile (CP) of this International Standard shall be stated as either

Compliance to IEC 61784-1:2003[9] CP n/n <Type>

or

Compliance to IEC 61784-1 (Ed.1.0) CP n/n <Type>

where the Type within the angle brackets < > is optional and the angle brackets are not to be included.

Product Standards shall not include any Conformity Assessment aspects (including QM provisions), neither normative nor informative, other than provisions for product testing (evaluation and examination).

---

[5] In accordance with ISO/IEC Directives

[6] Assumed to be published in 2003. The date should not be used when the edition number is used.

5 Communication Profile Family 1 (FOUNDATION® Fieldbus[7])

5.1 General overview

Communication Profile Family 1 defines profiles based on IEC 61158-2 through IEC 61158-6, protocol Type 1 (Fieldbus Foundation), and on other standards. (See Table 10.)

The FOUNDATION Fieldbus family of protocols consists primarily of two distinct protocol sets, known generically (for historical reasons) as H1 and HSE. The H1 profiles are a subset of IEC 61158 Type 1 services and protocols, and include both wire-media and fibre-media Physical Layers operating at 31,25 kbit/s. The HSE profiles are based on use of the ISO/IEC 8802–3 (Ethernet-like) MAC and Physical Layers, and on use of standard internet Network and Transport Layer protocols.

A third profile set has been developed within the Fieldbus Foundation, but is not in current or planned use. It is included in this profile because it provides a migration path to CPF 1 from some of the CPF 5 protocols, and exclusion from this International Standard could inhibit that migration.

Table 10 – CPF 1: overview of profile sets

Layer	Profile 1/1 (H1)	Profile 1/2 (HSE)	Profile 1/3 (H2)
Application	Type 9 of IEC 61158-5, -6	Type 5 of IEC 61158-5, -6	Type 9 of IEC 61158-5, -6
Transport	—	RFC 768, RFC 793	—
Network	—	RFC 791	—
Data Link	Type 1 of IEC 61158-3, -4	ISO/IEC 8802-3, -2, -10	Type 1 of IEC 61158-3, -4
Physical	IEC 61158-2, 31,25 kbit/s, primarily Type 1	any of ISO/IEC 8802-3	Type 1 of IEC 61158-2

NOTE See A.1 for an overview of FOUNDATION Fieldbus communications concepts.

5.2 Profile 1/1 – FF H1

5.2.1 Physical Layer

5.2.1.1 Communicating devices

5.2.1.1.1 Introduction

Table 11 specifies the IEC 61158-2 PhL selection for a communicating device and its MAU(s).

7 FOUNDATION Fieldbus™ is the trade name of the non-profit consortium “Fieldbus Foundation”. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name Foundation Fieldbus. Use of the trade name Foundation Fieldbus requires permission of the trade name holder.

Table 11 – CP 1/1: PhL selection for communicating devices and their MAUs

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2	Type 1: Terms and definitions	YES	—
3.3 – 3.7	––	NO	—
4	Symbols and abbreviations	—	—
4.1	Symbols	—	—
4.1.1	Type 1: Symbols	YES	—
4.1.2 – 4.1.6	––	NO	—
4.2	Abbreviations	—	—
4.2.1	Type 1: Additional abbreviations	YES	—
4.2.2 – 4.2.6	––	NO	—
5	Data Link Layer – Physical Layer interface	—	—
5.1	General	Partial	Used when applicable
5.2	Type 1: Required services	YES	—
5.3 – 5.7	––	NO	—
6	Station Management – Physical Layer interface	—	—
6.1	General	Partial	Used when applicable
6.2	Type 1: Station Management - Physical Layer interface	YES	—
6.3 – 6.7	––	NO	—
7	DCE Independent Sublayer (DIS)	—	—
7.1	General	Partial	Used when applicable
7.2	Type 1: DIS	YES	—
7.3 – 7.5	––	NO	—
8	DTE – DCE interface	—	—
8.1	General	Partial	Used when applicable
8.2	Type 1: DTE – DCE interface	YES	—
8.3 – 8.4	––	NO	—
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	Partial	Used when applicable
9.2	Type 1: MDS: Wire and optical media	YES	—
9.3 – 9.8	––	NO	—
10	MDS – MAU interface	—	—
10.1	General	Partial	Used when applicable
10.2	Type 1: MDS – MAU interface: wire and optical media	YES	—
10.3 – 10.6	––	NO	—
11	Type 1 and 7: Medium Attachment Unit: voltage mode, linear-bus-topology 150 Ω twisted-pair wire medium	NO	
12	Type 1 and 3: Medium Attachment Unit: 31,25 kbit/s, voltage-mode with low-power option, bus- and tree-topology, 100 Ω wire medium	YES	See 5.2.1.1.2
13 – 15	—	NO	—
16	Type 1: Medium Attachment Unit: 31,25 kbit/s, single-fibre optical medium	YES	See 5.2.1.1.2
17 – 20	—	NO	—
21	Type 3: Medium Attachment Unit: Synchronous transmission, 31,25 kbit/s, voltage mode, wire medium	YES	See 5.2.1.1.2 (denigrated)
22 – 28	––	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	[a]
A.2	External Connectors for wire medium	YES	[a]
A.3	External Connectors for optical medium	Partial	[b]
Annex B	Type 1: Cable specifications and trunk and spur lengths for the 31,25 kbit/s voltage-mode MAU	YES	—
Annex C	Type 1: Optical passive stars	Partial	[b]
Annex D	Type 1: Star topology	Partial	[b]
Annex E	Type 1: Alternate fibres	Partial	[b]
Annex F – M	—	NO	—

Clause	Header	Presence	Constraints
[a]	Connector is optional for use with shielded or twisted-pair 100 Ω wire media		
[b]	Single fibre specifications are optional for use with single fibre media		

5.2.1.1.2 MAU and device classes

Each MAU is classified according to its characteristics when interfacing to its associated medium, as specified in Table 12. For devices with a single attached MAU, whether separate or integral, the MAU class is also considered to be the device class. The selection of the proper clause of IEC 61158-2, Clause 12, Clause 16 or Clause 21, is based on the MAU class for which the MAU, and sometimes the associated device, are designed. The selection of Clause 21 is denigrated – not recommended for new designs – because the alternative clause, Clause 12, permits devices to lower their power consumption during periods of non-transmission.

This profile also lists recommendations, which are not mandatory for implementation and/or not specified in IEC 61158-2, but are included to achieve interoperability amongst devices conforming to this profile. Specifically, 5.2.1.1.3.3 applies to each MAU, as does 5.2.1.1.3.4 for MAUs meeting IS rules.

Table 12 – CP 1/1: PhL classification of MAUs and attached devices

Attribute	Atrribute value	FF MAU class										
		111	112	113	114	121	122	123	124	511	512	411
Connected medium	100 Ω shielded or twisted wire pair	X	X	X	X	X	X	X	X	X	X	
	Single bidirectional multimode fibre											X
Device powered from medium	Completely (see Note 1)	X		X		X		X		X		
	Partially; not completely (see Note 2)		X		X		X		X		X	
	Not at all											X
Power change when transmitting	Power from medium can increase					X	X	X	X	X	X	
	Power from medium does not change	X	X	X	X							X
Intrinsic Safety construction rules	Not specified by this profile											X
	None			X	X			X	X			
	Entity model (see IEC TS 60079-11)	X	X			X	X					
	FISCO model (see IEC TS 60079-27)									X	X	
Relevant MAU and device clause of IEC 61158-2	Clause 16 (see Table 13)											X
	Clause 12 (see Table 14)					X	X	X	X	X	X	
	Clause 21 (see Table 15) (denigrated)	X	X	X	X							

NOTE 1 The device does not contain a power supply, intrinsic safety barrier, galvanic isolator or terminator

NOTE 2 The MAU needs to draw at least the equivalent of its transmit power from the medium to ensure a positive current on the medium throughout the transmit waveform

Table 13 – CP 1/1: PhL selection of Clause 16 for devices and their MAUs

Clause	Header	Presence	Constraints
16.1	Object	YES	—
16.2	Nomenclature	YES	—
16.3	Network specifications	NO	—
16.4	MAU transmit circuit specifications	YES	—
16.5	MAU receive circuit specifications	Partial	High-sensitivity only
16.6	Jabber inhibit	YES	—
16.7	Medium specifications	—	—
16.7.1	Connector	YES	ST or FC type connector
16.7.2	Fibre optic cable (test fibre)	YES	The 1 m test fibre must be used with a mode filter
16.7.3	Optical passive star	NO	—
16.7.4	Optical active star	NO	—

Table 14 – CP 1/1: PhL selection of Clause 12 for devices and their MAUs

Clause	Header	Presence	Constraints
12.1	General	YES	—
12.2	Transmitted bit rate	YES	—
12.3	Network specifications	NO	—
12.4	MAU transmit circuit specifications	YES	—
12.5	MAU receive circuit specifications	YES	See 5.2.1.1.3.2 for recommended receive filters
12.6	Jabber inhibit	YES	—
12.7	Power distribution	—	—
12.7.1	General	Partial	IEC 61158-2, Table 63, applies only to FF device classes 121, 123 and 511. All else applies except IEC 61158-2, Table 64
12.7.2	Supply voltage	YES	—
12.7.3	Powered via signal conductors	YES	Applies only to FF device classes 121, 123 and 511
12.7.4	Power supply impedance	NO	—
12.7.5	Powered separately from signal conductors	Partial	Applies only to FF device class 122, 124 and 512, which do not require power on the bus. However, these devices shall be suitable for use on a powered bus. For example, a transformer-coupled device requires a DC-blocking capacitor in series with the transformer
12.7.6	Electrical isolation	YES	—
12.8	Medium specifications	—	—
12.8.1	Connector	YES	See 5.2.1.1.3.3 for labeling of the connector
12.8.2	Cable (standard test cable)	NO	—
12.8.3	Coupler	YES	—
12.8.4	Splices	NO	—
12.8.5	Terminator	NO	—
12.8.6	Shielding rules	NO	—
12.8.7	Grounding (earthing) rules	YES	—
12.9	Intrinsic safety	NO	See 5.2.1.1.3.4 for the IS device parameters for FF device classes 121, 122, 511 and 512
12.10	Galvanic isolators	NO	—

Table 15 – CP 1/1: PhL selection of Clause 21 for devices and their MAUs (denigrated)

Clause	Header	Presence	Constraints
21.1	General	YES	—
21.2	Transmitted bit rate	YES	—
21.3	Network specifications	NO	—
21.4	MAU transmit circuit specifications	Partial	Signal polarity is not specified – see 5.2.1.1.3.1
21.5	MAU receive circuit specifications	YES	See 5.2.1.1.3.2 for recommended receive filters
21.6	Jabber inhibit	YES	—
21.7	Power distribution	—	—
21.7.1	General	Partial	IEC 61158-2, Table 97, applies only to FF device classes 111 and 113. All else applies except IEC 61158-2, Table 98
21.7.2	Supply voltage	Partial	For FF device classes 111 and 113, the paragraphs after the first do not apply
21.7.3	Powered via signal conductors	Partial	Applies only to FF device classes 111 and 113
(12.7.5)	Powered separately from signal conductors	Partial	Applies only to FF device classes 112 and 114, which do not require power on the bus. However, these devices shall be suitable for use on a powered bus. For example, a transformer-coupled device requires a DC-blocking capacitor in series with the transformer.
21.7.4	Electrical isolation	YES	—
21.8	Medium specifications	—	—
21.8.1	Connector	YES	See 5.2.1.1.3.3 for labeling of the connector
21.8.2	Cable (standard test cable)	NO	Applies only to device test configuration
21.8.3	Coupler	YES	—
21.8.4	Splices	NO	—
21.8.5	Terminator	NO	—
21.8.6	Shielding rules	NO	—
21.8.7	Grounding (earthing) rules	YES	—
21.9	Intrinsic safety	NO	See 5.2.1.1.3.4 for the IS device parameters for FF device classes 111 and 112
21.10	Galvanic isolators	NO	—

5.2.1.1.3 Recommended values for MAUs and their devices

5.2.1.1.3.1 Signal polarity

The signal polarity for FF MAU classes 111 to 114 shall be the signal polarity specified in IEC 61158-2, 12.4.5.

5.2.1.1.3.2 Receive filters

The receive filters for MAU classes 111 to 114, 121 to 124, 511 and 512 should be:

a) 1 kHz 2-pole high pass, $0,6 \leq Q \leq 1,0$;

b) 40 kHz 2-pole low pass, $0,6 \leq Q \leq 1,0$.

5.2.1.1.3.3 Labeling

The positive (“+”) and negative (“–”) terminals shall be clearly identified on all MAUs that:

a) do not provide automatic polarity detection, and

b) do not use the external connectors specified in IEC 61158-2, Annex A.2.

Each device incorporating an MAU shall be labeled with the MAU’s FF class. Where a device contains multiple MAUs, the labeling shall indicate the MAUs to which it (the labeling) applies.

The apparatus marking requirements of IEC 60079-11 apply to MAU classes 111 to 114, 121 to 124, 511 and 512. The apparatus marking requirements of IEC TS 60079-27 apply to MAU classes 511 and 512.

5.2.1.1.3.4 IS device parameters

From a communications standpoint, devices of any of the FF classes can coexist on the same fieldbus segment. However, in IS applications, device power requirements and device and component approvals must be taken into consideration.

NOTE Bus powered devices require a compatible power supply. See 5.2.1.2.2.

The recommended IS parameters for devices meeting Entity-model IS rules are listed in Table 16.

Table 16 – CP 1/1: PhL selection of recommended IS parameters for FF MAU classes 111, 112, 121, 122, 511 and 512

Parameter	Recommended values	
	Entity model	FISCO model
Applicable FF devices classes	111, 112, 121, 122	511, 512
Device approval voltage	24 V minimum	17,5 V minimum
Device approval current	250 mA minimum	380 mA minimum
Device input power	1,2 W minimum	5,32 W minimum
Device residual capacitance	≤ 5 nF	≤ 5 nF
Device residual inductance	≤ 20 µH	≤ 10 µH
Leakage current	(not specified)	≤ 50 µA
IS classification	Ex ia, IIC (gas groups A & B), T4	Ex ia, IIC (gas groups A, B, C, D), T4 Ex ib, IIC (gas groups A, B, C, D), T4
Governing requirements	See IEC 60079-11	See IEC TS 60079-27

The FF class 111, 112, 511 and 512 devices shall be designed to only sink power from the bus; i.e., these devices shall not source power to the bus. Since the FF class 112 and 512 devices includes a separate source of power, extra precautions, such as galvanic isolation, may be required to prevent power transfer to the bus.

5.2.1.2 Wire media and related network components and considerations

5.2.1.2.1 Wire media

All components shall conform to IEC 61158-2 as shown in Table 17.

NOTE All wire media require termination. See 5.2.1.2.3.

Table 17 – CP 1/1: PhL selection for media components

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2 – 3.7	–-	NO	—
4 – 11	—	NO	—
12	Type 1 and 3: Medium Attachment Unit: 31,25 kbit/s, voltage-mode with low-power option, bus- and tree-topology, 100 Ω wire medium	—	—
12.1	General	YES	—
12.2	Network specifications	YES	This text contains important network configuration specifications
12.3 – 12.6	—	NO	—
12.8	—	NO	—
12.8.1	Connector	YES	—
12.8.2	Cable	YES	—
12.8.3	Coupler	YES	—
12.8.4	Splices	YES	—
12.8.5	—	NO	—
12.8.6	Shielding rules	YES	—
12.8.7	Grounding rules	YES	—
12.9 – 12.10	—	NO	—
13 – 28	—	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	[b]
A.2	External Connectors for wire medium	YES	[b]
A.3	—	NO	—
Annex B – M	—	NO	—

[a] The connector is optional

[b] Networks and their components designed to meet FISCO IS rules shall also conform to Table 18

Table 18 – CP 1/1: PhL selection of imperative IS parameters for media in FISCO systems

Parameter	Minimum	Maximum in IIC application	Maximum in IIB application
Maximum trunk cable for IIC applications	0 km	1 km	5 km
Maximum spur cable for IIC applications	0 m	30 m	
Loop resistance	15 Ω/km	150 Ω/km	
Inductance	0,4 µH / km	1 µH / km	
Capacitance	80 nF / km	200 nF / km	
See IEC TS 60079-27			

5.2.1.2.2 Power supplies

Unless specifically stated otherwise, it is assumed that a power supply does not contain a fieldbus device, terminator, Intrinsic safety barrier or galvanic isolator.

All power supplies shall conform to IEC 61158-2 as shown in Table 19.

Table 19 – CP 1/1: PhL selection for power supplies

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2 – 3.7	--	NO	—
4 – 11	—	NO	—
12	Type 1 and 3: Medium Attachment Unit: 31,25 kbit/s, voltage-mode with low-power option, bus- and tree-topology, 100 Ω wire medium	—	—
12.1	General	YES	—
12.2	Network specifications	YES	This text contains important network configuration specifications
12.3 – 12.7	—	NO	—
12.7	Power distribution	—	—
12.7.1	General	YES	[a, b]
12.7.2	Supply voltage	YES	[a]
12.7.3	Powered via signal conductors	Partial	[a, b]
12.7.4	Power supply impedance	YES	[a]
12.7.5	—	NO	—
12.7.6	Electrical isolation	YES	[a]
12.8	Medium specifications	—	—
12.8.1	Connector	YES	[c]
12.8.2 – 12.8.4	—	NO	—
12.8.5	Terminator	Partial	[a]
12.8.6	—	NO	—
12.8.7	Grounding rules	Partial	Used when applicable
12.9 – 12.10	—	NO	—
13 – 28	—	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	[c]
A.2	External Connectors for wire medium	YES	[c]
A.3	—	NO	—
Annex B – M	—	NO	—

[a] For power supplies designed to meet FISCO rules, in case of conflict, FISCO rules take precedence

[b] Power supplies with multiple outputs shall comply with the transmit and receive waveform requirements of IEC 61158-2, 12.7, with regard to the signal transfer characteristics between their output ports, and with the requirements of IEC 61158-2, 12.7.4.3

[c] The connector is optional

A fieldbus power supply is categorized as defined in Table 20.

Table 20 – CP 1/1: PhL selection of power supply types

Power supply type	Output voltage	Description
Type 131	compatible with barrier	Non-IS power supply intended for feeding an entity model IS barrier
Type 132	≤ 32 V	Non-IS power supply **not** intended for feeding an IS barrier
Type 133	≤ 24 V	Entity model, IS power supply
Type 551	≤ 14,0 – 17,5 V [a]	FISCO model, IS power supply for group IIC gas applications
Type 552	≤ 14,0 – 17,5 V [a]	FISCO model, IS power supply for group IIB gas applications

[a] The actual maximum output voltage is a function of the maximum rated current

Type 551 and Type 552 power supplies may

a) be linear (resistance limited),

b) have a trapezoidal (voltage limited) output characteristic, or

c) have a rectangular (voltage and current limited) output charcteristic.

The recommended output voltage and maximum IS parameters for a Type 551 or Type 552 power supply, which is intended to operate with devices of Types 511 or 512 or both, are listed in Table 22A. A Type 551 or Type 552 power supply shall be separated from the nearest terminator, at an end of the trunk cable, by no more than 30 m of cable.

Table 21 – CP 1/1: PhL selection of permissible output voltage and IS parameters for FISCO power supplies

Parameter	Permissible values	
	Type 551 – IIC	Type 552 – IIB
Voltage	14,0 V to 17,5 V	
Maximum current		
at 14,0 V	183 mA	380 mA
at 15,0 V	133 mA	354 mA
at 16,0 V	103 mA	288 mA
at 17,0 V	81 mA	240 mA
at 17,5 V	75 mA	213 mA
Maximum output power	2,52 W	5,32 W
Maximum residual capacitance	5 nF	
Maximum residual inductance	10 µH	
See IEC TS 60079-27		

5.2.1.2.3 Terminators

It is assumed that the terminator does not contain a fieldbus MAU, power supply, intrinsic safety barrier or galvanic isolator.

All terminators shall conform to IEC 61158-2 as shown in Table 22.

Table 22 – CP 1/1: PhL selection for terminators

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2 – 3.7	---	NO	—
4 – 11	—	NO	—
12	Type 1 and 3: Medium Attachment Unit: 31,25 kbit/s, voltage-mode with low-power option, bus- and tree-topology, 100 Ω wire medium	—	—
12.1	General	YES	—
12.2 – 12.6	—	NO	—
12.7	Power distribution	—	—
12.7.1	General	Partial	Does not include IEC 61158-2, Table 63 or Table 64
12.7.2 – 12.7.5	—	NO	—
12.7.6	Electrical isolation	YES	—
12.8	Medium	—	—
12.8.1	Connector	YES	—
12.8.2 – 12.8.4	—	NO	—
12.8.5	Terminator	YES	—
12.8.6	—	NO	—
12.8.7	Grounding (earthing) rules	YES	—
12.9	Intrinsic safety	—	For intrinsically safe networks the network terminator will require appropriate approvals if installed in a hazardous area. See Table 23 for the IS parameters for a terminator intended for installation in a hazardous area
12.9.1	—	NO	—
12.9.2	Barrier and terminator placement	YES	—
12.10	—	NO	—
13 – 28	—	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	[b]
A.2	External Connectors for wire medium	YES	[b]
A.3	—	NO	—
Annex B – M	—	NO	—

[a] For terminators designed to meet FISCO IS rules, in case of conflict, FISCO rules take precedence

[b] The connector is optional

Table 23 – CP 1/1: PhL selection of IS parameters for terminators

Parameter	Required values	
	Entity model	FISCO model
Mounting	Zone 0 (US Div. 1)	Zone 0 (US Div. 1)
Gas group	IIC (US Groups A & B)	IIC (US Groups A & B)
Device approval voltage	≥ 24 V	≥ 17,5 V
Device approval current	≥ 250 mA	≥ 380 mA
Device input power	≥ 1,2 W	≥ 5,32 W
Terminator residual inductance	≤ 20 µH	≤ 10 µH
IS classification	Ex ia, IIC (gas groups A & B), T4	Ex ia, IIC (gas groups A, B, C, D), T4 Ex ib, IIC (gas groups A, B, C, D), T4
Governing requirements	See IEC 60079-11	See IEC TS 60079-27

5.2.1.2.4 Intrinsic safety barriers

NOTE FISCO rules do not permit use of intrinsic safety barriers as separate components. See IEC TS 60079-27.

It is assumed that the intrinsic safety barrier does not contain a fieldbus MAU, terminator or power supply.

An Intrinsic safety barrier is used to communicate with devices and other network elements installed in a hazardous area. It must be suitably approved by relevant safety authorities for use in the intended application.

All Intrinsic safety barriers shall conform to IEC 61158-2, Clause 12, as shown in Table 24.

Table 24 – CP 1/1: PhL selection of Clause 12 for intrinsic safety barriers

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2 – 3.7	–-	NO	—
4 – 11	—	NO	—
12	Type 1 and 3: Medium Attachment Unit: 31,25 kbit/s, voltage-mode with low-power option, bus- and tree-topology, 100 Ω wire medium	—	—
12.1	General	YES	—
12.2	Transmitted bit rate	NO	—
12.3	Network specifications	NO	—
12.4	MAU transmit circuit specifications	YES	IS barriers shall comply with the transmit waveform requirements of this subclause
12.5	MAU receive circuit specifications	YES	IS barriers shall comply with the receive waveform requirements of this subclause
12.6	Jabber inhibit	NO	—
12.7	Power distribution	—	—
Table 54	Network powered device characteristics for the 31,25 kbits/s, voltage mode MAU	NO	—
Table 55	Network power supply requirements for the 31,25 kbits/s, voltage mode MAU	NO	—
12.7.1	General	NO	—
12.7.2	Supply voltage	NO	—
12.7.3	Powered via signal conductors	NO	—
12.7.4	Power supply impedance	—	—
12.7.4.1	Power supply impedance for single output power supplies	NO	—
12.7.4.2	Power distribution through an IS barrier	YES	—
12.7.4.3	Power supply impedance for multiple output supplies with signal coupling between outputs	NO	—
12.7.5	Powered separately from signal conductors	NO	—
12.7.6	Electrical isolation	YES	For system safety the network must be grounded only at the IS barrier
12.8	Medium specifications	—	—
12.8.1	Connector	YES	[a]
12.8.2-12.8.6		NO	—
12.8.7	Grounding rules	YES	For system safety the network must be grounded only at the IS barrier
12.9	Intrinsic safety	YES	See Table 25 for the IS parameters for intrinsic safety barriers
12.10	Galvanic isolators	NO	—
13 – 28	—	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	[a]
A.2	External Connectors for wire medium	YES	[a]
A.3	—	NO	—
Annex B – M		NO	—

[a] The connector is optional

Table 25 – CP 1/1: PhL selection of recommended IS parameters for intrinsic safety barriers and galvanic isolators (Entity model only)

Parameter	Value
Mounting	Zone 0 (US Div. 1)
Gas group	IIC (US Groups A & B)
Open circuit output voltage (see Note)	≤ 24 V
Short circuit output current	≤ 250 mA
Matched output power	≤ 1,2 W
NOTE The maximum working voltage of the barrier will be less than this value. The power supply voltage of the system must be selected to be compatible with the working voltage	

5.2.1.2.5 Galvanic isolators

NOTE FISCO rules do not permit use of galvanic isolators as separate components. See IEC TS 60079-27.

It is assumed that the Intrinsically safe galvanic isolator does not contain a fieldbus MAU, terminator or power supply.

An Intrinsically safe galvanic isolator is used to communicate with devices and other network elements installed in a hazardous area. It must be suitably approved by relevant safety authorities for use in the intended application.

All Intrinsically safe galvanic isolators shall conform to IEC 61158-2 as shown in Table 26.

Table 26 – CP 1/1: PhL selection of Clause 12 for intrinsically safe galvanic isolators

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2 – 3.7	---	NO	—
4 – 11	—	NO	—
12	Type 1 and 3: Medium Attachment Unit: 31,25 kbit/s, voltage-mode with low-power option, bus- and tree-topology, 100 Ω wire medium	—	—
12.1	General	YES	—
12.2	Transmitted bit rate	NO	—
12.3	Network specifications	NO	—
12.4	Transmit circuit specifications	YES	Intrinsically safe galvanic isolator shall comply with the transmit waveform requirements of this subclause
12.5	Receive circuit specifications	YES	Intrinsically safe galvanic isolator shall comply with the receive waveform requirements of this subclause
12.6	Jabber inhibit	NO	—
12.7	Power distribution	—	—
12.7.1	General	YES	—
Table 54	Network powered device characteristics for the 31,25 kbits/s, voltage mode MAU	NO	—
Table 55	Network power supply requirements for the 31,25 kbits/s, voltage mode MAU	NO	—
12.7.2-12.7-5		NO	—
12.7.6	Electrical isolation	YES	Where a galvanic isolator includes one or more fieldbus power supplies these shall comply with the relevant conditions in 5.2.1.2.2
12.8	Medium specifications	—	—
12.8.1	Connector	YES	—
12.8.2-12.8.7		NO	—
12.9	Intrinsic safety	YES	See Table 25 for the IS parameters
12.10	Galvanic isolators	YES	—
13 – 28	—	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	[a]
A.2	External Connectors for wire medium	YES	[a]
A.3	—	NO	—
Annex B – M		NO	—

[a] The connector is optional.

5.2.1.3 Fibre media and related network components and considerations

5.2.1.3.1 Optical fibre types

The alternatives for optical fibre type for a Type 411 device are listed in Table 27.

Table 27 – CP 1/1: PhL selection of Clause 15, recommended optical fibre types

Fibre use	31,25 kbit/s single fibre	NA (numerical aperture)	Attenuation (f = 850 nm)	Comments
Standard test fibre	100/140µm (A1d)	0,26 ± 0,03	≤ 4,0 dB/km	Mode filter required
Recommended operating fibre	100/140µm (A1d)	0,26 ± 0,03	≤ 4,0 dB/km	
	200/230µm (A3c)	0,4 ± 0,04	≤ 10,0 dB/km	
	50/125µm (A1a)	0,2 ± 0,02	≤ 3,0 dB/km	
	62,5/125µm (A1b)	0,275 ± 0,015	≤ 3,0 dB/km	
NOTE For fibre types A1d, A3c, A1a and A1b, structure (SI or GI) and bandwidth, refer to IEC 60793, optical fibre specifications. For attenuation, bandwidth and numerical aperture (NA), refer to the test methods of IEC 60793				

5.2.1.3.2 Passive star couplers

The recommended maximum insertion losses for optical passive star couplers for the 31,25 kbit/s single-fibre optical medium are listed in Table 28. Reflective star couplers (see IEC 61158-2, Annex D) are required for the single-fibre medium.

Table 28 – CP 1/1: PhL selection of passive star couplers, recommended maximum insertion loss

	FF class for passive star coupler	Number of branches					
		2	3	4	8	16	32
Recommended maximum insertion loss	FF class 421 (100/140 µm (A1d))	7,0	9,0	10,5	14,5	17,5	21,5
	FF class 422 (200/230 µm (A3c))	7,5	10,0	11,0	15,0	18,5	22,5
	FF class 423 (50/125 µm (A1a))	7,0	9,0	10,5	14,5	18,0	22,0
	FF class 424 (62,5/125 µm (A1b))	7,0	9,0	10,5	14,5	18,0	22,0
NOTE The insertion loss includes the loss due to two connectors.							

5.2.1.3.3 Active star couplers

The characteristics for active star couplers for the 31,25 kbit/s, single-fibre optical medium are listed in Table 29.

Table 29 – CP 1/1: PhL selection of active star couplers

Parameter	FF class 431 (with timing regeneration)	FF class 432 (without timing regeneration)
	Recommended value	
Peak emission wavelength	850 ± 30 nm	
Typical half Intensity wavelength	≤ 50 nm	
Effective launch power Hi level (see Note)	-13,5 ± 1,0 dBm	
Receiver operating range	-40,0 dBm to -20,0 dBm	
Maximum received bit cell jitter	± 14 % nominal bit time	
Rise and fall times of transmitted signal	≤ 2,0% nominal bit time	
Maximum temporal deformation	± 3,0 % nominal bit time	
Maximum transmitted bit cell jitter	± 2,0 % normal bit time	<not specified>
Propagation time	≤ 2,0 nominal bit times	<not specified>
Number of branches	≤32	
NOTE This is the power measured with a standard test fibre connected to a CPIC as defined in IEC 61158-2, 16.4 and 16.7.2		

5.2.1.3.4 Optical power budget

Optical power budget considerations are shown in Table 30, and an example optical power budget for a system is shown in Figure 2.

Table 30 – CP 1/1: Optical power budget considerations

Parameter	100/140 µm fibre system	200/230 µm fibre system	62,5/125 µm fibre system	50/125 µm fibre system
Launch power	-14,5 dBm	-8,0 dBm	-18,5 dBm	-21,5 dBm
Receiver sensitivity	-40 dBm	-40 dBm	-40 dBm	-40 dBm
Dynamic range	25,5 dB	31,0 dB	21,5 dB	18,5 dB
OPSC (Optical Passive Star Coupler) attenuation: (16/16 OPSC) (8/8 OPSC) (4/4 OPSC)	 17,5 dB — —	 18,5 dB — —	 — 14,5 dB —	 — — 10,5 dB
Attenuation margin	3 dB	6,5 dB	3 dB	3 dB
Attenuation of optical fibre cable	5 dB	6 dB	4 dB	5 dB
Maximum transmission distance: (16/16 OPSC) (8/8 OPSC) (4/4 OPSC)	 1,25 km — —	 0,6 km — —	 — 1,33 km —	 — — 1,66 km
NOTE OPSC attenuation measurements include loss from two connectors				

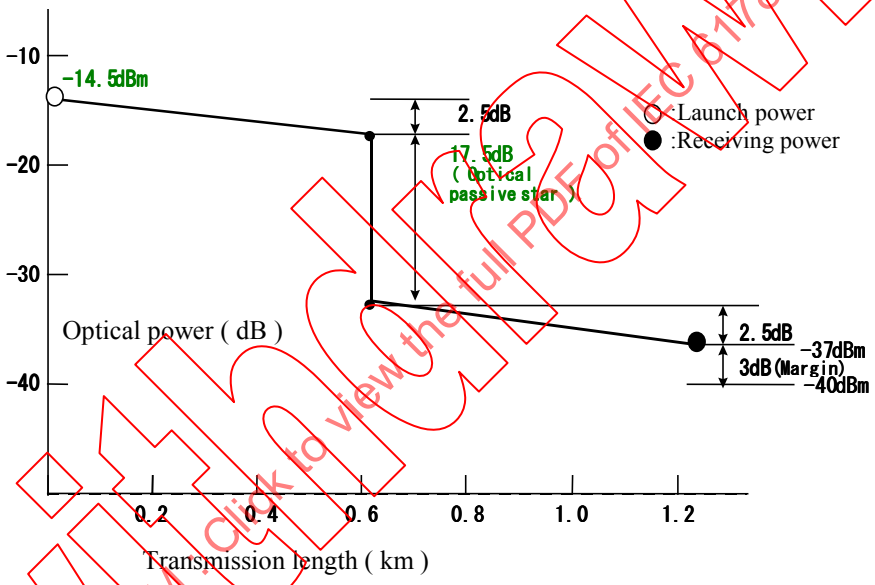

Figure 2 – Example optical power budget for a 100/140 µm fibre system with a 16/16 optical passive star coupler

5.2.1.4 Optical / electrical signaling converters

Active star couplers can have both optical-media and wire-media ports. FF class 433 devices are active star couplers with timing regeneration with one or more wire-media ports. Their optical ports shall meet the specifications of FF class 431 devices, while each of their electrical ports shall meet the relevant specifications of one of the following FF device classes: 121, 122, 123, 124, 511 or 512.

FF class 434 devices are active star couplers without timing regeneration with one or more wire-media ports. Their optical ports shall meet the specifications of FF class 432 devices, while each of their electrical ports shall meet the relevant specifications of one of the following FF device classes: 121, 122, 123, 124, 511 or 512.

5.2.2 Data Link Layer

5.2.2.1 DLL service selection

5.2.2.1.1 General

Table 31 specifies the DLL service selection within IEC 61158-3 for this profile.

Table 31 – CP 1/1: DLL service selection

Clause	Header	Presence	Constraints
1	Scope and object	YES	—
2	Normative references	Partial	Used as needed
3	Terms and definitions	Partial	Common definitions, and those for Type 1, used as needed
4	Symbols and abbreviations	Partial	Common symbols and abbreviations, and those for Type 1, used as needed
5	Conventions	Partial	Common conventions, and those for Type 1, used as needed
6	Type 1: Overview of Data Link Services	YES	—
7	Type 1: DL(SAP)-address, queue and buffer management Data Link Service	—	See Table 32
8	Type 1: Connection-mode Data Link Service	—	See Table 37
9	Type 1: Connectionless-mode Data Link Service	—	See Table 52
10	Type 1: Time and scheduling guidance Data Link Service	—	See Table 54
11	Type 1 and 4: DL-Management service definition	NO	—
12 - 20	—	NO	—

Table 32 – CP 1/1: DLL service selection of Clause 7

Clause	Header	Presence	Constraints
7.1	Facilities of the DL(SAP)-address, queue and buffer management Data Link Service	YES	—
7.2	Model of the DL(SAP)-address, queue and buffer management Data Link Service	YES	—
7.3	Sequence of primitives at one DL(SAP)	YES	—
7.4	DL(SAP)-address, queue and buffer management Services	—	See Table 33
7.5	Type 1: facilities of the connection-mode Data Link Service	YES	—

Table 33 – CP 1/1: DLL service selection of 7.4

Clause	Header	Presence	Constraints
7.4.0	—	YES	—
7.4.1	Create	Partial	Only the attributes of the objects created by this service are included. See Table 34
7.4.2	Delete	NO	—
7.4.3	Bind	Partial	Only the attributes of the objects bound by this service are included. See Table 35
7.4.4	Unbind	NO	—
7.4.5	Put	YES	—
7.4.6	Get	—	See Table 36

Table 34 – CP 1/1: DLL service selection of 7.4.1

Clause	Header	Presence	Constraints
7.4.1.1	Function	NO	—
7.4.1.2	Types of parameters	—	—
7.4.1.2.0	—	Partial	IEC 61158-3, Table 2, is not included in this profile
7.4.1.2.1	Buffer-or-queue DLS-user-identifier	NO	—
7.4.1.2.2	Queuing policy	Partial	Only BUFFER-R and QUEUE are included
7.4.1.2.2.1	Maximum queue depth	YES	—
7.4.1.2.3	Maximum DLSDU size	YES	—
7.4.1.2.4	Status	NO	—
7.4.1.2.5	Buffer-or-queue DL-identifier	YES	—
7.4.1.3	Sequence of primitives	NO	—

Table 35 – CP 1/1: DLL service selection of 7.4.3

Clause	Header	Presence	Constraints
7.4.3.1	Function	NO	—
7.4.3.2	Types of parameters	—	—
7.4.3.2.0	—	YES	—
7.4.3.2.1	DL(SAP)-address DLS-user-identifier	NO	—
7.4.3.2.2	DL(SAP)-address	YES	—
7.4.3.2.3	DL(SAP)-role	Partial	Values of DL(SAP)-role are basic and group, other values are not included in this profile. IEC 61158-3, Table 4, is not included in this profile
7.4.3.2.3.1	Indicate-null-Unitdata-Exchange-transactions	NO	—
7.4.3.2.3.2	Remote-DLSAP-address	NO	—
7.4.3.2.4	Receiving buffer-or-queue bindings	YES	—
7.4.3.2.5	Sending buffer-or-queue bindings	YES	—
7.4.3.2.6	Default QoS as sender	—	—
7.4.3.2.6.0	—	Partial	Only the first paragraph immediately under IEC 61158-3, 7.4.3.2.6, is included
7.4.3.2.6.1	DLL priority	YES	—
7.4.3.2.6.2	DLL maximum confirm delay	Partial	All maximum confirm delays, except remotely-confirmed DL-UNITDATA, are included
7.4.3.2.6.3	DLPDU authentication	YES	—
7.4.3.2.6.4	DL-scheduling-policy	Partial	Only the value IMPLICIT is included
7.4.3.2.7	Status	NO	—
7.4.3.2.8	DL(SAP)-address DL-identifier	YES	—
7.4.3.3	Sequence of primitives	NO	—

Table 36 – CP 1/1: DLL service selection of 7.4.6

Clause	Header	Presence	Constraints
7.4.6.1	Function	YES	—
7.4.6.2	Types of parameters	—	—
7.4.6.2.0	—	Partial	IEC 61158-3, Table 8, except for 'DLS-user-data-timeliness' is included in this profile
7.4.6.2.1	Buffer-or-queue DL-identifier	YES	—
7.4.6.2.2	Status	YES	—
7.4.6.2.3	Reported-service-identification-class	YES	—
7.4.6.2.4	Reported-service-identification	YES	—
7.4.6.2.5	DLS-user-data	YES	—
7.4.6.2.6	DLS-user-data-timeliness	Partial	—
7.4.6.2.6.0	—	YES	—
7.4.6.2.6.1	Local-DLE-timeliness	YES	—
7.4.6.2.6.2	Sender-and remote-DLE-timeliness	YES	—
7.4.6.2.6.3	Time-of-production	NO	—
7.4.6.2.7	Sequence number identification	NO	—
7.4.6.3	Sequence of primitives	YES	—

Table 37 – CP 1/1: DLL service selection of Clause 8

Clause	Header	Presence	Constraints
8.1	Facilities of the connection-mode Data Link Service	YES	—
8.2	Model of the connection-mode Data Link Service	YES	—
8.3	Quality of connection-mode service	—	—
8.3.0	—	YES	—
8.3.1	Determination of QoS for connection-mode service	YES	—
8.3.2	Definition of QoS parameters	—	—
8.3.2.1	DLCEP class	Partial	All three classes are included, but data transfer from Subscriber to Publisher is not included
8.3.2.2	DLCEP data delivery features	Partial	See Table 38 for included parameter values
8.3.2.3	DLL priority	YES	—
8.3.2.4	DLL maximum confirm delay	YES	—
8.3.2.5	DLPDU authentication	Partial	See Table 38 for included parameter values
8.3.2.6	Residual activity	Partial	See Table 38 for included parameter values
8.3.2.7	DL-scheduling-policy	Partial	See Table 38 for included parameter values
8.3.2.8	Maximum DLSDU sizes	Partial	Single segment DLSDU size is the maximum size of a DLSDU that can be conveyed in one DLPDU of the specified priority. In other words, the DLL is not required to support segmentation of the DLSDU
8.3.2.9	DLCEP buffer-or-queue bindings	Partial	See Table 38 for included parameter values
8.3.2.10	DLCEP timeliness	Partial	All are included except IEC 61158-3, 8.3.2.10.1.4
8.4	Sequence of primitives	—	—
8.4.1	Concepts used to define the connection-mode DLL service	YES	—
8.4.2	Constraints on sequence of primitives	Partial	All of this subclause, except DL-Reset and DL-Subscriber-Query services is included in this profile
8.4.2.1	Relation of primitives at the two DLC end-points	—	See Table 39
8.4.2.2	Sequence of primitives at one DLC end-point	Partial	IEC 61158-3, Figure 17, States 6 through 8 are not included in this profile because this profile does not include the DLC Reset service primitives
8.5	Connection establishment phase	—	See Table 40
8.6	Connection release phase	—	See Table 40
8.7	Data transfer phase	—	See Table 48

Table 38 – CP 1/1: DLL service selection of the summary of 8.3, DL-connection QoS

DLCEP Data Delivery feature	DLCEP Class	Buffer, Queue binding	Data Direction	DLPDU authentication	Max DLSDU size	DL-Scheduling	Residual Activity
CLASSICAL	PEER	QUEUE	Both directions	All three	Single segment DLSDU size	IMPLICIT	TRUE | FALSE
DISORDERED	PEER	QUEUE	Both directions	All three	Single segment DLSDU size	IMPLICIT	TRUE | FALSE
ORDERED	PUBLISHER SUBSCRIBER	BUFFER-R	Publisher to Subscriber only	SOURCE, ORDINARY	Single segment DLSDU size	EXPLICIT	FALSE
UNORDERED	PUBLISHER SUBSCRIBER	BUFFER-R	Publisher to Subscriber only	SOURCE, ORDINARY	Single segment DLSDU size	EXPLICIT	FALSE

Table 39 – CP 1/1: DLL service selection of figures 11–16 of 8.4

Figure	Sub-part of figure	Presence	Reason
11	a), c), d), e), f), g1), g2), g3)	YES	—
	b)	NO	Profile does not merge connections
12	h), i), n)	YES	—
	j), k), l), m), o), p)	NO	Corresponding services are not included
13	c), d), e), f), g1)	YES	—
	a), b), g2), g3)	NO	DLCEP-address is assigned by the DLS-user
14	h)	NO	DLCEP-address is assigned by the DLS-user
	i), o)	YES	—
	j), k), l), m), n), p)	NO	Corresponding services are not included
15	a), b), c2), c3)	NO	DLCEP-address is assigned by the DLS-user
	c1), d), e), f)	YES	—
	g)	NO	Corresponding services are not included
16	h), i), j), k)	NO	Corresponding services are not included

Table 40 – CP 1/1: DLL service selection of 8.5

Clause	Header	Presence	Constraints
8.5.1	Function	Partial	Simultaneous DL-CONNECT request primitives at the two DLSAPs cannot be merged into one DLC by the concurrently requesting-and-responding DLS-users in this profile
8.5.2	Types of primitives and parameters	Partial	Replace IEC 61158-3, Table 13 and Table 14, by IEC 61784-1, Table 41 and Table 42, respectively
8.5.2.1	Local-view identifiers	—	—
8.5.2.1.1	DLCEP DLS-user-identifier	NO	The DL-CONNECTION-ESTABLISHED indication primitive uses the DLCEP DL-identifier parameter
8.5.2.1.2	DLCEP DL-identifier	YES	—
8.5.2.2	Addresses	Partial	This profile includes a profile of all possible forms of addresses. The use of addresses for this profile is specified in Table 43 through Table 45
8.5.2.3	Quality of Service parameter set	Partial	All parameters except Time-of-production are included in this profile. For this profile, the value of Residual activity is the same for both directions: from sender and from receiver. The DLPDU-authentication parameter is not included in indication and confirm primitives of this profile
8.5.2.4	DLS-user-data	Partial	If the called address is a DLCEP-address, then the DLS-provider does not issue a DL-Connect indication at the called address. Therefore, in that case, DLS-user-data is not permitted in the request primitive. This parameter is permitted in all other primitives
8.5.3	Sequence of primitives	Partial	IEC 61158-3, Figures 18, 21 and 22, are included in this profile. IEC 61158-3, Figures 19, 20 and 24, are not included in this profile, because the DLCEP-address is assigned by the DLS-user, there is no DL-Connect indication to the DLS-user. IEC 61158-3, Figures 23 and 24, are not included in this profile, because the connections are not merged

Table 41 – CP 1/1: DLL service selection: replacement for Table 13 of 8.5

DL-Connect	Request		Indication	Response	Confirm
Parameter name	input	output	output	input	output
DLCEP DL-identifier		M	M	M (=)	M [a]
Called address	M		M (=)		
Calling address	M		M (=)		
Responding address				M	M (=)
Calling DLCEP-address	U			U	
QoS parameter set					
DLCEP class	U		M (=)	U [b]	M (=)
DLCEP data delivery features					
from requester to responder(s)	U		M (=, [c])	U (=, [c])	M (=)
from responder(s) to requester	U		M (=, [c])	U (=, [c])	M (=)
DLL priority	U		M (=)	U (=)	M (=)
Maximum confirm delay					
on DL-Connect	U		M (=)	U	M (=)
on DL-Data	U		M (=)	U	M (=)
DLPDU-authentication	U			U ([d])	
Residual activity [e]	U			U ([f])	
DL-scheduling-policy	U			U	
Maximum DLSDU sizes					
from requester	U		M (≤)	U (≤)	M (=)
from responder	U		M (≤)	U (≤)	M (=)
Buffer-and-queue bindings					
as sender	U			U	
as receiver	U			U	
Sender timeliness					
DL-timeliness-class	CU		M (=)	CU	M (=)
Time window size (ΔT)	CU			CU	
Synchronizing DLCEP	CU			CU	
Receiver timeliness					
DL-timeliness-class	CU		M (=)	CU	M (=)
Time window size (ΔT)	CU			CU	
Synchronizing DLCEP	CU			CU	
DLS-user-data	U		M (=)	U	M (=)

NOTE The Time-of-production parameter is not specified, because it is not used.

[a] The DLCEP DL-identifier on the confirm primitive shall equal the DL-identifier specified in the corresponding DL-CONNECT request primitive.

[b] The DLCEP classes shall match, Peer with Peer, and Publisher with Subscriber.

[c] The DLCEP data delivery feature UNORDERED may be upgraded to ORDERED, and DISORDERED may be upgraded to CLASSICAL.

[d] DLCEP establishment shall negotiate DLPDU-authentication from ORDINARY to SOURCE to MAXIMAL.

[e] For this profile, the value of Residual activity is the same for both directions: from sender and from receiver.

[f] DLCEP establishment shall negotiate Residual-activity from FALSE to TRUE.

Table 42 – CP 1/1: DLL service selection of 8.5, replacement for Table 14

DL-Connection-Established	Indication
Parameter name	output
DLCEP DL –identifier	M ([a])

[a] The DLCEP DL-identifier shall equal the DL-identifier returned in the corresponding DL-CONNECT response primitive.

Table 43 – CP 1/1: DLL service selection of 8.5 for use of addresses for peer DLC

DL-Connect	Request	Indication	Response	Confirm
Called address	Remote DLSAP-address	M (=)	—	—
Calling address	Local DLSAP-address	M (=)	—	—
Responding address	—	—	Local DLSAP-address	M (=)
Calling DLCEP-address	DLCEP-address assigned by DLS-user	—	DLCEP-address assigned by DLS-user	—
NOTE — means that the parameter is not allowed.				

Table 44 – CP 1/1: DLL service selection of 8.5 for use of addresses for multipeer DLC connect request at publisher

DL-Connect	Request	Confirm
Called address	UNKNOWN	—
Calling address	Local DLSAP-address	—
Responding address	—	UNKNOWN
Calling DLCEP-address	Publisher DLCEP-address	—
NOTE 1 — means that the parameter is not allowed. NOTE 2 No DLS-user data is allowed in the request primitive, because there is no indication at the subscriber.		

Table 45 – CP 1/1: DLL service selection of 8.5 for use of addresses for multipeer DLC connect request at subscriber

DL-Connect	Request	Confirm
Called address	Publisher DLCEP-address	—
Calling address	Local DLSAP-address	—
Responding address	—	Publisher DLSAP-address
Calling DLCEP-address	not used	—
NOTE — means that the parameter is not allowed		

Table 46 – CP 1/1: DLL service selection of 8.6

Clause	Header	Presence	Constraints
8.6.1	Function	YES	—
8.6.2	Types of primitives and parameters	Partial	Replace IEC 61158-3, Table 15, by IEC 61784-1, Table 47
8.6.2.0	—	YES	—
8.6.2.1	DLCEP-identifier-type	NO	—
8.6.2.2	DLCEP DLS-user-identifier	NO	—
8.6.2.3	DLCEP DL-identifier	YES	—
8.6.2.4	Originator	YES	—
8.6.2.5	Reason	YES	When the originator parameter indicates a DLS-user-initiated release, then the DLS-user can assign not only the values listed in IEC 61158-3, 8.6.2.5, but also other values to the reason parameter. These other values are considered as “reason unspecified” by IEC 61158-3, 8.6.2.5. The DLS-provider shall deliver the DLS-user provided reason in the indication primitive. The DLS-user of this profile has reserved 16 values for such “reason unspecified”
8.6.2.6	DLS-user-data	YES	—
8.6.3	Sequence of primitives when releasing an established DLC/DLCEP	YES	—
8.6.4	Sequence of primitives in a DLS-user rejection of a DLC / DLCEP establishment attempt	Partial	IEC 61158-3, Figures 35 and 38 to 41, are included in this profile. IEC 61158-3, Figures 36, 37, 42 and 43, are not included in this profile, because the DLCEP-address is assigned by DLS-user, and there is no DL-CONNECT indication to the DLS-user

Table 47 – CP 1/1: DLL service selection: replacement for Table 15 of 8.6

DL-Disconnect	Request	Indication
Parameter name	input	output
DLCEP DL-identifier	M	M
Originator		M
Reason	U	M (=)
DLS-user-data	U	M (=)

Table 48 – CP 1/1: DLL service selection of 8.7

Clause	Header	Presence	Constraints
8.7.1	Queue data transfer	—	—
8.7.1.1	Function	YES	—
8.7.1.2	Types of primitives and parameters	Partial	Replace IEC 61158-3, Table 16 by IEC 61784-1, Table 49
8.7.1.2.0	—	YES	—
8.7.1.2.1	DLCEP DL-identifier	YES	DLCEP DL-identifiers in request and indication primitives are local to the DLE at which the primitive is issued
8.7.1.2.2	DLCEP DLS-user-identifier	NO	—
8.7.1.2.3	Queue DLS-user-identifier	NO	A separate Queue DLS-user-identifier is not included, because the DLCEP address is sufficient to identify the queue, if any queue is bound to the DLCEP
8.7.1.2.4	DLS-user-data	YES	—
8.7.1.2.5	Sequence-number-identification	NO	—
8.7.1.2.6	Status	YES	—
8.7.1.3	Sequence of primitives	Partial	IEC 61158-3, Figures 45 and 46, are not included in this profile, because DLCEP data delivery or QoS are not included
8.7.2	Buffer data transfer	—	—
8.7.2.1	Function	YES	—
8.7.2.2	Types of primitives and parameters	Partial	Replace IEC 61158-3, Table 17 and Table 18, by IEC 61784-1, Table 50 and Table 51, respectively.
8.7.2.2.0	—	YES	—
8.7.2.2.1	DLCEP DLS-user-identifier	NO	A DLCEP DL-identifier is used in its stead
8.7.2.2.2	Buffer DLS-user-identifier	NO	—
8.7.2.2.3	DLSDU sequencing inference	YES	—
8.7.2.3	Sequence of primitives	Partial	IEC 61158-3, Figures 48, 50 and 51, are not included in this profile, because DLCEP data delivery or QoS are not included
8.7.3	Reset	NO	—
8.7.4	Subscriber query	NO	—

Table 49 – CP 1/1: DLL service selection of 8.7, replacement for Table 16

DL-Data	Request	Indication	Confirm
Parameter name	input	output	output
Request DLS-user-identifier	M		M (=)
DLCEP DL-identifier	M	M	
DLS-user-data	M	C (=)	
Status			M

Table 50 – CP 1/1: DLL service selection of 8.7, replacement for Table 17

DL-Buffer-Sent	Indication
Parameter name	output
DLCEP DL-identifier	M

Table 51 – CP 1/1: DLL service selection of 8.7, replacement for Table 18

DL-Buffer-Received	Indication
Parameter name	output
DLCEP DL-identifier	M
DLSDU sequencing inference	M

Table 52 – CP 1/1: DLL service selection of Clause 9

Clause	Header	Presence	Constraints
9.1	Facilities of the connectionless-mode Data Link Service	Partial	Paragraphs (b) to (e) are not included in this profile
9.2	Model of the connectionless-mode Data Link Service	—	—
9.2.0	—	YES	—
9.2.1	Model of DL-connectionless-mode unitdata transmission	YES	—
9.2.2	Model of DL-connectionless-mode unitdata exchange	NO	—
9.3	Quality of connectionless-mode service	—	—
9.3.0	—	YES	—
9.3.1	Determination of QoS for connectionless-mode service	YES	—
9.3.2	Definition of QoS parameters	—	—
9.3.2.1	DLL priority	YES	—
9.3.2.2	DLL maximum confirm delay	YES	—
9.3.2.3	Remote-DLE-confirmed	Partial	In this profile, the value of this parameter shall always be FALSE
9.4	Sequence of primitives	—	—
9.4.1	Constraints on sequence of primitives	Partial	All of this subclause, except the rows for DL-UNITDATA-EXCHANGE and DL-LISTENER-QUERY and related notes in IEC 61158-3, Table 22, are included in this profile
9.4.2	Relation of primitives at the end-points of connectionless service	Partial	IEC 61158-3, Figure 65 (a), is included in this profile. IEC 61158-3, Figures 65 (b), (c) and (d), are not included in this profile
9.4.3	Sequence of primitives at one DLSAP	Partial	In IEC 61158-3, Figure 66, the transitions for DL-UNITDATA-EXCHANGE and DL-LISTENER-QUERY services are not included in this profile
9.5	Connectionless-mode functions	—	—
9.5.0	—	YES	—
9.5.1	Data transfer	—	—
9.5.1.1	Function	YES	—
9.5.1.2	Types of primitives and parameters	—	—
9.5.1.2.0	—	YES	—
9.5.1.2.1	Addresses	YES	—
9.5.1.2.2	Quality of Service	—	—
9.5.1.2.2.0	—	YES	—
9.5.1.2.2.1	DLL priority	YES	—
9.5.1.2.2.2	DLL maximum confirm delay	YES	—
9.5.1.2.2.3	Remote-DLE-confirmed	Partial	Value of this parameter shall always be FALSE
9.5.1.2.3	Queue DLS-user-identifier	NO	Queue DLS-user-identifier is not included, because the DLSAP address is sufficient to identify the queue, if any queue is bound to the DLSAP
9.5.1.2.4	DLS-user data	YES	—
9.5.1.2.5	Status	YES	—
9.5.1.3	Sequence of primitives	Partial	IEC 61158-3, Figure 68, is not included in this profile
9.5.2	Data exchange	NO	—
9.5.3	Listener query	NO	—

Table 53 – CP 1/1: DLL service selection of 9.5, replacement for table 23

DL-Unitdata	Request	Indication	Confirm
Parameter name	**input**	**output**	**output**
Called address	M	M (=)	
Calling address	M	M (=)	
QoS parameter set			
DLL priority	U	M (=)	
DLL maximum confirm delay	U		
remote-DLE-confirmed	U		
DLS-user-data	M	C (=)	
Status			M

Table 54 – CP 1/1: DLL service selection of Clause 10

Clause	Header	Presence	Constraints
10.1	Facilities and classes of the time and scheduling guidance Data Link Service	Partial	Subclauses (b), (c), (e), (f), (g) and (h) are not included in this profile
10.2	Model of the time and scheduling guidance Data Link Service	YES	—
10.3	Quality of scheduling guidance service	YES	—
10.4	Sequence of primitives at one DLE	—	—
10.4.1	Constraints on sequence of primitives	Partial	All of this subclause, except the rows for Schedule Sequence, Cancel Schedule and Profile Schedule services and related notes in IEC 61158-3, Table 26 and Figure 72, are not included
10.5	Scheduling guidance functions	—	—
10.5.0	—	YES	—
10.5.1	DL-time	YES	—
10.5.2	Compel service	—	—
10.5.2.1	Function	Partial	Subclauses (a), (b), (c), (d) and (f) are not included in this profile
10.5.2.2	Types of primitives and parameters	Partial	Replace IEC 61158-3, Table 28, by IEC 61784-1 Table 55
10.5.2.2.0	—	YES	—
10.5.2.2.1	Action class	Partial	Subclauses (c) and (d) are not included in this profile
10.5.2.2.1.0	—	YES	—
10.5.2.2.1.1	DLCEP DL-identifier	YES	—
10.5.2.2.1.2	Local-DLSAP-address DL-identifier	NO	—
10.5.2.2.1.3	Remote-DLSAP-address	NO	—
10.5.2.2.1.4	DLL-priority	NO	—
10.5.2.2.2	Schedule DL-identifier	N	—
10.5.2.2.3	Status	YES	—
10.5.2.3	Sequence of primitives	YES	—
10.5.3 – 10.5.5	---	NO	—

Table 55 – CP 1/1: DLL service selection of 10.5, replacement for table 28

DL-Compel-Service	Request	
Parameter name	**input**	**output**
Action class	M	
DLCEP DL-identifier	M	
Status		M

5.2.2.2 DLL protocol selection

5.2.2.2.1 General

Table 56 specifies the selection of the Data Link services within IEC 61158-4 for this profile.

Table 56 – CP 1/1: DLL protocol selection

Clause	Header	Presence	Constraints
1	Scope and object	YES	—
2	Normative references	Partial	Used as needed
3	Terms and definitions	Partial	Common definitions, and those for Type 1, used as needed
4	Symbols and abbreviations	Partial	Common symbols and abbreviations, and those for Type 1, used as needed
5	DLL protocol elements common to multiple DL-protocol Types	YES	—
6	Type 1: Overview of DLL protocol	—	See Table 57
7	Type 1:General structure and encoding of PhIDUs and DLPDUs, and related elements of procedure	YES	—
8	Type 1: DLPDU-specific structure, encoding and elements of procedure	—	See 5.2.2.2.2
9	Type 1: DLPDU-parameter structure and encoding	—	See 5.2.2.2.3
10	Type 1: DLL service elements of procedure	—	See 5.2.2.2.4
11	Type 1: DL-support sub-protocol	—	See 5.2.2.2.5
12	Type 1: Other DLE elements of procedure	—	See 5.2.2.2.6
13	Type 1: PICS proforma	NO	—
14 –26		NO	—
Annex A	Types 1, 2, 3 (synchronous), 5 (first FCS), 6, 7 and 8: Exemplary FCS implementations	Partial	Type 1 portions used as appropriate
Annex B	Type 1: Formal protocol finite state machines	NO	—
Annex C	Type 1: DLPDU and DL-addressing short-form summaries	Partial	As required by earlier clauses
Annex D – J	—	NO	—

Table 57 – CP 1/1: DLL protocol selection of Clause 6

Clause	Header	Presence	Constraints
6.1	Three-level model of the DLL	YES	—
6.2	Service provided by the DLL	Partial	This subclause is the summary of service definitions. See 5.2.3.2 for details and the list of services that are not included
6.3	Structure and definition of DL-addresses	Partial	See Table 58 for the selection of subclauses
6.4	Service assumed from the Physical Layer	YES	—
6.5	Functions of the DLL	Partial	All types of functions specified in each subclause are included, but only to the extent required by the Data Link Services of this profile
6.6	Functional classes	YES	—
6.7	Local parameters, variables, counters, timers and queues	—	See Table 64 for the selection of subclauses

Table 58 – CP 1/1: DLL protocol selection of 6.3

Clause	Header	Presence	Constraints
6.3.0	—	YES	—
6.3.1	Form of DL-addresses	YES	—
6.3.2	Predefined Values and Ranges for DL-Address Components	—	—
6.3.2.0	—	YES	
6.3.2.1	Link designators	Partial	Table 59 specifies the Link designators included in this profile
6.3.2.2	Node designators	YES	Table 60 specifies the use of Node designators included in this profile
6.3.2.3	Selectors	YES	The value 07 is reserved for the Application Layer Entity of this profile and shall be used as the default DLSAP-address for establishing connections
6.3.3	Predefined DL-Addresses	—	—
6.3.3.1	Predefined flat non-local DL-addresses	Partial	Table 61 specifies the Predefined flat non-local DL-addresses included in this profile
6.3.3.2	Predefined flat local DL-addresses	Partial	Table 62 specifies the Predefined flat local DL-addresses included in this profile
6.3.3.3	Predefined node-local DL-addresses	Partial	Table 63 specifies the Predefined node-local DL-addresses included in this profile
6.3.4	Representation of DL-Addresses as locally-administered 48-bit MAC-addresses	NO	—

Table 59 – CP 1/1: DLL protocol selection of 6.3.2.1 for use of link designators

Link	Usage
0000	Local link
0001	All links
1000 - ML	Individual link, where ML is the configured value of the highest link address. Each link shall be assigned only one address (primary), and a secondary link address shall not be assigned

Table 60 – CP 1/1: DLL protocol selection of 6.3.2.2 for use of node designators

Node	Usage
00	Local node, N =0 never appears on the bus
01 - 03	Flat link-local group DL-addresses, assignable in the link-local address range 0140 - 03FF
04	Flat link-local DLSAP-addresses, with link-local addresses of 0400 = LAS, 0404 = dominant bridge, 0440 - 04FF assignable to redundant device sets for node independence
05 - 0F	Flat link-local DLCEP-addresses, used by redundant device sets for node independence, with link-local addresses 0500 - 0FBF assignable to redundant device sets for node independence
10 - FF	Individual node, assigned based on device class and permanence and, for Bridge and Link Master class devices, the preferred order of LAS role assumption (where a lower address takes precedence over a higher). Each node shall be assigned only a single node address; secondary node addresses shall not be used

Table 61 – CP 1/1: DLL protocol selection of 6.3.3.1 for predefined flat non–local DL-addresses

link || N || S		Assigned use for specified DL-address
0001	0000	The DL-support functions of “all” (see Note 1) DLEs on the extended link
0001	0001	The DL-support functions of “all” (see Note 1) LM DLEs on the extended link
0001	0002	The DL-support functions of “all” (see Note 1) Bridge DLEs on the extended link
0001	0003	The DL-bridge functions of “all” (see Note 1) Bridge DLEs on the extended link
0001	0009	The SMAEs of “all” (see Note 1) DLEs on the extended link

NOTE 1 DLEs which do not recognize LONG DL-addresses are necessarily excluded from these sets
NOTE 2 SMAE is the System Management Application Entity

Table 62 – CP 1/1: DLL protocol selection of 6.3.3.2 for predefined flat link–local DL-addresses

node || selector		Assigned use for specified DL-address
01	00	The DL-support functions of all DLEs on the link
01	01	The DL-support functions of all LM DLEs on the link
01	02	The DL-support functions of all Bridge DLEs on the link
01	03	The DL-bridge functions of all Bridge DLEs on the link
01	09	The SMAEs of all DLEs on the link
04	00	The “DLSAP”-address for the DL-support functions of the DLE on the link which is serving as LAS
04	04	The “DLSAP”-address for the DL-bridge functions of the bridge DLE on the link which is dominant (closest to the root) in the bridge spanning tree

Table 63 – CP 1/1: DLL protocol selection of 6.3.3.3 for predefined node–local DL-addresses

selector	Assigned use for specified DL-address
00	The “DLSAP”-address for the DL-support functions of the node’s DLE
01	The “DLSAP”-address for the DL-bridge functions of the node’s DLE
02	The DLSAP-address for the same’s SMAE

Table 64 – CP 1/1: DLL protocol selection of 6.7

Clause	Header	Presence	Constraints
6.7.0	—	YES	—
6.7.1	Parameters, variables, counters, timers and queues to support the Basic class	—	—
6.7.1.0	—	YES	—
6.7.1.1	V(ST) slot-time	YES	—
6.7.1.2	V(PhLO) per-DLPDU-PhL-overhead	YES	—
6.7.1.3	V(MRD) maximum-response-delay	YES	—
6.7.1.4	V(IRRD) immediate-response-recovery-delay	YES	—
6.7.1.5	V(MRC) maximum-retry-count	Partial	Number of retries is always 0 for this profile
6.7.1.6	V(NRC) network-repeat-count	Partial	Number of repeats is always 0 for this profile
6.7.1.7	V(NDL) network-DLPDU-lifetime	Partial	Network-DLPDU-lifetime is always 0 for this profile
6.7.1.8	V(TN) this-node	YES	—
6.7.1.9	V(TL) this-link	YES	—
6.7.1.10	V(MEP) DL-MAC-address-embedding-prefix	NO	Variable is not used by the protocol
6.7.1.11	C(RD) remaining-duration counter	YES	—
6.7.1.12	V(MID) minimum-inter-DLPDU-delay	YES	—
6.7.1.13	T(IRRD) immediate-response-recovery-delay monitor	YES	—
6.7.1.14	V(RA) reply-address	YES	—
6.7.1.15	V(OTA) outstanding-transaction-array	NO	Not required because V(MRC)=0
6.7.1.16	V(LTI) last-transaction-index	NO	Not required because V(MRC)=0
6.7.1.17	Q(US) unscheduled-service queue	Partial	References to user requests as per items a.1), a.3) and a.4) only; items a.2), b) and c) do not apply to this profile
6.7.1.18	V(RID) random identifier	YES	—
6.7.1.19	C(NT) node-time counter	YES	—
6.7.1.20	V(LSTO) local-link-scheduling-time-offset	YES	—
6.7.1.21	V(DLTO) DL-time-offset	YES	—
6.7.1.22	V(TQ) time-quality	YES	—
6.7.1.23	V(MD) measured-delay	YES	—
6.7.1.24	V(LN) LAS-node	YES	—
6.7.1.25	V(TSC) time-synchronization-class	YES	—
6.7.1.26	T(TDP) time-distribution-period monitor	YES	—
6.7.1.27	V(TSL) time-source-link	YES	—
6.7.2	Parameters and timers to support a DLS-user's request	YES	—
6.7.3	Queues to support DL-address-based DL-scheduling	YES	—
6.7.4	Variables and timers to support a DLCEP	—	See Table 65
6.7.5	Variables and timers to support the Link Master class	—	See Table 66
6.7.6	Variables and timers to support the Bridge class	YES	—

Table 65 – CP 1/1: DLL protocol selection of 6.7.4

Clause	Header	Presence	Constraints
6.7.4.0	—	YES	—
6.7.4.1	VC(ST) DLCEP state	YES	—
6.7.4.2	VC(NP) negotiated DLCEP parameters	YES	—
6.7.4.3	VC(N) next sequence number to assign to a DLSDU	YES	—
6.7.4.4	VC(R) maximum non-transmittable DLSDU sequence number	NO	Not required for DLCEP data delivery features of this profile
6.7.4.5	VC(A) maximum acknowledged DLSDU sequence number	YES	—
6.7.4.6	VC(M) maximum transmitted DLSDU sequence number	YES	—
6.7.4.7	VC(MS) maximum transmitted DLSDU segment number	NO	Max DLSDU size is restricted to one segment
6.7.4.8	VC,K (SS) segments to send	Partial	Number of segments is always one; only for Classical and Disordered Peer DLCs
6.7.4.9	TC,K(SS) sent-segments monitor	YES	—
6.7.4.9.1	TC(SS) simplified sent-segments monitor	YES	—
6.7.4.10	VC(L) last-reported DLSDU sequence number	YES	—
6.7.4.11	VC(H) highest-detected DLSDU sequence number	YES	—
6.7.4.12	VC(HS) highest-detected segment number of the highest-detected DLSDU sequence number	Partial	Max DLSDU size is restricted to one segment
6.7.4.13	VC,K(MRS) missing received segments	Partial	Number of segments is always one; only for Classical and Disordered Peer DLCs
6.7.4.14	VC,K(RRS) retransmission-request required segments	Partial	Number of segments is always one; only for Classical and Disordered Peer DLCs
6.7.4.15	TC,K(RRS) retransmission request monitor	NO	Not required for DLCEP data delivery features of this profile
6.7.4.16	TC(RAS) residual activity stimulus	YES	—
6.7.4.17	TC(RAM) residual activity monitor	YES	—
6.7.4.18	VC(TNA) DL-time of last network access	YES	—
6.7.4.19	VB(TW) DL-time of last buffer write	YES	—
6.7.4.20	VB(TP) DL-time of production	NO	Time-of-production is not included in this profile
6.7.4.21	VB(TS) Timeliness-status of buffer write	YES	—

Table 66 – CP 1/1: DLL protocol selection of 6.7.5

Clause	Header	Presence	Constraints
6.7.5.0	—	YES	—
6.7.5.1	V(DTA) delegation-address	YES	—
6.7.5.2	V(LL) local-link live-list	YES	—
6.7.5.3	V(TCL) token-circulation list	YES	—
6.7.5.4	V(ENRL) expected-non-response list	NO	Fractional Duty Cycle (FDC) DLEs are not included in this profile
6.7.5.5	V(MST) maximum-scheduled-traffic	NO	LAS does not construct the schedule for this profile
6.7.5.6	V(MSO) maximum-scheduling-overhead	YES	—
6.7.5.7	V(DMDT) default-minimum-token-delegation-time	YES	—
6.7.5.8	V(DTHT) default-token-holding-time	YES	—
6.7.5.9	V(LTHT) link-maintenance-token-holding-time	YES	—
6.7.5.10	V(MTHA) maximum-token-holding-time-array	YES	—
6.7.5.11	V(TTRT) target-token-rotation-time	YES	—
6.7.5.12	V(ATRT) actual-token-rotation-time	YES	—
6.7.5.13	V(RTHA) remaining-token-holding-time-array	YES	—
6.7.5.14	V(NTHN) next-token-holding-node	YES	—
6.7.5.15	V(FUN) first-unpolled-node	YES	—
6.7.5.16	V(NUN) number-of-consecutive-unpolled-nodes	YES	—
6.7.5.17	P(TRD) token-recovery-delay	YES	—
6.7.5.18	V(TDP) time-distribution-period	YES	—
6.7.5.19	V(MICD) maximum-inactivity-to-claim-LAS-delay	YES	—
6.7.5.20	V(LDDP) LAS-data-base-distribution-period	YES	—

5.2.2.2.2 IEC 61158-4, Clause 8

5.2.2.2.2.1 General

The subclauses “8.*x*.4.3 Additional actions required of a Bridge class DLE” of IEC 61158-4, for *x* = 1 to 23, apply to this profile only for forwarding the DLPDU. The bridge function of this profile does not include updating its routing tables based on the received DLPDU.

Table 67 specifies the selection of the other subclauses for this profile.

Table 67 – CP 1/1: DLL protocol selection of Clause 8

Clause	Header	Presence	Constraints
8.0	—	Partial	All of this subclause, except IEC 61158-4, Table 10 , which is replaced by IEC 61784-1, Table 68, is included in this profile
8.1	Establish Connection (EC) DLPDU	YES	—
8.2	Disconnect Connection (DC) DLPDU	YES	—
8.3	Reset Connection (RC) DLPDU	NO	DLC Reset is not part of the services included in this profile
8.4	Compel Acknowledgement (CA) DLPDU	NO	Acknowledgement from the remote DLE is not required for the services included in this profile
8.5	Compel Data (CD) DLPDU	Partial	See 5.2.2.2.2.2
8.6	Exchange Data (ED) DLPDU	NO	—
8.7	Data (DT) DLPDU	Partial	See 5.2.2.2.2.10
8.8	Status Response (SR) DLPDU	Partial	See 5.2.2.2.2.23
8.9	Compel Time (CT) DLPDU	YES	—
8.10	Time Distribution (TD) DLPDU	YES	—
8.11	Round-Trip-Delay Query (RQ) DLPDU	Partial	See 5.2.2.2.2.26
8.12	Round-Trip-Delay Reply (RR) DLPDU	Partial	See 5.2.2.2.2.27
8.13	Probe Node DL-address (PN) DLPDU	YES	—
8.14	Probe Response (PR) DLPDU	YES	—
8.15	Pass Token (PT) DLPDU	Partial	See 5.2.2.2.2.28
8.16	Execute Sequence (ES) DLPDU	NO	Schedule is executed only by the LAS
8.17	Return Token (RT) DLPDU	YES	—
8.18	Request Interval (RI) DLPDU	YES	—
8.19	Claim LAS (CL) DLPDU	YES	—
8.20	Transfer LAS (TL) DLPDU	Partial	See 5.2.2.2.2.31
8.21	Wakeup (WK) DLPDU	NO	Fractional Duty Cycle (FDC) DLEs are not included in this profile
8.22	Idle (IDLE) DLPDU	YES	—
8.23	Spare DLPDUs	YES	—
8.24	Reserved (can't use) DLPDUs	YES	—

Table 68 – CP 1/1: DLL protocol selection, replacement for Table 10 of 8.0

DLPDU class	Frame control	DL-addresses			Parameters	User data
		Destination	Source	2nd source		
EC 1	1111 LF00	[HL.]N.S	[HL.]N.S	[HL.]N.S	EC-p	o-DLSDU
EC 2	1110 LF00		[HL.]N.S	[HL.]N.S	EC-p	o-DLSDU
DC 1	0111 LF00	[HL.]N.S	[HL.]N.S		DC-p	o-DLSDU
DC 2	0110 LF00		[HL.]N.S		DC-p	o-DLSDU
CD 1	1111 LFPP	[HL.]N.S	[HL.]N.S		—	—
CD 2	1011 LFPP	[HL.]N.S	—		—	—
DT 1	1101 LFPP	[HL.]N.S	[HL.]N.S		SD-p	o-DLSDU
DT 2	1001 LFPP	[HL.]N.S	—		SD-p	o-DLSDU
DT 3	0101 LFPP		[HL.]N.S		SD-p	o-DLSDU
DT 5	0101 0F00		[PDA]		SD-p	o-DLSDU
SR	0001 0F11	[PSA]	N		o-SR-p	—
CT	0001 0F00	—	—		—	—
TD	0001 0F01	—	N		TD-p	—
RQ	1100 0F00	N.0	N.0		RQ-p	—
RR	1101 0F00	N.0	N.0		RR-p	—
PN	0010 0110	N	—		PN-p	—
PR	0010 0111	—	—		—	SPDU
PT	0011 0FPP	N	—		DD-p	—
RT	0011 0100	—	[DTH]		—	—
RI	0010 0000	—	[DTH]		DD-p	—
CL	0000 0001	—	N		—	—
TL	0000 0110	N	—		—	SPDU
Idle	0001 0F10	—	—		—	o-DLSDU

LEGEND:
L indicates the length of the associated DL-addresses (0 = SHORT, 1 = LONG)
F indicates final use of a token, or that a sequence should be finished rather than restarted
PP specifies the priority of the DLPDU and any passed token
shading indicates a logically non-existent field
— indicates a logically existent field whose contents are required to be null
[HL.]N.S is a four-octet LONG DL-address (HLNS) when L = 1
or a two-octet SHORT DL-address (NS) with HL=00 implied when L = 0
N is a one-octet NODE DL-address
N.0 is the two-octet SHORT DL-address form of a one-octet NODE DL-address
[PDA] is the implied DL-address equal to the explicit destination DL-address of the immediately prior DLPDU on the link, which must have been a CD DLPDU
[PSA] is the implied DL-address equal to the implied or explicit source DL-address of the immediately prior DLPDU on the link
o- indicates optional field contents
xx-p indicates xx-class DLPDU parameters
DLSDU is a DL Service Data Unit
SPDU is a Support Protocol Data Unit

5.2.2.2.2 IEC 61158-4, 8.5

In IEC 61158-4, 8.5, the COMPEL DATA (CD) DLPDU is used by a DLE to request the transfer of user data from another DLE and the destination address of a CD can be either a DLCEP-address or a DLSAP-address. In this profile, CD is used only by the LAS or by a subscriber to request the transfer of user data from a publishing DLCEP

Table 69 specifies the selection of the subordinate subclauses for this profile.

Table 69 – CP 1/1: DLL protocol selection of 8.5

Clause	Header	Presence	Constraints
8.5.0	—	YES	—
8.5.1	Structure of the CD DLPDUs	Partial	See 5.2.2.2.2.3
8.5.2	Content of the CD DLPDU	—	—
8.5.2.0	—	Partial	See 5.2.2.2.2.4
8.5.2.1	Content of the CD DLPDU when specifying a destination DLSAP-address	NO	—
8.5.2.2	Content of the CD DLPDU when specifying a destination DLCEP-address	Partial	See 5.2.2.2.2.5
8.5.3	Sending the CD DLPDU	Partial	See 5.2.2.2.2.6
8.5.4	Receiving the CD DLPDU	—	—
8.5.4.0	—	Partial	See 5.2.2.2.2.7
8.5.4.1	Actions required of all DLEs	Partial	See 5.2.2.2.2.8
8.5.4.2	Additional actions required of a Link-Master class DLE	YES	—
8.5.4.3	Additional actions required of a Bridge class DLE	Partial	See 5.2.2.2.2.9
8.5.4.4	Additional actions required of the current LAS DLE	YES	—

5.2.2.2.2.3 IEC 61158-4, 8.5.1

This subclause and all its subclauses (i.e. all formats and all fields) are included in this profile, but with a null SD-parameter.

5.2.2.2.2.4 IEC 61158-4, 8.5.2.0

The destination address shall be a DLCEP-address. The source address, if present shall be the subscriber's DL-address.

5.2.2.2.2.5 IEC 61158-4, 8.5.2.2

NOTE 1 Only a publisher's DLCEP-address is permitted as a destination DLCEP-address.

When the first address is a DLCEP-address, as in IEC 61158-4, 8.5.2(b) and 8.5.2(c), then

a) this DLPDU shall request state information from the addressed DLCEP, and shall request that DLS-user data be included in the reply DLPDU, and

b) the second address, if present, shall be a subscriber DLCEP's calling-DLSAP-address of the same DLC as the destination publisher DLCEP-address; and

c) the SD-parameters field should not be present; and

d) the user data shall be null.

NOTE 2 IEC 61158-4, 8.5.2(c), formats 1l and 1s, are used for subscriber-to-publisher communications when the DLPDU-authentication attribute is SOURCE. IEC 61158-4, 8.5.2(c), formats 2l and 2s, are used for subscriber-to-publisher communications when the DLPDU-authentication attribute is ORDINARY.

5.2.2.2.2.6 IEC 61158-4, 8.5.3

NOTE Since the destination is not a DLSAP-address, there is no immediate retry.

A CD DLPDU may be selected for transmission on the link when

a) the sending DLE holds a scheduler token or delegated token which is the dominant token on the local link, and

b) the remaining allocated duration of token usage, C(RD), permits completion of the transactions prior to expiration of the token, where the transaction consists of sending the CD DLPDU that requires an immediate reply, and awaiting a worst-case SR DLPDU or worst-case permitted DT reply DLPDU containing DLS-user data.

If the DLE holds a delegated token, and no additional use of that token after sending this DLPDU and awaiting its immediate reply is needed at that time, then the DLE may set the final-token-use subfield of the CD DLPDU to the value FINAL; else that subfield shall have the value NOT-FINAL.

Each explicit DL-address in the CD DLPDU shall be delocalized before transmission as specified in IEC 61158-4, 7.2.2.4.

After sending a CD DLPDU, the sending DLE shall monitor the local link for a reply as specified in IEC 61158-4, 7.2.7.1.

The permissible reply DLPDU is either,

1) a DT DLPDU without a destination DL-address, or
2) a SR DLPDU.

5.2.2.2.7 IEC 61158-4, 8.5.4.0

NOTE Only a publisher's DLCEP-address is permitted as a destination DLCEP-address; there is no immediate retry. A received CD with a peer DLCEP-address as the destination address is ignored by the receiving DLE.

Each DL-address in the DLPDU shall be delocalized upon reception as specified in IEC 61158-4, 7.2.2.4.

A received CD DLPDU shall be treated as follows by the receiving DLE:

5.2.2.2.8 IEC 61158-4, 8.5.4.1

NOTE Subclause (c) is included only for publisher DLCEPs. For this profile, a CD addressed to a peer DLCEP is ignored.

a) not included;

b) not included;

c) If the destination DL-address specified by the DLPDU designates an active DLCEP-address of a DLC for which the receiving DLE
   - is a publisher, and the DLL priority of the DLCEP is not equal to the priority specified in the received DLPDU, then the receiving DLE shall initiate a reply within a period of maximum-response-delay slot-times, V(MRD) × V(ST) octet-durations, of receipt of the CD DLPDU. The reply DLPDU shall be a DT DLPDU in the format negotiated for the DLC for the selected direction of transmission, and shall contain SD-parameters appropriate to the sending DLCEP, but should not contain DLS-user-data.
   - is a peer, then the receiving DLE shall ignore the received DLPDU;

d) If (c) does not apply, and the destination DL-address specified by the DLPDU designates an active DLCEP-address of a DLC for which the receiving DLE is a publisher, then
   1) not included;
   2) The receiving DLE shall initiate a reply within a period of maximum-response-delay slot-times, V(MRD) × V(ST) octet-durations, of receipt of the CD DLPDU. The reply DLPDU shall be a DT DLPDU in the format negotiated for the DLC for the selected direction of transmission, shall contain SD-parameters appropriate to the sending DLCEP, and shall contain DLS-user-data if any was available and waiting for transmission or retransmission from the DLCEP;
   3) not included;

e) If the destination DL-address specified by the DLPDU designates an active DLCEP-address of a DLC for which the receiving DLE is a subscriber, then
   1) not included;

2) The receiving DLE shall record the destination DL-address from the received CD DLPDU in V(RA) for subsequent association with the expected immediate reply DT DLPDU, which should be the next DLPDU received;

3) The receiving DLE shall monitor the local link for a reply and then act based on the result of that monitoring, all as specified in IEC 61158-4, 7.2.7.3.

5.2.2.2.2.9 IEC 61158-4, 8.5.4.3

a) Since every bridge class DLE has Link Master capability, any actions specified in IEC 61158-4, 8.5.4.2, also apply to a Bridge class DLE.

b) Subclauses (A) – (E), (1) and (2) do not apply.

1) If the destination DL-address specified in the DLPDU is one which the bridge should forward but which the bridge DLE itself would not otherwise receive, then the bridge shall form and send a SR DLPDU,

   i) within a period of maximum-response-delay slot-times, V(MRD)×V(ST) octet-durations, of receipt of the CD DLPDU,

   ii) with status indicating whether or not the bridge was able to buffer the received DLPDU.

2) If the destination DL-address specified in the DLPDU is one which the bridge should forward, and the bridge was able to receive and buffer the DLPDU without error, then the received DLPDU shall be forwarded with modification of the frame-control field in the forwarded DLPDU as appropriate. See IEC 61158-4, 5.1.3.

3) This subclause does not apply

c) It is a protocol error for a bridge DLE which will forward the received CD DLPDU to not send a SR reply DLPDU when a reply is required.

NOTE At most one bridge DLE on the local link should be forwarding the received CD DLPDU.

5.2.2.2.2.10 IEC 61158-4, 8.7

A DATA (DT) DLPDU is used to transfer a limited amount of transparent user data from one DLS-user to one or more other DLS-users; to acknowledge the transfer of such data; and to assist in the synchronization of DLCEPs and of DLS-users.

It is also used by a DLE to send an SPDU to one or more other DLEs.

Table 70 specifies the selection of the subordinate subclauses for this profile.

Table 70 – CP 1/1: DLL protocol selection of 8.7

Clause	Header	Presence	Constraints
8.7.0	—	—	—
8.7.1	Structure of the DT DLPDUs	Partial	Modified as in 5.2.2.2.2.11
8.7.2	Content of the DT DLPDU	—	—
8.7.2.0	—	Partial	Modified as in 5.2.2.2.2.12
8.7.2.1	Content of the DT DLPDU when specifying a destination DL(SAP)-address	Partial	Modified as in 5.2.2.2.2.13
8.7.2.2	Content of the DT DLPDU when specifying a destination or source DLCEP-address	Partial	Modified as in 5.2.2.2.2.14
8.7.3	Sending the DT DLPDU	—	—
8.7.3.0	—	Partial	Modified as in 5.2.2.2.2.15
8.7.3.1	Transmission when the reply token is dominant	Partial	Modified as in 5.2.2.2.2.16
8.7.3.2	Transmission when the delegated token is dominant	YES	—
8.7.3.3	Transmission when the scheduler token is dominant	YES	—
8.7.4	Receiving the DT DLPDU	—	—
8.7.4.0	—	Partial	Modified as in 5.2.2.2.2.17
8.7.4.1	Actions required of all DLEs	—	—
8.7.4.1.1	Actions required when the reply token was not dominant at start-of-reception	Partial	Modified as in 5.2.2.2.2.18
8.7.4.1.2	Actions required when the reply token was dominant at start-of-reception and the receiving DLE sent the CA, CD or ED DLPDU which created the reply token	Partial	Modified as in 5.2.2.2.2.19
8.7.4.1.3	Actions required when the reply token was dominant at start-of-reception and the receiving DLE did not send the CA, CD or ED DLPDU which created the reply token	Partial	Modified as in 5.2.2.2.2.20
8.7.4.2	Additional actions required of a Link-Master class DLE	YES	—
8.7.4.3	Additional actions required of a Bridge class DLE	—	—
8.7.4.3.0	—	Partial	Modified as in 5.2.2.2.2.21
8.7.4.3.1	Actions required when the reply token was dominant at start-of-reception and the receiving bridge DLE forwarded, but did not originate, the CA, CD or ED DLPDU which created the reply token	Partial	Modified as in 5.2.2.2.2.22
8.7.4.4	Additional actions required of the current LAS DLE	YES	—

5.2.2.2.2.11 IEC 61158-4, 8.7.1

This subclause and all its subclauses, except format 4 of DT DLPDU, are included in this profile.

5.2.2.2.2.12 IEC 61158-4, 8.7.2.0

The frame control field shall be encoded as specified in IEC 61158-4, Table 18.

Either the DL-addresses shall be

a) the first a group DL-address and the second a DLSAP-address, or

b) all DLSAP-addresses, or

c) all DLCEP-addresses, or

d) not included.

5.2.2.2.2.13 IEC 61158-4, 8.7.2.1

When the first address is a group DL-address as in IEC 61158-4, 8.7.2(a), then

a) If the DLPDU format is format 1L or 1S, then

   1) the DLPDU is being used to implement the unitdata transfer service,

   2) the DL(SAP)-role for the source DLSAP-address shall be BASIC,

3) the SD-parameters field shall be null, and

4) the user data shall be a single DLSDU whose size is limited to the maximum size for the priority specified in IEC 61158-4, 8.7.1.1(b), and shall not be null.

b) No other DLPDU format may be used.

When the addresses are DLSAP-addresses as in IEC 61158-4, 8.7.2(b), then

c) If the DLPDU format is format 1L or 1S, then

1) this DLPDU is being used to implement the unitdata transfer service,

2) the DL(SAP)-role for the destination DLSAP-address shall be BASIC,

3) the DL(SAP)-role for the source DLSAP-address shall be BASIC,

4) the SD-parameters field shall be null, and

5) the user data shall be a single DLSDU whose size is limited to the maximum size for the priority specified in IEC 61158-4, 8.7.1.1(b), and shall not be null.

d) not included

e) No other DLPDU format may be used.

5.2.2.2.14 IEC 61158-4, 8.7.2.2

When the first address is a DLCEP-address, as in IEC 61158-4, 8.7.2(c), then

a) this DLPDU can convey a single DLSDU

1) from one peer DLCEP to its corresponding peer DLCEP, or

2) from a publisher DLCEP to its corresponding subscriber DLCEPs,

and

b) the second address, if present, shall be the peer DLCEP-address of the same DLC as the destination DLCEP-address;

c) the SD-parameters field shall specify state information for the addressed DLCEP, and the contents of this field shall be as described in IEC 61158-4, 9.4.2; and

NOTE The size and structure of this field is dependent on the QoS attributes associated with the DLCEP addressed by the destination DL-address specified in this DLPDU, and is determined during DLCEP establishment.

d) the user data shall specify those octets of a DLSDU consistent with the negotiated DLSDU size and the segmentation information specified in the accompanying SD-parameters, and may be null.

NOTE 1 Formats 1l, 2l, 1s and 2s are used for peer-to-peer communications; 1l is used when the DLPDU-authentication attribute is source or maximal, 1s is used when the DLPDU-authentication attribute is source, 2l and 2s are used when the DLPDU-authentication attribute is ordinary.
Formats 3l and 3s are used for publisher-to-subscriber communications when the DLPDU-authentication attribute is ordinary or source.
The specific format to be used (of formats 1l to 3s) is determined as part of DLCEP establishment.

NOTE 2 Format 5 can be used instead of formats 2s and 3s, respectively, only when the sending DLE holds a reply token and when the DLPDU-authentication attribute is ORDINARY.

5.2.2.2.15 IEC 61158-4, 8.7.3.0

A DT DLPDU may be selected for transmission on the link when the sending DLE

a) has just received a reply token in a CD DLPDU, permitting a single transmission of a DT or SR DLPDU, or

b) holds a scheduler token or delegated token which is the dominant token on the local link, and when the remaining allocated duration of token usage, C(RD), permits completion of the DT DLPDU's transmission prior to expiration of the token.

Each explicit DL-address in the DLPDU shall be delocalized IEC 61158-4, 7.2.2.4 before transmission.

5.2.2.2.2.16 IEC 61158-4, 8.7.3.1

NOTE 1 Only CD DLPDU with publisher's DLCEP-address as destination address is included.

a) A DT DLPDU may be sent on the link when the sending DLE has received a CD DLPDU addressed to one of its active DLCEP-addresses for which it has a publisher DLCEP, and the sending DLE is replying as specified by IEC 61158-4, 8.5.4.1, by forming as an immediate reply a DT DLPDU which may include a DLSDU which was already buffered at that responding DLE at the time of the CD DLPDU's reception.

When an immediate reply to a CD DLPDU is required, as specified in (a), then the replying DLE shall send a reply DT DLPDU within a period of maximum-response-delay slot-times, V(MRD) × V(ST) octet-durations, of receipt of the requesting CD DLPDU.

The final-token-use subfield of the reply DT DLPDU shall have the same value as that in the requesting CD DLPDU.

Each explicit DL-address in the reply DT DLPDU shall be delocalized IEC 61158-4, 7.2.2.4 before transmission.

It is a protocol error for the addressed DLE to not send a DT reply DLPDU when a reply is required.

NOTE 2 At most one DLE on the local link should be sending a reply to the received CD DLPDU. That reply shall be a DT DLPDU.

5.2.2.2.2.17 IEC 61158-4, 8.7.4.0

Each DL-address in the DLPDU shall be delocalized IEC 61158-4, 7.2.2.4 upon reception. A received DT DLPDU shall be treated as follows by the receiving DLE.

5.2.2.2.2.18 IEC 61158-4, 8.7.4.1.1

NOTE 1 Subclause (b) is not included. In subclause (c), subscriber to publisher DT DLDPU is not included.

a) If the received DT DLPDU has format 1L or 1S, and its destination DL-address designates a DL(SAP)-address of the receiving DLE, then the received DLPDU shall be forwarded to the DLE's upper-level functions IEC 61158-4, 10.3.1.3, for further processing.

b) not included

c) If the received DT DLPDU

   1) has format 1L, 1S, 2L or 2S, and its destination DL-address designates a DLCEP-address designating a peer DLCEP of the receiving DLE, or

   2) has format 3L or 3S, and its source DL-address designates a DLCEP-address designating a subscriber DLCEP of the receiving DLE, then the received DLPDU shall be forwarded to the DLE's upper-level functions IEC 61158-4, 10.2 for further processing.

d) If the received DT DLPDU has format 1L or 1S, and its destination DL-address designates NODE.0 DL-address, V(TN).0, of the receiving DLE's DL-support functions, then the received DLPDU shall be forwarded to the DLE's upper-level functions IEC 61158-4, 12.3, for further processing.

e) If none of (a) or (c) or (d) apply, then the DT DLPDU shall be reported to local DL-management as an unexpected response, and shall be discarded.

NOTE 2 This report may take the form of incrementing a DL-management error counter.

5.2.2.2.19 IEC 61158-4, 8.7.4.1.2

a) not included;

b) not included;

c) not included;

d) If the received DT DLPDU has format 3L or 3S, and its source DL-address designates the publisher's DLCEP-address of a subscriber DLCEP of the receiving DLE, and this source DL-address is equal to the destination DL-address from the immediately-prior CD DLPDU, then

   1) the DLE shall consider the prior transmission to have been error-free, and

   2) the received DT DLPDU shall be forwarded to the DLE's upper-level functions IEC 61158-4, 10.2, for further processing;

e) If the received DT DLPDU has format 5, and the explicit destination DL-address from the immediately-prior CD DLPDU was a DLCEP-address of a subscriber DLCEP of the receiving DLE, then

   1) the DLE shall consider the prior transmission to have been error-free, and

   2) the received DT DLPDU shall be forwarded to the DLE's upper-level functions IEC 61158-4, 10.2, for further processing, with its implied source DLCEP-address assumed to be the explicit destination DL-address from that immediately-prior CD DLPDU;

f) If none of (d) to (e) apply, then the DT DLPDU shall be reported to local DL-management as an unexpected response, and shall be discarded.

   NOTE This report may take the form of incrementing a DL-management error counter.

5.2.2.2.20 IEC 61158-4, 8.7.4.1.3

NOTE Only CD DLPDU with publisher's DLCEP-address as destination address is included.

a) If the received DT DLPDU has format 3L or 3S, and its source DL-address designates a DLCEP-address of a subscriber DLCEP of the receiving DLE, and this source DL-address is equal to the destination DL-address, V(RA), from the immediately-prior CD DLPDU, then

   1) the DLE shall consider the prior transmission to have been error-free, and

   2) the received DT DLPDU shall be forwarded to the DLE's upper-level functions IEC 61158-4, 10.2, for further processing.

b) If the received DT DLPDU has format 5, and the explicit destination DL-address from the immediately-prior CD DLPDU was the publisher's DLCEP-address of a subscriber DLCEP of the receiving DLE, then

   1) the DLE shall consider the prior transmission to have been error-free, and

   2) the received DT DLPDU shall be forwarded to the DLE's upper-level functions IEC 61158-4, 10.2, for further processing, with its implied source DLCEP-address assumed to be the explicit destination DL-address from that immediately-prior CD DLPDU.

5.2.2.2.21 IEC 61158-4, 8.7.4.3.0

a) Since every Bridge class DLE has Link Master capability, any actions specified in IEC 61158-4, 8.7.4.2, also apply to a Bridge class DLE.

b) If the first DL-address specified in the DLPDU is an explicit DL-address to which the bridge should forward the DLPDU and the bridge was able to buffer the DLPDU without error, then the DLPDU shall be forwarded with modification of the frame-control field in the forwarded DLPDU as appropriate IEC 61158-4, 5.1.3.

c) not included

d) Otherwise, if (b) does not apply, then the DLE shall not forward the DLPDU.

5.2.2.2.2.22 IEC 61158-4, 8.7.4.3.1

This subclause is not included in this profile, because it applies only if the destination address of the CD DLPDU was a DLSAP-address.

5.2.2.2.2.23 IEC 61158-4, 8.8

A STATUS RESPONSE (SR) DLPDU is sent only while holding a reply token; it is used

a) to indicate the receipt of the immediately prior CD DLPDU by the bridge which would normally forward that DLPDU toward the addressed DLE, to indicate to the sending DLE that no error occurred, or that the indicated error occurred; and

b) to reject an attempted transfer of the LAS role from the current LAS DLE to another link-master DLE.

Table 71 specifies the selection of the subordinate subclauses for this profile.

Table 71 – CP 1/1: DLL protocol selection of 8.8

Clause	Header	Presence	Constraints
8.8.0	—	YES	—
8.8.1	Structure of the SR DLPDU	YES	—
8.8.2	Content of the SR DLPDU	YES	—
8.8.3	Sending the SR DLPDU	YES	—
8.8.4	Receiving the SR DLPDU	—	—
8.8.4.0	—	YES	—
8.8.4.1	Actions required of all DLEs	Partial	Modified as in 5.2.2.2.2.24
8.8.4.2	Additional actions required of a Link-Master class DLE	YES	—
8.8.4.3	Additional actions required of a Bridge class DLE	Partial	Modified as in 5.2.2.2.2.25
8.8.4.4	Additional actions required of the current LAS DLE	YES	—

5.2.2.2.2.24 IEC 61158-4, 8.8.4.1

NOTE Item (a) is not included, because this profile does not include CD DLPDUs with a DLSAP-address as the destination address.

a) not included

b) A received SR DLPDU, received as a reply to an immediately prior TL DLPDU which was originated by the receiving (LAS) DLE shall cause the receiving DLE

1) to consider the prior transmission to have been error-free, and

2) as specified in IEC 61158-4, 8.20.3,

i) to re-assume the scheduler token,

ii) to inform local DL-management of the event, and

iii) to resume active operation as the LAS, and commence transmission on the link.

5.2.2.2.2.25 IEC 61158-4, 8.8.4.3

This subclause is not included in this profile, because this profile does not include CD DLPDUs with a DLSAP-address as the destination address.

5.2.2.2.2.26 IEC 61158-4, 8.11

A ROUND-TRIP-DELAY QUERY (RQ) DLPDU is sent from one DLE to the LAS DLE on the local link to initiate the measurement and computation of the round-trip delay intrinsic to their inter-communication. Its receipt results in the return of a complementary ROUND-TRIP-DELAY REPLY (RR) DLPDU completing the measurement.

Table 72 specifies the selection of the subordinate subclauses for this profile.

Table 72 – CP 1/1: DLL protocol selection of 8.11

Clause	Header	Presence	Constraints
8.11.1	Structure of the RQ DLPDU	YES	—
8.11.2	Content of the RQ DLPDU	Partial	Only local LAS, 0400_{16}, as destination address is included
8.11.3	Sending the RQ DLPDU	Partial	Item (b) is not included, because this profile does not include the LAS as the source of an RQ DLPDU
8.11.4	Receiving the RQ DLPDU	—	—
8.11.4.1	Actions required of all DLEs	Partial	Only the LAS DLE is required to receive an RQ DLPDU for this profile
8.11.4.2	Additional actions required of a Link-Master class or Bridge class DLE	YES	—
8.11.4.3	Additional actions required of a Bridge class DLE	YES	—
8.11.4.4	Additional actions required of the current LAS DLE	YES	—

5.2.2.2.27 IEC 61158-4, 8.12

A ROUND-TRIP-DELAY REPLY (RR) DLPDU is sent from LAS DLE to another on the local link to permit completion of the measurement and computation of the round-trip delay intrinsic to their inter-communication. It is only sent as an immediate reply to a received RQ DLPDU.

Table 73 specifies the selection of the subordinate subclauses for this profile.

Table 73 – CP 1/1: DLL protocol selection of 8.12

Clause	Header	Presence	Constraints
8.12.1	Structure of the RR DLPDU	YES	—
8.12.2	Content of the RR DLPDU	Partial	Only the source address of the local LAS, 0400_{16} is included in this profile
8.12.3	Sending the RR DLPDU	Partial	Only the LAS DLE is required to send RR DLPDU for this profile
8.12.4	Receiving the RR DLPDU	YES	—

5.2.2.2.28 IEC 61158-4, 8.15

A PASS TOKEN (PT) DLPDU is used to pass a delegated token from the DLE functioning as a LAS to a DLE on the local link. By doing this repeatedly, the LAS DLE provides a delegated token which "circulates" successively, usually in NODE DL-address order, to all active DLEs on the local link which are included in the link's token-circulation list, V(TCL) IEC 61158-4, 6.7.5.3.

This DLPDU provides the receiving DLE with the right to initiate DL-transactions for a period of time specified in the delegating DLPDU.

Table 74 specifies the selection of the subordinate subclauses for this profile.

Table 74 – CP 1/1: DLL protocol selection of 8.15

Clause	Header	Presence	Constraints
8.15.1	Structure of the PT DLPDU	YES	—
8.15.2	Content of the PT DLPDU	Partial	For this profile, each DLE's NODE DL-address is in the live list, V(LL), and is also in the list of DLEs, V(TCL). Therefore, the value of DD-parameter is always non-zero
8.15.3	Sending the PT DLPDU	—	—
8.15.3.0	—	YES	—
8.15.3.1	Determination of the PT DLPDU fields and related "token-rotation" parameters	YES	—
8.15.3.2	Sending the PT DLPDU and monitoring the DLE to which the token is delegated	Partial	Modified as in 5.2.2.2.2.29
8.15.4	Receiving the PT DLPDU	—	—
8.15.4.0	—	YES	—
8.15.4.1	Actions required of all DLEs	Partial	This subclause is included except that this profile does not include REPETITIVE sequences. Therefore, the token-use subfield of the received PT DLPDU need not be used by the receiving DLE
8.15.4.1.1	Selection of the next transaction to be executed	Partial	Modified as in 5.2.2.2.2.30
8.15.4.1.2	Additional considerations	YES	—
8.15.4.2	Additional actions required of a Link-Master class or Bridge class DLE	YES	—
8.15.4.3	Additional actions required of a Bridge class DLE	YES	—
8.15.4.4	Additional actions required of the current LAS DLE	YES	—

5.2.2.2.2.29 IEC 61158-4, 8.15.3.2

NOTE 1 Number of retry-count is zero for this profile.

d) If the monitoring period of immediate-response-recovery-delay slot-times, V(IRRD) × V(ST) octet-durations, expires and a) does not apply, then the LAS DLE shall

— inform local DL-management of the event;

NOTE 2 DLEs with node DL-addresses in the set { $F8_{16}$..FF_{16} } are expected to terminate operation by dropping out of the token circulation process. Thus, DL-management should not treat such occurrences as evidence of DLE or local-link malfunction.

— start the next transmission within token-recovery-delay slot-times, P(TRD) × V(ST) octet-durations, of the beginning of the current period of link non-activity.

5.2.2.2.2.30 IEC 61158-4, 8.15.4.1.1

All subclauses except as shown are included in this profile.

(a.1) Compel of a DLSDU from a peer DLCEP is not included.

(a.2) This subclause is not included, because the DL-Unitdata exchange service is not included in this profile.

(b) This subclause is not included, because this profile does not include REPETITIVE sequences.

(c) This subclause is not included, because this profile does not include sequences.

5.2.2.2.2.31 IEC 61158-4, 8.20

A TRANSFER LAS (TL) DLPDU is used by the current LAS DLE to transfer the scheduler token and the role of LAS to another LM DLE on the local link. The TL DLPDU is sent only after having been requested by the addressed LM DLE, and may be rejected if the addressed DLE determines that its own copy of the local link's live-list is not current.

Table 75 specifies the selection of the subordinate subclauses for this profile.

Table 75 – CP 1/1: DLL protocol selection of 8.20

Clause	Header	Presence	Constraints
8.20.1	Structure of the TL DLPDU	YES	—
8.20.2	Content of the TL DLPDU	YES	—
8.20.3	Sending the TL DLPDU	Partial	Modified as in 5.2.2.2.2.32
8.20.4	Receiving the TL DLPDU	—	—
8.20.4.1	Actions required of all DLEs	YES	—
8.20.4.2	Additional actions required of a Link-Master class or Bridge class DLE	Partial	Modified as in 5.2.2.2.2.33
8.20.4.3	Additional actions required of a Bridge class DLE	YES	—
8.20.4.4	Additional actions required of the current LAS DLE	YES	—

5.2.2.2.2.32 IEC 61158-4, 8.20.3

The LAS DLE shall reject a request to transfer the LAS role to a requesting DLE when

a) the DLE has been instructed by the DLME to be the Primary Link Master (that is, the preferred LAS) and

NOTE Some implementations may use Network Management variable associated with the LAS DLE e.g. PrimaryLinkMaster to do so.

b) the node-designator of the DLE requesting the transfer (that is, the node-designator of the DL-source address of the conveying DLPDU) has a higher numeric value than the node designator of this LM DLE (which is currently acting as LAS).

5.2.2.2.2.33 IEC 61158-4, 8.20.4.2

NOTE For this profile, schedule construction and execution abilities are not a consideration.

If the destination DL-address specified by the DLPDU designates the DLE's NODE DL-address, then

a) If

1) the receiving DLE is not awaiting receipt of the TL DLPDU, or

2) not included

3) if the schedule construction and live-list information conveyed in the LAS-database-status SPDU within the received TL DLPDU indicates that the receiving DLE does not have a current copy of the live-list,

then the receiving DLE shall reply with an SR DLPDU within a period of maximum-response-delay slot-times, V(MRD) × V(ST) octet-durations, as measured at the receiving DLE, with a status of "failure —LAS transfer rejected".

b) Otherwise, when (a) does not apply, then the receiving DLE shall assume the scheduler token, activate its LAS functions, and re-commence operation as the LAS.

5.2.2.2.3 IEC 61158-4, Clause 9

5.2.2.2.3.1 General

Table 76 specifies the selection of the subclauses for this profile.

Table 76 – CP 1/1: DLL protocol selection of Clause 9

Clause	Header	Presence	Constraints
9.	Type 1: DLPDU-parameter structure and encoding	—	—
9.0	—	YES	—
9.1	Structure and encoding of EC-Parameters	Partial	Modified as in 5.2.2.2.3.2
9.2	Structure and encoding of DC-Parameters	Partial	Modified as in 5.2.2.2.3.3
9.3	Structure and encoding of RC-Parameters	NO	This profile does not include sending or receiving a RC DLPDU
9.4	Structure and encoding of SD-Parameters	Partial	Modified as in 5.2.2.2.3.4
9.5	Structure and encoding of SR-parameters	YES	—
9.6	Structure and encoding of TD-parameters	YES	—
9.7	Structure and encoding of RQ-parameters	YES	—
9.8	Structure and encoding of RR-parameters	YES	—
9.9	Structure and encoding of PN-parameters	YES	—
9.10	Structure and encoding of DD-parameters	YES	—

5.2.2.2.3.2 IEC 61158-4, 9.1

NOTE Values of some of the fields are restricted.

This profile includes only a limited negotiation of the DLC. The values of some of the parameters is either fixed or limited by this profile to the following:

a.1) as required

a.2) as required

a.3) path-diversity (Q) = 0 (ANY-PATH),

a.4) protocol version number (VVV) = 001.

a.5) as required

a.6) as required

a.7) as required

a.8) as required

b) as required

c.1) as required

c.2) as required

c.3) as required

c.4) as required

c.5) format subfield (FFF_S):
D for peer DLC;
A and G for multi-peer publisher DLC;

c.6) 2-way data exchange subfield (E_S) = 0 (FALSE);

c.7) as required

c.8) as required

c.9) time-stamp-format subfield (HHs) = 00 (format J i.e. null).

c.10) as required

d.1) as required

d.2) as required

d.3) as required

d.4) as required

d.5) format subfield (FFF_R):
D for peer DLC;
A and G for multi-peer publisher DLC;

d.6) 2-way data exchange subfield (Er) = 0 (FALSE);

d.7) as required

d.8) as required

d.9) time-stamp-format subfield (HHr) = 00 (format J i.e. null).

d.10) as required

e.1) not used

e.2) not used

e.3) not used

e.4) not used

e.5) not used

5.2.2.2.3.3 IEC 61158-4, 9.2

a) as required

b) Not all reason codes listed in this subclause are used. The required reason codes are specified in IEC 61158-4, 10.2, where the conditions leading to disconnect are specified. The reason codes in the range of 00 to 3F, which are not specified in this subclause, are meant to be specified and used by the DLS-user. Within this range, reason codes 30 to 3F are reserved for use by the IEC 61158-4 DLS-user.

5.2.2.2.3.4 IEC 61158-4, 9.4

Table 77 specifies the selection of the subclauses for this profile.

Table 77 – CP 1/1: DLL protocol selection of 9.4

Clause	Header	Presence	Constraints
9.4.1	SD-Parameters in DLPDUs addressed to a DL(SAP)-address	NO	For connectionless data transfer, only the DT1 DLPDU is included for this profile. Therefore, only format P of the SD-parameters (the null format) is included for a DT1 DLPDU addressed to a DLSAP-address
9.4.2	SD-Parameters in DLPDUs addressed to a DLCEP	Partial	Modified as in 5.2.2.2.3.5
9.4.2.1	Parameters conveying DLCEP state and DLSDU timeliness	Partial	Only formats A, D, G are included
9.4.2.2	Parameters conveying DLSDU time-of-production	Partial	Only format J, the null format, is included

5.2.2.2.3.5 IEC 61158-4, 9.4.2 – SD–parameters in DLPDUs addressed to a DLCEP

The various SD-parameter formats, and their applicability to connection-oriented DT DLPDUs, for this profile are as follows:

– For a peer DLC: IEC 61158-4, Table 57, DLPDU frame formats 7 and 8, and DLPDU parameter formats D and J.

– For a multipeer DLC: IEC 61158-4, Table 57, DLPDU frame formats 3, 4, 9 and 11, and DLPDU parameter formats A, G and J.

The DLSDU source-time-stamp field, format J above, shall in all cases be null.

5.2.2.2.4 IEC 61158-4, Clause 10

5.2.2.2.4.1 General

Table 78 specifies the selection of the subclauses for this profile.

Table 78 – CP 1/1: DLL protocol selection of Clause 10

Clause	Header	Presence	Constraints
10.0	—	YES	—
10.1	Operation of the DL(SAP)-address, buffer and queue management services	—	—
10.1.1	Receipt of a DL-CREATE request primitive	NO	—
10.1.2	Receipt of a DL-DELETE request primitive	NO	—
10.1.3	Receipt of a DL-BIND request primitive	NO	—
10.1.4	Receipt of a DL-UNBIND request primitive	NO	—
10.1.5	Receipt of a DL-PUT request primitive	Partial	All, except subclause 10.1.5 (c.5) are included, because the time-of-production is not included in this profile
10.1.6	Receipt of a DL-GET request primitive	Partial	All, except subclause 10.1.6 (a.4), 10.1.6(a.5) and 10.1.6(a.6) are included, because the time-of-production and sequence-number-identification and non-retentive buffer (BUFFER-NR) are not included in this profile
10.1.7	Computation of DL-timeliness	YES	—
10.2	Operation of the connection-mode services	Partial	Modified as in 5.2.2.2.4.2
10.3	Operation of the connectionless-mode services	Partial	This profile includes only Unitdata request, indication and confirm services, and without confirmation from the remote DLE. Modified as in 5.2.2.2.4.29
10.4	Operation of the scheduling guidance services	Partial	See 5.2.2.2.4.30

5.2.2.2.4.2 IEC 61158-4, 10.2

This profile only includes the procedures for Classical and Disordered Peer DLCEP bound to a queue and Ordered and Unordered Multi-peer DLCEP bound to a buffer, and without segmentation of DLSDUs. The scheduling for a Peer DLCEP is always implicit. The scheduling for the buffer transfer is always explicit. The DL-Connect response from the DLS-user does not try to merge two connections.

The following states and the transitions associated with these states in IEC 61158-4, Figure 13, are not included in this profile:

0: Aging DLCEP-address

6: Waiting for reset completion

See Table 79 for selection of subclauses.

NOTE The text in this subclause is taken from IEC 61158-4, 10.2, and edited to satisfy the requirements of this profile. Therefore, in some subclauses, some of the subclause numbers may be missing.

Table 79 – CP 1/1: DLL protocol selection of 10.2

Clause	Header	Presence	Constraints
10.2.1	Operation of the DLCEP establishment and DLCEP release services	—	—
10.2.1.0	—	Partial	First paragraph is included in this profile. All other paragraphs are not included
10.2.1.1	DLC negotiation rules	Partial	(a), (c), (h), (i) and (j.2) apply only partially. The remainder of 10.2.1.1 is fully included. Replaced by 5.2.2.2.4.3
10.2.1.2	Receipt of a DL-CONNECT request primitive	Partial	(c), (e), (h), (j.2) are partially included. The remainder of 10.2.1.2 is fully included. Replaced by 5.2.2.2.4.4
10.2.1.3	Receipt of a DL-CONNECT response primitive	Partial	(d), (g), (h.2) and (i) are not included; (f) is partially included. Replaced by 5.2.2.2.4.5
10.2.1.4	Receipt of an EC DLPDU	—	—
10.2.1.4.0	—	YES	—
10.2.1.4.1	Receipt of an EC DLPDU with two addresses	YES	—
10.2.1.4.2	Receipt of an EC DLPDU with three addresses	Partial	Replaced by 5.2.2.2.4.6
10.2.1.5	Expiration of the timer T_U(MCD)	Partial	Replaced by 5.2.2.2.4.7
10.2.1.6	Receipt of a DL-DISCONNECT request primitive	Partial	Replaced by 5.2.2.2.4.8
10.2.1.7	Receipt of a DC DLPDU	Partial	Replaced by 5.2.2.2.4.9
10.2.1.8	DLE-initiated disconnection	Partial	Replaced by 5.2.2.2.4.10
10.2.2	Operation of the DLC data transfer services	—	See Table 80 f
10.2.3	Operation of the DLC subscriber query service	NO	DLC subscriber query service is not included in this profile

5.2.2.2.4.3 IEC 61158-4, 10.2.1.1

The DLS-user-visible aspects of the DLC negotiation rules are specified in IEC 61158-3. Additional negotiation rules which do not impact DLS-user visible aspects of the DLC are specified in IEC 61158-4, 9.1. In case of apparent conflict, the rules specified in this subclause take precedence over those specified in IEC 61158-4, 9.1, which in turn take precedence over those specified in IEC 61158-3.

a) If the publisher, or either peer, of a DLC specifies a DLPDU-authentication attribute of MAXIMAL, then

NOTE DLPDU-authentication of MAXIMAL is provided primarily for use in safety systems. For this reason it maximizes the amount of state information exchanged in each DLPDU sent on the DLC and prohibits two-way user-data exchange in a single transaction, centralized schedule execution and other activities in which multiple DLEs need to have consistent state information.

1) each DLPDU sent from each DLCEP of the DLC shall contain the maximum permitted number of explicit addresses; and

2) the EC-parameters in each EC DLPDU shall be constrained as follows:

i) the address-size subfield (SS) shall specify LONG;

ii) the DLPDU-authentication subfield (XX) shall specify MAXIMAL;

iii) the residual-activity subfield (A) shall specify TRUE in the publisher-to-subscriber direction, or in all sending peer-to-peer directions, of data transfer;

NOTE Residual activity is not meaningful in the subscribers-to-publisher direction.

iv) both 2-way data exchange subfields (E) shall specify FALSE;

v) SD-parameter format B (subfield FFF), and time-stamp formats K and L (subfield HH), shall not be requested or used in either direction on the DLC.

b) If (a) does not apply then

1) If the publisher, or either peer, of a DLC specifies a DLPDU-authentication attribute of SOURCE, then the DLPDU-authentication subfield (XX) in the EC-parameters shall specify SOURCE, and each DLPDU sent from each DLCEP of the DLC shall contain the maximum permitted number of explicit addresses.

2) If a subscriber of a DLC specifies a DLPDU-authentication attribute of MAXIMAL in a DL-CONNECT request primitive, then the DLPDU-authentication subfield (XX) in the resulting EC-parameters DLPDU shall specify MAXIMAL. If the requested DLC was already established, then

   i) If that DLC was not established with DLPDU-authentication attribute of MAXIMAL then the publishing DLE shall reject the connection establishment request from that subscriber;

   ii) Otherwise, when (A) does not apply, then the publishing DLE shall attempt to add that subscriber to the existing DLC.

3) If a subscriber of a DLC specifies a DLPDU-authentication attribute of SOURCE in a DL-CONNECT request primitive, then the DLPDU-authentication subfield (XX) in the resulting EC-parameters DLPDU shall specify SOURCE. If the requested DLC was already established, then

   i) If that DLC was established with a DLPDU-authentication attribute of ordinary then the publisher's DLE shall change the DLPDU-authentication to source and each DLPDU sent from each DLCEP of the DLC shall thereafter contain the maximum permitted number of explicit addresses,

   ii) Otherwise, when (A) does not apply, then the publishing DLE shall attempt to add that subscriber to the existing DLC.

4) Else if none of (i) to (iii) apply, then the DLPDU-authentication subfield (XX) in the EC-parameters shall specify ORDINARY, and each DLPDU sent from each DLCEP of the DLC shall contain the minimum permitted number of explicit addresses.

c) The DLL path-diversity subfield (Q) of the EC-parameters shall specify ANY-PATH.

d) The address-size subfield of the EC-parameters shall be determined as follows:

1) If required by (a.2.i), or if any of the DL-addresses of the EC DLPDU have only a LONG representation, then the address-size subfield of the EC-parameters shall specify LONG.

2) Else, when (1) does not apply, and either (b.i) applies or any member of the DLC is a fractional-duty-cycle (FDC) DLE, then the address-size subfield of the EC-parameters shall specify short.

3) Otherwise, when (1) and (2) do not apply, the address-size subfield of the EC-parameters shall specify VERY-SHORT.

NOTE The address-size VERY-SHORT applies only to DT DLPDUs sent using a reply token IEC 61158-4, 8.7.1 formats 4 and 5; in all other cases the address-size SHORT is actually used.

e) The DLCEP-data-delivery-features subfield (TT) of the EC-parameters shall specify, independently for each direction of the DLC, the provided data-delivery features, as specified in IEC 61158-3, except that the value NONE shall be replaced by UNORDERED with a maximum window size (WWWW) of zero and maximum-DLSDU-size subfield (M…M) of zero in the corresponding direction, indicating a simplex DLC.

f) The residual-activity subfield (A) of the EC-parameters shall specify true in a publisher-to-subscriber or sending peer-to-peer direction of data transfer when so required by (a.2.iii), or by DL-management, or by a publishing or peer DLS-user, and shall specify false otherwise Negotiation of this subfield is from false to true.

g) Window size negotiation occurs independently for each direction of the DLC. The actual maximum window size for a given direction of transmission shall be the smaller of the sender's maximum window size and the receiver's maximum window size in that direction, and the maximum-window-size subfield (WWWW) of the EC-parameters shall specify zero only when the maximum-DLSDU-size subfield (M…M) in the same direction is zero, indicating a simplex DLC.

h) The SD-parameter-format subfield (FFF) of the EC-parameters shall specify the format for each direction of data transmission. Only the formats A, D and G are included in this profile. The formats for the transmission shall be selected by the following procedure:

1) if DLCEP class is Peer then format D for both directions of data transmission; else if DLCEP class is Multi-peer then

   i) if the data-delivery-feature is ORDERED or Timeliness is required then format G;

   ii) else if the data-delivery-feature is UNORDERED then format A.

i) The 2-way-data-exchange subfield (E) shall specify FALSE.

j) Timeliness attributes of the DLCEP are communicated but not negotiated.

1) The timeliness-included subfield (G) of the EC-parameters shall specify FALSE when the specified sender-timeliness is NONE, and shall specify TRUE otherwise.

2) The time-stamp-format subfield (HH) of the EC-parameters shall specify format J (null).

k) If one direction of data communication is not required for the DLC, because the DLS-user-specified data delivery features for that direction specified NONE, then in that direction

1) The residual-activity subfield (A) shall be specified as FALSE;

2) The Queue/Buffer (B) subfield shall be specified as QUEUE;

3) The timeliness subfield (G) shall be specified as FALSE; and

4) The time-stamp-format subfield (HH) shall be specified as format J.

5.2.2.2.4.4 IEC 61158-4, 10.2.1.2

When the DLE receives a DL-CONNECT request primitive from a DLS-user, the DLE shall perform the following series of actions, and if any error is detected during the process, then the DLCEP shall be disconnected as specified in IEC 61158-4, 10.2.1.8.

NOTE The procedures of subclauses (a), (c) to (h) are local to the DLE and the implementation of the local procedures does not have to conform to the description in this document. The DLE of this profile does not assign DLCEP-address; therefore the procedures of IEC 61158-4, 10.2.1.2(h) and (j.2), are partially included. This profile does not require support for a DL-Connect request for an existing publisher DLCEP, and therefore, the procedure of IEC 61158-4, 10.2.1.2(c), is partially included and the procedure of IEC 61158-4, 10.2.1.2(e.1), has been changed to reject such request.

a) The DLE shall assign a new DLCEP-identifier to the DLCEP which may result from the request, and provide that DLCEP-identifier to the DLS-user as the single output parameter of the request.

b) The DLE shall create and start a user-request timer T_U(MCD) with a duration based on the user-specified maximum confirm delay for DL-CONNECT primitive. If the specified value was other than UNLIMITED, then the duration of this timer should be Vc(NP).MCD_CRS; otherwise the duration should be 60s. DL-management may override these preferred durations.

NOTE The value of V(NRC) is zero for this profile. Therefore the timer values in the above subclause (b) have been expressed for V(NRC) = 0.

c) The DLE shall validate the calling-DLSAP-address provided by the DLS-user; if invalid, the DLE shall reject the DL-CONNECT request with a DL-DISCONNECT indication.

d) The DLE shall validate the self-consistency of the requested QoS parameter set, where all static and non-specified dynamic parameters assume the default values associated with the calling-DLSAP-address, and where the following automatic adjustments to that QoS occur:

1) Where any parameter is in violation of a local DL-management-imposed limit, then that parameter shall be set equal to that limit, if permitted by the negotiation rules specified in IEC 61158-4, 10.2.1.1, or the DLE shall reject the DL-CONNECT request with a DL-DISCONNECT indication.

2) If any maximum DLSDU size equals zero or the sending DLCEP data delivery features specify NONE, then the corresponding sending DLCEP data delivery features shall be set to UNORDERED.

NOTE This special case is not considered to be a violation of the negotiation rules of IEC 61158-4, 10.2.1.1.

e) If the calling address identifier is a DLCEP-identifier for an existing DLCEP, then

1) If the existing DLCEP is a publisher DLCEP, then the DLE shall reject the DL-CONNECT request with a DL-DISCONNECT indication.

2) If the existing DLCEP's DLCEP-class is PEER or SUBSCRIBER, then the DLE shall reject the DL-CONNECT request with a DL-DISCONNECT indication.

f) Otherwise, if (e) does not apply, then the DLE shall determine the maximum send and receive window sizes based on the respective buffer-and-queue bindings, as follows

1) If the DLCEP-features are NONE, then the corresponding window size shall be zero (0).

2) Otherwise, if (1) does not apply, then

i) If the binding was to a buffer, then the corresponding window size shall be one (1).

ii) If the binding was to a queue-K, then the corresponding window size shall be the smaller of K or 15.

iii) If the default binding was used, then the corresponding window size shall be at least one (1).

iv) In all cases, DL-management can further constrain this window size.

g) If the optional calling-DLCEP-address was specified in the request primitive, then the DLE shall assign the calling-DLCEP-address specified in the request primitive to the DLCEP; if any conflicting assignment is detected, then the DLCEP shall be terminated as specified in IEC 61158-4, 10.2.1.8.

h) Otherwise, if (g) does not apply, and if the called address is a DLCEP-address presumed to be for a publisher DLCEP, then the DLE shall not assign any DLCEP-address to this DLCEP.

NOTE In this profile IEC 61158-4, 10.2.1.2(h), applies only to DL-Connect request primitive at a SUBSCRIBER, because for all others, the calling-DLCEP-address is specified in the request.

i) The DLC shall initialize the DLCEP's VC(NR), VC(N), VC(R), VC(A), VC(M), VC(MS), VC(H), VC(HS) and VC(L) variables as specified in IEC 61158-4, 6.7.4.

j) The DLE shall encode an EC DLPDU as specified in IEC 61158-4, 8.1 and 9.1.

1) If the called-DL-address parameter specifies a DL(SAP)-address or DLCEP-address, then the DLE shall form an EC DLPDU with three addresses, whose values shall be, respectively,

i) the called-DL(SAP)-address or DLCEP-address,

ii) the DLCEP-address assigned to the DLCEP, or calling-DLSAP-address if no such assignment was done as in (h),

iii) the calling-DLSAP-address.

2) If the called-DL(SAP)-address parameter specifies UNKNOWN, then

i) not used

ii) The DLCEP-class is PUBLISHER, and the DLE shall form an EC DLPDU with two addresses, whose values shall be the DLCEP-address assigned to the DLCEP, and the calling-DLSAP-address, respectively.

iii) not used

k) If the DLCEP class of the DLE is to be either PEER or SUBSCRIBER, then

1) If an EC DLPDU was formed, then

i) The DLE shall set the reply-requested field in the EC-parameters in the DLPDU.

ii) The DLE shall queue the DLPDU at TIME-AVAILABLE priority as specified in IEC 61158-4, 10.4.5.

2) The DLE shall activate recognition of the DLCEP's local DLCEP-address and change the DLCEP state, V_C(ST), to WAITING-FOR-EC-DLPDU.

l) If the sending DLCEP class of the DLE is to be PUBLISHER, then

1) The DLE shall clear the reply-requested field in the EC-parameters in the DLPDU.

2) If the source DLCEP-address is not that of an existing DLCEP, then the DLE shall assign a new value to the publisher-DLCEP-address reuse-discriminator subfield (NNN) of the EC-parameters IEC 61158-4, 9.1(a.2).

i) If the DLE is capable of recording the publisher-DLCEP-address reuse-discriminator between DLCEP incarnations, then it should maximize the interval between reuse of the same discriminator value;

ii) Otherwise, when (i) does not apply, the DLE shall choose the discriminator value randomly.

3) The DLE shall queue the DLPDU at TIME-AVAILABLE priority as specified in IEC 61158-4, 10.4.5.

4) The DLE shall issue the DL-Connect confirm for the DLCEP immediately after transmission of the EC DLPDU.

5) The DLE shall cancel the user-request timer TU(MCD).

6) If (e) did not apply, then the DLE shall activate recognition of the DLCEP's local DLCEP-address and change the DLCEP state, VC(ST), to data-transfer -ready.

5.2.2.2.4.5 IEC 61158-4, 10.2.1.3

When the DLE receives a DL-CONNECT response primitive from a DLS-user, the DLE shall perform the following series of actions; if any error is detected during the process, then the DLCEP shall be disconnected as specified in IEC 61158-4, 10.2.1.8.

NOTE The procedures of subclauses (a), (c) and (f) are local to the DLE and the implementation of the local procedures does not have to conform to the description in this document. The following procedures are either not included or partially included for the following reasons.
IEC 61158-4, 10.2.1.3(d): this profile does not include DLCEP merging,
IEC 61158-4, 10.2.1.3(f): the DLE of this profile does not assign the DLCEP-address,
IEC 61158-4, 10.2.1.3(g): the DLS-user at the subscriber does not use DL-Connect response,
IEC 61158-4, 10.2.1.3 (h.2), (i): the DLS-user at the publisher does not use DL-Connect response,

a) The DLE shall validate the DLCEP-identifier, and the responding DLSAP-address or DLCEP-identifier, provided by the DLS-user, and shall associate the provided DLS-user-identifier with the DLCEP.

b) If the identified DLCEP is not in the WAITING-FOR-CONNECT-RESPONSE state, the DLCEP shall be disconnected.

c) The DLE shall validate the self-consistency of the response QoS parameter set, where all static and non-specified parameters assume their default values associated with the responding-DLSAP-address, and where the automatic adjustments to that QoS specified in IEC 61158-4, 12.2.1.2(d), occur. The DLE shall then validate the consistency of the resulting QoS parameter set with the corresponding parameters from the received EC DLPDU, and the adherence to the rules of parameter negotiation specified in IEC 61158-4, 10.2.1.1.

d) not used

e) If the responding address identifier in the DL-CONNECT response was a DLSAP-address, then

1) that DLSAP-address shall be used as the local DLSAP-address, and

2) the DLE shall determine the local maximum send and receive window sizes based on the respective buffer-and-queue bindings, possibly further restricted by DL-management, as specified in IEC 61158-4, 10.2.1.2.

The DLE shall then determine the actual maximum send window size as the smaller of the local send window size and the received EC DLPDU's receive window size, and the actual maximum receive window size as the smaller of the local receive window size and the received EC DLPDU's send window size, as specified in IEC 61158-4, 10.2.1.1. The DLE also shall perform all other required negotiations, as specified in IEC 61158-4, 10.2.1.1.

f) The DLE shall assign the calling-DLCEP-address specified in the response primitive to the DLCEP-address to the DLCEP; if any conflicting assignment is detected, then the DLCEP shall be disconnected as specified in IEC 61158-4, 10.2.1.8, with a reason of "disconnection—incorrect DLCEP pairing, permanent condition".

g) not used

h) The DLE shall

1) encode an EC DLPDU not requesting a reply, with three addresses as specified in IEC 61158-4, 8.1 and 9.1, where its addresses are, respectively,

i) the first of the two source DL-addresses from the received EC DLPDU which resulted in the DL-CONNECT indication and its consequent DL-CONNECT response,

ii) the DLCEP-address just assigned to the DLCEP, and

iii) the responding DLSAP-address, respectively; and

2) not used, and

3) schedule the DLPDU for transmission at TIME-AVAILABLE priority as specified in IEC 61158-4, 10.4.5.

i) not used

j) If the responding DLCEP class is PEER, then the DLE shall

1) stop the timer which was started in IEC 61158-4, 10.2.1.4.2(b.4.iv)

2) start a timer as in IEC 61158-4, 10.2.1.2(b), with a duration equal to the value for the maximum confirm delay on DL-Connect as specified in the DL-Connect response primitive;

3) activate recognition of the DLCEP's local DLCEP-address, and

4) change the DLCEP's state, VC(ST), to waiting-for-connect-completion.

5.2.2.2.4.6 IEC 61158-4, 10.2.1.4.2

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.1.4.2(a), (c.1): group destination address is not included in this profile,
IEC 61158-4, 10.2.1.4.2(c.3), (d.1): this profile does not include repeating the sending of the EC DLPDU,
IEC 61158-4, 10.2.1.4.2(c), (d): in this profile, these subclauses apply only to a peer DLC,
IEC 61158-4, 10.2.1.4.2(b.2), (b.3), (d.2), (e): this profile does not include connection merger.
Several input events are not possible in this profile, e.g. the conditions of IEC 61158-4, 10.2.1.4.2(c.1). This profile does not include testing for such input conditions, and thus implementations may ignore such conditions.

The DLE shall perform the following series of actions, and if any error is detected during the process, then the DLC shall be disconnected as specified in IEC 61158-4, 10.2.1.8.

a) not used

b) If the first address of the received EC DLPDU is a DLSAP-address, then

1) The DLE shall validate the self-consistency of the received EC DLPDU, where all static and non-specified dynamic parameters assume the default values associated with that called-DLSAP-address, and where any parameter in violation of a local DL-management-imposed limit shall be set equal to that limit, if permitted by the negotiation rules of IEC 61158-4, 10.2.1.1, or the DLCEP shall be disconnected as specified in IEC 61158-4, 10.2.1.8, with a reason of "connection rejection — QoS not available, permanent condition".

2) not used

3) not used

4) The DLE shall assign a new DLCEP identifier to the DLCEP, and shall apply the negotiation rules of IEC 61158-4, 10.2.1.2(d). If any violation of the negotiation rules occurs, then the DLE shall disconnect the proposed DLCEP as specified in IEC 61158-4, 10.2.1.8, with a reason of "connection rejection—QoS not available, permanent condition". If no violation is detected, then for the DLS-user associated with the DLSAP-address which was the first address of the received EC DLPDU, the DLE shall

i) create a DLCEP, initializing its $V_S(NP)$, $V_S(N)$, $V_S(R)$, $V_S(A)$, $V_S(M)$, $V_S(MS)$, $V_S(H)$, $V_S(HS)$ and $V_S(L)$ variables as specified in IEC 61158-4, 6.7.4;

ii) record the source DLCEP-address and source DLSAP-address from the received EC DLPDU as the DLCEP's remote DLCEP-address and remote DLSAP-address, respectively and when sender's DLCEP class is PUBLISHER, also record the publisher-DLCEP-address reuse-discriminator of the EC DLPDU as the DLCEP's local publisher-DLCEP-address reuse-discriminator;

iii) report a DL-CONNECT indication to the DLS-user;

iv) start a timer to monitor for the DLS-user's response to the DL-CONNECT indication, as specified in IEC 61158-4, 10.2.1.2(b); and

v) change the DLCEP state, $V_C(ST)$, to WAITING-FOR-CONNECT-RESPONSE.

c) Else if the first address of the received EC DLPDU is a DLCEP-address for an existing DLCEP, and if the addressed DLCEP is in the WAITING-FOR-EC-DLPDU state, then the DLE shall validate the received DLC parameters, and if an error is detected, then

1) not used

2) the DLE shall disconnect the DLCEP as specified in IEC 61158-4, 10.2.1.8, with a reason of "connection rejection—QoS not available, permanent condition".

If no error is detected during the validation of the received EC DLPDU, then

3) not used

4)

i) If the receiving DLCEP's DLCEP-class is PEER, then the two source DL-addresses of the received EC DLPDU shall be noted as the remote-DLCEP-address and remote-DLSAP-address of the DLCEP;

ii) If the DLCEP-class of the receiving DLCEP is PEER, then

A) a DT DLPDU not containing DLS-user data,

B) with a destination address equal to the first source DL-address specified in the received EC DLPDU, and

C) when the DLCEP's attributes require the DLPDU to have a source address, with a source address equal to the DLCEP's local DLCEP-address

D) shall be encoded and shall be queued at the DLCEP's priority as specified in IEC 61158-4, 10.4.5, to notify the peer DLE of the successful receipt of the confirming EC DLPDU;

iii) not used

iv) The DLE shall issue a DL-CONNECT confirm primitive, conveying the negotiated DLCEP-attributes, to the requesting DLS-user;

v) The DLE shall cancel the user-request timer $T_U(MCD)$ and change the DLCEP state to DATA-TRANSFER-READY.

d) not used, including

1) not used

2) not used

e) Else if the first address of the received EC DLPDU is a DLCEP-address for an existing DLCEP, and the received EC DLPDU requests a reply, and if the addressed DLCEP is in the DATA-TRANSFER-READY state, then

1) If the existing DLCEP is a publisher DLCEP, then the DLE shall

i) set each QoS parameter, and the publisher-DLCEP-address reuse-discriminator, equal to the corresponding parameter of the specified DLCEP, if permitted by the negotiation rules of IEC 61158-4, 10.2.1.1; and

ii) if necessitated by the rule of IEC 61158-4, 10.2.1.1(d), then change the address size of the existing DLC from VERY-SHORT to SHORT or from SHORT to LONG.

2) If no negotiation-rule violation is detected, then the DLE shall

i) encode an EC DLPDU not requesting a reply, with two addresses as specified in IEC 61158-4, 8.1 and 9.1, where its addresses are, respectively,

A) the DLCEP-address of the existing DLC, and

B) the DLSAP-address associated with this existing DLCEP-address, respectively; and

ii) schedule the EC DLPDU for transmission at TIME-AVAILABLE priority as specified in IEC 61158-4, 10.4.5.

3) When (2) does not apply because a negotiation rule violation was detected, then the DLE shall reject the received DLC-establishment request and terminate processing of the received EC DLPDU, as follows:

i) The DLE shall encode a DC DLPDU as specified in IEC 61158-4, 8.2 and 9.2, with its reply-requested field set to FALSE, with a reason of "provider-originated disconnection—QoS not available, permanent condition", and schedule the DC DLPDU for transmission at TIME-AVAILABLE priority as specified in IEC 61158-4, 10.4.5.

ii) The DC DLPDU shall have both destination and source addresses IEC 61158-4, 8.2.1 formats 1L and 1S, the destination address shall be identical to the first source DL-address of the received EC DLPDU, and the source address shall be identical to the destination DL-address of that received EC DLPDU.

f) Otherwise, the DLE shall ignore the received EC DLPDU.

5.2.2.2.4.7 IEC 61158-4, 10.2.1.5

NOTE The following procedures are either not included or partially included for the following reasons: IEC 61158-4, 10.2.1.5(a.2), (c.2): this profile does not include repeating the sending of an EC DLPDU, IEC 61158-4, 10.2.1.5(e): this profile does not include DLC Reset.

If the timer T_U(MCD) expires, then if the DLCEP state, V_C(ST), is

a) waiting-for-EC-DLPDU, then

1) If this is the (V(NRC)+1)'th consecutive expiration, then

i) the DLE shall terminate processing of the request, and

ii) if the user-specified maximum confirm delay on the DL-CONNECT request primitive specified a value other than UNLIMITED, then

A) The DLE shall initiate a DL-Disconnect indication reporting "connection rejection—DLSAP unreachable, transient condition, local origin"; and

B) If the called address was either a DLSAP-address or a DLCEP-address, and the DLCEP's DLCEP-class is PEER, then the DLE

I) shall encode a DC DLPDU requesting disconnect, with a reason of "reason unspecified", to the same DL-address as that to which the previous EC DLPDU had been sent, and

II) shall be queued at TIME-AVAILABLE priority as specified in IEC 61158-4, 10.4.5.

b) WAITING-FOR-CONNECT-RESPONSE, then the DLE shall disconnect the DLCEP as specified in IEC 61158-4, 10.2.1.8, specifying a disconnect reason of "provider-originated disconnection — timeout".

c) waiting-for-connect-completion, then

1) If this is the (V(NRC)+1)'th consecutive expiration, then the DLE shall disconnect the DLCEP as specified in IEC 61158-4, 10.2.1.8, specifying a disconnect reason of "provider-originated disconnection — timeout".

d) DATA-TRANSFER-READY , then the DLE shall act as specified in IEC 61158-4, 10.2.2.10.

5.2.2.2.4.8 IEC 61158-4, 10.2.1.6

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.1.6(a.1), (a.2): group destination address is not included in this profile, the destination address of value Unknown is used only by the publisher,
IEC 61158-4, 10.2.1.6(b.2): this profile does not include DLC Reset.
This profile does not include connection aging, and therefore it is permitted to reuse the DLCEP-address any time after sending DC DLPDU.

When the DLE receives at a DLCEP a DL-DISCONNECT request from a DLS-user, then the DLE

a) shall encode a DC DLPDU as specified in IEC 61158-4, 8.2 and 9.2, requesting disconnect and specifying the DLS-user-given reason, and shall schedule the DLPDU for transmission at TIME-AVAILABLE priority as specified in IEC 61158-4, 10.4.5, except when the DLCEP

   1) not used

   2) not used

   3) is a SUBSCRIBER DLCEP;

      If DC DLPDU is encoded, then

      i) If the DLCEP being disconnected is a PEER DLCEP, then the DC DLPDU shall have both destination and source addresses IEC 61158-4, 8.2.1 formats 1L and 1S, and the destination address shall be the remote DLCEP-address of the DLC, if known, or the called-DL(SAP)-address of the initiating EC DLPDU in all other cases. The reply-requested field shall be set to TRUE in the DC-parameters of the initiating DC DLPDU.

      ii) If the DLCEP being disconnected is a PUBLISHER DLCEP, then the DC DLPDU shall have only a source address IEC 61158-4, 8.2.1 formats 2L and 2S. The reply-requested field shall be set to FALSE in the DC-parameters of the initiating DC DLPDU.

      iii) The source address of the DC DLPDU shall be the local DLCEP-address, if one exists; or the responding or calling local DLSAP-address, if one exists, or the called-DLSAP-address of the initiating EC DLPDU in all other cases.

b) shall terminate the DLCEP, including

   1) for each outstanding (that is, not-yet-confirmed) DL-DATA request:

      i) remove the request from the appropriate DLCEP user-request queue, Q_A(UR), and references to the request from all DLE queues;

      ii) initiate a DL-DATA confirm with the associated request identifier reporting “failure—reset or disconnection”; and

      iii) delete the timer T_U(MCD) associated with the request.

   2) not used

   3) delete all timers associated with the DLCEP.

5.2.2.2.4.9 IEC 61158-4, 10.2.1.7

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.1.7(b): This profile never checks for a reply, and therefore never returns a responding DC DLPDU.
IEC 61158-4, 10.2.1.7(c.5): This profile does not include connection aging, and therefore it is permitted to reuse the DLCEP-address any time after sending DC DLPDU.

When the DLE receives a DC DLPDU, specifying that the DLCEP should be disconnected, then

a) The DLE shall determine the version number of the DLL protocol in use, as specified in the received DC DLPDU, and shall interpret the other DC-parameters of the DLPDU accordingly;

b) not used

c) If the received DC DLPDU

1) specifies only a source address IEC 61158-4, 8.2.1 formats 2L and 2S, and the source address is a DLCEP-address of a multi-peer DLC to which the DLE is a subscriber, or

2) specifies both destination and source addresses IEC 61158-4, 8.2.1 formats 1L and 1S, and

i) the destination address is a DL(SAP)-address, and the DLE has a DLCEP, at a DLSAP to which that DL(SAP)-address is bound, whose remote DLCEP-address has the same value as the received source DL-address, or

ii) the destination address is a DLCEP-address, and the remote DLCEP-address of the identified DLCEP has the same value as the received source DL-address,

iii) the destination address is a DLCEP-address, and the called DLSAP-address of the identified DLCEP has the same value as the received source DL-address,

then if the DLCEP is known to the local DLS-user, then

3) The DLE shall report a DL-Disconnect indication to the local DLS-user specifying both the non-local origin and the reason for the DL-Disconnect indication as received in the DC DLPDU;

4) The DLE shall terminate the DLCEP as specified in IEC 61158-4, 10.2.1.6.(b).

5.2.2.2.4.10 IEC 61158-4, 10.2.1.8

NOTE The following procedures are either not included or partially included for the following reasons: This profile does not include connection aging, and therefore it is permitted to reuse the DLCEP-address any time after sending DC DLPDU.

When the DLE determines on its own that it is necessary to disconnect the DLCEP, then

a) If the DLCEP is known to the local DLS-user, then the DLE shall report a DL-Disconnect indication to the local DLS-user, specifying both the reason for the DL-Disconnect indication and that its origin was local.

NOTE The DLCEP will not be known to the local DLS-user if the disconnection occurs while processing a received EC DLPDU whose receipt had just triggered the DL to create the DLCEP.

b) If

1) the DLCEP's DLCEP-class is PEER or PUBLISHER; and

2) the called DL(SAP)-address of the EC DLPDU which activated the DLCEP was not a group DL-address,

then

3) The DLE shall encode a DC DLPDU as specified in IEC 61158-4, 8.2 and 9.2, and shall schedule the DLPDU for transmission at TIME-AVAILABLE priority as specified in IEC 61158-4, 10.4.5.

4) If the DLCEP being disconnected is a PEER DLCEP, then the DC DLPDU shall have both destination and source addresses IEC 61158-4, 8.2.1 formats 1L and 1S, and the destination address shall be the remote DLCEP-address of the DLC, if known, or the called-DL(SAP)-address of the initiating EC DLPDU in all other cases. The reply-requested field shall be set to TRUE in the DC-parameters of the initiating DC DLPDU.

5) If the DLCEP being disconnected is a PUBLISHER DLCEP, then the DC DLPDU shall have only a source address IEC 61158-4, 8.2.1 formats 2L and 2S. The reply-requested field shall be set to FALSE in the DC-parameters of the initiating DC DLPDU.

6) The source address of the DC DLPDU shall be the local DLCEP-address, if one exists; or the responding or calling local DLSAP-address, if one exists, or the called-DLSAP-address of the initiating EC DLPDU in all other cases.

c) The DLE shall terminate the DLCEP as specified in IEC 61158-4, 10.2.1.6.(b).

Table 80 – CP 1/1: DLL protocol selection of 10.2.2

Clause	Header	Presence	Constraints
10.2.2.0	—	YES	—
10.2.2.1	Selection of the format of a CA, CD, DT and ED DLPDUs	Partial	Replaced by 5.2.2.2.4.11
10.2.2.2	Receipt of a DL-DATA request primitive	Partial	Replaced by 5.2.2.2.4.12
10.2.2.3	Transmission of a DT DLPDU from a DLCEP	—	—
10.2.2.3.0	—	YES	—
10.2.2.3.1	Formation of the user-data field and related SD-parameter subfields	Partial	Replaced by 5.2.2.2.4.13
10.2.2.3.2	Formation of the other SD-parameter subfields	Partial	Replaced by 5.2.2.2.4.14
10.2.2.3.3	Transmission completion	Partial	Replaced by 5.2.2.2.4.15
10.2.2.4	Transmission of a CA, CD or ED DLPDU from a DLCEP	—	—
10.2.2.4.1	Transmission of a CA DLPDU	NO	—
10.2.2.4.2	Transmission of a CD DLPDU	Partial	Replaced by 5.2.2.2.4.16
10.2.2.4.3	Transmission of an ED DLPDU	NO	—
10.2.2.5	Validation and processing of SD-parameters in a CA, CD, ED or DT DLPDU received at a DLCEP	—	—
10.2.2.5.0	—	Partial	Replaced by 5.2.2.2.4.17
10.2.2.5.1	Validation of the NDS, TNS, ASN and truncated-DL-time subfields of the received SD-parameters		Replaced by 5.2.2.2.4.18
10.2.2.5.2	Validation of the NDR, RSN, J and K subfields of the received SD-parameters		Replaced by 5.2.2.2.4.19
10.2.2.5.3	Processing of the T and truncated DL-time subfields of the received SD-parameters		Replaced by 5.2.2.2.4.20
10.2.2.6	Validation and processing of user-data received in a DT DLPDU	Partial	Replaced by 5.2.2.2.4.21
10.2.2.7	Delivery of an entire DLSDU which has been completely received at a DLCEP	—	—
10.2.2.7.0	—	YES	—
10.2.2.7.1	Delivery to a receive buffer	Yes	—
10.2.2.7.2	Delivery to a receive queue	Partial	Replaced by 5.2.2.2.4.22
10.2.2.7.3	OSI-default delivery	YES	—
10.2.2.8	Receipt of a DT DLPDU addressed to a DLCEP	Partial	Replaced by 5.2.2.2.4.23
10.2.2.9	Receipt of a CD DLPDU	NO	This subclause is not included, because this profile does not include CA, ED DLPDU and CD DLPDU for peer DLC. In this profile the CD DLPDU for multipeer does not include the SD-parameter
10.2.2.10	Starting, cancellation and expiration of the timer T_U(MCD) on a DL-DATA request	Partial	Replaced by 5.2.2.2.4.24
10.2.2.11	Starting, cancellation and expiration of the timer $T_{C,K}$(SS)	—	—
10.2.2.11.0	—	Partial	Replaced by 5.2.2.2.4.25
10.2.2.11.1	Use of the simplified timer TC(SS)	Partial	Replaced by 5.2.2.2.4.26
10.2.2.12	Starting, cancellation and expiration of the timer $T_{C,K}$(RRS)	NO	—
10.2.2.13	Starting, cancellation and expiration of the timer T_C(RAS)	Partial	Replaced by 5.2.2.2.4.27
10.2.2.14	Starting, cancellation and expiration of the timer T_C(RAM)	Partial	Replaced by 5.2.2.2.4.28
10.2.2.15	Receipt of a DL-RESET request primitive	NO	—
10.2.2.16	Receipt of a DL-RESET response primitive	NO	—
10.2.2.17	Receipt of an RC DLPDU	NO	—
10.2.2.18	Expiration of the timer T_U(MCD) on a DL-RESET request or indication	NO	—
10.2.2.19	DLE-initiated reset	NO	—

5.2.2.2.4.11 IEC 61158-4, 10.2.2.1

NOTE 1 CA and ED DLPDUs are not included in this profile

The address format of all CD and DT DLPDUs sent from a DLCEP shall be chosen as determined during the DLCEP-establishment process IEC 61158-4, 10.2.1.1 and as specified in IEC 61158-4, 8.5.3 and 8.7.3, respectively. The SD-parameter format of all such CD and DT DLPDUs formed by the DLE shall be the same as that negotiated for the sending DLCEP IEC 61158-4, 9.1(c.5), 9.1(d.5), 10.2.1.1.

All CD DLPDUs sent from an LAS DLE as part of its schedule execution activities, and not from a DLCEP of the LAS DLE, shall specify an explicit destination address of the length negotiated in IEC 61158-4, 10.2.1.1 and shall omit both source address and SD-parameters.

NOTE 2 An address format of very-short is always realised by use of short addresses in any associated CD DLPDU.

5.2.2.2.4.12 IEC 61158-4, 10.2.2.2

NOTE The following procedures are either not included or partially included for the following reasons: IEC 61158-4, 10.2.2.2(d.1): this profile does not include explicit scheduling for DL-Data requests, IEC 61158-4, 10.2.2.2(d.2.ii): the data delivery features of this subclause is not included in this profile.

If the request is accepted, as indicated by a returned status of "success" for the DL-DATA request, then upon completion of the request, either successfully or after failure, the DLE shall issue a DL-DATA confirm with the same request identifier as specified by the DLS-user in the corresponding DL-DATA request primitive, conveying the status of the request to the DLS-user.

The DLCEP source specified in the DL-DATA request should be bound to either an explicit (user-controlled) queue or to an implicit (DLE-controlled) queue. If the queue is full, or if the specified DLSDU length, $P_U(L)$, is invalid, or if the DLCEP-state $V_C(ST)$ is not DATA-TRANSFER-READY, then the DLE shall immediately return the corresponding DL-DATA confirm indicating the reason for failure.

Otherwise

a) The DLE shall create and start a user-request timer $T_U(MCD)$ with a duration based on the user-specified maximum confirm delay for DL-DATA primitives. If the specified value was other than UNLIMITED, then the duration of this timer shall be equal to that user-specified maximum confirm delay; otherwise the duration should be 60 s. DL-management may override these preferred durations.

b) The DLE shall assign the next unassigned sequence number N = VC(N) to the request and its associated DLSDU;

c) The DLE shall initialize the variable VC,N(SS) based on the length, PN(L), of the Nth DLSDU, to indicate that all segments of the Nth DLSDU, and no other segments of that DLSDU, need transmission;

d) The DLE shall append the request to the DLCEP-address's user-request queue, $Q_A(UR)$, as follows:

   1) not used

   2) i) if $N > V_C(A) + P_C(WS)$, and the sending DLCEP is a CLASSICAL or DISORDERED peer, then the request shall be placed in the third partition of $Q_A(UR)$;

   3) Else if (2) does not apply, then the third partition of $Q_A(UR)$ is empty, and so the request shall be placed in the second partition of $Q_A(UR)$, and the DLE shall append to the DLE's unscheduled-service queue, Q(US), a reference to $Q_A(UR)$ of the same priority as the just-appended request.

      NOTE Q(US) never needs to have more references to a QA(UR) than the number of DLSDUs waiting for transmission or retransmission.

The DLE shall increment $V_C(N)$.

5.2.2.2.4.13 IEC 61158-4, 10.2.2.3.1

NOTE The following procedures are either not included or partially included for the reasons shown below:
IEC 61158-4 10.2.2.3.1(a), (b.i), (b.iii), (b.iv): the data delivery features of this subclause is not included in this profile,
IEC 61158-4 10.2.2.3.1(b.2), (b.3): the ASN, TNS subfields are not part of the SD-parameter format of this profile,
IEC 61158-4 10.2.2.3.1(c.3.iii), (d.2):the DL-time subfield is not part of the SD-parameter format of this profile.

The T, NDS, and the DLPDU's user-data field, shall be formed as follows:

a) not used

b) If the sending DLCEP is bound to a sending queue, and is

   i) not used;

   ii) a DISORDERED or CLASSICAL PEER DLCEP, and there is a *K* such that $V_C(A) < K \leq \min(V_C(A)+P_C(WS), V_C(N)-1)$ and $V_{C,K}(SS)$ is non-empty;

   iii) not used;

   iv) not used;

then the DLE shall form the remainder of the DLPDU as follows:

   1) the NDS subfield, if present, shall convey the lowest-order five bits of the value *K*, as appropriate;

   2) not used

   3) not used

   4) the user-data field shall consist of all octets of user-data;

   5) the T subfield shall specify FALSE;

   6) not used;

   and the DLE shall remove member from $V_{C,K}(SS)$;

c) If the sending DLCEP is bound to a sending buffer, then

   1) The DLE shall increment $V_C(N)$, if the buffer has been written since the last transmission from the buffer on this DLCEP;

   2) The DLE shall let *K* equal $V_C(N)$-1;

   3) If K is not equal to zero, then the DLE shall form the remainder of the DLPDU as specified in (b.1) to (b.4) and as follows:

      i) If the DLSDU has no timeliness attribute, then the T subfield shall specify FALSE;

      ii) If the DLCEP has a sender's-DL-timeliness class other than NONE, then the DLE shall

         A) compute the timeliness of the S'th segment of the *K*'th DLSDU as specified in IEC 61158-4 10.1.7,

         B) perform a logical AND of that computed timeliness status with the timeliness-status associated with writing the buffer, $V_B(TS)$ IEC 61158-4 6.7.4.21, and

         C) convey that result in the T subfield of the DLPDU;

      iii) not used;

and the DLE shall remove member from $V_{C,K}(SS)$;

d) If there is no such *K* as in (b), or if K is equal to zero in (c), or if the DLE is required to send the DLPDU without user-data as in IEC 61158-4 8.5.4.1(c) or 8.5.4.1(d), then

   1) the T subfield of the SD-parameters shall be encoded as zero (0); NDS shall be encoded as the appropriate number of low-order bits of $V_C(M)$;

2) not used; and

3) the user-data field shall be null.

5.2.2.2.4.14 IEC 61158-4, 10.2.2.3.2

NOTE 1 The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.3.2(b.1): the check of segment number is not included,
the text has been edited so that it only applies to SD-parameter format included in this profile.

The J, K, NDR and RSN subfields of the SD-parameters shall be formed as follows:

a) If the sending DLCEP is a PUBLISHER DLCEP, then the J, K, NDR and RSN subfields of the SD-parameters shall be encoded as zero (0);

b) If the sending DLCEP is a PEER DLCEP, then

1) If there is a smallest *K* such that $V_C(L) < K \leq V_C(H)$ and $V_{C,K}(RRS)$ is non-empty, then

i) the J subfield of the SD-parameters shall be encoded as one (1);

ii) the NDR subfield shall convey the lowest-order four bits of the value *K*;

iii) the RSN subfield shall be encoded as zero; and

iv) $V_{C,K}(RRS)$ shall be set to empty.

2) Otherwise, if (1) does not apply, then

i) the J and RSN subfields shall be encoded as zero (0), and

ii) the NDR subfield shall convey the lowest-order four bits of $(V_C(L)+1)$.

3) If the value of the NDR subfield equals the value of the corresponding lowest-order bits of $(V_C(L)+1)$, then the K subfield shall be encoded as one (1); otherwise the K subfield shall be encoded as zero (0).

NOTE 2 If Receive window size, PC(WR) = 1, then
NDR = VC(L)+1; RSN = 0; K = 1;
if VC,L+1(RRS) is non-empty, then J = 1; else J = 0.

5.2.2.2.4.15 IEC 61158-4, 10.2.2.3.3

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.3.3(a): the variable VC(MS) is not included in this profile,
IEC 61158-4, 10.2.2.3.3(b): edited, because only unordered publisher DLCEP bound to buffer is included in this profile,
IEC 61158-4, 10.2.2.3.3(c): edited, because only ordered publisher DLCEP bound to buffer is included in this profile,

a) If the just-transmitted DLPDU contained DLS-user data, then the DLE shall update $V_C(M)$ from the local variable *K* of IEC 61158-4 10.2.2.3.1 as follows:

If $K > V_C(M)$, then $V_C(M)$ shall be set equal to *K*.

b) If the sending DLCEP

1) is a publisher DLCEP whose sending DLCEP features are UNORDERED; and

2) the DT DLPDU has a non-null user data field;

then

3) the DLE shall issue a DL-BUFFER-SENT indication primitive specifying the DLS-user-identifier if known, or the DL-identifier otherwise, for the DLCEP.

4) not used.

c) If the sending DLCEP

1) is a publisher DLCEP whose sending DLCEP features are ORDERED; and

2) the DT DLPDU has a non-null user data field;

then

3) the DLE shall issue a DL-BUFFER-SENT indication primitive specifying the DLS-user-identifier if known, or the DL-identifier otherwise, for the DLCEP.

4) not used.

d) If this DLCEP has been specified as a synchronizing DLCEP during the establishment of one or more other local DLCEPs, and if a DL-BUFFER-SENT indication primitive was issued in (b.1) or (c.1), then the DLE shall record the DL-time of network access, V_C(TNA), for use in the timeliness computations of those referencing DLCEP(s).

5.2.2.2.4.16 IEC 61158-4, 10.2.2.4.2

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.4.2(a.2): in this profile, the CD DLPDU is used only from subscriber to publisher and data transfer from subscriber to publisher is not included,
The CD DLPDU for this profile does not include SD-parameter field.

This subclause does not apply to the LAS DLE when it sends CD DLPDUs as part of its scheduled activity and not from a DLCEP of the LAS DLE; such DLPDUs are constrained as specified in IEC 61158-4, 8.5 and 10.2.2.

Upon receipt of a transmission opportunity to compel transmission from a remote DLCEP, when

a) the DLC is

1) simplex, with DLS-user-data transmission only from the remote DLCEP to the local DLCEP (and possibly other DLCEPs);

2) not used.

b) the local execution of a DL-COMPEL-SERVICE request primitive compels transmission from a remote publisher DLCEP;

then the DLE shall form and send a CD DLPDU of the specified priority; with DL-address field and SD-parameter field formats as specified in IEC 61158-4 8.5, 9.4 and 10.2.2.2; with the remote (destination) and local (source) DLCEP-addresses of the DLC, as appropriate; and with null SD-parameter-field.

1) not used;

2) not used;

3) not used; and

4) not used.

5.2.2.2.4.17 IEC 61158-4, 10.2.2.5.0

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.5(1.i): this profile does not include connection merging,
IEC 61158-4, 10.2.2.5(2): this profile does not include DLC Reset,
Only formats A, D and G are included in this profile.

If the DLCEP state, V_C(ST), is

1) waiting-for-connect-completion, then

i) not used

ii) the DLE shall issue a DL-CONNECTION-ESTABLISHED indication primitive to the receiving DLS-user and cancel the associated user request timer T_U(MCD);

iii) The DLE shall change the DLCEP state, V_C(ST), to DATA TRANSFER READY; and shall apply the remainder of this subclause.

2) not used

3) not WAITING-FOR-CONNECT-COMPLETION, and not DATA-TRANSFER-READY, then the received DLPDU shall be ignored by the upper-level DLC functions.

Otherwise, the DLE shall validate and process the SD-parameters of the received DLPDU according to the SD-parameter format, $P_C(NP.FFF_R)$, negotiated for this (receiving) direction of DLC transmission. This validation and processing shall be as specified in the remainder of IEC 61158-4, 10.2.2.5, with format-dependent considerations as follows, based on the SD-parameter format (A – G)and the truncated DL-time format (J—M). The format-dependent value of the sending modulus MOD_S shall also be used in the procedures of IEC 61158-4, 10.2.2.6.

format A) The sending and receiving SD-parameters of the DLPDU are implicit and thus always valid; the implied values of RSN, T, TNS, ASN and truncated DL-time are all zero; and any accompanying user-data is a complete DLSDU. IEC 61158-4, 10.2.2.5.2, does not apply.

format D) The sending and receiving SD-parameters of the DLPDU are explicit; the sending modulus MODS equals 25; the receiving modulus MODR equals 24; the implied values of TNS and ASN are zero; and any accompanying user-data is a complete DLSDU.

format G) The sending SD-parameters of the DLPDU are explicit; the receiving SD-parameters of the DLPDU are non-existent; the sending modulus MOD_S equals 2^5; the implied value of NDR is $V_C(M)+1$; the implied values of RSN, TNS and ASN are zero; and any accompanying user-data is a complete DLSDU.

5.2.2.2.4.18 IEC 61158-4, 10.2.2.5.1

NOTE The following procedures are either not included or partially included, or different for the following reasons:
IEC 61158-4, 10.2.2.5.1(b.1), (b.2), (b.3) and (b.4), are included only for CLASSICAL or DISORDERED DLCEP,
IEC 61158-4, 10.2.2.5.1 (a), (b.2.ii), (b.3), are partially included, because this profile does not include segmentation (TNS subfield is not included),
Item (b.1) is not identical to IEC 61158-4, 10.2.2.5.1 (b.1), because this profile does disconnect instead of reset,
Item (c) is added as a new subclause for ordered DLCEP bound to receiving buffer.

In the following, $P_C(NP.WWWW_R)$ is the negotiated receive window size and $P_C(NP.TT_R)$ is the negotiated receiving DLCEP data delivery features.

a) If $P_C(NP.TT_R)$ specifies UNORDERED, as is always the case with format A, then if the received DLPDU's user-data field is non-null, then the receiving DLE

   i) shall increment $V_C(H)$, and shall let *K* equal the new value of $V_C(H)$,

   ii) not used

   iii) shall process the received user-data as specified in IEC 61158-4 10.2.2.6.

b) Otherwise, when $P_C(NP.TT_R)$ specifies ORDERED, DISORDERED or CLASSICAL, then

If the receiving DLCEP is a subscriber DLCEP, and this is the first DT DLPDU received after the DLCEP state was changed to DATA-TRANSFER-READY, then the DLE shall set the variables $V_C(L)$ and $V_C(H)$ to the value of the $N_R(NDS)$ subfield of the received DT DLPDU.

If $P_C(NP.TT_R)$ is CLASSICAL or DISORDERED DLCEP, then the DLE shall compute

$TEMP = (N_R(NDS) + P_C(NP.WWWW_R) – V_C(H) –1)$ modulo MOD_S (Eq. 16)

and shall apply subclauses (1) to (4).

1) If

   $TEMP > (V_C(L) + 2 \times P_C(NP.WWWW_R) – V_C(H) –1)$ modulo MOD_S

   then the received DLSDU sequence number is invalid; the procedures of IEC 61158-4 10.2.2.6 do not apply; and the DLE shall disconnect the DLCEP as specified in IEC 61158-4 10.2.1.8, specifying a disconnect reason of "wrong DLPDU format or parameters, permanent condition".

2) Else if (1) does not apply, then if

— *TEMP* > (P_C(NP.WWWW$_R$) –1),

then

i) The DLE shall set *N* equal to *TEMP* – (P_C(NP.WWWW$_R$) –1); and

ii) The received DLSDU sequence number is for a new DLSDU, not previously received or inferred; the DLE shall repeat the following step (A) *N* times.

A) The DLE shall increment V_C(H). Let *K* equal the just-incremented value of V_C(H). Then $V_{C,K}$(MRS) shall be created and shall indicate that segment number zero (0) of the *K*'th DLSDU is missing; and $V_{C,K}$(RRS) shall be created and shall indicate that segment number zero (0) of the *K*'th DLSDU is missing.

B) not used.

iii) not used

iv) For all values of N,

A) If there is any accompanying user data in the received DLPDU, then the DLE shall modify both $V_{C,K}$(MRS) and $V_{C,K}$(RRS) to indicate that the segment whose zero-origin number is equal to the value of N_R(ASN) field is not missing, and the procedures of IEC 61158-4 10.2.2.6 also shall be applied.

B) If there is any $V_{C,K}$(RRS), as created in (b.2.ii.A), which is not empty and which therefore requires a retransmission request, then

I) the DLE shall check for a reference to the DLCEP on the DLE's unscheduled-service queue, Q(US), and

II) if no such reference is found then the DLE shall add a reference to the DLCEP onto the DLE's unscheduled-service queue, Q(US), to ensure that another DLPDU requesting retransmission of the missing segment, is sent from the receiving DLCEP.

3) Else if (1) and (2) do not apply, and

TEMP < V_C(L) + P_C(NP.WWWW$_R$) – V_C(H)) modulo MOD$_S$

then the received DLSDU sequence number is for a previously delivered, and on peer DLCs previously acknowledged, DLSDU. If there is any accompanying user data in the received DLPDU, then the DLE shall check for a reference to the DLCEP on the DLE's unscheduled-service queue, Q(US), and if not found then add a reference to the DLCEP to the DLE's unscheduled-service queue, Q(US), to ensure that another DLPDU reacknowledging the just-referenced DLSDU is sent from the receiving DLCEP. The procedures of IEC 61158-4 10.2.2.6 do not apply.

4) Else if (1), (2) and (3) do not apply, then the received DLSDU sequence number is for a previously received or inferred, but not yet acknowledged, or delivered, or both, DLSDU.

Let *K* = V_C(H) + *TEMP* +1 – P_C(NP.WWWW$_R$).

If there is any accompanying user data in the received DLPDU, and $V_{C,K}$(MRS) indicates that the user data has not previously been received, then the DLE shall modify both $V_{C,K}$(MRS) and $V_{C,K}$(RRS) to indicate that the segment whose zero-origin number is equal to the value of N_R(ASN) field is not missing, and the procedures of IEC 61158-4 10.2.2.6 also shall be applied.

c) If P_C(NP.TT$_R$) is ORDERED, then

i) The DLE shall compute

TEMP1 = (N_R(NDS) – V_C(H)) modulo MOD$_S$;

V_C(H) = *TEMP1* + V_C(H);

ii) If *TEMP1* = 0, then the received DLSDU sequence number is for a previously delivered DLSDU. The receipt of the duplicate DLPDU shall be reported to the DLS-user with a DL-BUFFER-RECEIVED indication specifying that the reported DLSDU is a duplicate DLSDU;

iii) If *TEMP1* > 0, then the received DLSDU sequence number is for a new DLSDU, not previously received or inferred. If there is any accompanying user data in the received DLPDU, then the procedures of IEC 61158-4 10.2.2.6 shall be applied.

NOTE If receive DLCEP is CLASSICAL or DISORDERED PEER DLCEP and window size = 1, then

TEMP1 = (N_R(NDS) – V_C(H)) modulo MOD_S;

If (V_C(H) == V_C(L)), then

if (TEMP1 > 1) then it is invalid;

if (TEMP1 == 1) then it is a new DLSDU;

increment V_C(H);

set K = V_C(H);

procedures of IEC 61158-4 10.2.2.6 apply;

if (TEMP1 == 0) then it is a repeat of a prior DLSDU;

If (V_C(H) == V_C(L)+1), then

if (TEMP1 > 0) then it is invalid;

if (TEMP1 == 0) then it is a repeat of a prior DLSDU;

5.2.2.2.4.19 IEC 61158-4, 10.2.2.5.2

NOTE 1 The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.5.2(a): not required,
IEC 61158-4, 10.2.2.5.2(c): the data delivery features of this subclause are not included in this profile.

In the following, P_C(NP.WWWW$_R$) is the negotiated receive window size and P_C(NP.TT$_R$) is the negotiated receiving DLCEP data delivery features.

a) not used

b) If the DLCEP is a CLASSICAL or DISORDERED peer DLCEP, and the J and K subfields of the received SD-parameters are not both zero, then the DLE shall compute

TEMP = (N_R(NDR) – V_C(A)) modulo MOD_R

N = *TEMP* + V_C(A)

The received DLPDU is acknowledging a previously-unacknowledged transmitted DLSDU (K=1), or requesting retransmission of a segment of a previously-transmitted DLSDU (J=1), or both.

If K=1, and the DLCEP is a CLASSICAL or DISORDERED peer DLCEP, and V_C(A) < *N* ≤ V_C(M) + 1,

then the DLE shall

i) set V_C(A) equal to *N-1*;

ii) issue, in the order originally requested, a DL-DATA confirm for each DL-DATA request which was acknowledged by the received NDR;

iii) cancel the set of associated user request timers { T_U(MCD) } for the just-confirmed DL-DATA requests;

iv) cancel any retransmission timers $T_{C,K}$(SS) associated with the just-confirmed DL-DATA requests, or the simplified timer T_C(SS) associated with the DLCEP, and in this latter case (using T_C(SS)), if V_C(A) < V_C(M), which implies that there are unacknowledged DLSDUs, then T_C(SS) shall be restarted;

v) where possible and permitted, move DL-DATA requests from the third partition to the second partition of the corresponding user-request queue, Q_A(UR), as specified in IEC 61158-4, 10.2.2.2(d);

and

if the $V_{C,K}$(SS) associated with the just-confirmed DL-DATA requests were not empty, then the DLE may cancel such retransmission requests and set the corresponding $V_{C,K}$(SS) to empty.

If J=1, and *N* is greater than V_C(A), and

$N \leq V_C$(M)

then the DLE shall add the RSN'th member to the set $V_{C,N}$(SS); and if the set $V_{C,N}$(SS) was previously empty, then the DLE shall

1) cancel any retransmission timers $T_{C,N}$(SS) associated with the *N*'th DLSDU, or T_C(SS) associated with the DLCEP, and

2) add to the DLE's unscheduled-service queue, Q(US), a reference to Q_A(UR) of the receiving DLCEP, to ensure that the requested DLPDU is sent from the receiving DLCEP.

c) not used.

NOTE Q(US) never needs to have more references to a QA(UR) than the number of DLSDUs waiting for transmission or retransmission.

NOTE 2 If send window size = 1, then VC(M) is VC(A) or VC(A) +1;

Valid values of NDR are VC(A) +1 or VC(A) +2.

5.2.2.2.4.20 IEC 61158-4, 10.2.2.5.3

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.5.3(b.1.ii): this profile does not include DL-time in SD-parameter,
IEC 61158-4, 10.2.2.5.3(b.2): this profile does not include DLSDU with more than one segment.

If the DLCEP's receive binding is to a buffer, then

a) If the receiving DLCEP has a sender's DL-timeliness class of NONE, then the timeliness-status, V_B(TS) IEC 61158-4, 6.7.4.21, associated with writing the buffer shall be set to FALSE.

b) Otherwise, when (a) does not apply, then

1)

i) The buffer's associated timeliness-status, V_B(TS), specified in IEC 61158-4, 6.7.4.21, shall be set equal to the T subfield of the received DLPDU;

ii) not used

iii) the DL-time of reception of the DLPDU shall be used as the time of writing the buffer, V_B(TW), specified in IEC 61158-4, 6.7.4.19.

2) not used.

5.2.2.2.4.21 IEC 61158-4, 10.2.2.6

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.6(a), (b), (c) and other text are excluded - this profile does not include DLSDUs with more than one segment, so re-assembly is never required.

If a received DT DLPDU has a non-null user data field following its SD-parameters field, then receiving DLE shall check whether the length of the received user-data is less than or equal to the permitted maximum DLSDU size, P_C(NP.M...M_R), negotiated for this (receiving) direction of DLC transmission. If this requirement is violated, then the DLE shall disconnect the DLCEP as specified in IEC 61158-4, 10.2.1.8, with a reason of "provider-originated disconnection—wrong DLSDU size, permanent condition".

a) not used

b) not used

c) not used

d) The receiving DLE shall attempt to deliver the DLSDU as specified in IEC 61158-4, 10.2.2.7.

5.2.2.2.4.22 IEC 61158-4, 10.2.2.7.2

NOTE 1 The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.7.2(b): the timer TC,K(RRS) is not included in this profile,
IEC 61158-4, 10.2.2.7.2(c): the UNORDERED or ORDERED DLC bound to a queue is not included in this profile.

The DLE shall attempt to append the complete DLSDU, together with identification of the receiving DLCEP, to the receiving queue.

If unsuccessful, the DLE shall inform local DL-management of this queue-full situation.

NOTE 2 This DL-management notification may take the form of incrementing a counter of discarded DLSDUs.

If successful,

a) The DLE shall report a DL-DATA indication to the DLS-user;

b) Not used

c) Not used

d) If the DLC is a DISORDERED DLC, and if *K* equals ($V_C(L)$ +1), then

   1) The DLE shall set $V_C(L)$ equal to *K*.

   2) If *K* is less than $V_C(H)$, then the DLE shall increment *K*. If the set variable $V_{C,K}(MRS)$ is empty, then the DLE shall set $V_C(L)$ equal to *K* and shall repeat this step.

   3) If the DLC is a PEER DLC, then if the DLE's DL-address unscheduled-service queue, Q(US), does not already contain a reference to the DLCEP, then the DLE shall append a reference to the DLCEP to that Q(US) to ensure that an acknowledgement of DLSDU receipt is sent from the receiving DLCEP.

e) If the DLC is a CLASSICAL DLC, then

   1) The DLE shall set $V_C(L)$ equal to *K*.

   2) If *K* is less than $V_C(H)$, then the DLE shall increment *K*. If the set variable $V_{C,K}(MRS)$ is empty, then the DLE shall repeat the entire data delivery procedure IEC 61158-4, 10.2.2.7.2(a) and (e), using the new value of *K*.

   3) If the DLC is a PEER DLC, then the DLE shall do as specified in IEC 61158-4, 10.2.2.7.2(d.3).

NOTE 3 If receive window size = 1, then K is always equal to VC(L) + 1 and procedures for CLASSICAL and DISORDERED DLC are identical.

5.2.2.2.4.23 IEC 61158-4, 10.2.2.8

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.8(a): this profile does not include DLC reset,
IEC 61158-4, 10.2.2.8(b3): this profile does not include Data transfer from Subscriber to Publisher.
IEC 61158-4, 10.2.2.8(c): this profile does not include residual activity for multipeer DLC.

When the DLE receives a DT DLPDU addressed to a DLCEP of the DLE, the DLE shall perform the following series of actions.

a) not used

b) The DLE shall validate that

   1) the priority of the received DT is as expected;

2) in a received DT DLPDU addressed to all subscribers of a PUBLISHER DLCEP, the length of the publisher's DL-address is greater than or equal to that expected;

3) not used

4) that in a received DT DLPDU addressed to a PEER DLCEP,

i) the length and number of the DL-address(es) is as expected (only LONG; or only SHORT; or either SHORT or VERY-SHORT at the sender's option), and

ii) when two addresses are expected, that the second DL-address of the DLPDU is the DLCEP-address of the remote peer of the DLCEP addressed by the DT DLPDU's first DL-address.

If this validation fails, then

iii) if the DLCEP is PEER DLCEP, the DLE shall disconnect the DLCEP from the DLC as specified in IEC 61158-4, 10.2.1.8, with a reason of "provider-originated disconnection—wrong DLPDU format or parameters, permanent condition",

iv) else the DLE shall discard the DT DLPDU.

c) If the DLCEP is a PEER DLCEP whose negotiated residual-activity attribute is TRUE, then the DLE shall restart the DLCEP's T_C(RAM) as specified in IEC 61158-4, 10.2.2.14.

d) If the remaining number of octets in the DLPDU is less than the number of octets in the negotiated SD-parameters format for the applicable sender-to-receiver direction of transmission, then

1) if the DLCEP is PEER or SUBSCRIBER DLCEP, then the DLE shall disconnect the DLCEP from the DLC as specified in IEC 61158-4, 10.2.1.8, with a reason of "provider-originated disconnection—wrong DLPDU format or parameters, permanent condition",

2) else the DLE shall discard the DT DLPDU.

Otherwise the DLE shall parse and process the applicable-format SD-parameters from those remaining octets as specified in IEC 61158-4, 10.2.2.5; and if the remaining number of octets in the DLPDU, after the SD-parameters, is greater than zero, then the DLE shall process that user-data as specified in IEC 61158-4, 10.2.2.6 and possibly 10.2.2.7.

5.2.2.2.4.24 IEC 61158-4, 10.2.2.10

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.10(a), text at the beginning of this subclause only CLASSICAL or DISORDERED peer DLCEP are included for DL-Data request.
IEC 61158-4, 10.2.2.10(d), this profile does not include DLC reset.

The timer T_U(MCD) shall be started when the DLS-user issues the corresponding DL-DATA request. It shall be cancelled at a CLASSICAL or DISORDERED peer DLCEP, when the DLE issues the corresponding DL-DATA confirm.

If the timer T_U(MCD) expires on a DL-DATA request, then the DLE shall

a) not used

b) remove the request from the sending DLCEP-address's user-request queue, Q_A(UR), and terminate processing of the request;

c) maintain any appropriate DL-management statistics;

d) if a DL-DATA confirm primitive for the request has not yet been issued, then:

1) initiate a DL-DATA confirm reporting "provider-originated failure—request timeout"; and

2) disconnect the DLCEP as specified in IEC 61158-4, 10.2.1.8.

5.2.2.2.4.25 IEC 61158-4, 10.2.2.11.0

NOTE 1 The following procedures are either not included or partially included for the following reasons:
This profile does not include DLSDU with more than one segment.

NOTE 2 This timer is used only by peer DLCEPs whose sending data delivery features are DISORDERED or CLASSICAL.

The timer $T_{C,K}(SS)$ shall be started whenever a DLPDU containing all or part of $DLSDU_K$ is transmitted and $V_{C,K}(SS)$ is empty; it shall be cancelled whenever $V_C(A)$ is greater than or equal to *K* or whenever $V_{C,K}(SS)$ becomes non-empty IEC 61158-4, 10.2.2.5.2(b).

The duration of this timer shall be based on the local user-specified maximum confirm delay for DL-DATA primitives. If the specified value was other than UNLIMITED, then the duration of this timer should be between 12.5% and 25% of Vc(NP).MCD_D; otherwise the duration should be between 12.5% and 25% of 60s. DL-management may override these preferred durations.

If the timer $T_{C,K}(SS)$ expires, then the DLE shall

a) modify the variable $V_{C,K}(SS)$ to indicate that the *K*'th DLSDU need retransmission; and

b) append to the DLE's unscheduled-service queue, Q(US), a reference to the DLCEP's $Q_A(UR)$, to schedule a retransmission of the unacknowledged DLSDU; and

c) maintain any appropriate DL-management statistics.

5.2.2.2.4.26 IEC 61158-4, 10.2.2.11.1

NOTE The following procedures are either not included or partially included for the following reasons:
This profile does not include DLSDU with more than one segment.

When the permission of IEC 61158-4, 6.7.4.9.1, is employed, the following rules apply:

a) The timer $T_C(SS)$ shall be started, but not restarted, whenever a DLPDU containing all or part of $DLSDU_K$ is transmitted and $V_{C,K}(SS)$ is empty. The timer shall be restarted whenever it is not running and $V_C(A)$ is less than $V_C(M)$; it shall be cancelled whenever $V_C(A)$ equals $V_C(M)$ or whenever $V_{C,K}(SS)$ becomes non-empty due to receipt of a request for retransmission IEC 61158-4, 10.2.2.5.2(b).

b) The duration of this timer shall be based on the local user-specified maximum confirm delay for DL-DATA primitives. If the specified value was other than UNLIMITED, then the duration of this timer should be between 25% and 50% of $\frac{Vc(NP).MCD\_D}{2}$; otherwise the duration should be between 25% and 50% of 60s. DL-management may override these preferred durations.

If the timer $T_C(SS)$ expires, then the DLE shall

c) modify the variable $V_{C,K}(SS)$, for the unacknowledged $DLSDU_K$ with the lowest sequence number, to indicate that the *K*'th DLSDU need retransmission;

d) append to the DLE's unscheduled-service queue, Q(US), a reference to the DLCEP's $Q_A(UR)$, to schedule a retransmission of the unacknowledged DLSDU; and

e) maintain any appropriate DL-management statistics.

5.2.2.2.4.27 IEC 61158-4, 10.2.2.13

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.2.2.13(b): this profile does not include residual activity for multipeer DLC.

When applicable (see IEC 61158-4, 6.7.4.16, for the conditions of the timer's use), the timer $T_C(RAS)$ shall be started

a) at a sending DISORDERED or CLASSICAL PEER DLCEP, whenever it is not running and when $V_C(A)$ equals ($V_C(N) - 1$).

b) not used.

The duration of this timer shall be based on the user-specified maximum confirm delay for DL-CONNECT request or response primitives. If the specified value was other than UNLIMITED, then the duration of this timer should be between 70% and 95% of Vc(NP).MCD_CRS/2; otherwise the duration should be between 70% and 95% of 30s. DL-management may override these preferred durations.

It shall be cancelled whenever $V_C(A)$ is not equal to ($V_C(N) – 1$). If the timer T_C(RAS) expires, then the DLE shall check for a reference to the DLCEP on the DLE's unscheduled-service queue, Q(US), and if not found then append a reference to the DLCEP to the DLE's unscheduled-service queue, Q(US), to schedule a transmission to the remote DLCEP(s).

5.2.2.2.4.28 IEC 61158-4, 10.2.2.14

When applicable (see IEC 61158-4, 6.7.4.17, for the conditions of the timer's use), the timer T_C(RAM) shall run continuously. It shall be restarted whenever any DLPDU is received on the DLCEP.

The duration of this timer shall be based on the remote user-specified maximum confirm delay for DL-CONNECT request or response primitives and conveyed in an EC DLPDU previously-received from the sending DLCEP. If the specified value was UNLIMITED, then the duration of this timer should be 60 s. Otherwise, the duration should be V_C(NP).MCD_CRS. DL-management may override these preferred durations.

If the timer T_C(RAM) expires, then the DLE shall disconnect the DLCEP as specified in IEC 61158-4, 10.2.1.8.

5.2.2.2.4.29 IEC 61158-4, 10.3

Table 81 specifies the selection of the subclauses for this profile.

Table 81 – CP 1/1: DLL protocol selection of 10.3

Clause	Header	Presence	Constraints
10.3.1	Operation of the connectionless data transfer with local-DLE-confirmation service	—	—
10.3.1.1	Receipt of a DL-UNITDATA request primitive not specifying remote-DLE-confirmation	Partial	Item d.2)i) is not included in this profile because the scheduling is always IMPLICIT for this profile
10.3.1.2	Transmission of a unitdata DT DLSDU	YES	—
10.3.1.3	Receipt of a DT DLPDU, with an explicit source address, addressed to a DL(SAP)-address	Partial	Item a) is not included in this profile because the DLSAP-role is limited to BASIC or GROUP.
10.3.1.4	Expiration of the timer T_U(MCD) on a DL-UNITDATA request not specifying remote-DLE-confirmation	YES	—
10.3.2	Operation of the connectionless data transfer service with remote-DLE-confirmation (including all of subclauses)	NO	Remote-DLE confirmation is not included in this profile
10.3.3	Operation of the connectionless data exchange service (including all subclauses)	NO	DL-Unitdata exchange is not included in this profile
10.3.4	Operation of the listener query service (including all of subclauses)	NO	DL-Listener Query is not included in this profile

5.2.2.2.4.30 IEC 61158-4, 10.4

Table 82 specifies the selection of the subclauses for this profile.

Table 82 – CP 1/1: DLL protocol selection of 10.4

Clause	Header	Presence	Constraints
10.4.1	Operation of the DL-time service	—	—
10.4.1.1	Receipt of a DL-TIME request primitive	YES	—
10.4.1.2	Transmission of a TD DLPDU	YES	—
10.4.1.3	Receipt of a TD DLPDU	Partial	See 5.2.2.2.4.31
10.4.1.3.1	Additional actions required of a bridge	Partial	See 5.2.2.2.4.32
10.4.1.4	Receipt of an RQ DLPDU	YES	—
10.4.1.5	Receipt of an RR DLPDU	YES	—
10.4.1.6	Expiration of the timer T(TDP)	YES	—
10.4.2	Operation of the compel-service service	—	—
10.4.2.1	Receipt of a DL-COMPEL-SERVICE request primitive	Partial	See 5.2.2.2.4.33
10.4.3	Operation of the sequence scheduling service	NO	—
10.4.4	Operation of the subsequence selection service	NO	—
10.4.5	Implicit scheduling of DLS-user requests	YES	—

5.2.2.2.4.31 IEC 61158-4, 10.4.1.3

All of IEC 61158-4, 10.4.1.3, except the following subclauses, are included in this profile:

e)4)ii), because this profile does not use the link-id of the source of time distribution of periodic scheduled activities in IEC 61158-4, 11.3.5.1(j); and

e)5)ii), because this profile does not use the periodic schedule DL-time base (T0) in IEC 61158-4, 11.3.5.1(k).

5.2.2.2.4.32 IEC 61158-4, 10.4.1.3.1

All of IEC 61158-4, 10.4.1.3.1, except following subclauses, are included in this profile:

a)2), because this profile does not use the periodic schedule DL-time base (T0) in IEC 61158-4, 11.3.5.1(k); and

a)3), because this profile does not use the link-id of the source of time distribution of periodic scheduled activities in IEC 61158-4, 11.3.5.1(j).

5.2.2.2.4.33 IEC 61158-4, 10.4.2.1

NOTE The following procedures are either not included or partially included for the following reasons:
IEC 61158-4, 10.4.2.1(a), (a.1): this profile includes this service only for local publisher DLCEP, which is bound to a sending buffer,
IEC 61158-4, 10.4.2.1(a.2 ii.A), (b.1.i): this profile does not include scheduled sequence in the DLE,
IEC 61158-4, 10.4.2.1(b), (b.1): this profile includes this service only for remote publisher DLCEP,
IEC 61158-4, 10.4.2.1(c): this profile does not include this service for DLSAP-address.

When the DLE receives a DL-COMPEL-SERVICE request, it shall classify the request and take the appropriate corresponding action. If the request is for

a) a local (to the DLE) publisher DLCEP, for which the DL-scheduling-policy is EXPLICIT, then

1) not used

2) If the DL-address is bound to a sending buffer, then the DLE shall

i) modify the variable $V_{C,K}(SS)$, for the appropriate *K* corresponding to the DLSDU currently associated with the buffer, to indicate that the DLSDU requires transmission,

ii) form a **reference** to the $Q_A(UR)$ of the specified local peer or publisher DLCEP, at the DLCEP's priority, where the **reference** indicates the need to send a DLSDU from the sending buffer identified in (2), and append the **reference** to

A) not used

B) the DLE's unscheduled-service queue, Q(US);

iii) not used

iv) return an immediate status of “success”.

b) the remote publisher DLCEP of a local subscriber DLCEP, then the DLE shall

1) form a **reference** to the Q_A(UR) of the specified local subscriber DLCEP, at the DLCEP’s priority, where the **reference** indicates the need to compel the transmission of a DLSDU from the remote correspondent publisher DLCEP identified in (b), and append the **reference** to

i) not used;

ii) the DLE’s unscheduled-service queue, Q(US);

2) return an immediate status of “success”;

c) not used

some other DL-address, then the DLE shall return an immediate status of “user failure—invalid DL-address”.

5.2.2.2.5 IEC 61158-4, Clause 11

5.2.2.2.5.1 General

Table 83 specifies the selection of the subclauses for this profile.

Table 83 – CP 1/1: DLL protocol selection of Clause 11

Clause	Header	Presence	Constraints
11.1	Scope	Partial	Includes (a), (b) and (d), but does not include (c), because the DL-SUBSCRIBER-QUERY request and DL-LISTENER-QUERY request are not included in this profile, and bridges do not use SPDUs for forwarding-database maintenance
11.2	Overview of LAS operation	Partial	Includes (a) to (e), but does not include (f) and (g)
11.3	DL-support subprotocol definition	Partial	See 5.2.2.2.5.2
11.4	Elements of Procedures for receiving SPDUs	NO	—

5.2.2.2.5.2 IEC 61158-4, 11.3

The DL-support subprotocol defines Support Protocol Data Unit (SPDU) encodings to support the needs of LAS operation, including scheduling and other DLE functions.

Any DLPDU sent to, or by, the DL-support functions within a DLE, including any DLPDU addressed to a NODE DL-address, which has a non-null user-data field, shall contain as “user data” a single SPDU whose encoding and interpretation is as described in this subclause. This requirement includes any DLPDU addressed to a DLSAP-address designating LAS functionality, such as link-local DL-address 0400_{16}. It also includes any PR or TL DLPDU, both of which always have a user-data field.

See Table 84 for selection of subclauses.

Table 84 – CP 1/1: DLL protocol selection of 11.3

Clause	Header	Presence	Constraints
11.3.1	Common definitions	YES	—
11.3.2	Link-maintenance SPDUs	—	—
11.3.2.1	Probe-response SPDU	Partial	See 5.2.2.2.5.3
11.3.2.2	Node-activation SPDU	Partial	See 5.2.2.2.5.4
11.3.2.3	LAS-data-base-status SPDU	Partial	See 5.2.2.2.5.5
11.3.2.4	Live-list-change SPDU	Partial	See 5.2.2.2.5.6
11.3.2.5	Live-list-request SPDU	YES	—
11.3.2.6	Live-list-detail SPDU	Partial	This profile includes all of fields of live-list-detail SPDU, except DLE-type as specified in (g) of this subclause
11.3.2.7	DL-conformance-query SPDU	NO	—
11.3.2.8	DL-conformance-reply SPDU	NO	—
11.3.2.9	Link-basic-parameters-request SPDU	NO	—
11.3.2.10	Link-basic-parameters-reply SPDU	NO	—
11.3.2.11	Link-master-parameters-request SPDU	NO	—
11.3.2.12	Link-master-parameters-reply SPDU	NO	—
11.3.2.13	Token-hold-time-request SPDU	NO	—
11.3.2.14	Token-hold-time-array SPDU	NO	—
11.3.2.15	FDC-DLE-has-“awakened” SPDU	NO	—
11.3.2.16	FDC-DLE-may-“go-to-sleep”-notification SPDU	NO	—
11.3.2.17	FDC-DLE-may-“go-to-sleep”-acknowledge SPDU	NO	—
11.3.3	LAS-transfer SPDUs	—	—
11.3.3.1	Relinquish-LAS-role-request SPDU	YES	—
11.3.3.2	Accept-LAS-role-request SPDU	NO	—
11.3.3.3	Accept-LAS-role-reply SPDU	NO	—
11.3.4	Schedule-construction SPDUs	NO	—
11.3.5	Schedule-transfer SPDUs	Partial	See 5.2.2.2.5.7
11.3.6	Non-LAS SPDUs	NO	—

5.2.2.2.5.3 IEC 61158-4, 11.3.2.1

NOTE N = 0, F = 0

This profile includes all the Probe-response SPDU subclauses, but the values of some of the fields are fixed by this profile to following:

a) as required

b) as required

c) Octets 3 and 4 shall specify, as depicted in IEC 61158-4, Table 83:

1) the DLE’s lack of need for token circulation without an explicit request, encoded as a Boolean, N: 0 (no, token circulation is needed);

2) that the DLE does not report its functional class, encoded as CC = 0;

3) whether the DLE will function as an FDC DLE which can be expected to be non-responsive to some live-list link-maintenance queries, and whether that DLE should be included in the expected-non-response list, V(ENRL) IEC 61158-4, 6.7.5.4, encoded as a Boolean, F:0 (the DLE will not function as an FDC DLE);

5.2.2.2.5.4 IEC 61158-4, 11.3.2.2

This profile includes all the node-activation SPDU subclauses, but the values of some of the fields are fixed by this profile to following:

V(MRC) = 0;

V(NRC) = 0; and

V(NDL) = 0.

5.2.2.2.5.5 IEC 61158-4, 11.3.2.3

NOTE T = 0, D = 0, S = 1

This profile includes all the LAS-data-base-status SPDU subclauses , but the values of some of the fields are fixed by this profile to following:

a) as required

b) Octet 2 shall specify, as depicted in IEC 61158-4, Table 87:

1) the LAS's capability to transfer its schedule, T, encoded as a Boolean: 0 (no, LAS is not capable);

2) as required

3) whether all or part of the active schedule is has been dynamically constructed by the LAS, D, encoded as a Boolean: 0 (no);

4) whether all or part of the active schedule has been statically constructed by DL-management, S, encoded as a Boolean: 1 (yes).

5.2.2.2.5.6 IEC 61158-4, 11.3.2.4

NOTE N = 0, F = 0, SS = 01 or 11

This profile includes all the Live-list-change SPDU subclauses, but the values of some of the fields are fixed by this profile to following:

a) as required

b) as required

c) The remainder of the SPDU is an array of two octet members specifying DLE-status and structured as shown in IEC 61158-4, Table 89:

1) as required

2) The second octet of each member shall specify the status of the DLE, encoded as:

i) N, the DLE's non-need for token circulation, always encoded as 0;

ii) F, whether the DLE is an FDC DLE, always encoded as 0;

iii) as required

iv) SS, the last-observed status of that DLE, encoded as

01: not present; or

11: present and awake.

5.2.2.2.5.7 IEC 61158-4, 11.3.5

In IEC 61158-4, 11.3.5, the schedule-transfer SPDUs convey link schedule from LAS DLE to a non-LAS DLE on the same link. In this profile, the same SPDUs are used to transfer link schedule via network management protocol. These SPDUs are transported in a domain using FMS domain download. It is permitted to transfer more than one SPDU in one FMS PDU. The format of each SPDU is such that the octets comprising each SPDU can be determined without any ambiguity.

All of the paragraphs of IEC 61158-4, 11.3.5, except the first paragraph are included in this profile.

See Table 85 for selection of subclauses.

Table 85 – CP 1/1: DLL protocol selection of 11.3.5

Clause	Header	Presence	Constraints
11.3.5.1	Schedule-summary SPDU	Partial	See 5.2.2.2.5.8
11.3.5.2	Sub-schedule SPDU	—	—
11.3.5.2.0	—	YES	—
11.3.5.2.1	Sequence sub-SPDU	Partial	See 5.2.2.2.5.9
11.3.5.2.2	Element	Partial	See 5.2.2.2.5.10
11.3.5.3	Schedule-summary-request SPDU	NO	—
11.3.5.4	Sub-schedule-request SPDU	NO	—

5.2.2.2.5.8 IEC 61158-4, 11.3.5.1

NOTE 1 V(TSL) and T0 are not used

This profile includes all schedule-summary SPDU subclauses in the format specified in IEC 61158-4, 11.3.5.1, but does not use V(TSL) and periodic schedule DL-time base (T0) fields of this SPDU. Therefore, in this profile, IEC 61158-4, 11.3.5.1(j) and (k), are replaced as shown in the following:

a) as required

b) as required

c) as required

d) as required

e) as required

f) as required

g) as required

h) as required

i) as required

j) Octets 15 and 16 are not used and can be set to any value

k) Octets 17 to 22 are not used and can be set to any value.

l) as required

m) as required

n) as required

NOTE 2 The starting DL-time, (T0), of all periodic sub-schedules in this schedule is fixed to a zero value of (DL-time - V(DLTO). Therefore, the starting time of a macro-cycle in the schedule is given by:

(DL-time - V(DLTO)) = V(LSTO) + C(NT) = N x macro-cycle duration, where N is a non-negative integer.

5.2.2.2.5.9 IEC 61158-4, 11.3.5.2.1

This subclause is included in this profile, except for (a) which is replaced by:

a) The starting time of the schedule is fixed as specified in IEC 61158-4, 11.3.5.1(k). Therefore, the starting time of a sequence is given by:
(DL-time - V(DLTO)) = V(LSTO) + C(NT) =
N x macro-cycle duration + M x (sub-schedule period) + scheduled-starting-time-offset,
where N and M are non-negative integers.

5.2.2.2.5.10 IEC 61158-4, 11.3.5.2.2

NOTE This profile includes only CD-request, short DL-address. Therefore, the parts of this subclause included in this profile are as follows.

The element is the lowest level component of the schedule, and it represents a transaction IEC 61158-4, 3.4.10. The element shall be encoded as specified in Table 86. Multi-octet values shall be encoded with the most significant octet of the value encoded in the lowest-index octet of the multi-octet field.

Table 86 – CP 1/1: DLL protocol selection of 11.3.5.2.2, replacement for element encoding

Octet index	Contents of subfield
1	Element-type
2 ...	Element-parameter

a) Octet 1 shall specify the type of transaction and shall be encoded as:
1011 00PP — CD-request, SHORT DL-address, PP = priority IEC 61158-4, 7.2.1.3;

b) Octet 2 and up shall specify the parameters for the element. The length and encoding depends upon the element-type.

1) If the element type is CD-request, SHORT DL-address, then the element parameter shall have two octets and these two octets, octet 2 and 3 shall specify a SHORT DLCEP-address.

5.2.2.2.6 IEC 61158-4, Clause 12

5.2.2.2.6.1 General

Table 87 specifies the selection of subclauses for this profile.

Table 87 – CP 1/1: DLL protocol selection of Clause 12

Clause	Header	Presence	Constraints
12.0	—	YES	—
12.1	DLE initialization	YES	—
12.2	LAS behaviour and operation	Partial	See Table 88
12.3	DL-support operation	Partial	See 5.2.2.2.6.4
12.4	DL-bridge elements of procedure and bridge sub-protocol	Partial	See 5.2.2.2.6.11
12.5	DL-management-information	Partial	See 5.2.2.2.6.12
12.6	Implementation profiles	Partial	See 5.2.2.2.6.13

Table 88 – CP 1/1: DLL protocol selection of 12.2

Clause	Header	Presence	Constraints
12.2.1	LAS operation when holding a scheduler token	Partial	All of this subclause, except (b.2), are included in this profile; because the ES DLPDU is not part of this profile
12.2.2	Return of a delegated token; assumption of a scheduler token	Partial	All of this subclause are included in this profile, except paragraph 2 (including items a), b), 1) and 2)), because the ES DLPDU is not part of this profile
12.2.3	Receipt of a probe-response (PR) SPDU	YES	—
12.2.4	Lack of response to a PT DLPDU	YES	—
12.2.5	Receipt of a live-list-request SPDU	YES	—
12.2.6	Receipt of a relinquish-LAS-role-request SPDU	YES	See 5.2.2.2.6.2 for additional text
12.2.7	Other link-maintenance requirements	YES	See 5.2.2.2.6.3 for additional text
12.2.8	Receipt of a link-master-parameters-request SPDU	NO	Link master parameters are distributed by the NM protocol
12.2.9	Receipt of a token-hold-time-request SPDU	NO	Token-hold-time array is distributed by the NM protocol
12.2.10	Receipt of a schedule-summary-request SPDU	NO	Schedule-summary is distributed by the NM protocol
12.2.11	Receipt of a sub-schedule-request SPDU	NO	Sub-schedules are distributed by the NM protocol

5.2.2.2.6.2 IEC 61158-4, 12.2.6

In this profile the LAS shall also ignore the received SPDU if

a) the DLE has been instructed by the DLME to be the Primary Link Master (that is, the preferred LAS) and

b) the node-designator of the DLE requesting the transfer (that is, the node-designator of the DL-source address of the conveying DLPDU) has a higher numeric value than the node designator of this LM DLE (which is currently acting as LAS).

NOTE This extension provides for explicit management selection of the DLE that will provide the LAS role.

5.2.2.2.6.3 IEC 61158-4, 12.2.7

Whenever there is a change in the value of V(FUN) or V(NUN), the LAS DLE shall respond as in IEC 61158-4, 12.2.5, to notify the other LMs on the link of this parameter change.

5.2.2.2.6.4 IEC 61158-4, 12.3

All of the paragraphs of IEC 61158-4, 12.3, except (a), (b), (c), (k) and (m) to (v), are included in this profile.

See Table 89 for selection of subclauses.

Table 89 – CP 1/1: DLL protocol selection of 12.3

Clause	Header	Presence	Constraints
12.3.1	Receipt of an LAS-database-status SPDU by an LM DLE	Partial	See 5.2.2.2.6.5
12.3.2	Receipt of a live-list-change SPDU by an LM DLE	YES	—
12.3.3	Receipt of a live-list-detail SPDU by an LM DLE	Partial	All of this subclause, except "—the expected-non-response-list, V(ENRL)," is included in this profile, because V(ENRL) is not part of this profile
12.3.4	Request for LAS parameters by an LM DLE	Partial	See 5.2.2.2.6.6
12.3.5	Receipt of a link-master-parameter-reply SPDU by an LM DLE	Partial	See 5.2.2.2.6.7
12.3.6	Receipt of a token-hold-time-array SPDU by an LM DLE	NO	Token-hold-time array is distributed by the NM protocol
12.3.7	Receipt of a schedule-summary SPDU by an LM DLE	Partial	See 5.2.2.2.6.8 for the replacement text for IEC 61158-4, 12.3.7
12.3.8	Receipt of a sub-schedule SPDU by an LM DLE	Partial	See 5.2.2.2.6.9 for the replacement text for IEC 61158-4, 10.3.8
12.3.9	Request for LAS transfer by an LM DLE	Partial	See 5.2.2.2.6.10

5.2.2.2.6.5 IEC 61158-4, 12.3.1

The first paragraph and its bullets only are included in this profile. The second paragraph, beginning "The receiving LM DLE shall compare the schedule version-number …", and its bullets are not included in this profile, because the schedule is distributed via the Network Management protocol.

5.2.2.2.6.6 IEC 61158-4, 12.3.4

NOTE Only the parts of this subclause that are included in this profile are reprinted here. Other parts are not included in this profile, because the link master receives all parameters, except V(LL) via NM protocol.

A link master requires the following parameters to operate as the LAS:

a) the local link's configuration parameters defined in IEC 61158-4, 6.7.5;

b) the local-link-live-list, V(LL);

c) not used

d) the token-circulation-list, V(TCL);

e) the maximum-token-holding-time-array, V(MTHA);

f) the local link's schedule; and

g) a sense of the current LAS DLE's DL-time.

If a link master DLE does not have the necessary parameters required to operate as the LAS, as may be the case when the link master DLE has just changed its state to ONLINE, then the link master DLE shall schedule the transmission of the following SPDU to the local LAS in connectionless DT DLPDUs each with format 1S, NORMAL priority, a destination address of 0400_{16}, and a source address of V(TN).00:

— a live-list-request SPDU IEC 61158-4, 11.3.2.5, and

the link-master DLE shall note the need to transmit a CT DLPDU at its first opportunity.

After sending the SPDU, the sending DLE shall wait for reception of the live-list-detail SPDU.

If this SPDU is not received within fifteen receptions of a PT DLPDU with a token-use-subfield equal to RESTART, then the requesting LM DLE shall again schedule the transmission of the appropriate request SPDU for the missing reply SPDU.

5.2.2.2.6.7 IEC 61158-4, 12.3.5

NOTE The link master parameters are received via the NM protocol, but it is necessary to perform the check described in this subclause. Only the parts of this subclause that are included in this profile are reprinted here.

If the DLE's maximum-inactivity-to-claim-LAS-delay is less than or equal to the link's configured value of maximum-inactivity-to-claim-LAS-delay, V(MICD), then the DLE shall note that it is capable of operating as the local link's LAS.

5.2.2.2.6.8 IEC 61158-4, 12.3.7

NOTE The schedule-summary is received via NM protocol in a FMS domain download, but it is necessary to perform the check described in this subclause.

If the schedule version-number field of the received schedule-summary (see IEC 61158-4, 11.3.5.1) is non-zero, then

a) if either the DLE has no link schedule, or the schedule version-number of the link schedule stored in the specified domain is different than the schedule version-number field of the just received schedule-summary, and either the receiving DLE is not an LAS DLE, or the previously stored schedule in the specified domain is not active, then the DLE shall

   1) check that it is capable of executing the link schedule whose summary was just received. The DLE shall

      i) check that it has the capability to execute the number of sub-schedules in the schedule-summary, otherwise the DLE shall notify the local DL-management with the error "number of sub-schedules exceeds the capability" as specified in Table 90;

      ii) check that the DLE's value of maximum-scheduling-overhead, V(MSO), IEC 61158-4, 6.7.5.6 is less than or equal to the value of V(MSO) specified in the schedule-summary, otherwise the DLE shall notify the local DL-management with the error "required maximum-scheduling-overhead exceeds the capability" as specified in Table 90;

      iii) check that the DLE has the required storage capacity specified in the schedule-summary, otherwise the DLE shall notify the local DL-management with the error "not enough storage capacity" as specified in Table 90;

      iv) check that the DLE has the required timing resolution specified in the schedule-summary, otherwise the DLE shall notify the local DL-management with the error "required timing resolution exceeds the capability" as specified in Table 90;

      v) check that the link's configured value of V(MRD)x V(ST) is less than or equal to the value specified in the schedule-summary, otherwise the DLE shall notify the local DL-management with the error "required response-delay larger than the link's configured value" as specified in Table 90;

If any of these checks fail, then the DLE shall discard the just received schedule-summary.

   2) Otherwise, when these checks are all passed, then the DLE shall update the Network Management variables associated with the just received schedule-summary.

b) Otherwise, when the receiving DLE is an LAS DLE and the previously stored schedule in the specified domain is active, then the DLE shall discard the just received schedule-summary, and the DLE shall notify the local DL-management with the error "specified domain is active" as specified in Table 90.

c) Otherwise, when the DLE has a link schedule stored in the specified domain and the version-number of that link schedule is equal to the schedule version-number field of the just received schedule-summary, then the DLE shall discard the just received schedule-summary, and the DLE shall notify the local DL-management with the error "specified schedule already exists" as specified in Table 90.

Otherwise, when the schedule version-number field of the just received schedule-summary is zero, then the DLE shall record that there is no link schedule in the specified domain and the DLE shall update the Network Management variables associated with the just received schedule-summary.

If the LM DLE discards the just received schedule-summary, then it shall return an error to local DL- management, specifying the reason for discard. The errors (and their suggested coding) are listed in Table 90.

Table 90 – CP 1/1: DLL protocol selection of 12.3.7, specification of errors

Error	Description
1	Specified domain is active
2	Number of sub-schedules exceeds the capability
3	Required maximum-scheduling-overhead exceeds the capability
4	Not enough storage capacity
5	Required timing resolution exceeds the capability
6	Required response-delay larger than the link's configured value
7	Specified schedule already exists
8	Sub-schedule reference inconsistent with schedule-summary
9	Schedule version-number in sub-schedule inconsistent with schedule-summary

5.2.2.2.6.9 IEC 61158-4, 12.3.8, receipt of a sub–schedule SPDU by an LM DLE

NOTE The sub-schedule is received via the NM protocol in a FMS domain download, but it is necessary to perform the procedure described in this subclause.

If the schedule version-number field of the just received sub-schedule IEC 61158-4, 11.3.5.2 is equal to the schedule version-number field of the last received schedule-summary IEC 61158-4, 11.3.5.1 for the same domain, then

a) If the sub-schedule identifier field of the received sub-schedule is equal to a sub-schedule-SPDU reference included in the last received schedule-summary for the same domain, then the DLE shall store the sub-schedule as part of the link schedule.

b) Otherwise, when the sub-schedule identifier field of the received sub-schedule is equal to zero, then the DLE shall discard the just received sub-schedule.

c) Otherwise, when the sub-schedule identifier field of the received sub-schedule is neither equal to zero nor equal to a sub-schedule-SPDU reference included in the last received schedule-summary for the same domain, then the DLE has received a sub-schedule inconsistent with the DLE's last-received schedule-summary. Therefore the DLE shall discard the entire schedule for the specified domain and the DLE notify the local DL-management with the error "sub-schedule reference inconsistent with schedule-summary" as specified in Table 90.

d) Otherwise, when the schedule version-number field of the just received sub-schedule is not equal to the schedule version-number field of the last received schedule-summary for the same domain, or if the DLE had never received a schedule-summary for that domain, then the DLE shall discard the entire schedule for the specified domain the DLE notify the local DL-management with the error "schedule version-number in sub-schedule inconsistent with schedule-summary" as specified in Table 90.

5.2.2.2.6.10 IEC 61158-4, 12.3.9, request for LAS transfer by an LM DLE

This subclause is included in this profile, but with items (e) and (f) replaced by the following single item:

if a TL DLPDU is received, but is rejected as specified in IEC 61158-4, 7.20.4.2, then the LM DLE shall inform local DL-management of this failure.

5.2.2.2.6.11 IEC 61158-4, 12.4

The first paragraph immediately after IEC 61158-4, 12.4 is not included in this profile. Table 91 specifies the selection of the subclauses for this profile.

Table 91 – CP 1/1: DLL protocol selection of 12.4

Clause	Header	Presence	Constraints
12.4.1	Common features of the Type 1 bridge protocols and elements of procedure	Partial	Only subclauses (a), (b) and (c) are included in this profile
12.4.1.1	Introduction	Partial	Subclauses (d) and (e) are not included in this profile
12.4.1.2	Extent of specification	YES	—
12.4.1.3	Support of the DLL service	YES	—
12.4.1.4	Principles of operation	—	—
12.4.1.4.0	—	YES	—
12.4.1.4.1	Bridge operation	YES	—
12.4.1.4.2	Bridge Architecture	—	—
12.4.1.4.2.0	—	YES	—
12.4.1.4.2.1	Bridge management entity (BME)	YES	—
12.4.1.4.2.2	Root port determination	YES	—
12.4.1.4.2.3	Port state information	YES	—
12.4.1.4.2.4	Filtering database	Partial	All of this subclause, except (c), (d), (e) and associated notes is included
12.4.1.4.2.5	Republishing database	YES	—
12.4.1.4.3	Addressing	YES	—
12.4.1.4.4	Statistics and diagnostic information	YES	—
12.4.1.5	Detailed conceptual model of bridge functions (informative)	YES	—
12.4.2	Adaptive bridge sub-protocol and elements of procedure	NO	—
12.4.3	Non-adaptive bridge sub-protocol and elements of procedure	YES	—

5.2.2.2.6.12 IEC 61158-4, 12.5 – DL-management–information

Table 92 specifies the selection of the subclauses for this profile.

Table 92 – CP 1/1: DLL protocol selection of 12.5

Clause	Header	Presence	Constraints
12.5.1	Scope	Partial	This annex enumerates the set of DL-parameters, defined as variables in IEC 61158-4, 5.7, which need to be preconfigured before proper DLE operation is possible
12.5.2	DLE configuration parameters	—	—
12.5.2.1	Node-specific DL-configuration parameters	YES	—
12.5.2.2	Additional node-independent DL-configuration parameters	Partial	This subclause is included in this profile except for the assignments to the V(MRC), V(NRC), V(NDL) and V(MEP) parameters
12.5.2.3	Additional node-independent DL-configuration parameters for link-master class DLEs	Partial	This subclause is included in this profile except for the assignments to the V(MRC), V(NRC), V(NDL), V(MEP) and V(MST) parameters
12.5.2.4	Additional node-independent DL-configuration parameters for bridge class DLEs	Partial	This subclause is included in this profile except for the assignments to the V(MRC), V(NRC), V(NDL), V(MEP) and V(MST) parameters and all of the configuration parameters defined in ISO/IEC 10038
12.5.2.5	Node-independent Ph-configuration parameters required for minimal DL-communication	YES	—
12.5.3	DLE-collected fault-management data	—	—
12.5.3.1	Required statistical measures	—	—
12.5.3.1.1	Transmission-related statistical measures	Partial	This subclause is included in this profile except for item b)
12.5.3.1.2	Reception-related statistical measures	Partial	This subclause is included in this profile except for item e)
12.5.3.1.3	Additional reception-related statistical measures required of a bridge DL	NO	—
12.5.3.2	Additional required DLE-collected fault-management data	YES	—
12.5.3.3	Additional statistical measures	YES	—
12.5.4	DLE Variables which can be read and set by DL—management	NO	—
12.5.5	DLE Actions Requestable by DL-management	NO	—

5.2.2.2.6.13 IEC 61158-4, 12.6

The profiles of IEC 61158-4, 12.6 and its subclauses apply. The values for this profile are given in Table 93.

Table 93 – CP 1/1: DLL protocol selection of 12.6

Clause	Header	Presence	Constraints
12.6.1	Support for Long address	YES	—
12.6.2 a)	Priorities	YES	Multi
12.6.2 b)	Data Delivery for Connection Mode	Partial	B, although this profile does not include Ordered and Unordered Peer DLC
12.6.2 c)	Subscriber to Publisher Data	NO	—
12.6.2 d)	DLSDU Segmentation ratio	Partial	1
12.6.2 e)	Timeliness	YES	All choices
12.6.2 f)	DL-Time stamp	NO	—
12.6.2 g)	Data Delivery for Connection-less	YES	Z
12.6.3 a)	Time synchronization class	Partial	Depends upon the device profile
12.6.3 b)	Request for time-based scheduling from DLS-user	NO	—
12.6.3 c)	LAS scheduling capability	YES	STATIC

5.2.3 Application Layer

5.2.3.1 AL service selection

Table 94 specifies the AL subclause selection within IEC 61158-5.

Table 94 – CP 1/1: AL service selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Uses only a subset of the references
3	Terms and definitions	Partial	Uses only a subset of the definitions
4	Concepts	Partial	Uses only a subset of the concepts, as reflected by the selected classes and services
5	Data type ASE	—	See Table 95
5.4	Data type ASE Service Specification	YES	—
5.5	Summary of data types	YES	—
6 — 13		NO	—
14	Communication model type 9 specification	YES	—
15		NO	—
Annex A	Model for service error reporting	YES	—

Table 95 – CP 1/1: AL service selection of Clause 3

Clause	Header	Presence	Constraints
5.1	Overview	YES	—
5.2	Formal Definition of Data Type Objects	YES	Restricts nesting level of constructed types to 1. That is, constructed types cannot contain constructed types. Additionally, arrays of constructed types is not permitted
5.3	FAL Defined Data Types	—	Supports only a subset of the data types, as shown in the remainder of this table
5.3.1	Fixed Length Types	—	—
5.3.1.1	Boolean	YES	—
5.3.1.3	Integer8	YES	—
5.3.1.5	Integer16	YES	—
5.3.1.7	Integer32	YES	—
5.3.1.9	Integer64	YES	—
5.3.1.11	Unsigned8	YES	—
5.3.1.13	Unsigned16	YES	—
5.3.1.15	Unsigned32	YES	—
5.3.1.20	Floating Point	YES	—
5.3.1.26	Date	YES	—
5.3.1.28	TimeOfDay	YES	—
5.3.1.32	TimeDifference	YES	—
5.3.1.35	TimeValue	YES	—
5.3.2.1	VisibleString	YES	—
5.3.2.2	OctetString	YES	—
5.3.2.3	BitString	YES	—
5.4	Data type ASE Service Specification	YES	—
5.5	Summary of data types	YES	—

5.2.3.2 AL protocol selection

Table 96 specifies the AL protocol selection within IEC 61158-6.

Table 96 – CP 1/1: AL protocol selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Uses only a subset of the references
3	Terms and definitions	—	—
3.1	Definitions from other ISO/IEC standards	YES	—
3.2	Definitions from IEC 61158-5	YES	—
3.3	Other definitions	Partial	Only Type 1 and Type 9 definitions apply
3.4	Abbreviations and symbols	Partial	Only Type 1 and Type 9 abbreviations and symbols apply
3.5	Conventions	Partial	Only Type 1 and Type 9 conventions apply
3.6	Conventions used in State Machines	Partial	Only conventions for Type 1 and Type 9 state machines apply
4 – 11	–-	NO	—
12	Type 9	YES	—
13	Type 10	NO	

5.3 Profile 1/2 – FF HSE

NOTE This profile supports communications through both local- and wide-area network infrastructures. It is readily obtainable as commercial off-the-shelf (COTS) technology.

5.3.1 Physical Layer

Any appropriate Physical Layer(s) for ISO/IEC 8802-3 may be used. The specific Physical Layer options selected shall be documented in the statement of conformance.

5.3.2 Data Link Layer

5.3.2.1 MAC sublayer

ISO/IEC 8802-3 shall be used. Any standard options selected shall be documented in the statement of conformance.

5.3.2.2 LLC sublayer

ISO/IEC 8802-2 shall be used. Any standard options selected shall be documented in the statement of conformance.

5.3.2.3 Security on LANs (optional)

ISO/IEC 8802-10 may be used. Any standard options selected shall be documented in the statement of conformance.

5.3.3 Network Layer

Internet standard RFC 791 (IP, Internet Protocol) and its amendments and successors shall be used. Any standard options selected shall be documented in the statement of conformance.

5.3.4 Transport Layer

Internet standard RFC 768 (UDP, User Datagram Protocol) and its amendments and successors shall be used. Any standard options selected shall be documented in the statement of conformance.

Internet standard RFC 793 (TCP, Terminal Control Protocol) and its amendments and successors may be used. Any standard options selected shall be documented in the statement of conformance.

5.3.5 Application Layer

5.3.5.1 AL service selection

Table 97 specifies the AL service selection within IEC 61158-5.

Table 97 – CP 1/2: AL service selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Uses only a subset of the references
3	Definitions	Partial	Uses only a subset of the definitions
4	Concepts	Partial	Uses only a subset of the concepts, as reflected by the selected classes and services
5	Data type ASE	—	Same as selected for the H1 Profile. See Table 94 above
6 – 9	–-	NO	—
10	Communication model type 5 specification	YES	—
12 – 14	–-	NO	—
15	Communication model type 9 specification	—	See Table 98
16	Communication model type 10 specification	NO	—
Annex A	Model for service error reporting	YES	—

Table 98 – CP 1/2: AL service selection of Clause 15

Clause	Header	Presence	Constraints
15.1	Type 9 Concepts	YES	—
15.2	Type 9 ASEs	YES	—
15.2.1	Virtual Field Device ASE	YES	—
15.2.2	Object Dictionary (OD) ASE	YES	—
15.2.3	Context Management ASE	YES	—
15.2.4	Application Relationship ASE	–-	—
15.2.4.1	Overview	YES	—
15.2.4.2	Application Relationship Endpoint Class Specifications	YES	—
15.2.4.3	Application Relationship ASE Service Specifications	–-	—
15.2.4.3.1	AR-Unconfirmed Send Service	YES	—
15.2.4.3.2	AR-Confirmed Send Service	YES	—
15.2.4.3.3	AR-Abort Service	YES	—
15.2.4.3.4 – 15.2.4.3.7	AR-Compel Service	NO	—
15.2.5	Variable ASE	YES	—
15.2.6	Event ASE	YES	—
15.2.7	Load Region ASE	YES	—
15.2.8	Function Invocation ASE	YES	—
15.3	Type 9 ARs	YES	—
15.4	Summary of Type 9 Classes	YES	—
15.5	Permitted Type 9 Type 9 Services by AREP Role	YES	—

5.3.5.2 AL protocol selection

Table 99 specifies the AL protocol selection within IEC 61158-6.

Table 99 – CP 1/2: AL protocol selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Uses only a subset of the references
3	Definitions	—	—
3.1	Definitions from other ISO/IEC standards	YES	—
3.2	Definitions from IEC 61158-5	YES	—
3.3	Other definitions	Partial	Type 1 and Type 5 definitions apply. A subset of the Type 9 definitions applies, as referenced by Clause 8
3.4	Abbreviations and symbols	Partial	Type 1 and Type 5 abbreviations and symbols apply. A subset of the Type 9 abbreviations and symbols apply, as referenced by Clause 8
3.5	Conventions	Partial	Type 1 and Type 5 conventions apply. A subset of the Type 9 conventions applies, as referenced by Clause 8
3.6	Conventions used in State Machines	Partial	Conventions for Type 1 and Type 5 state machines apply. A subset of the Type 9 conventions applies, as referenced by Clause 8
4	Type 1	NO	—
5	Type 2	NO	—
6	Type 3	NO	—
7	Type 4	NO	—
8	Type 5	NO	—
9	Type 6	NO	—
10	Type 7	NO	—
11	Type 8	NO	—
12	Type 9	Partial	Uses only a subset of the subclauses, as referenced by Clause 8
13	Type 10	NO	—

5.4 Profile 1/3 – FF H2

NOTE This profile is similar to 5.2, but with a different and more varied selection of Physical Layer data rates. It provides a migration path for existing CPF 5/1 installations, such that passive media components are unaffected by the migration.

5.4.1 Physical Layer

Table 100 specifies the PhL selection for FF H2 devices, using either 150 Ω twisted-pair or dual-fibre optical media.

Table 100 – CP 1/3: PhL selection for FF H2 devices

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2	Type 1: Terms and definitions	YES	—
3.3 – 3.7	---	NO	—
4	Symbols and abbreviations	—	—
4.1	Symbols	—	—
4.1.1	Type 1: Symbols	YES	—
4.1.2 – 4.1.6	---	NO	—
4.2	Abbreviations	—	—
4.2.1	Type 1: Additional abbreviations	YES	—
4.2.2 – 4.2.6	---	NO	—
5	Data Link Layer – Physical Layer interface	—	—
5.1	General	Partial	Used as needed
5.2	Type 1: Required services	YES	—
5.3 – 5.7	---	NO	—
6	Station Management – Physical Layer interface	—	—
6.1	General	Partial	Used as needed
6.2	Type 1: Station Management - Physical Layer interface	YES	—
6.3 – 6.7	---	NO	—
7	DCE Independent Sublayer (DIS)	—	—
7.1	General	Partial	Used as needed
7.2	Type 1: DIS	YES	—
7.3 – 7.5	---	NO	—
8	DTE – DCE interface	—	—
8.1	General	Partial	Used as needed
8.2	Type 1: DTE – DCE interface	YES	—
8.3 – 8.4	---	NO	—
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	Partial	Used as needed
9.2	Type 1: MDS: Wire and optical media	YES	—
9.3 – 9.8	---	NO	—
10	MDS – MAU interface	—	—
10.1	General	Partial	Used as needed
10.2	Type 1: MDS – MAU interface: wire and optical media	YES	—
10.3 – 10.6	---	NO	—
11	Type 1 and 7: Medium Attachment Unit: voltage mode, linear-bus-topology, 150 Ω twisted-pair wire medium	YES	See Note 1
12 – 14	---	NO	—
15	Type 1 and 7: Medium Attachment Unit: dual-fibre optical media	YES	See Note 1
16 – 28	—	NO	—
Annex A	Type 1: Connector specification		
A.1	Internal Connector for wire medium	YES	See Note 2
A.2	External Connectors for wire medium	YES	See Note 2
A.3	External Connectors for optical medium	YES	See Note 2
Annex B – M	—	NO	—

NOTE 1 The selection is an alternate solution. All selected solutions are required to operate at a single common data rate

NOTE 2 The selection is an alternate solution, depending on the solution chosen from Clauses 11 or 15

Table 101 specifies the PhL selection for FF H2 media and related components, either for 150 Ω twisted-pair or for dual-fibre optical media.

Table 101 – CP 1/3: PhL selection for FF H2 media and related components

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2	Type 1: Terms and definitions	YES	—
3.3 – 3.7	---	NO	—
4	Symbols and abbreviations	—	—
4.1	Symbols	—	—
4.1.1	Type 1: Symbols	YES	—
4.1.2 – 4.1.6	---	NO	—
4.2	Abbreviations	—	—
4.2.1	Type 1: Additional abbreviations	YES	—
4.2.2 – 4.2.6	---	NO	—
5 – 10	---	NO	—
11	Type 1 and 7: Medium Attachment Unit: voltage mode, linear-bus-topology 150 Ω twisted-pair wire medium	YES	See Note 1
12 – 14	---	NO	—
15	Type 1 and 7: Medium Attachment Unit: dual-fibre optical media	YES	See Note 1
16 – 28	—	NO	—
Annex A	Type 1: Connector specification		
A.1	Internal Connector for wire medium	YES	See Note 2
A.2	External Connectors for wire medium	YES	See Note 2
A.3	External Connectors for optical medium	YES	See Note 2
Annex B	Type 1: Cable specifications and trunk and spur lengths for the 31,25 kbit/s voltage-mode MAU	NO	—
Annex C	Type 1: Optical passive stars	Partial	See Note 2
Annex D	Type 1: Star topology	NO	See Note 2
Annex E	Type 1: Alternate fibres	NO	See Note 2
Annex F – M		NO	—

NOTE 1 The selection is an alternate solution. All selected solutions are required to operate at a single common data rate

NOTE 2 The selection is an alternate solution, depending on the solution chosen from Clauses 11 or 15

5.4.2 Data Link Layer

See 5.2.1.4

5.4.3 Application Layer

See 5.2.3

6 Communication Profile Family 2 (ControlNet™[8])

6.1 General overview

Communication Profile Family 2 defines two communication profiles based on IEC 61158-2 through IEC 61158-6, protocol type 2, which correspond to parts of a communication system commonly known as ControlNet.

1) Profile 2/1 ControlNet
   This profile contains a selection of AL, DLL and PhL services and protocol definitions from IEC 61158-2 through IEC 61158-6, protocol type 2.

2) Profile 2/2 EtherNet/IP™[9]
   This profile contains a selection of AL, DLL and PhL services and protocol definitions from IEC 61158-4 through IEC 61158-6, protocol type 2, and the TCP/UDP/IP/Ethernet protocol suite.

NOTE See A.2 for an overview of ControlNet communications concepts.

6.2 Profile 2/1 ControlNet

6.2.1 Physical Layer

Table 102 specifies the PhL selection within IEC 61158-2.

---

8 ControlNet™ is a trade name of ControlNet International, an independent organisation of users and vendors of ControlNet products. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name ControlNet. Use of the trade name ControlNet requires permission of the trade name holder.

9 EtherNet/IP™ is a trade name of ControlNet International and ODVA, two independent organisations of users and vendors of EtherNet/IP products. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name EtherNet/IP. Use of the trade name EtherNet/IP requires permission of the trade name holder(s).

Table 102 – CP 2/1: PhL selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Relevant definitions only
3.2	—	NO	—
3.3	Type 2: Terms and definitions	YES	—
3.4 – 3.7	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Symbols	—	—
4.1.1	—	NO	—
4.1.2	Type 2: Symbols	YES	—
4.1.3 – 4.1.6	—	NO	—
4.2	Abbreviations	—	—
4.2.1	—	NO	—
4.2.2	Type 2: Abbreviations	YES	—
4.2.3 – 4.2.6	—	NO	—
5	Data Link Layer – Physical Layer interface	—	—
5.1	General	YES	—
5.2	—	NO	—
5.3	Type 2: Required services	YES	—
5.4 – 5.7	—	NO	—
6 – 8	—	NO	—
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	YES	—
9.2 – 9.3	—	NO	—
9.4	Type 2: MDS: Wire and optical media	YES	—
9.5 – 9.8	—	NO	—
10	MDS – MAU interface	—	—
10.1	General	YES	—
10.2 – 10.3	—	NO	—
10.4	Type 2: MDS – MAU interface: Wire and optical media	YES	Used MAU(s) are selected at device level
10.5 – 10.6	—	NO	—
11 – 17	—	NO	—
18	Type 2: Medium Attachment Unit: 5 Mbit/s, voltage-mode, coaxial wire medium	YES	Used MAU(s) are selected at device level
19	Type 2: Medium Attachment Unit: 5 Mbit/s, optical medium	YES	Used MAU(s) are selected at device level
20	Type 2: Medium Attachment Unit: Network Access Port (NAP)	YES	Used MAU(s) are selected at device level
21 – 28	—	NO	—
Annex A – E	—	NO	—
Annex F	(normative) Type 2: Connector specification	YES	—
Annex G	(normative) Type 2: Repeater machine sublayers (RM, RRM) and redundant Physical Layers	YES	—
Annex H	(informative) Type 2: Reference design examples	YES	—
Annex I – M	—	NO	—

6.2.2 Data Link Layer

6.2.2.1 DLL service selection

Table 103 specifies the DLL service selection within IEC 61158-3.

Table 103 – CP 2/1: DLL service selection

Clause	Header	Presence	Constraints
1	Scope and object	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Reference model definitions	Partial	Used in type 2 when applicable
3.2	Service convention definitions	Partial	Used in type 2 when applicable
3.3	Common Data Link Service definitions	Partial	Relevant definitions only
3.4	—	NO	—
3.5	Type 2: additional Data Link Service definitions	YES	—
3.6 – 3.10	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Common symbols and abbreviations	Partial	Relevant symbols and abbreviations only
4.2	—	NO	—
4.3	Type 2: additional symbols and abbreviations	YES	—
4.4 – 4.8	—	NO	—
5	Conventions	—	—
5.1	General conventions	Partial	Used in type 2 when applicable
5.2	—	NO	—
5.3	Type 2: additional conventions	YES	—
5.4 – 5.8	—	NO	—
6 – 11	—	NO	—
12	Type 2: Connection-mode and connectionless-mode Data Link Service	YES	—
13	Type 2: DL-management Services	YES	—
14 – 20	—	NO	—

6.2.2.2 DLL protocol selection

Table 104 specifies the DLL protocol selection within IEC 61158-4.

Table 104 – CP 2/1: DLL protocol selection

Clause	Header	Presence	Constraints
1	Scope and object	—	—
1.0	—	Partial	Type 2 only
1.1	Specifications	—	—
1.1.0	—	YES	—
1.1.1	—	NO	—
1.1.2	Type 2: Additional characteristics	YES	—
1.1.3 – 1.1.8	—	NO	—
1.2	Procedures	YES	—
1.3	Applicability	YES	—
1.4	Conformance	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Reference model terms and definitions	Partial	Used in type 2 when applicable
3.2	Service convention terms and definitions	Partial	Used in type 2 when applicable
3.3	Common terms and definitions	Partial	Relevant definitions only
3.4	—	NO	—
3.5	Type 2: additional terms and definitions	YES	—
3.6 – 3.11	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Common symbols and abbreviations	Partial	Relevant symbols and abbreviations only
4.2	—	NO	—
4.3	Type 2: additional symbols and abbreviations	YES	—
4.4 – 4.9	—	NO	—
5	DL-protocol elements common to multiple DL-protocol Types	—	—
5.1	Frame check sequence	—	—
5.1.0	—	Partial	Table 1, use only type 2 definition
5.1.1	At the sending DLE	YES	—
5.1.2	At the receiving DLE	YES	—
5.1.3	Modification within bridges	NO	—
6 – 13	—	NO	—
14	Type 2: Overview of the DL-protocol	YES	—
15	Type 2: General structure and encoding of PhIDUs and DLPDUs and related elements of procedure	YES	—
16	Type 2: Specific DLPDU structure, encoding and procedures	YES	—
17	Type 2: Objects for station management	—	See Table 105
18	Type 2: Other DLE elements of procedure	YES	—
19	Type 2: Detailed specification of DL components	YES	—
20 – 32	—	NO	—
Annex A	(informative) – Types 1, 2, 3 (synchronous), 5 (first FCS), 6, 7 and 8: Exemplary FCS implementations	Partial	See Note
Annex B – C	—	NO	—
Annex D	(informative) – Type 2: Indicators and Switches	YES	—
Annex E – J	—	NO	—
NOTE The feedback patterns and logic for checking the received residual are not correct for HDLC. This is stated in the text, and must be understood by the reader			

Table 105 specifies the management objects selection.

Table 105 – CP 2/1: DLL protocol selection of management objects

Clause	Header	Presence	Constraints
17	Type 2: Objects for station management	—	—
17.1	General	Partial	Relevant objects only
17.2	ControlNet object	YES	—
17.3	Keeper object	YES	—
17.4	Scheduling object	YES	—
17.5	TCP/IP interface object	NO	—
17.6	Ethernet link object	NO	—

6.2.3 Application Layer

6.2.3.1 AL service selection

Table 106 specifies the AL service selection within IEC 61158-5.

Table 106 – CPF 2: AL service selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	Partial	Relevant definitions only
4	Concepts	Partial	Differences are indicated in IEC 61158-5, 7.1
5	Data type ASE	Partial	Selection and restrictions are specified in IEC 61158-5, 7.1.5
6	Communication model type 1 specification	NO	—
7	Communication model type 2 specification	—	—
7.1	Type 2 Concepts	YES	—
7.2	Type 2 ASEs	—	—
7.2.1	Type 2 Object Management ASE	—	—
7.2.1.1	Overview	YES	—
7.2.1.2	FAL Management Model Class Specification	—	—
7.2.1.2.1	General Type 2 Formal Model	YES	—
7.2.1.2.2	Identity Formal Model	YES	—
7.2.1.2.3	Assembly Formal Model	YES	—
7.2.1.2.4	Message Router Formal Model	YES	—
7.2.1.3	FAL Management Model ASE Service Specification	YES	—
7.2.2	Connection Manager ASE	—	—
7.2.2.1	Overview	YES	—
7.2.2.2	Connection Manager Class Specification	—	—
7.2.2.2.1	Connection Manager Formal Model	YES	Single class in this ASE
7.2.2.3	Connection Manager ASE Service Specification	YES	—
7.3	Type 2 AR's	YES	—
7.4	Summary of FAL Type 2 Classes	YES	—
7.5	Permitted FAL Type 2 Services by AR Type	YES	—
8 – 15	—	NO	—

6.2.3.2 AL protocol selection

Table 107 specifies the AL protocol selection within IEC 61158-6.

Table 107 – CP 2/1: AL protocol selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Summary	YES	—
3.2	Terms and definitions from other ISO/IEC standards	Partial	Relevant definitions only
3.3	Terms and definitions from IEC 61158-5	Partial	Relevant definitions only
3.4	Other terms and definitions	—	—
3.4.1	Summary	YES	—
3.4.2	Type 1 Terms and definitions	Partial	Relevant definitions only
3.4.3	Type 2 Terms and definitions	YES	—
3.4.4 – 3.4.11	—	NO	—
3.5	Abbreviations and symbols	—	—
3.5.1	Common note	YES	—
3.5.2	Type 1 Abbreviations and symbols	Partial	Relevant abbreviations and symbols only
3.5.3	Type 2 Abbreviations and symbols	YES	—
3.5.4 – 3.5.11	—	NO	—
3.6	Conventions	YES	—
3.6.1	General concept	YES	—
3.6.2	Conventions for Type 1	NO	—
3.6.3	Conventions for Type 2	YES	—
3.6.4 – 3.6.11	—	NO	—
3.7	Conventions used in state machines	—	—
3.7.1	Conventions for Type 1	NO	—
3.7.2	Conventions for Type 2	YES	—
3.7.3 – 3.7.10	—	NO	—
4	Type 1	NO	—
5	Type 2	—	—
5.1	Type 2 abstract syntax	—	—
5.1.1	FAL PDU abstract syntax	YES	—
5.1.2	Data abstract syntax specification	YES	—
5.1.3	Encapsulation abstract syntax	NO	—
5.2	Type 2 transfer syntax	YES	—
5.3	Structure of Type 2 FAL protocol state machines	YES	—
5.4	Type 2 AP context state machine	YES	—
5.5	FAL service protocol machine (FSPM)	YES	—
5.6	Application relationship protocol machines (ARPMs)	YES	—
5.7	DLL mapping protocol machine (DMPM)	YES	—
5.8	Alternate DLL mapping protocol machine	NO	—
6 – 13	—	NO	—

6.3 Profile 2/2 EtherNet/IP

6.3.1 Physical Layer

The Physical Layer of the Ethernet/IP profile is according to ISO/IEC 8802-3.

Recommended connectors and cables are specified in ODVA/CI EtherNet/IP Specification.

6.3.2 Data Link Layer

6.3.2.1 DLL service selection

The Data Link Layer of the Ethernet/IP profile is according to ISO/IEC 8802-3.

6.3.2.2 DLL protocol selection

The Data Link Layer of the Ethernet/IP profile is according to ISO/IEC 8802-3.

Table 108 specifies the DLL protocol selection within IEC 61158-4.

Table 108 – CP 2/2: DLL protocol selection

Clause	Header	Presence	Constraints
1	Scope and object	—	—
1.0	—	Partial	Type 2 only
1.1	Specifications	—	—
1.1.0	—	YES	—
1.1.1 – 1.1.8	—	NO	—
1.2	Procedures	YES	—
1.3	Applicability	YES	—
1.4	Conformance	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Reference model terms and definitions	Partial	Used in type 2 when applicable
3.2	Service convention terms and definitions	Partial	Used in type 2 when applicable
3.3	Common terms and definitions	Partial	Relevant definitions only
3.4	Type 1: additional terms and definitions	NO	—
3.5	Type 2: additional terms and definitions	YES	—
3.6 – 3.11	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Common symbols and abbreviations	Partial	Relevant symbols and abbreviations only
4.2	Type 1: additional symbols and abbreviations	NO	—
4.3	Type 2: additional symbols and abbreviations	YES	—
4.4 – 4.9	—	NO	—
5 – 15	—	NO	—
16	Type 2: Specific DLPDU structure, encoding and procedures	—	—
16.1	Modeling language	YES	—
16.2 – 16.13	—	NO	—
17	Type 2: Objects for station management	—	See Table 109
18 – 32	—	NO	—
Annex A – C	—	NO	—
Annex D	(informative) – Type 2: Indicators and Switches	—	—
D.1	Purpose	YES	—
D.2	General indicator requirements	Partial	Only one network indicator is required
D.3	Common indicator requirements	—	—
D.3.1	Applicability of common requirements	YES	—
D.3.2	Visibility of indicators	YES	—
D.3.3	Indicator flash rate	YES	—
D.3.4	Indicators at power up	NO	—
D.4	Module status indicator	—	—
D.4.1	Behavior	YES	—
D.4.2	Labeling	Partial	For labeling, “OK” and “status” are not used, “Mod” is allowed
D.5	Network status indicators	—	—
D.5.1	Description	Partial	Only one network indicator is required
D.5.2 – D.5.6	—	NO	—
D.6	Switches	NO	—
Annex E – J	—	NO	—

Table 109 specifies the management objects selection.

Table 109 – CP 2/2: DLL protocol selection of management objects

Clause	Header	Presence	Constraints
17	Type 2: Objects for station management	—	—
17.1	General	Partial	Relevant objects and features only
17.2	ControlNet object	NO	—
17.3	Keeper object	NO	—
17.4	Scheduling object	NO	—
17.5	TCP/IP interface object	YES	—
17.6	Ethernet link object	YES	—

6.3.3 Application Layer

6.3.3.1 AL service selection

The AL service selection within IEC 61158-5 for this 2/2 profile is identical to the selection for the 2/1 profile, as specified in Table 106.

In addition AL services are mapped onto the TCP/UDP/IP protocol suite, as defined in RFC 768, RFC 791, RFC 792, RFC 793, RFC 826, RFC 894, RFC 1112 and RFC 2236.

6.3.3.2 AL protocol selection

Table 110 specifies the AL protocol selection within IEC 61158-6.

Table 110 – CP 2/2: AL protocol selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Summary	YES	—
3.2	Terms and definitions from other ISO/IEC standards	Partial	Relevant definitions only
3.3	Terms and definitions from IEC 61158-5	Partial	Relevant definitions only
3.4	Other terms and definitions	—	—
3.4.1	Summary	YES	—
3.4.2	Type 1 Terms and definitions	Partial	Relevant definitions only
3.4.3	Type 2 Terms and definitions	YES	—
3.4.4 – 3.4.11	—	NO	—
3.5	Abbreviations and symbols	—	—
3.5.1	Common note	YES	—
3.5.2	Type 1 Abbreviations and symbols	Partial	Relevant abbreviations and symbols only
3.5.3	Type 2 Abbreviations and symbols	YES	—
3.5.4 – 3.5.11	—	NO	—
3.6	Conventions	YES	—
3.6.1	General concept	YES	—
3.6.2	Conventions for Type 1	NO	—
3.6.3	Conventions for Type 2	YES	—
3.6.4 – 3.6.11	—	NO	—
3.7	Conventions used in state machines	—	—
3.7.1	Conventions for Type 1	NO	—
3.7.2	Conventions for Type 2	YES	—
3.7.3 – 3.7.10	—	NO	—
4	Type 1	NO	—
5	Type 2	—	—
5.1	Type 2 abstract syntax	YES	—
5.2	Type 2 transfer syntax	YES	—
5.3	Structure of Type 2 FAL protocol state machines	YES	—
5.4	Type 2 AP context state machine	YES	—
5.5	FAL service protocol machine (FSPM)	YES	—
5.6	Application relationship protocol machines (ARPMs)	YES	—
5.7	DLL mapping protocol machine (DMPM)	NO	—
5.8	Alternate DLL mapping protocol machine	YES	—
6 – 13	—	NO	—

In addition, the AL protocol is mapped onto the TCP/UDP/IP protocol suite, as defined in RFC 768, RFC 791, RFC 792, RFC 793, RFC 826, RFC 894, RFC 1112 and RFC 2236.

7 Communication Profile Family 3 (PROFIBUS[10])

7.1 General overview

Communication Profile Family 3 (CPF3) defines communication profiles based on IEC 61158-2 through IEC 61158-6, using Type 3 and Type 10, which corresponds to parts of the communication systems commonly known as PROFIBUS and PROFInet. Table 111 give an overview of the specified profile sets.

Table 111 – CPF 3: overview of profile sets

Layer	Profile 3/1				Profile 3/2	Profile 3/3
Application	Type 3 of IEC 61158-5, -6					Type 10 of IEC 61158-5, -6
Data Link	Type 3 of IEC 61158-3, -4 Asynchronous transmission				Type 3 of IEC 61158-3, -4 Synchronous transmission	ISO/IEC 8802-3
Physical	0[a]	2[a]	3[a]	4[a]	1[a]	ISO/IEC 8802-3

[a] These numbers are the CP identifier used within Communication Feature List (GSD) in keyword "*Physical Interface*".

Coding: 0: RS 485 (ANSI TIA/EIA RS-485-A);optional RS 485-IS
1: Manchester coded and bus powered (MBP); optional IS (MBP-IS) and lower power (MBP-LP)
2: Plastic fiber;
3: Glass multi mode fiber or Glass single mode fiber;
4: PCF fiber;

NOTE 1 PROFIBUS uses Profile 3/1 and 3/2. PROFIBUS DP is the name of AL protocol and service part, which is identical for CP 3/1 and CP 3/2 and uses the Type 3 DL parts.

NOTE 2 PROFInet uses Profile 3/3.

NOTE 1 See A.3 for an overview of PROFIBUS communications concepts and definition of DP-V0, DP-V1 and Options.

An implementation profile like temperature transmitter or master device shall select from CPF 3 these behaviours that are needed for a certain device type. The manufacturer of a device shall describe the selection for CP 3/1 and CP 3/2 by writing a Communication Feature List (GSD). The GSD is necessary to specify an implementation profile and is specified in ISO 15745-3. CP 3/3 specifies an Ethernet based communication system.

NOTE 2 It is recommended to perform a conformance test, which is not normative but specified within the consortium PROFIBUS International. Each CP 3/1 and CP 3/2 conformant device shall have a type specific GSD, which is part of the conformance test.

The CPF3 PROFIBUS consists of three distinct profile sets:

a) Profile 3/1
Profile 3/1 is a subset of IEC 61158 Type 3 services and protocols and uses the as Physical Layer (PhL) four different MAU, see Table 111. A Communication Profile (CP) identifier identifies these.

b) Profile 3/2
Profile 3/2 is a subset of IEC 61158 Type 3 services and protocols and uses the Manchester coded bus powered (MBP) synchronous transmission of PhL specified in Type 3. Based on different transmission technologies for PROFIBUS DP the DLL contains different interfaces to the PhL. That causes different communication profiles for PROFIBUS DP.
The MBP non-IS PhL is the basis for the extended specification for IS (MBP-IS) and low power (MBP-LP) capability. MBP-LP supports IS. Slave devices with a MAU supporting MBP-LP are also usable in systems that require MBP-IS or MBP. Slave devices with a

[10] PROFIBUS Logo is the registered trademark of PROFIBUS Nutzer Organisation (PNO). PNO is a non-profit trade organization to support the fieldbus PROFIBUS. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the registered trademark. Use of the registered trademark PROFIBUS Logo requires permission of the trade name holder.

MAU supporting MBP-IS are also usable in a system that requires MBP. Figure 3 shows this hierarchy.

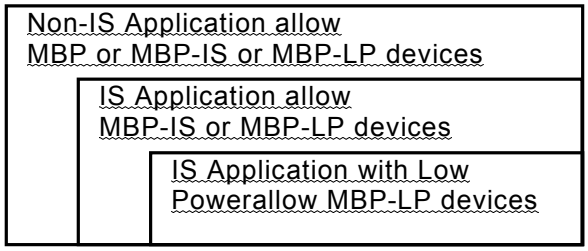

Figure 3 – CP 3/2 Slave devices usable in applications

c) Profile 3/3
Profile 3/3 contains a selection of AL services and protocol definitions from IEC 61158-5 and IEC 61158-6, protocol type 10, and the TCP/IP/Ethernet protocol suite.

NOTE Profile 3/3 deploys the DCE-RPC (CAE Specification, OSF 9046) and DCOM* (The Component Object Model Specification) as the implementation technology for the abstract ORPC model defined in Type 10. However, other technologies may be applied to conform to this International Standard.
** DCOM is a trade name of Microsoft Corporation. This implementation example is given for the convenience of the user of this international Standard and does not constitute an endorsement by IEC of DCOM.*

7.2 Profile 3/1

7.2.1 Physical Layer

7.2.1.1 PhL selection

Table 112 specifies the selection of IEC 61158-2 for devices of all types of this profile. Subclause 7.2.1.2 specifies additional considerations.

Table 112 – CP 3/1: PhL selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	Partial	See Table 113
4	Symbols and abbreviations	Partial	See Table 114
5	Data Link Layer - Physical Layer interface	—	—
5.1	General	YES	—
5.2 – 5.3	—	NO	—
5.4	Type 3: Required services	—	—
5.4.1	Synchronous transmission	NO	—
5.4.2	Asynchronous transmission	YES	—
5.5 – 5.7	—	NO	—
6	Station Management – Physical Layer interface	—	—
6.1	General	YES	—
6.2	—	NO	—
6.3	Type 3: Station Management – Physical Layer interface	—	—
6.3.1	Synchronous transmission	NO	—
6.3.2	Asynchronous transmission	YES	—
6.4 - 6.6	—	NO	—
7	DCE Independent Sublayer (DIS)	—	—
7.1	General	YES	—
7.2	—	NO	—
7.3	Type 3: DIS	—	—
7.3.1	Synchronous transmission	NO	—
7.3.2	Asynchronous transmission	YES	—
7.4 – 7.5	—	NO	—
8	DTE – DCE interface	—	—
8.1	General	YES	—
8.2	—	NO	—
8.3	Type 3: DTE — DCE interface	—	—
8.3.1	Synchronous transmission	NO	—
8.3.2	Asynchronous transmission	YES	—
8.4	—	NO	—
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	YES	—
9.2 – 9.4	—	NO	—
9.5	Type 3: MDS: Wire and optical media	—	—
9.5.1	Synchronous Transmission	NO	—
9.5.2	Asynchronous Transmission	YES	—
9.6 – 9.8	—	NO	—
10	MDS – MAU interface	—	—
10.1	General	YES	—
10.2 – 10.4	—	NO	—
10.5	Type 3: MDS - MAU interface: Wire and optical media	—	—
10.5.1	Synchronous Transmission	NO	—
10.5.2	Asynchronous Transmission	YES	—
10.6	—	NO	—
11 – 21	—	NO	—
22	Type 3: Medium Attachment Unit: Asynchronous Transmission, wire medium	YES	For CP 0
23	Type 3: Medium Attachment Unit: Asynchronous Transmission, optical medium	YES	For CP 2, 3, 4
24 – 28	---	NO	—
Annex A – H	—	NO	—
Annex I	(normative) Type 3: Connector specification	---	—
I.1	Connector for synchronous transmission	NO	—
I.2	Connector for asynchronous transmission	YES	For CP 0
I.3	Connector for fibre optic cable	YES	For CP 2, 3, 4

Clause	Header	Presence	Constraints
Annex J	(normative) Type 3: Redundancy of Physical Layer and Medium	YES	Redundancy is optional
Annex K	(normative) Type 3: Optical network topology	YES	For CP 2, 3, 4
Annex L – M	—	NO	—

Table 113 – CP 3/1: PhL selection of Clause 3

Clause	Header	Presence	Constraints
3.1	Common terms and definitions	Partial	See 3.4
3.2 – 3.3	—	NO	—
3.4	Type 3: Terms and definitions	Partial	Relevant terms and definitions only
3.5 – 3.7	—	NO	—

Table 114 – CP 3/1: PhL selection of Clause 4

Clause	Header	Presence	Constraints
4.1	Symbols	YES	—
4.1.1 – 4.1.2	—	NO	—
4.1.3	Type 3: Symbols	YES	—
4.1.4 – 4.1.6	—	NO	—
4.2	Abbreviations	—	—
4.2.1 – 4.2.2	—	NO	—
4.2.3	Type 3: Abbreviations	Partial	Relevant abbreviations only
4.2.4 – 4.2.6	—	NO	—

7.2.1.2 EMC

PROFIBUS devices shall comply with the legal requirements of that country where they are deployed (for example, as indicated by the CE mark). The measures for protection against electrical shocks (i.e. electrical safety) within industrial applications shall be based on the IEC 61010 series or IEC 61131-2, Clause 10 depending on device type specified therein.

7.2.2 Data Link Layer

7.2.2.1 DLL service selection

7.2.2.1.1 General selection

Table 115 specifies the selection of the Data Link services within IEC 61158-3.

Table 115 – CP 3/1: General DLL service selection

Clause	Header	Presence	Constraints
1	Scope and object	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Reference model definitions	Partial	Used when applicable
3.2	Service convention definitions	Partial	Used when applicable
3.3	Common Data Link Service definitions	Partial	Used when applicable
3.4 – 3.5	—	NO	—
3.6	Type 3: Additional Data Link Service definitions	YES	—
3.7 – 3.10	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Common symbols and abbreviations	Partial	Used when applicable
4.2 – 4.3	—	NO	—
4.4	Type 3: Additional symbols and abbreviations	YES	—
4.5 – 4.8	—	NO	—
5	Conventions	—	—
5.1	General conventions	Partial	Used when applicable
5.2 – 5.3	—	NO	—
5.4	Type 3: Additional conventions	YES	—
5.5 – 5.8	—	NO	—
6 - 13	—	NO	—
14	Type 3: Connectionless-mode Data Link Service	Partial	See 7.2.2.1.2 to 7.2.2.1.4
15	Type 3: DL-management service	Partial	See 7.2.2.1.2 to 7.2.2.1.4
16 - 20	—	NO	—

7.2.2.1.2 Selection for DP-master (class 1)

7.2.2.1.2.1 DP-V0 master (class 1)

Table 116 specifies CP 3/1 DL services, which are part of DP-master (class 1) and using features named DP-V0.

Table 116 – CP 3/1: DLL service selection for DP-V0 master (class 1)

Clause	Header	Presence	Constraints
14.1	General	YES	—
14.2	Model of the connectionless-mode Data Link Service	YES	—
14.3	Sequence of primitives	YES	Used when applicable
14.4	Detailed description of DL services	—	—
14.4.1	Send Data with Acknowledge (SDA)	NO	—
14.4.2	Send Data with No Acknowledge (SDN)	—	—
14.4.2.1	Function	YES	—
14.4.2.2	Types of primitives and parameters	YES	Used when applicable
14.4.2.3	SDN request primitive	YES	—
14.4.2.4	SDN indication primitive	YES	Option
14.4.2.5	SDN confirm primitive	YES	—
14.4.3	Send and Request Data with Reply (SRD)	—	—
14.4.3.1	Function	YES	—
14.4.3.2	Types of primitives and parameters of SRD data-reply	YES	—
14.4.3.3	SRD data-reply request primitive	YES	—
14.4.3.4	SRD data-reply indication primitive	YES	Option
14.4.3.5	SRD data-reply confirm primitive	YES	—
14.4.3.6	Types of primitives and parameters of SRD reply-update	YES	Option
14.4.3.7	SRD reply-update request primitive	YES	Option
14.4.3.8	SRD reply-update confirm primitive	YES	Option
14.4.4	Send and Request Data with Multicast reply (MSRD)	NO	—
14.4.5	Clock Synchronisation (CS)	NO	—

Table 123 specifies CP 3/1 DLM services, which are part of DP-master (class 1) and using features named DP-V0.

Table 117– CP 3/1: DLM service selection for DP-V0 master (class 1)

Clause	Header	Presence	Constraints
15.1	General	YES	—
15.2	Facilities of the DLMS	YES	—
15.3	Services of the DL-management	YES	Used when applicable
15.4	Overview of interactions	YES	Used when applicable
15.5	Detailed specification of services and interactions	—	—
15.5.1	Reset	YES	—
15.5.2	Set Value	YES	Only subset of DLE-variables according to IEC 61158-3
15.5.3	Read Value	YES	Option Only subset of DLE-variables according to IEC 61158-3
15.5.4	Event	YES	Only subset of Event/Fault according to IEC 61158-3
15.5.5	Ident	YES	Option
15.5.6	DLSAP Status	YES	Option
15.5.7	DLSAP Activate	YES	—
15.5.8	DLSAP Activate Responder	YES	Option
15.4.3.2	DLSAP Activate Subscriber	NO	—
15.4.3.3	DLSAP Deactivate	YES	—

7.2.2.1.2.2 DP-V1 master (class 1)

Table 118 specifies CP 3/1 DL services, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 118 – CP 3/1: DLL service selection for DP-V1 master (class 1)

Clause	Header	Presence	Constraints
14.1	General	YES	—
14.2	Model of the connectionless-mode Data Link Service	YES	—
14.3	Sequence of primitives	YES	Used when applicable
14.4	Detailed description of DL services	—	—
14.4.1	Send Data with Acknowledge (SDA)	NO	—
14.4.2	Send Data with No Acknowledge (SDN)	—	—
14.4.2.1	Function	YES	—
14.4.2.2	Types of primitives and parameters	YES	Used when applicable
14.4.2.3	SDN request primitive	YES	—
14.4.2.4	SDN indication primitive	YES	Option
14.4.2.5	SDN confirm primitive	YES	—
14.4.3	Send and Request Data with Reply (SRD)	—	—
14.4.3.1	Function	YES	—
14.4.3.2	Types of primitives and parameters of SRD data-reply	YES	—
14.4.3.3	SRD data-reply request primitive	YES	—
14.4.3.4	SRD data-reply indication primitive	YES	Option
14.4.3.5	SRD data-reply confirm primitive	YES	—
14.4.3.6	Types of primitives and parameters of SRD reply-update	YES	Option
14.4.3.7	SRD reply-update request primitive	YES	Option
14.4.3.8	SRD reply-update confirm primitive	YES	Option
14.4.4	Send and Request Data with Multicast reply (MSRD)	—	—
14.4.4.1	Function	YES	Option
14.4.4.2	Types of primitives and parameters of MSRD MCT-data-reply	YES	Option
14.4.4.3	MSRD MCT-DATA-REPLY request primitive	YES	Option
14.4.4.4	MSRD MCT-data-reply indication primitive	NO	—
14.4.4.5	MSRD MCT-data-reply confirm primitive	YES	Option
14.4.4.6	Type of primitive and parameters of MSRD DXM data reply	YES	Option
14.4.4.7	MSRD DXM data reply indication primitive	YES	Option
14.4.4.8	SRD reply-update request primitive	NO	—
14.4.4.9	SRD reply-update confirm primitive	NO	—
14.4.5	Clock Synchronisation (CS)	—	—
14.4.5.1	Function	YES	Option
14.4.5.2	Types of primitives and parameters of the CS time event	YES	Option
14.4.5.3	CS time event request primitive	YES	Option
14.4.5.4	CS time event confirm primitive	YES	Option
14.4.5.5	Types of primitives and parameters of the CS clock value	YES	Option
14.4.5.6	CS clock value request primitive	YES	Option
14.4.5.7	CS clock value indication primitive	YES	Option
14.4.5.8	CS clock value confirm primitive	YES	Option

Table 119 specifies CP 3/1 DLM services, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 119 – CP 3/1: DLM service selection for DP-V1 master (class 1)

Clause	Header	Presence	Constraints
15.1	General	YES	—
15.2	Facilities of the DLMS	YES	—
15.3	Services of the DL-management	YES	Used when applicable
15.4	Overview of interactions	YES	Used when applicable
15.5	Detailed specification of services and interactions	—	—
15.5.1	Reset	YES	—
15.5.2	Set Value	YES	—
15.5.3	Read Value	YES	Option
15.5.4	Event	YES	—
15.5.5	Ident	YES	Option
15.5.6	DLSAP Status	YES	Option
15.5.7	DLSAP Activate	YES	—
15.5.8	DLSAP Activate Responder	YES	Option
15.4.3.2	DLSAP Activate Subscriber	NO	—
15.4.3.3	DLSAP Deactivate	YES	—

7.2.2.1.3 Selection for DP-master (Class 2)

7.2.2.1.3.1 DP-V0 master (Class 2)

Table 120 specifies CP 3/1 DL services, which are part of DP-master (class 2) and using features named DP-V0.

Table 120 – CP 3/1: DLL service selection for DP-V0 master (class 2)

Clause	Header	Presence	Constraints
14.1	General	YES	—
14.2	Model of the connectionless-mode Data Link Service	YES	—
14.3	Sequence of primitives	YES	Used when applicable
14.4	Detailed description of DL services	—	—
14.4.1	Send Data with Acknowledge (SDA)	NO	—
14.4.2	Send Data with No Acknowledge (SDN)	—	—
14.4.2.1	Function	YES	—
14.4.2.2	Types of primitives and parameters	YES	Used when applicable
14.4.2.3	SDN request primitive	YES	Option
14.4.2.4	SDN indication primitive	NO	—
14.4.2.5	SDN confirm primitive	YES	Option
14.4.3	Send and Request Data with Reply (SRD)	—	—
14.4.3.1	Function	YES	—
14.4.3.2	Types of primitives and parameters of SRD data-reply	YES	Used when applicable
14.4.3.3	SRD data-reply request primitive	YES	—
14.4.3.4	SRD data-reply indication primitive	NO	—
14.4.3.5	SRD data-reply confirm primitive	YES	—
14.4.3.6	Types of primitives and parameters of SRD reply-update	NO	—
14.4.3.7	SRD reply-update request primitive	NO	—
14.4.3.8	SRD reply-update confirm primitive	NO	—
14.4.4	Send and Request Data with Multicast reply (MSRD)	NO	—
14.4.5	Clock Synchronisation (CS)	NO	—

The CP 3/1 DLM services, which are part of DP-master (class 2) and using features named DP-V0, are the same as specified for DP-V0-master (class 1) in Table 123.

7.2.2.1.3.2 DP-V1 master (Class 2)

Table 120 specifies CP 3/1 DL services, which are part of DP-master (class 2) and using features named DP-V0.

Table 121 – CP 3/1: DLL service selection for DP-V1 master (class 2)

Clause	Header	Presence	Constraints
14.1	General	YES	—
14.2	Model of the connectionless-mode Data Link Service	YES	—
14.3	Sequence of primitives	YES	Used when applicable
14.4	Detailed description of DL services	—	—
14.4.1	Send Data with Acknowledge (SDA)	NO	—
14.4.2	Send Data with No Acknowledge (SDN)	—	—
14.4.2.1	Function	YES	—
14.4.2.2	Types of primitives and parameters	YES	Used when applicable
14.4.2.3	SDN request primitive	YES	Option
14.4.2.4	SDN indication primitive	NO	—
14.4.2.5	SDN confirm primitive	YES	Option
14.4.3	Send and Request Data with Reply (SRD)	—	—
14.4.3.1	Function	YES	—
14.4.3.2	Types of primitives and parameters of SRD data-reply	YES	Used when applicable
14.4.3.3	SRD data-reply request primitive	YES	—
14.4.3.4	SRD data-reply indication primitive	NO	—
14.4.3.5	SRD data-reply confirm primitive	YES	—
14.4.3.6	Types of primitives and parameters of SRD reply-update	NO	—
14.4.3.7	SRD reply-update request primitive	NO	—
14.4.3.8	SRD reply-update confirm primitive	NO	—
14.4.4	Send and Request Data with Multicast reply (MSRD)	—	—
14.4.4.1	Function	YES	Option
14.4.4.2	Types of primitives and parameters of MSRD MCT-data-reply	YES	Option
14.4.4.3	MSRD MCT-DATA-REPLY request primitive	NO	—
14.4.4.4	MSRD MCT-data-reply indication primitive	NO	—
14.4.4.5	MSRD MCT-data-reply confirm primitive	NO	—
14.4.4.6	Type of primitive and parameters of MSRD DXM data reply	YES	Option
14.4.4.7	MSRD DXM data reply indication primitive	YES	Option
14.4.4.8	SRD reply-update request primitive	NO	—
14.4.4.9	SRD reply-update confirm primitive	NO	—
14.4.5	Clock Synchronisation (CS)	—	—
14.4.5.1	Function	YES	Option
14.4.5.2	Types of primitives and parameters of the CS time event	YES	Option
14.4.5.3	CS time event request primitive	YES	Option
14.4.5.4	CS time event confirm primitive	YES	Option
14.4.5.5	Types of primitives and parameters of the CS clock value	YES	Option
14.4.5.6	CS clock value request primitive	YES	Option
14.4.5.7	CS clock value indication primitive	YES	Option
14.4.5.8	CS clock value confirm primitive	YES	Option

The CP 3/1 DLM services, which are part of DP-master (class 2) and using features named DP-V1 and Options, are the same as specified for DP-V1-master (class 1) in Table 119.

7.2.2.1.4 Selection for DP-slave

7.2.2.1.4.1 DP-V0 slave

Table 122 specifies CP 3/1 DL services, which are part of DP-slave and using features named DP-V0.

Table 122 – CP 3/1: DLL service selection for DP-V0 slave

Clause	Header	Presence	Constraints
14.1	General	YES	—
14.2	Model of the connectionless-mode Data Link Service	YES	—
14.3	Sequence of primitives	YES	Used when applicable
14.4	Detailed description of DL services	—	—
14.4.1	Send Data with Acknowledge (SDA)	NO	—
14.4.2	Send Data with No Acknowledge (SDN)	—	—
14.4.2.1	Function	YES	—
14.4.2.2	Types of primitives and parameters	YES	Used when applicable
14.4.2.3	SDN request primitive	NO	—
14.4.2.4	SDN indication primitive	YES	—
14.4.2.5	SDN confirm primitive	NO	—
14.4.3	Send and Request Data with Reply (SRD)	—	—
14.4.3.1	Function	YES	—
14.4.3.2	Types of primitives and parameters of SRD data-reply	YES	Used when applicable
14.4.3.3	SRD data-reply request primitive	NO	—
14.4.3.4	SRD data-reply indication primitive	YES	—
14.4.3.5	SRD data-reply confirm primitive	NO	—
14.4.3.6	Types of primitives and parameters of SRD reply-update	YES	—
14.4.3.7	SRD reply-update request primitive	YES	—
14.4.3.8	SRD reply-update confirm primitive	YES	—
14.4.4	Send and Request Data with Multicast reply (MSRD)	NO	—
14.4.5	Clock Synchronisation (CS)	NO	—

Table 123 specifies CP 3/1 DLM services, which are part of DP-slave and using features named DP-V0.

Table 123 – CP 3/1: DLM service selection for DP-V0 slave

Clause	Header	Presence	Constraints
15.1	General	YES	—
15.2	Facilities of the DLMS	YES	—
15.3	Services of the DL-management	YES	Used when applicable
15.4	Overview of interactions	YES	Used when applicable
15.5	Detailed specification of services and interactions	—	—
15.5.1	Reset	YES	—
15.5.2	Set Value	YES	Only subset of DLE-variables according to IEC 61158-3
15.5.3	Read Value	YES	Option Only subset of DLE-variables according to IEC 61158-3
15.5.4	Event	NO	Only subset of Event/Fault according to IEC 61158-3
15.5.5	Ident	YES	Option Only local
15.5.6	DLSAP Status	NO	Option Only local
15.5.7	DLSAP Activate	YES	Restrictions to parameter values according to to IEC 61158-3
15.5.8	DLSAP Activate Responder	YES	Restrictions to parameter values according to to IEC 61158-3
15.4.3.2	DLSAP Activate Subscriber	NO	—
15.4.3.3	DLSAP Deactivate	YES	—

7.2.2.1.4.2 DP-V1 slave

Table 124 specifies CP 3/1 DL services, which are part of DP-slave and using features named DP-V1 and Options.

Table 124 – CP 3/1: DLL service selection for DP-V1 slave

Clause	Header	Presence	Constraints
14.1	General	YES	—
14.2	Model of the connectionless-mode Data Link Service	YES	—
14.3	Sequence of primitives	YES	Used when applicable
14.4	Detailed description of DL services	—	—
14.4.1	Send Data with Acknowledge (SDA)	NO	—
14.4.2	Send Data with No Acknowledge (SDN)	—	—
14.4.2.1	Function	YES	—
14.4.2.2	Types of primitives and parameters	YES	Used when applicable
14.4.2.3	SDN request primitive	NO	—
14.4.2.4	SDN indication primitive	YES	—
14.4.2.5	SDN confirm primitive	NO	—
14.4.3	Send and Request Data with Reply (SRD)	YES	—
14.4.3.1	Function	YES	—
14.4.3.2	Types of primitives and parameters of SRD data-reply	YES	Used when applicable
14.4.3.3	SRD data-reply request primitive	NO	—
14.4.3.4	SRD data-reply indication primitive	YES	—
14.4.3.5	SRD data-reply confirm primitive	NO	—
14.4.3.6	Types of primitives and parameters of SRD reply-update	YES	—
14.4.3.7	SRD reply-update request primitive	YES	—
14.4.3.8	SRD reply-update confirm primitive	YES	—
14.4.4	Send and Request Data with Multicast reply (MSRD)	—	—
14.4.4.1	Function	YES	Option
14.4.4.2	Types of primitives and parameters of MSRD MCT-data-reply	YES	Option
14.4.4.3	MSRD MCT-DATA-REPLY request primitive	NO	—
14.4.4.4	MSRD MCT-data-reply indication primitive	YES	Option
14.4.4.5	MSRD MCT-data-reply confirm primitive	NO	—
14.4.4.6	Type of primitive and parameters of MSRD DXM data reply	YES	Option
14.4.4.7	MSRD DXM data reply indication primitive	YES	Option
14.4.4.8	SRD reply-update request primitive	YES	Option
14.4.4.9	SRD reply-update confirm primitive	YES	Option
14.4.5	Clock Synchronisation (CS)	—	—
14.4.5.1	Function	YES	Option
14.4.5.2	Types of primitives and parameters of the CS time event	NO	—
14.4.5.3	CS time event request primitive	NO	—
14.4.5.4	CS time event confirm primitive	NO	—
14.4.5.5	Types of primitives and parameters of the CS clock value	YES	Option
14.4.5.6	CS clock value request primitive	NO	—
14.4.5.7	CS clock value indication primitive	YES	Option
14.4.5.8	CS clock value confirm primitive	NO	—

Table 125 specifies CP 3/1 DLM services, which are part of DP-slave and using features named DP-V1 and Options.

Table 125 – CP 3/1: DLM service selection for DP-V1 slave

Clause	Header	Presence	Constraints
15.1	General	YES	—
15.2	Facilities of the DLMS	YES	—
15.3	Services of the DL-management	YES	Used when applicable
15.4	Overview of interactions	YES	Used when applicable
15.5	Detailed specification of services and interactions	—	—
15.5.1	Reset	YES	—
15.5.2	Set Value	YES	Only subset of DLE-variables according to IEC 61158-3
15.5.3	Read Value	YES	Option Only subset of DLE-variables according to IEC 61158-3
15.5.4	Event	NO	Only subset of Event/Fault according to IEC 61158-3
15.5.5	Ident	YES	Option Only local
15.5.6	DLSAP Status	NO	Option Only local
15.5.7	DLSAP Activate	YES	Restrictions to parameter values according to to IEC 61158-3
15.5.8	DLSAP Activate Responder	YES	—
15.4.3.2	DLSAP Activate Subscriber	YES	Option
15.4.3.3	DLSAP Deactivate	YES	—

7.2.2.2 DLL protocol selection

7.2.2.2.1 General selection

The Table 126 specifies the selection of the Data Link protocol within IEC 61158-4.

Table 126 – CP 3/1: General DLL protocol selection

Clause	Header	Presence	Constraints
1	Scope and object	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Reference model terms and definitions	Partial	Used when applicable
3.2	Service convention terms and definitions	Partial	Used when applicable
3.3	Common terms and definitions	Partial	Used when applicable
3.4 – 3.5	—	NO	—
3.6	Type 3: Additional terms and definitions	YES	—
3.7 – 3.11	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Common symbols and abbreviations	Partial	Used when applicable
4.2 – 4.3	—	NO	—
4.4	Type 3: Additional symbols and abbreviations	YES	—
4.5 – 4.9	—	NO	—
5	DL-protocol elements common to multiple DL-protocol Types	YES	Used when applicable
6 - 19	—	NO	—
20	Type 3: Overview of the DL-protocol	Partial	See 7.2.2.2.2 to 7.2.2.2.4
21	Type 3: General structure and encoding of DLPDUs, and related elements of procedure	Partial	See 7.2.2.2.2 to 7.2.2.2.4
22	Type 3: DLPDU-specific structure, encoding and elements of procedure	Partial	See 7.2.2.2.2 to 7.2.2.2.4
23	Type 3: Other DLE elements of procedure	Partial	See 7.2.2.2.2 to 7.2.2.2.4
24 – 32	—	NO	—
Annex A – D	—	NO	—
Annex E	Type 3: DL-protocol state machines	YES	—
Annex F	Type 3: Exemplary token procedure and message transfer periods	YES	—
Annex G – J	—	NO	—

Table 127 – CP 3/1: DLL protocol selection of Clause 20

Clause	Header	Presence	Constraints
20.1	General	YES	—
20.2	Overview of the medium access control and transmission protocol	YES	—
20.3	Transmission mode and DL-entity	YES	—
20.4	Service assumed from the PhL	—	—
20.4.1	Asynchronous transmission	YES	—
20.4.2	Synchronous transmission	NO	—
20.5	Operation elements	—	—
20.5.1	Overview	YES	—
20.5.2	Bit time t_{BIT}	YES	—
20.5.3	Asynchronous transmission	YES	—
20.5.4	Synchronous transmission	NO	—
20.5.5	Timers and counters	—	—
20.5.5.1	Asynchronous transmission	YES	—
20.5.5.2	Synchronous transmission	NO	—
20.6	Cycle and system reaction times	—	—
20.6.1	Asynchronous transmission	YES	—
20.6.2	Synchronous transmission	NO	—

Table 128 – CP 3/1: DLL protocol selection of Clause 21

Clause	Header	Presence	Constraints
21.1	DLPDU character	—	—
21.1.1	Asynchronous transmission – UART character	YES	—
21.1.2	Synchronous transmission	NO	—
21.2	Length octet (LE, LEr)	YES	—
21.3	Address octet	YES	—
21.4	Control octet (FC)	YES	—
21.5	DLPDU check	—	—
21.5.1	Asynchronous transmission - frame check sequence (FCS)	YES	—
21.5.2	Synchronous transmission - cyclic redundancy check (CRC)	NO	—
21.6	DATA_UNIT	YES	—
21.7	Error control procedures	—	—
21.7.1	Asynchronous transmission	YES	—
21.7.2	Synchronous transmission	NO	—

Table 129 – CP 3/1: DLL protocol selection of Clause 22

Clause	Header	Presence	Constraints
22.1	DLPDUs of fixed length with no data field	—	—
22.1.1	Asynchronous transmission	YES	—
22.1.2	Synchronous transmission	NO	—
22.2	DLPDUs of fixed length with data field	—	—
22.2.1	Asynchronous transmission	YES	—
22.2.2	Synchronous transmission	NO	—
22.3	DLPDUs with variable data field length	—	—
22.3.1	Asynchronous transmission	YES	—
22.3.2	Synchronous transmission	NO	—
22.4	Token DLPDU	—	—
22.4.1	Asynchronous transmission	YES	—
22.4.2	Synchronous transmission	NO	—
22.5	ASP DLPDU	YES	—
22.6	SYNCH DLPDU	YES	—
22.7	Time Event (TE) DLPDU	YES	—
22.8	Clock Value (CV) DLPDU	YES	—
22.9	Transmission procedures	YES	—
22.9.1	Asynchronous transmission	YES	—
22.9.2	Synchronous transmission	NO	—

7.2.2.2.2 Selection for DP-master (class 1)

7.2.2.2.2.1 DP-V0 master (class 1)

The Table 130 specifies the CP 3/1 selection of the time parameters of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0.

Table 130 – CP 3/1: Time variable selection for DP-V0 master (class 1)

Clause	Variable name	Usage	Constraint
20.5.3.1	Synchronisation time (T_{SYN})	M	—
20.5.3.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.3.3	Station delay time (T_{SDx})	M	—
20.5.3.4	Quiet time (T_{QUI})	M	—
20.5.3.5	Ready time (T_{RDY})	M	—
20.5.3.6	Safety margin (T_{SM})	M	—
20.5.3.7	Idle time (T_{Idx})	M	—
20.5.3.8	Transmission delay time (T_{TD})	M	—
20.5.3.9	Slot time (T_{SL})	M	—
20.5.3.10	Time-out T_{TO})	M	—
20.5.3.11	GAP update time (T_{GUD})	M	—
20.5.3.12	Isochronous cycle time (T_{CT})	—	—
20.5.3.13	IsoM synchronisation message time (T_{SYNCH})	—	—
20.5.3.14	Active spare time message time (T_{ASM})	—	—
20.5.3.15	Real isochronous cycle time (T_{RCT})	—	—
20.5.3.16	Spare time (T_{RES})	—	—
20.5.3.17	Passive spare time (T_{PSP})	—	—
20.5.3.18	Time shift (T_{SH})	—	—
20.5.3.19	Send delay time (T_{SD})	—	—
20.5.3.20	Receive delay time (T_{RD})	—	—
20.5.3.21	Clock synchronisation interval time (T_{CSI})	—	—

The Table 131 specifies the CP 3/1 selection of the timers and counters of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0.

Table 131 – CP 3/1: Timer and counter selection for DP-V0 master (class 1)

Clause	Timer or counter	Usage	Constraint
20.5.5.1.1	token-rotation-timer	M	—
20.5.5.1.1	idle-timer	M	—
20.5.5.1.1	slot-timer	M	—
20.5.5.1.1	time-out-timer	M	—
20.5.5.1.1	syn-interval-timer	M	—
20.5.5.1.1	GAP-update-timer	M	—
20.5.5.1.1	isochronous-cycle-timer	—	—
20.5.5.1.1	passive-spare-timer	—	—
20.5.5.1.1	send-delay-timer	—	—
20.5.5.1.1	receive-delay-timer	—	—
20.5.5.1.2	DLPDU_sent_count	O	—
20.5.5.1.2	Retry_count	O	—
20.5.5.1.2	DLPDU_sent_count_sr	O	—
20.5.5.1.2	Error_count	O	—
20.5.5.1.2	SD_count	O	—
20.5.5.1.2	SD_error_count	O	—

The Table 132 specifies the CP 3/1 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0.

Table 132 – CP 3/1: DLPDU selection for DP-V0 master (class 1)

Clause	DLPDU	Usage	Constraint
22.1.1	Frames of fixed length with no data field	M	—
22.2.1	Frames of fixed length with data field	M	Option for sending
22.3.1	Frames with variable data field length	M	—
22.4.1	Token frame	M	—
22.5	ASP DLPDU	—	—
22.6	SYNCH DLPDU	—	—
22.7	Time Event (TE) DLPDU	—	—
22.8	Clock Value (CV) DLPDU	—	—

The Table 132 specifies the CP 3/1 selection of the states of the media access control of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0.

Table 133 – CP 3/1: MAC state selection for DP-V0 master (class 1)

Clause	MAC state	Usage	Constraint
23.2.2	Offline	M	—
23.2.3	Passive_Idle	O	—
23.2.4	Listen_Token	M	—
23.2.5	Active_Idle	M	—
23.2.6	Claim_Token	M	—
23.2.7	Wait_T_{CT}		—
23.2.8	Use_Token	M	—
23.2.9	Await_Data_Response	M	—
23.2.10	Check_Access_Time	M	—
23.2.11	Pass_Token	M	—
23.2.12	Check_Token_Pass	M	—
23.2.13	Await_Status_Response	M	—

The CP 3/1 selection of the clock synchronisation protocol of the DL-entity of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0, is empty.

7.2.2.2.2.2 DP-V1 master (class 1)

The Table 134 specifies the CP 3/1 selection of the time parameters of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 134 – CP 3/1: Time variable selection for DP-V1 master (class 1)

Clause	Variable name	Usage	Constraint
20.5.3.1	Synchronisation time (T_{SYN})	M	—
20.5.3.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.3.3	Station delay time (T_{SDx})	M	—
20.5.3.4	Quiet time (T_{QUI})	M	—
20.5.3.5	Ready time (T_{RDY})	M	—
20.5.3.6	Safety margin (T_{SM})	M	—
20.5.3.7	Idle time (T_{Idx})	M	—
20.5.3.8	Transmission delay time (T_{TD})	M	—
20.5.3.9	Slot time (T_{SL})	M	—
20.5.3.10	Time-out (T_{TO})	M	—
20.5.3.11	GAP update time (T_{GUD})	M	—
20.5.3.12	Isochronous cycle time (T_{CT})	O	—
20.5.3.13	IsoM synchronisation message time (T_{SYNCH})	O	—
20.5.3.14	Active spare time message time (T_{ASM})	O	—
20.5.3.15	Real isochronous cycle time (T_{RCT})	O	—
20.5.3.16	Spare time (T_{RES})	O	—
20.5.3.17	Passive spare time (T_{PSP})	O	—
20.5.3.18	Time shift (T_{SH})	O	—
20.5.3.19	Send delay time (T_{SD})	O	—
20.5.3.20	Receive delay time (T_{RD})	O	—
20.5.3.21	Clock synchronisation interval time (T_{CSI})	O	—

The Table 135 specifies the CP 3/1 selection of the timers and counters of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 135 – CP 3/1: Timer and counter selection for DP-V1 master (class 1)

Clause	Timer or counter	Usage	Constraint
20.5.5.1.1	token-rotation-timer	M	—
20.5.5.1.1	idle-timer	M	—
20.5.5.1.1	slot-timer	M	—
20.5.5.1.1	time-out-timer	M	—
20.5.5.1.1	syn-interval-timer	M	—
20.5.5.1.1	GAP-update-timer	M	—
20.5.5.1.1	isochronous-cycle-timer	O	—
20.5.5.1.1	passive-spare-timer	O	—
20.5.5.1.1	send-delay-timer	O	—
20.5.5.1.1	receive-delay-timer	O	—
20.5.5.1.2	DLPDU_sent_count	O	—
20.5.5.1.2	Retry_count	O	—
20.5.5.1.2	DLPDU_sent_count_sr	O	—
20.5.5.1.2	Error_count	O	—
20.5.5.1.2	SD_count	O	—
20.5.5.1.2	SD_error_count	O	—

The Table 136 specifies the CP 3/1 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 136 – CP 3/1: DLPDU selection for DP-V1 master (class 1)

Clause	DLPDU	Usage	Constraint
22.1.1	Frames of fixed length with no data field	M	—
22.2.1	Frames of fixed length with data field	M	Option for sending
22.3.1	Frames with variable data field length	M	—
22.4.1	Token frame	M	—
22.5	ASP DLPDU	O	—
22.6	SYNCH DLPDU	O	—
22.7	Time Event (TE) DLPDU	O	—
22.8	Clock Value (CV) DLPDU	O	—

The Table 137 specifies the CP 3/1 selection of the states of the media access control of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 137 – CP 3/1: MAC state selection for DP-V1 master (class 1)

Clause	MAC state	Usage	Constraint
23.2.2	Offline	M	—
23.2.3	Passive_Idle	O	—
23.2.4	Listen_Token	M	—
23.2.5	Active_Idle	M	—
23.2.6	Claim_Token	M	—
23.2.7	Wait_T_{CT}	O	—
23.2.8	Use_Token	M	—
23.2.9	Await_Data_Response	M	—
23.2.10	Check_Access_Time	M	—
23.2.11	Pass_Token	M	—
23.2.12	Check_Token_Pass	M	—
23.2.13	Await_Status_Response	M	—

The Table 138 specifies the CP 3/1 selection of the clock synchronisation protocol of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 138 – CP 3/1: CS protocol selection for DP-V1 master (class 1)

Clause	Header	Usage	Constraint
23.3.1	Overview	O	—
23.3.2	State machine time master	O	—
23.3.3	State machine time receiver	O	—

7.2.2.2.3 Selection for DP-master (class 2)

7.2.2.2.3.1 DP-V0 master (class 2)

The CP 3/1 selection of the time parameters, of timers and counters, of DLPDUs, of states of the media access control and of the clock synchronisation protocol, which are part of DP-master (class 2) and using features named DP-V0, are the same as specified for DP-V0-master (class 1) in 7.2.2.2.2.1.

7.2.2.2.3.2 DP-V1 master (class 2)

The Table 139 specifies the CP 3/1 selection of the time parameters of the Data Link protocol, which are part of DP-master (class 2) and using features named DP-V1 and Options.

Table 139 – CP 3/1: Time variable selection for DP-V1 master (class 2)

Clause	Variable name	Usage	Constraint
20.5.3.1	Synchronisation time (T_{SYN})	M	—
20.5.3.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.3.3	Station delay time (T_{SDx})	M	—
20.5.3.4	Quiet time (T_{QUI})	M	—
20.5.3.5	Ready time (T_{RDY})	M	—
20.5.3.6	Safety margin (T_{SM})	M	—
20.5.3.7	Idle time (T_{IDx})	M	—
20.5.3.8	Transmission delay time (T_{TD})	M	—
20.5.3.9	Slot time (T_{SL})	M	—
20.5.3.10	Time-out T_{TO})	M	—
20.5.3.11	GAP update time (T_{GUD})	M	—
20.5.3.12	Isochronous cycle time (T_{CT})	—	—
20.5.3.13	IsoM synchronisation message time (T_{SYNCH})	—	—
20.5.3.14	Active spare time message time (T_{ASM})	—	—
20.5.3.15	Real isochronous cycle time (T_{RCT})	—	—
20.5.3.16	Spare time (T_{RES})	—	—
20.5.3.17	Passive spare time (T_{PSP})	—	—
20.5.3.18	Time shift (T_{SH})	—	—
20.5.3.19	Send delay time (T_{SD})	O	—
20.5.3.20	Receive delay time (T_{RD})	O	—
20.5.3.21	Clock synchronisation interval time (T_{CSI})	O	—

The Table 140 specifies the CP 3/1 selection of the timers and counters of the Data Link protocol, which are part of DP-master (class 2) and using features named DP-V1 and Options.

Table 140 – CP 3/1: Timer and counter selection for DP-V1 master (class 2)

Clause	Timer or counter	Usage	Constraint
20.5.5.1.1	token-rotation-timer	M	—
20.5.5.1.1	idle-timer	M	—
20.5.5.1.1	slot-timer	M	—
20.5.5.1.1	time-out-timer	M	—
20.5.5.1.1	syn-interval-timer	M	—
20.5.5.1.1	GAP-update-timer	M	—
20.5.5.1.1	isochronous-cycle-timer	—	—
20.5.5.1.1	passive-spare-timer	—	—
20.5.5.1.1	send-delay-timer	O	—
20.5.5.1.1	receive-delay-timer	O	—
20.5.5.1.2	DLPDU_sent_count	O	—
20.5.5.1.2	Retry_count	O	—
20.5.5.1.2	DLPDU_sent_count_sr	O	—
20.5.5.1.2	Error_count	O	—
20.5.5.1.2	SD_count	O	—
20.5.5.1.2	SD_error_count	O	—

The Table 141 specifies the CP 3/1 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-master (class 2) and using features named DP-V1 and Options.

Table 141 – CP 3/1: DLPDU selection for DP-V1 master (class 2)

Clause	DLPDU	Usage	Constraint
22.1.1	Frames of fixed length with no data field	M	—
22.2.1	Frames of fixed length with data field	M	Option for sending
22.3.1	Frames with variable data field length	M	—
22.4.1	Token frame	M	—
22.5	ASP DLPDU	—	—
22.6	SYNCH DLPDU	—	—
22.7	Time Event (TE) DLPDU	O	—
22.8	Clock Value (CV) DLPDU	O	—

For Clause 23 the following constraints apply:

a) The CP 3/1 selection of states of the media access, which are part of DP-master (class 2) and using features named DP-V1 and Options, are the same as specified for DP-V0-master (class 1) in Table 133.

b) The CP 3/1 selection of the clock synchronisation protocol, which are part of DP-master (class 2) and using features named DP-V1 and Options, are the same as specified for DP-V1-master (class 1) in Table 138

7.2.2.2.4 Selection for DP-slave

7.2.2.2.4.1 DP-V0 slave

The Table 142 specifies the CP 3/1 selection of the time parameters of the Data Link protocol, which are part of DP-slave and using features named DP-V0.

Table 142 – CP 3/1: Time variable selection for DP-V0 slave

Clause	Variable name	Usage	Constraint
20.5.3.1	Synchronisation time (T_{SYN})	M	—
20.5.3.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.3.3	Station delay time (T_{SDx})	M	—
20.5.3.4	Quiet time (T_{QUI})	—	—
20.5.3.5	Ready time (T_{RDY})	—	—
20.5.3.6	Safety margin (T_{SM})	—	—
20.5.3.7	Idle time (T_{IDx})	M	—
20.5.3.8	Transmission delay time (T_{TD})	—	—
20.5.3.9	Slot time (T_{SL})	M	—
20.5.3.10	Time-out T_{TO})	M	—
20.5.3.11	GAP update time (T_{GUD})	—	—
20.5.3.12	Isochronous cycle time (T_{CT})	—	—
20.5.3.13	IsoM synchronisation message time (T_{SYNCH})	—	—
20.5.3.14	Active spare time message time (T_{ASM})	—	—
20.5.3.15	Real isochronous cycle time (T_{RCT})	—	—
20.5.3.16	Spare time (T_{RES})	—	—
20.5.3.17	Passive spare time (T_{PSP})	—	—
20.5.3.18	Time shift (T_{SH})	—	—
20.5.3.19	Send delay time (T_{SD})	—	—
20.5.3.20	Receive delay time (T_{RD})	—	—
20.5.3.21	Clock synchronisation interval time (T_{CSI})	—	—

The Table 143 specifies the CP 3/1 selection of the timers and counters of the Data Link protocol, which are part of DP-slave and using features named DP-V0.

Table 143 – CP 3/1: Timer and counter selection for DP-V0 slave

Clause	Timer or counter	Usage	Constraint
20.5.5.1.1	token-rotation-timer	—	—
20.5.5.1.1	idle-timer	M	—
20.5.5.1.1	slot-timer	—	—
20.5.5.1.1	time-out-timer	M	—
20.5.5.1.1	syn-interval-timer	M	—
20.5.5.1.1	GAP-update-timer	—	—
20.5.5.1.1	isochronous-cycle-timer	—	—
20.5.5.1.1	passive-spare-timer	—	—
20.5.5.1.1	send-delay-timer	—	—
20.5.5.1.1	receive-delay-timer	—	—
20.5.5.1.2	DLPDU_sent_count	—	—
20.5.5.1.2	Retry_count	—	—
20.5.5.1.2	DLPDU_sent_count_sr	—	—
20.5.5.1.2	Error_count	—	—
20.5.5.1.2	SD_count	O	—
20.5.5.1.2	SD_error_count	O	—

The Table 144 specifies the CP 3/1 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-slave and using features named DP-V0.

Table 144 – CP 3/1: DLPDU selection for DP-V0 slave

Clause	DLPDU	Usage	Constraint
22.1.1	Frames of fixed length with no data field	M	—
22.2.1	Frames of fixed length with data field	M	Option for sending
22.3.1	Frames with variable data field length	M	—
22.4.1	Token frame	M	Only for receiving
22.5	ASP DLPDU	—	—
22.6	SYNCH DLPDU	—	—
22.7	Time Event (TE) DLPDU	—	—
22.8	Clock Value (CV) DLPDU	—	—

The Table 132 specifies the CP 3/1 selection of the states of the media access control of the Data Link protocol, which are part of DP-slave and using features named DP-V0.

Table 145 – CP 3/1: MAC state selection for DP-V0 slave

Clause	MAC state	Usage	Constraint
23.2.2	Offline	M	—
23.2.3	Passive_Idle	M	—
23.2.4	Listen_Token	—	—
23.2.5	Active_Idle	—	—
23.2.6	Claim_Token	—	—
23.2.7	Wait_TCT	—	—
23.2.8	Use_Token	—	—
23.2.9	Await_Data_Response	—	—
23.2.10	Check_Access_Time	—	—
23.2.11	Pass_Token	—	—
23.2.12	Check_Token_Pass	—	—
23.2.13	Await_Status_Response	—	—

The CP 3/1 selection of the clock synchronisation protocol of the DL-entity of the Data Link protocol, which are part of DP-slave and using features named DP-V0, is empty.

7.2.2.2.4.2 DP-V1 slave

The Table 146 specifies the CP 3/1 selection of the time parameters of the Data Link protocol, which are part of DP-slave and using features named DP-V1 and Options.

Table 146 – CP 3/1: Time variable selection for DP-V1 slave

Clause	Variable name	Usage	Constraint
20.5.3.1	Synchronisation time (T_{SYN})	M	—
20.5.3.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.3.3	Station delay time (T_{SDx})	M	—
20.5.3.4	Quiet time (T_{QUI})	—	—
20.5.3.5	Ready time (T_{RDY})	—	—
20.5.3.6	Safety margin (T_{SM})	—	—
20.5.3.7	Idle time (T_{IDx})	M	—
20.5.3.8	Transmission delay time (T_{TD})	—	—
20.5.3.9	Slot time (T_{SL})	M	—
20.5.3.10	Time out (T_{TO})	M	—
20.5.3.11	GAP update time (T_{GUD})	—	—
20.5.3.12	Isochronous cycle time (T_{CT})	—	—
20.5.3.13	IsoM synchronisation message time (T_{SYNCH})	—	—
20.5.3.14	Active spare time message time (T_{ASM})	—	—
20.5.3.15	Real isochronous cycle time (T_{RCT})	—	—
20.5.3.16	Spare time (T_{RES})	—	—
20.5.3.17	Passive spare time (T_{PSP})	—	—
20.5.3.18	Time shift (T_{SH})	—	—
20.5.3.19	Send delay time (T_{SD})	O	—
20.5.3.20	Receive delay time (T_{RD})	O	—
20.5.3.21	Clock synchronisation interval time (T_{CSI})	O	—

The Table 147 specifies the CP 3/1 selection of the timers and counters of the Data Link protocol, which are part of DP-slave and using features named DP-V1 and Options.

Table 147 – CP 3/1: Timer and counter selection for DP-V1 slave

Clause	Timer or counter	Usage	Constraint
20.5.5.1.1	token-rotation-timer	—	—
20.5.5.1.1	idle-timer	M	—
20.5.5.1.1	slot-timer	—	—
20.5.5.1.1	time-out-timer	M	—
20.5.5.1.1	syn-interval-timer	M	—
20.5.5.1.1	GAP-update-timer	—	—
20.5.5.1.1	isochronous-cycle-timer	—	—
20.5.5.1.1	passive-spare-timer	—	—
20.5.5.1.1	send-delay-timer	—	—
20.5.5.1.1	receive-delay-timer	O	—
20.5.5.1.2	DLPDU_sent_count	—	—
20.5.5.1.2	Retry_count	—	—
20.5.5.1.2	DLPDU_sent_count_sr	—	—
20.5.5.1.2	Error_count	—	—
20.5.5.1.2	SD_count	O	—
20.5.5.1.2	SD_error_count	O	—

The Table 148 specifies the CP 3/1 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-slave and using features named DP-V1 and Options.

Table 148 – CP 3/1: DLPDU selection for DP-V1 slave

Clause	DLPDU	Usage	Constraint
22.1.1	Frames of fixed length with no data field	M	—
22.2.1	Frames of fixed length with data field	M	Option for sending
22.3.1	Frames with variable data field length	M	—
22.4.1	Token frame	M	Only for receiving
22.5	ASP DLPDU	O	Only for receiving
22.6	SYNCH DLPDU	O	Only for receiving
22.7	Time Event (TE) DLPDU	O	Only for receiving
22.8	Clock Value (CV) DLPDU	O	Only for receiving

The CP 3/1 selection of states of the media access, which are part of DP-slave and using features named DP-V1 and Options, are the same as specified for DP-V0-slave in Table 145.

The Table 149 specifies the CP 3/1 selection of the clock synchronisation protocol of the Data Link protocol, which are part of DP-slave and using features named DP-V1 and Options.

Table 149 – CP 3/1: CS protocol selection for DP-V1 slave

Clause	Header	Usage	Constraint
23.3.1	Overview	O	—
23.3.2	State machine time master	—	—
23.3.3	State machine time receiver	O	—

7.2.3 Application Layer

7.2.3.1 AL service selection

7.2.3.1.1 General selection

Table 150 specifies the selection of the Application Layer services within IEC 61158-5.

Table 150 – CP 3/1, 3/2: AL service selection

Clause	Header	Presence	Constraints
1	SCOPE	YES	—
2	NORMATIVE REFERENCES	Partial	Used if referenced
3	DEFINITIONS	Partial	Used when applicable
4	CONCEPTS	YES	—
5	DATA TYPE ASE	—	—
5.1	Overview	YES	—
5.2	Formal Definition of Data Type Objects	YES	—
5.3	FAL Defined Data Types	Partial	See Table 151
5.4	Data Type ASE Service Specification	YES	—
5.5	Summary of data types	YES	—
6	COMMUNICATION MODEL TYPE 1 SPECIFICATION	NO	—
7	COMMUNICATION MODEL TYPE 2 SPECIFICATION	NO	—
8	COMMUNICATION MODEL TYPE 3 SPECIFICATION	Partial	See 7.2.3.1.2, 7.2.3.1.3, and 7.2.3.1.4
9	COMMUNICATION MODEL TYPE 4 SPECIFICATION	NO	—
10	COMMUNICATION MODEL TYPE 5 SPECIFICATION	NO	—
11	COMMUNICATION MODEL TYPE 6 SPECIFICATION	NO	—
12	COMMUNICATION MODEL TYPE 7 SPECIFICATION	NO	—
13	COMMUNICATION MODEL TYPE 8 SPECIFICATION	NO	—
14	COMMUNICATION MODEL TYPE 9 SPECIFICATION	NO	—
15	COMMUNICATION MODEL TYPE 10 SPECIFICATION	NO	—
Annex A	(informative) Model for Service Error Reporting	NO	—

Table 151 – CP 3/1, 3/2: AL service selection of data types

Clause	Header	Presence	Constraints
5.3.1	Fixed Length Types	—	—
5.3.1.1	Boolean types	—	—
5.3.1.1.1	Boolean	YES	—
5.3.1.1.2	Bool	NO	—
5.3.1.1.3	VT_BOOLEAN	NO	—
5.3.1.2	Bitstring types	NO	—
5.3.1.3	Currency types	NO	—
5.3.1.4	Date types	—	—
5.3.1.4.1	BinaryDate	NO	—
5.3.1.4.2	BinaryDate2000	NO	—
5.3.1.4.3	Date	YES	—
5.3.1.4.4	DATE	NO	—
5.3.1.4.5	date	NO	—
5.3.1.4.6	TimeOfDay	YES	—
5.3.1.4.7	TimeOfDay with date indication	YES	—
5.3.1.4.8	TimeOfDay without date indication	YES	—
5.3.1.4.9	TIME_OF_DAY	NO	—
5.3.1.4.10	TimeDifference	YES	—
5.3.1.4.11	TimeDifference with date indication	YES	—
5.3.1.4.12	TimeDifference without date indication	YES	—
5.3.1.4.13	TimeValue	NO	—
5.3.1.4.14	UniversalTime	NO	—
5.3.1.4.15	FieldbusTime	NO	—

Clause	Header	Presence	Constraints
5.3.1.5	Enumerated types	NO	—
5.3.1.6	Handle types	NO	—
5.3.1.7	Numeric types	—	—
5.3.1.7.1	BCD	NO	—
5.3.1.7.2	Floating Point types	NO	—
5.3.1.7.2.1	Float32	YES	—
5.3.1.7.2.2	Floating point	YES	—
5.3.1.7.2.3 - 5.3.1.7.2.7	—	NO	—
5.3.1.7.3	Integer types	—	—
5.3.1.7.3.1	Integer8	YES	—
5.3.1.7.3.2 - 5.3.1.7.3.6	—	NO	—
5.3.1.7.3.7	Integer32	YES	—
5.3.1.7.3.8 - 5.3.1.7.3.11	—	NO	—
5.3.1.7.4	Unsigned types		—
5.3.1.7.4.1	Unsigned8	YES	—
5.3.1.7.4.2	USINT	NO	—
5.3.1.7.4.3	unsigned char	NO	—
5.3.1.7.4.4	Unsigned16	YES	—
5.3.1.7.4.5	UINT	NO	—
5.3.1.7.4.6	unsigned short	NO	—
5.3.1.7.4.7	Unsigned32	YES	—
5.3.1.7.4.8	UDINT	NO	—
5.3.1.7.4.9	unsigned long	NO	—
5.3.1.7.4.10	Unsigned64	NO	—
5.3.1.7.4.11	ULINT	NO	—
5.3.1.8	OctetString character types	NO	—
5.3.1.9	Pointer types	NO	—
5.3.1.10	Time types	—	—
5.3.1.10.1 - 5.3.1.10.14	—	NO	—
5.3.1.10.15	NetworkTime	YES	—
5.3.1.10.16	NetworkTimeDifference	YES	—
5.3.1.11	VisibleString character types	NO	—
5.3.2	String types	—	—
5.3.2.1	BitString	NO	—
5.3.2.2	CompactBooleanArray	NO	—
5.3.2.3	CompactBCDArray	NO	—
5.3.2.4	OctetString	YES	—
5.3.2.5	UNICODEString	NO	—
5.3.2.6	VisibleString	YES	—
5.3.3	Structure types	—	—
5.3.3.1 - 5.3.3.10	—	NO	—
5.3.3.11	QualifiedOctetString2	YES	—
5.3.3.12	QualifiedFloat32	YES	—
5.3.3.13	QualifiedUnsigned8	YES	—
5.3.3.14- 5.3.3.23	—	NO	—
5.4	Data type ASE service specification	NO	—

7.2.3.1.2 DP-master (Class 1)

7.2.3.1.2.1 DP-V0

Table 152 specifies CP 3/1 and 3/2 ASEs, which are part of DP-Master (Class 1) and using features named DP-V0 and Options (see 7.2.3.2.5).

Table 152 – CP 3/1, 3/2: AL service selection of Clause 8

Clause	Header	Presence	Constraints
8.1	Type 3 Fieldbus DP Concepts	YES	—
8.2	Type 3 Fieldbus ASEs	—	—
8.2.1	Process Data ASE	NO	—
8.2.2	I/O Data ASE	Partial	See Table 153
8.2.3	Diagnosis ASE	Partial	See Table 154
8.2.4	Alarm ASE	NO	—
8.2.5	Context ASE	Partial	See Table 155
8.2.6	Management ASE	Partial	See Table 156
8.2.7	Load Region ASE	NO	—
8.2.8	Function Invocation ASE	NO	—
8.2.9	Time ASE	NO	—
8.2.10	AR ASE	Partial	See Table 157
8.3	Summary of Type 3 Fieldbus AL Classes	YES	—
8.4	Permitted AL Type 3 Fieldbus Services by AREP	YES	—
8.5	Conformance Classes	YES	—
8.6	Application Characteristics	YES	—

Table 153 – CP 3/1, 3/2: AL service selection of I/O data ASE

Clause	Header	Presence	Constraints
8.2.2.1	Overview	YES	—
8.2.2.2	I/O Data Class Specification	NO	—
8.2.2.3	I/O Data Service Specification	—	—
8.2.2.3.1	Set Input	NO	—
8.2.2.3.2	Read Input	NO	—
8.2.2.3.3	Get Input	YES	—
8.2.2.3.4	New Input	YES	—
8.2.2.3.5	Set Output	YES	—
8.2.2.3.6	Read Output	NO	—
8.2.2.3.7	Get Output	NO	—
8.2.2.3.8	New Output	NO	—
8.2.2.3.9	Global Control	YES	Only request and confirm primitives and see 7.2.3.2.5.4
8.2.2.3.10	New Publisher Data	NO	—
8.2.2.3.11	Get Publisher Data	NO	—
8.2.2.3.12	SYNCH	NO	—
8.2.2.3.13	SYNCH Delayed	NO	—
8.2.2.3.14	DX Finished	NO	—
8.2.2.3.15	SYNCH Event	NO	—
8.2.2.4	Behaviour of I/O Data Objects	NO	—

Table 154 – CP 3/1, 3/2: AL service selection of Diagnosis ASE

Clause	Header	Presence	Constraints
8.2.3.1	Overview	YES	—
8.2.3.2	Diagnosis Class Specification	NO	—
8.2.3.3	Diagnosis Service Specification	—	—
8.2.3.3.1	Set Slave Diag	NO	—
8.2.3.3.2	Get Slave Diag	YES	—
8.2.3.3.3	Read Slave Diag	NO	—
8.2.3.3.4	New Slave Diag	YES	—

Table 155 – CP 3/1, 3/2: AL service selection of Context ASE

Clause	Header	Presence	Constraints
8.2.5.1	Overview	YES	—
8.2.5.2	Context Class Specification	NO	—
8.2.5.3	Context Service Specification	—	—
8.2.5.3.1	Check User Prm	NO	—
8.2.5.3.2	Check User Prm Result	NO	—
8.2.5.3.3	Check Ext User Prm	NO	—
8.2.5.3.4	Check Ext User Prm Result	NO	—
8.2.5.3.5	Check Cfg	NO	—
8.2.5.3.6	Check Cfg Result	NO	—
8.2.5.3.7	Set Cfg	NO	—
8.2.5.3.8	Get Cfg	NO	—
8.2.5.3.9	Set Slave Add	NO	—
8.2.5.3.10	Initiate	NO	—
8.2.5.3.11	Abort	NO	—
8.2.5.3.12	MS0 Init DP Slave	NO	—
8.2.5.3.13	MS1 Init DP Slave	NO	—
8.2.5.3.14	M2 Init DP Slave	NO	—
8.2.5.3.15	DP Slave Started	NO	—
8.2.5.3.16	DP Slave Stopped	NO	—
8.2.5.3.17	Reset DP Slave	NO	—
8.2.5.3.18	DP Slave Fault	NO	—
8.2.5.3.19	Application Ready DP Slave	NO	—
8.2.5.3.20	Start Subscriber	NO	—
8.2.5.3.21	Stop Subscriber	NO	—
8.2.5.3.22	Publisher Active	NO	—
8.2.5.3.23	Init DP Master CI1	YES	—
8.2.5.3.24	DP Master CI1 Started	YES	Only for MS0 AR
8.2.5.3.25	DP Master CI1 Stopped	YES	Only for MS0 AR
8.2.5.3.26	Reset DP Master CI1	YES	—
8.2.5.3.27	DP Master CI1 Fault	YES	—
8.2.5.3.28	DP Master CI1 Reject	NO	—
8.2.5.3.29	Set Mode DP Master CI1	YES	—
8.2.5.3.30	DP Master CI1 Mode Changed	YES	—
8.2.5.3.31	Load Bus Par DP Master CI1	YES	—
8.2.5.3.32	Mark DP Master CI1	YES	—
8.2.5.3.33	Abort DP Master CI1	YES	—
8.2.5.3.34	Read Value DP Master CI1	YES	—
8.2.5.3.35	Delete SC DP Master CI1	YES	—
8.2.5.3.36	DP Master CI1 Event	YES	—
8.2.5.3.37	Init DP Master CI2	NO	—
8.2.5.3.38	Reset DP Master CI2	NO	—
8.2.5.3.39	DP Master CI2 Fault	NO	—
8.2.5.3.40	DP Master CI2 Reject	NO	—
8.2.5.3.41	DP Master CI2 Closed	NO	—
8.2.5.3.42	DP Master CI2 Event	NO	—

Table 156 – CP 3/1, 3/2: AL service selection of Management ASE

Clause	Header	Presence	Constraints
8.2.6.1	Overview	YES	—
8.2.6.2	Management Class Specification	—	—
8.2.6.2.1	Master Diag Class Specification	YES	—
8.2.6.2.2	Master Parameter Class Specification	YES	See also 7.2.3.2.5.7 only for DP-V1
8.2.6.3	Management Service Specification	—	—
8.2.6.3.1	Get Master Diag	YES	Only indication and response primitives
8.2.6.3.2	Start Seq	YES	Only indication and response primitives
8.2.6.3.3	Download	YES	Only indication and response primitives
8.2.6.3.4	Upload	YES	Only indication and response primitives
8.2.6.3.5	End Seq	YES	Only indication and response primitives
8.2.6.3.6	Act Para Brct	YES	Only indication primitive
8.2.6.3.7	Act Para	YES	Only indication and response primitives

Table 157 – CP 3/1, 3/2: AL service selection of AR ASE

Clause	Header	Presence	Constraints
8.2.10.1	Overview	YES	—
8.2.10.2	Type 3 Fieldbus ARs	—	—
8.2.10.2.1	MS0 Application Relationship	YES	—
8.2.10.2.2	MS1 Application Relationship	NO	—
8.2.10.2.3	MS2 Application Relationship	NO	—
8.2.10.2.4	MS3 Application Relationship	NO	—
8.2.10.2.5	MM1 Application Relationship	YES	—
8.2.10.2.6	MM2 Application Relationship	YES	—
8.2.10.3	Application Relationship Class Specification	—	—
8.2.10.3.1	ARL DP-Slave Class Specification	NO	—
8.2.10.3.2	ARL DP-Master (Class 1) Class Specification	YES	—
8.2.10.3.3	ARL DP-Master (Class 2) Class Specification	NO	—
8.2.10.4	Communication Relationship Class Specification	—	—
8.2.10.4.1	CRL DP-Slave Class Specification	NO	—
8.2.10.4.2	CRL DP-Master (Class 1) Class Specification	YES	See 7.2.3.2.5.1
8.2.10.4.3	CRL DP-Master (Class 2) Class Specification	NO	—
8.2.10.5	AR Service Specification	—	—
8.2.10.5.1	DLL Init DP Slave	NO	—
8.2.10.5.2	Load ARL DP Slave	NO	—
8.2.10.5.3	Get ARL DP Slave	NO	—
8.2.10.5.4	Set ARL Isochronous Mode	NO	—
8.2.10.5.5	Load ARL DP Master Cl1	YES	—
8.2.10.5.6	Get ARL DP Master Cl1	YES	—
8.2.10.5.7	ARL Slave Update DP Master Cl1	NO	—
8.2.10.5.8	Load ARL DP Master Cl2	NO	—
8.2.10.5.9	Get ARL DP Master Cl2	NO	—
8.2.10.5.10	Load CRL DP Slave	NO	—
8.2.10.5.11	Load CRL DXB Link Entries	NO	—
8.2.10.5.12	Get CRL DP Slave	NO	—
8.2.10.5.13	Load CRL DP Master Cl1	YES	—
8.2.10.5.14	Get CRL DP Master Cl1	YES	—
8.2.10.5.15	CRL Slave Activate	YES	—
8.2.10.5.16	CRL Slave New Prm	YES	—
8.2.10.5.17	CRL Slave New Prm Data	YES	—
8.2.10.5.18	Load CRL DP Master Cl2	NO	—
8.2.10.5.19	Get CRL DP Master Cl2	NO	—

7.2.3.1.2.2 DP-V1

Table 158 specifies CP 3/1 and CP 3/2: ASEs, which are part of DP-Master (Class 1) and using features named DP-V1 and Options (see 7.2.3.2.5).

NOTE If a device supports DP-V1 features and Options, then it is to specify within the communication feature list of this device type (GSD-file).

Table 158 – CP 3/1, 3/2: AL service selection of Clause 8

Clause	Header	Presence	Constraints
8.1	Type 3 Fieldbus DP Concepts	YES	—
8.2	Type 3 Fieldbus ASEs	—	—
8.2.1	Process Data ASE	Partial	See Table 159 and 7.2.3.2.5.1
8.2.2	I/O Data ASE	Partial	See Table 160
8.2.3	Diagnosis ASE	Partial	See Table 154
8.2.4	Alarm ASE	Partial	See Table 161and 7.2.3.2.5.2
8.2.5	Context ASE	Partial	See Table 162
8.2.6	Management ASE	Partial	See Table 156
8.2.7	Load Region ASE	Partial	See Table 163 and 7.2.3.2.5.8
8.2.8	Function Invocation ASE	Partial	See Table 164 and 7.2.3.2.5.9
8.2.9	Time ASE	Partial	See Table 165 and 7.2.3.2.5.10
8.2.10	AR ASE	Partial	See Table 166
8.3	Summary of Type 3 Fieldbus AL Classes	YES	—
8.4	Permitted AL Type 3 Fieldbus Services by AREP	YES	—
8.5	Conformance Classes	YES	—
8.6	Application Characteristics	YES	—

Table 159 – CP 3/1, 3/2: AL service selection of Process data ASE

Clause	Header	Presence	Constraints
8.2.1.1	Overview	YES	—
8.2.1.2	Process Data Class Specification	NO	—
8.2.1.3	Access Protection on Process Data objects	NO	—
8.2.1.4	Process Data Service Specification	—	—
8.2.1.4.1	Read	YES	Only request and confirm primitives
8.2.1.4.2	Write	YES	Only request and confirm primitives
8.2.1.4.3	Data Transport	NO	—

Table 160 – CP 3/1, 3/2: AL service selection of I/O data ASE

Clause	Header	Presence	Constraints
8.2.2.1	Overview	YES	—
8.2.2.2	I/O Data Class Specification	NO	—
8.2.2.3	I/O Data Service Specification	—	—
8.2.2.3.1	Set Input	NO	—
8.2.2.3.2	Read Input	NO	—
8.2.2.3.3	Get Input	YES	—
8.2.2.3.4	New Input	YES	—
8.2.2.3.5	Set Output	YES	—
8.2.2.3.6	Read Output	NO	—
8.2.2.3.7	Get Output	NO	—
8.2.2.3.8	New Output	NO	—
8.2.2.3.9	Global Control	YES	Only request and confirm primitives and see 7.2.3.2.5.4
8.2.2.3.10	New Publisher Data	NO	—
8.2.2.3.11	Get Publisher Data	NO	—
8.2.2.3.12	SYNCH	YES	—
8.2.2.3.13	SYNCH Delayed	YES	—
8.2.2.3.14	DX Finished	YES	—
8.2.2.3.15	SYNCH Event	NO	—
8.2.2.4	Behaviour of I/O Data Objects	Partial	Only for isochronous mode, see 7.2.3.2.5.5

Table 161 – CP 3/1, 3/2: AL service selection of Alarm ASE

Clause	Header	Presence	Constraints
8.2.4.1	Overview	YES	—
8.2.4.2	Alarm Class Specification	NO	—
8.2.4.3	Alarm Service Specification	—	—
8.2.4.3.1	Alarm Notification	YES	Only indication primitive
8.2.4.3.2	Alarm Ack	YES	Only request and confirm primitives

Table 162 – CP 3/1, 3/2: AL service selection of Context ASE

Clause	Header	Presence	Constraints
8.2.5.1	Overview	YES	—
8.2.5.2	Context Class Specification	NO	
8.2.5.3	Context Service Specification	—	—
8.2.5.3.1 - 8.2.5.3.22	—	NO	—
8.2.5.3.23 - 8.2.5.3.36	—	YES	—
8.2.5.3.37 - 8.2.5.3.42	Init DP Master CI2	NO	—

Table 163 – CP 3/1, 3/2: AL service selection of Load region ASE

Clause	Header	Presence	Constraints
8.2.7.1	Overview	YES	—
8.2.7.2	Load Region Class Specification	NO	—
8.2.7.3	Load Region Service Specification	—	—
8.2.7.3.1	Initiate Load	YES	Only request and confirm primitives
8.2.7.3.2	Push Segment	YES	Only request and confirm primitives
8.2.7.3.3	Pull Segment	YES	Only request and confirm primitives
8.2.7.3.4	Terminate Load	YES	Only request and confirm primitives
8.2.7.4	Behaviour of the Load Region object	NO	—

Table 164 – CP 3/1, 3/2: AL service selection of Function invocation ASE

Clause	Header	Presence	Constraints
8.2.8.1	Overview	YES	—
8.2.8.2	Function Invocation Model Class Specification	NO	—
8.2.8.3	Function Invocation Service Specification	—	—
8.2.8.3.1	Start	YES	Only request and confirm primitives
8.2.8.3.2	Stop	YES	Only request and confirm primitives
8.2.8.3.3	Resume	YES	Only request and confirm primitives
8.2.8.3.4	Reset	YES	Only request and confirm primitives
8.2.8.3.5	Get FI State	YES	Only request and confirm primitives
8.2.8.3.6	Call	YES	Only request and confirm primitives
8.2.8.4	Behaviour of the Function Invocation object	NO	—

Table 165 – CP 3/1, 3/2: AL service selection of Time ASE

Clause	Header	Presence	Constraints
8.2.9.1	Overview	YES	—
8.2.9.2	Time Class Specification	—	—
8.2.9.2.1	Slave Time Class Specification	NO	—
8.2.9.2.2	Link Time Class Specification	YES	—
8.2.9.3	Time Service Specification	—	—
8.2.9.3.1	Set Time	YES	—
8.2.9.3.2	Sync Interval Violation	NO	—

Table 166 – CP 3/1, 3/2: AL service selection of AR ASE

Clause	Header	Presence	Constraints
8.2.10.1	Overview	YES	—
8.2.10.2	Type 3 Fieldbus ARs	—	—
8.2.10.2.1	MS0 Application Relationship	YES	—
8.2.10.2.2	MS1 Application Relationship	YES	—
8.2.10.2.3	MS2 Application Relationship	NO	—
8.2.10.2.4	MS3 Application Relationship	YES	—
8.2.10.2.5	MM1 Application Relationship	YES	—
8.2.10.2.6	MM2 Application Relationship	YES	—
8.2.10.3	Application Relationship Class Specification	—	—
8.2.10.3.1	ARL DP-Slave Class Specification	NO	—
8.2.10.3.2	ARL DP-Master (Class 1) Class Specification	YES	—
8.2.10.3.3	ARL DP-Master (Class 2) Class Specification	NO	—
8.2.10.4	Communication Relationship Class Specification	—	—
8.2.10.4.1	CRL DP-Slave Class Specification	NO	—
8.2.10.4.2	CRL DP-Master (Class 1) Class Specification	YES	—
8.2.10.4.3	CRL DP-Master (Class 2) Class Specification	NO	—
8.2.10.5	AR Service Specification	—	—
8.2.10.5.1	DLL Init DP Slave	NO	—
8.2.10.5.2	Load ARL DP Slave	NO	—
8.2.10.5.3	Get ARL DP Slave	NO	—
8.2.10.5.4	Set ARL Isochronous Mode	NO	—
8.2.10.5.5	Load ARL DP Master CI1	YES	—
8.2.10.5.6	Get ARL DP Master CI1	YES	—
8.2.10.5.7	ARL Slave Update DP Master CI1	YES	—
8.2.10.5.8	Load ARL DP Master CI2	NO	—
8.2.10.5.9	Get ARL DP Master CI2	NO	—
8.2.10.5.10	Load CRL DP Slave	NO	—
8.2.10.5.11	Load CRL DXB Link Entries	NO	—
8.2.10.5.12	Get CRL DP Slave	NO	—
8.2.10.5.13	Load CRL DP Master CI1	YES	—
8.2.10.5.14	Get CRL DP Master CI1	YES	—
8.2.10.5.15	CRL Slave Activate	YES	—
8.2.10.5.16	CRL Slave New Prm	YES	—
8.2.10.5.17	CRL Slave New Prm Data	YES	—
8.2.10.5.18	Load CRL DP Master CI2	NO	—
8.2.10.5.19	Get CRL DP Master CI2	NO	—

7.2.3.1.3 DP-master (Class 2)

7.2.3.1.3.1 DP-V0

Table 167 specifies CP 3/1 and CP 3/2: ASEs, which are part of DP-Master (Class 2) and using features named DP-V0 and Options (see 7.2.3.2.5).

Table 167 – CP 3/1, 3/2: AL service selection of Clause 8

Clause	Header	Presence	Constraints
8.1	Type 3 Fieldbus DP Concepts	YES	—
8.2	Type 3 Fieldbus ASEs	—	—
8.2.1	Process Data ASE	NO	—
8.2.2	I/O Data ASE	Partial	See Table 168
8.2.3	Diagnosis ASE	Partial	See Table 169
8.2.4	Alarm ASE	NO	—
8.2.5	Context ASE	Partial	See Table 170
8.2.6	Management ASE	Partial	See Table 171
8.2.7	Load Region ASE	NO	—
8.2.8	Function Invocation ASE	NO	—
8.2.9	Time ASE	NO	—
8.2.10	AR ASE	Partial	See Table 172
8.3	Summary of Type 3 Fieldbus AL Classes	YES	—
8.4	Permitted AL Type 3 Fieldbus Services by AREP	YES	—
8.5	Conformance Classes	YES	—
8.6	Application Characteristics	YES	—

Table 168 – CP 3/1, 3/2: AL service selection of I/O data ASE

Clause	Header	Presence	Constraints
8.2.2.1	Overview	YES	—
8.2.2.2	I/O Data Class Specification	NO	—
8.2.2.3	I/O Data Service Specification	—	—
8.2.2.3.1	Set Input	NO	—
8.2.2.3.2	Read Input	YES	Only request and confirm primitives
8.2.2.3.3	Get Input	NO	—
8.2.2.3.4	New Input	NO	—
8.2.2.3.5	Set Output	NO	—
8.2.2.3.6	Read Output	YES	Only request and confirm primitives
8.2.2.3.7	Get Output	NO	—
8.2.2.3.8	New Output	NO	—
8.2.2.3.9	Global Control	NO	—
8.2.2.3.10	New Publisher Data	NO	—
8.2.2.3.11	Get Publisher Data	NO	—
8.2.2.3.12	SYNCH	NO	—
8.2.2.3.13	SYNCH Delayed	NO	—
8.2.2.3.14	DX Finished	NO	—
8.2.2.3.15	SYNCH Event	NO	—
8.2.2.4	Behaviour of I/O Data Objects	NO	—

Table 169 – CP 3/1, 3/2: AL service selection of Diagnosis ASE

Clause	Header	Presence	Constraints
8.2.3.1	Overview	YES	—
8.2.3.2	Diagnosis Class Specification	NO	—
8.2.3.3	Diagnosis Service Specification	—	—
8.2.3.3.1	Set Slave Diag	NO	—
8.2.3.3.2	Get Slave Diag	NO	—
8.2.3.3.3	Read Slave Diag	YES	—
8.2.3.3.4	New Slave Diag	NO	—

Table 170 – CP 3/1, 3/2: AL service selection of Context ASE

Clause	Header	Presence	Constraints
8.2.5.1	Overview	YES	—
8.2.5.2	Context Class Specification	NO	—
8.2.5.3	Context Service Specification	—	—
8.2.5.3.1	Check User Prm	NO	—
8.2.5.3.2	Check User Prm Result	NO	—
8.2.5.3.3	Check Ext User Prm	NO	—
8.2.5.3.4	Check Ext User Prm Result	NO	—
8.2.5.3.5	Check Cfg	NO	—
8.2.5.3.6	Check Cfg Result	NO	—
8.2.5.3.7	Set Cfg	NO	—
8.2.5.3.8	Get Cfg	YES	—
8.2.5.3.9	Set Slave Add	YES	Only request and confirm primitives
8.2.5.3.10	Initiate	NO	—
8.2.5.3.11	Abort	NO	—
8.2.5.3.12	MS0 Init DP Slave	NO	—
8.2.5.3.13	MS1 Init DP Slave	NO	—
8.2.5.3.14	M2 Init DP Slave	NO	—
8.2.5.3.15	DP Slave Started	NO	—
8.2.5.3.16	DP Slave Stopped	NO	—
8.2.5.3.17	Reset DP Slave	NO	—
8.2.5.3.18	DP Slave Fault	NO	—
8.2.5.3.19	Application Ready DP Slave	NO	—
8.2.5.3.20	Start Subscriber	NO	—
8.2.5.3.21	Stop Subscriber	NO	—
8.2.5.3.22	Publisher Active	NO	—
8.2.5.3.23	Init DP Master CI1	NO	—
8.2.5.3.24	DP Master CI1 Started	NO	—
8.2.5.3.25	DP Master CI1 Stopped	NO	—
8.2.5.3.26	Reset DP Master CI1	NO	—
8.2.5.3.27	DP Master CI1 Fault	NO	—
8.2.5.3.28	DP Master CI1 Reject	NO	—
8.2.5.3.29	Set Mode DP Master CI1	NO	—
8.2.5.3.30	DP Master CI1 Mode Changed	NO	—
8.2.5.3.31	Load Bus Par DP Master CI1	NO	—
8.2.5.3.32	Mark DP Master CI1	NO	—
8.2.5.3.33	Abort DP Master CI1	NO	—
8.2.5.3.34	Read Value DP Master CI1	NO	—
8.2.5.3.35	Delete SC DP Master CI1	NO	—
8.2.5.3.36	DP Master CI1 Event	NO	—
8.2.5.3.37	Init DP Master CI2	YES	—
8.2.5.3.38	Reset DP Master CI2	YES	—
8.2.5.3.39	DP Master CI2 Fault	YES	—
8.2.5.3.40	DP Master CI2 Reject	NO	—
8.2.5.3.41	DP Master CI2 Closed	NO	—
8.2.5.3.42	DP Master CI2 Event	YES	—

Table 171 – CP 3/1, 3/2: AL service selection of Management ASE

Clause	Header	Presence	Constraints
8.2.6.1	Overview	YES	—
8.2.6.2	Management Class Specification	NO	
8.2.6.3	Management Service Specification	—	—
8.2.6.3.1	Get Master Diag	YES	Only request and confirm primitives
8.2.6.3.2	Start Seq	YES	Only request and confirm primitives
8.2.6.3.3	Download	YES	Only request and confirm primitives and see 7.2.3.2.5.7 only for DP-V1
8.2.6.3.4	Upload	YES	Only request and confirm primitives
8.2.6.3.5	End Seq	YES	Only request and confirm primitives
8.2.6.3.6	Act Para Brct	YES	Only request primitive
8.2.6.3.7	Act Para	YES	Only request and confirm primitives

Table 172 – CP 3/1, 3/2: AL service selection of AR ASE

Clause	Header	Presence	Constraints
8.2.10.1	Overview	YES	—
8.2.10.2	Type 3 Fieldbus ARs	—	—
8.2.10.2.1	MS0 Application Relationship	YES	—
8.2.10.2.2	MS1 Application Relationship	NO	—
8.2.10.2.3	MS2 Application Relationship	NO	—
8.2.10.2.4	MS3 Application Relationship	NO	—
8.2.10.2.5	MM1 Application Relationship	YES	—
8.2.10.2.6	MM2 Application Relationship	YES	—
8.2.10.3	Application Relationship Class Specification	—	—
8.2.10.3.1	ARL DP-Slave Class Specification	NO	—
8.2.10.3.2	ARL DP-Master (Class 1) Class Specification	NO	—
8.2.10.3.3	ARL DP-Master (Class 2) Class Specification	YES	—
8.2.10.4	Communication Relationship Class Specification	—	—
8.2.10.4.1	CRL DP-Slave Class Specification	NO	—
8.2.10.4.2	CRL DP-Master (Class 1) Class Specification	NO	—
8.2.10.4.3	CRL DP-Master (Class 2) Class Specification	YES	—
8.2.10.5	AR Service Specification	—	—
8.2.10.5.1	DLL Init DP Slave	NO	—
8.2.10.5.2	Load ARL DP Slave	NO	—
8.2.10.5.3	Get ARL DP Slave	NO	—
8.2.10.5.4	Set ARL Isochronous Mode	NO	—
8.2.10.5.5	Load ARL DP Master Cl1	NO	—
8.2.10.5.6	Get ARL DP Master Cl1	NO	—
8.2.10.5.7	ARL Slave Update DP Master Cl1	NO	—
8.2.10.5.8	Load ARL DP Master Cl2	YES	—
8.2.10.5.9	Get ARL DP Master Cl2	YES	—
8.2.10.5.10	Load CRL DP Slave	NO	—
8.2.10.5.11	Load CRL DXB Link Entries	NO	—
8.2.10.5.12	Get CRL DP Slave	NO	—
8.2.10.5.13	Load CRL DP Master Cl1	NO	—
8.2.10.5.14	Get CRL DP Master Cl1	NO	—
8.2.10.5.15	CRL Slave Activate	NO	—
8.2.10.5.16	CRL Slave New Prm	NO	—
8.2.10.5.17	CRL Slave New Prm Data	NO	—
8.2.10.5.18	Load CRL DP Master Cl2	YES	—
8.2.10.5.19	Get CRL DP Master Cl2	YES	—

7.2.3.1.3.2 DP-V1

Table 173 specifies CP 3/1 and CP 3/2: ASEs, which are part of DP-Master (Class 2) and using features named DP-V1 and Options (see 7.2.3.2.5).

NOTE If a device supports DP-V1 features and Options, then it is to specify within the communication feature list of this device type (GSD-file).

Table 173 – CP 3/1, 3/2: AL service selection of Clause 8

Clause	Header	Presence	Constraints
8.1	Type 3 Fieldbus DP Concepts	YES	—
8.2	Type 3 Fieldbus ASEs	—	—
8.2.1	Process Data ASE	Partial	See Table 174 and 7.2.3.2.5.1
8.2.2	I/O Data ASE	Partial	See Table 168
8.2.3	Diagnosis ASE	Partial	See Table 169
8.2.4	Alarm ASE	NO	—
8.2.5	Context ASE	Partial	See Table 175
8.2.6	Management ASE	Partial	See Table 171
8.2.7	Load Region ASE	Partial	See Table 176 and 7.2.3.2.5.8
8.2.8	Function Invocation ASE	Partial	See Table 177 and 7.2.3.2.5.9
8.2.9	Time ASE	Partial	See Table 178 and 7.2.3.2.5.10
8.2.10	AR ASE	Partial	See Table 179
8.3	Summary of Type 3 Fieldbus AL Classes	YES	—
8.4	Permitted AL Type 3 Fieldbus Services by AREP	YES	—
8.5	Conformance Classes	YES	—
8.6	Application Characteristics	YES	—

Table 174 – CP 3/1, 3/2: AL service selection of Process data ASE

Clause	Header	Presence	Constraints
8.2.1.1	Overview	YES	—
8.2.1.2	Process Data Class Specification	NO	—
8.2.1.3	Access Protection on Process Data objects	NO	—
8.2.1.4	Process Data Service Specification	—	—
8.2.1.4.1	Read	YES	Only request and confirm primitives
8.2.1.4.2	Write	YES	Only request and confirm primitives
8.2.1.4.3	Data Transport	YES	Only request and confirm primitives

Table 175 – CP 3/1, 3/2: AL service selection of Context ASE

Clause	Header	Presence	Constraints
8.2.5.1	Overview	YES	—
8.2.5.2	Context Class Specification	NO	—
8.2.5.3	Context Service Specification	—	—
8.2.5.3.1	Check User Prm	NO	—
8.2.5.3.2	Check User Prm Result	NO	—
8.2.5.3.3	Check Ext User Prm	NO	—
8.2.5.3.4	Check Ext User Prm Result	NO	—
8.2.5.3.5	Check Cfg	NO	—
8.2.5.3.6	Check Cfg Result	NO	—
8.2.5.3.7	Set Cfg	NO	—
8.2.5.3.8	Get Cfg	YES	—
8.2.5.3.9	Set Slave Add	YES	Only request and confirm primitives
8.2.5.3.10	Initiate	YES	Only request and confirm primitives
8.2.5.3.11	Abort	YES	—
8.2.5.3.12	MS0 Init DP Slave	NO	—
8.2.5.3.13	MS1 Init DP Slave	NO	—
8.2.5.3.14	M2 Init DP Slave	NO	—
8.2.5.3.15	DP Slave Started	NO	—
8.2.5.3.16	DP Slave Stopped	NO	—
8.2.5.3.17	Reset DP Slave	NO	—
8.2.5.3.18	DP Slave Fault	NO	—
8.2.5.3.19	Application Ready DP Slave	NO	—
8.2.5.3.20	Start Subscriber	NO	—
8.2.5.3.21	Stop Subscriber	NO	—
8.2.5.3.22	Publisher Active	NO	—
8.2.5.3.23	Init DP Master Cl1	NO	—
8.2.5.3.24	DP Master Cl1 Started	NO	—
8.2.5.3.25	DP Master Cl1 Stopped	NO	—
8.2.5.3.26	Reset DP Master Cl1	NO	—
8.2.5.3.27	DP Master Cl1 Fault	NO	—
8.2.5.3.28	DP Master Cl1 Reject	NO	—
8.2.5.3.29	Set Mode DP Master Cl1	NO	—
8.2.5.3.30	DP Master Cl1 Mode Changed	NO	—
8.2.5.3.31	Load Bus Par DP Master Cl1	NO	—
8.2.5.3.32	Mark DP Master Cl1	NO	—
8.2.5.3.33	Abort DP Master Cl1	NO	—
8.2.5.3.34	Read Value DP Master Cl1	NO	—
8.2.5.3.35	Delete SC DP Master Cl1	NO	—
8.2.5.3.36	DP Master Cl1 Event	NO	—
8.2.5.3.37	Init DP Master Cl2	YES	—
8.2.5.3.38	Reset DP Master Cl2	YES	—
8.2.5.3.39	DP Master Cl2 Fault	YES	—
8.2.5.3.40	DP Master Cl2 Reject	YES	—
8.2.5.3.41	DP Master Cl2 Closed	YES	—
8.2.5.3.42	DP Master Cl2 Event	YES	—

Table 176 – CP 3/1, 3/2: AL service selection of Load region ASE

Clause	Header	Presence	Constraints
8.2.7.1	Overview	YES	—
8.2.7.2	Load Region Class Specification	NO	—
8.2.7.3	Load Region Service Specification	—	—
8.2.7.3.1	Initiate Load	YES	Only request and confirm primitives
8.2.7.3.2	Push Segment	YES	Only request and confirm primitives
8.2.7.3.3	Pull Segment	YES	Only request and confirm primitives
8.2.7.3.4	Terminate Load	YES	Only request and confirm primitives
8.2.7.4	Behaviour of the Load Region object	NO	—

Table 177 – CP 3/1, 3/2: AL service selection of Function invocation ASE

Clause	Header	Presence	Constraints
8.2.8.1	Overview	YES	—
8.2.8.2	Function Invocation Model Class Specification	NO	—
8.2.8.3	Function Invocation Service Specification	—	—
8.2.8.3.1	Start	YES	Only request and confirm primitives
8.2.8.3.2	Stop	YES	Only request and confirm primitives
8.2.8.3.3	Resume	YES	Only request and confirm primitives
8.2.8.3.4	Reset	YES	Only request and confirm primitives
8.2.8.3.5	Get FI State	YES	Only request and confirm primitives
8.2.8.3.6	Call	YES	Only request and confirm primitives
8.2.8.4	Behaviour of the Function Invocation object	NO	—

Table 178 – CP 3/1, 3/2: AL service selection of Time ASE

Clause	Header	Presence	Constraints
8.2.9.1	Overview	YES	—
8.2.9.2	Time Class Specification	—	—
8.2.9.2.1	Slave Time Class Specification	NO	—
8.2.9.2.2	Link Time Class Specification	YES	—
8.2.9.3	Time Service Specification	—	—
8.2.9.3.1	Set Time	YES	—
8.2.9.3.2	Sync Interval Violation	NO	—

Table 179 – CP 3/1, 3/2: AL service selection of AR ASE

Clause	Header	Presence	Constraints
8.2.10.1	Overview	YES	—
8.2.10.2	Type 3 Fieldbus ARs	—	—
8.2.10.2.1	MS0 Application Relationship	YES	—
8.2.10.2.2	MS1 Application Relationship	NO	—
8.2.10.2.3	MS2 Application Relationship	YES	—
8.2.10.2.4	MS3 Application Relationship	YES	—
8.2.10.2.5	MM1 Application Relationship	YES	—
8.2.10.2.6	MM2 Application Relationship	YES	—
8.2.10.3	Application Relationship Class Specification	—	—
8.2.10.3.1	ARL DP-Slave Class Specification	NO	—
8.2.10.3.2	ARL DP-Master (Class 1) Class Specification	NO	—
8.2.10.3.3	ARL DP-Master (Class 2) Class Specification	YES	—
8.2.10.4	Communication Relationship Class Specification	—	—
8.2.10.4.1	CRL DP-Slave Class Specification	NO	—
8.2.10.4.2	CRL DP-Master (Class 1) Class Specification	NO	—
8.2.10.4.3	CRL DP-Master (Class 2) Class Specification	YES	—
8.2.10.5	AR Service Specification	—	—
8.2.10.5.1	DLL Init DP Slave	NO	—
8.2.10.5.2	Load ARL DP Slave	NO	—
8.2.10.5.3	Get ARL DP Slave	NO	—
8.2.10.5.4	Set ARL Isochronous Mode	NO	—
8.2.10.5.5	Load ARL DP Master Cl1	NO	—
8.2.10.5.6	Get ARL DP Master Cl1	NO	—
8.2.10.5.7	ARL Slave Update DP Master Cl1	NO	—
8.2.10.5.8	Load ARL DP Master Cl2	YES	—
8.2.10.5.9	Get ARL DP Master Cl2	YES	—
8.2.10.5.10	Load CRL DP Slave	NO	—
8.2.10.5.11	Load CRL DXB Link Entries	NO	—
8.2.10.5.12	Get CRL DP Slave	NO	—
8.2.10.5.13	Load CRL DP Master Cl1	NO	—
8.2.10.5.14	Get CRL DP Master Cl1	NO	—
8.2.10.5.15	CRL Slave Activate	NO	—
8.2.10.5.16	CRL Slave New Prm	NO	—
8.2.10.5.17	CRL Slave New Prm Data	NO	—
8.2.10.5.18	Load CRL DP Master Cl2	YES	—
8.2.10.5.19	Get CRL DP Master Cl2	YES	—

7.2.3.1.4 DP-slave

7.2.3.1.4.1 DP-V0

Table 180 specifies CP 3/1 and CP 3/2: ASEs, which are part of DP-Slave and using features named DP-V0 and Options (see 7.2.3.2.5).

Table 180 – CP 3/1, 3/2: AL service selection of Clause 8

Clause	Header	Presence	Constraints
8.1	Type 3 Fieldbus DP Concepts	YES	—
8.2	Type 3 Fieldbus ASEs	—	—
8.2.1	Process Data ASE	NO	—
8.2.2	I/O Data ASE	Partial	See Table 181
8.2.3	Diagnosis ASE	Partial	See Table 182
8.2.4	Alarm ASE	NO	—
8.2.5	Context ASE	Partial	See Table 183
8.2.6	Management ASE	NO	—
8.2.7	Load Region ASE	NO	—
8.2.8	Function Invocation ASE	NO	—
8.2.9	Time ASE	NO	—
8.2.10	AR ASE	Partial	See Table 184
8.3	Summary of Type 3 Fieldbus AL Classes	YES	—
8.4	Permitted AL Type 3 Fieldbus Services by AREP	YES	See 7.2.3.2.5
8.5	Conformance Classes	YES	—
8.6	Application Characteristics	YES	—

Table 181 – CP 3/1, 3/2: AL service selection of I/O data ASE

Clause	Header	Presence	Constraints
8.2.2.1	Overview	YES	—
8.2.2.2	I/O Data Class Specification	YES	—
8.2.2.3	I/O Data Service Specification	—	—
8.2.2.3.1	Set Input	YES	—
8.2.2.3.2	Read Input	NO	—
8.2.2.3.3	Get Input	NO	—
8.2.2.3.4	New Input	NO	—
8.2.2.3.5	Set Output	NO	—
8.2.2.3.6	Read Output	NO	—
8.2.2.3.7	Get Output	YES	—
8.2.2.3.8	New Output	YES	—
8.2.2.3.9	Global Control	YES	Only indication primitive
8.2.2.3.10	New Publisher Data	NO	—
8.2.2.3.11	Get Publisher Data	NO	—
8.2.2.3.12	SYNCH	NO	—
8.2.2.3.13	SYNCH Delayed	NO	—
8.2.2.3.14	DX Finished	NO	—
8.2.2.3.15	SYNCH Event	NO	—
8.2.2.4	Behaviour of I/O Data Objects	—	—
8.2.2.4.1	General Behaviour of the Output Data object	YES	—
8.2.2.4.2	Characteristics of a DP System with Isochronous Mode functionality	NO	—
8.2.2.4.3	Application Model of the DP-Master (Class 1) with Isochronous Mode functionality	NO	—
8.2.2.4.4	Output Data State Machine Desciption for Isochronous Mode	NO	—
8.2.2.4.5	Behaviour of the Input Data object	YES	—
8.2.2.4.6	Input Data State Machine Desciption for Isochronous Mode	NO	—

Table 182 – CP 3/1, 3/2: AL service selection of Diagnosis ASE

Clause	Header	Presence	Constraints
8.2.3.1	Overview	YES	—
8.2.3.2	Diagnosis Class Specification	—	—
8.2.3.2.1	Device Related Diagnosis Class Specification	YES	—
8.2.3.2.2	Identifier Related Diagnosis Class Specification	YES	—
8.2.3.2.3	Channel Related Diagnosis Class Specification	YES	—
8.2.3.2.4	Status Class Specification	NO	—
8.2.3.2.5	Module Status Class Specification	NO	—
8.2.3.2.6	DXB-Link Status Class Specification	NO	—
8.2.3.3	Diagnosis Service Specification	—	—
8.2.3.3.1	Set Slave Diag	YES	—
8.2.3.3.2	Get Slave Diag	NO	—
8.2.3.3.3	Read Slave Diag	NO	—
8.2.3.3.4	New Slave Diag	NO	—

Table 183 – CP 3/1, 3/2: AL service selection of Context ASE

Clause	Header	Presence	Constraints
8.2.5.1	Overview	YES	—
8.2.5.2	Context Class Specification	—	—
8.2.5.2.1	MS0 User Parameter Class Specification	YES	—
8.2.5.2.2	MS0 Structured User Parameter Class Specification	NO	—
8.2.5.2.3	DXB-Linktable Class Specification	NO	—
8.2.5.2.4	DXB-Subscribertable Class Specification	NO	—
8.2.5.2.5	IsoM ParameterClass Specification	NO	—
8.2.5.2.6	MS0 Configuration Elements Class Specification	YES	—
8.2.5.2.7	Remanent Parameter Class Specification	YES	—
8.2.5.2.8	MS2 User Parameter Class Specification	NO	—
8.2.5.3	Context Service Specification	—	—
8.2.5.3.1	Check User Prm	YES	—
8.2.5.3.2	Check User Prm Result	YES	—
8.2.5.3.3	Check Ext User Prm	NO	—
8.2.5.3.4	Check Ext User Prm Result	NO	—
8.2.5.3.5	Check Cfg	YES	—
8.2.5.3.6	Check Cfg Result	YES	—
8.2.5.3.7	Set Cfg	YES	—
8.2.5.3.8	Get Cfg	NO	—
8.2.5.3.9	Set Slave Add	YES	Only indication primitive
8.2.5.3.10	Initiate	NO	—
8.2.5.3.11	Abort	NO	—
8.2.5.3.12	MS0 Init DP Slave	YES	—
8.2.5.3.13	MS1 Init DP Slave	NO	—
8.2.5.3.14	M2 Init DP Slave	NO	—
8.2.5.3.15	DP Slave Started	NO	—
8.2.5.3.16	DP Slave Stopped	YES	Only for MS0 AR
8.2.5.3.17	Reset DP Slave	YES	—
8.2.5.3.18	DP Slave Fault	YES	—
8.2.5.3.19	Application Ready DP Slave	YES	—
8.2.5.3.20	Start Subscriber	NO	—
8.2.5.3.21	Stop Subscriber	NO	—
8.2.5.3.22	Publisher Active	NO	—
8.2.5.3.23	Init DP Master Cl1	NO	—
8.2.5.3.24	DP Master Cl1 Started	NO	—
8.2.5.3.25	DP Master Cl1 Stopped	NO	—
8.2.5.3.26	Reset DP Master Cl1	NO	—
8.2.5.3.27	DP Master Cl1 Fault	NO	—
8.2.5.3.28	DP Master Cl1 Reject	NO	—
8.2.5.3.29	Set Mode DP Master Cl1	NO	—
8.2.5.3.30	DP Master Cl1 Mode Changed	NO	—
8.2.5.3.31	Load Bus Par DP Master Cl1	NO	—
8.2.5.3.32	Mark DP Master Cl1	NO	—
8.2.5.3.33	Abort DP Master Cl1	NO	—
8.2.5.3.34	Read Value DP Master Cl1	NO	—
8.2.5.3.35	Delete SC DP Master Cl1	NO	—
8.2.5.3.36	DP Master Cl1 Event	NO	—
8.2.5.3.37	Init DP Master Cl2	NO	—
8.2.5.3.38	Reset DP Master Cl2	NO	—
8.2.5.3.39	DP Master Cl2 Fault	NO	—
8.2.5.3.40	DP Master Cl2 Reject	NO	—
8.2.5.3.41	DP Master Cl2 Closed	NO	—
8.2.5.3.42	DP Master Cl2 Event	NO	—

Table 184 – CP 3/1, 3/2: AL service selection of AR ASE

Clause	Header	Presence	Constraints
8.2.10.1	Overview	YES	—
8.2.10.2	Type 3 Fieldbus ARs	—	—
8.2.10.2.1	MS0 Application Relationship	YES	—
8.2.10.2.2	MS1 Application Relationship	NO	—
8.2.10.2.3	MS2 Application Relationship	NO	—
8.2.10.2.4	MS3 Application Relationship	NO	—
8.2.10.2.5	MM1 Application Relationship	NO	—
8.2.10.2.6	MM2 Application Relationship	NO	—
8.2.10.3	Application Relationship Class Specification	—	—
8.2.10.3.1	ARL DP-Slave Class Specification	YES	—
8.2.10.3.2	ARL DP-Master (Class 1) Class Specification	NO	—
8.2.10.3.3	ARL DP-Master (Class 2) Class Specification	NO	—
8.2.10.4	Communication Relationship Class Specification	—	—
8.2.10.4.1	CRL DP-Slave Class Specification	YES	—
8.2.10.4.2	CRL DP-Master (Class 1) Class Specification	NO	—
8.2.10.4.3	CRL DP-Master (Class 2) Class Specification	NO	—
8.2.10.5	AR Service Specification	—	—
8.2.10.5.1	DLL Init DP Slave	YES	—
8.2.10.5.2	Load ARL DP Slave	YES	—
8.2.10.5.3	Get ARL DP Slave	YES	—
8.2.10.5.4	Set ARL Isochronous Mode	NO	—
8.2.10.5.5	Load ARL DP Master CI1	NO	—
8.2.10.5.6	Get ARL DP Master CI1	NO	—
8.2.10.5.7	ARL Slave Update DP Master CI1	NO	—
8.2.10.5.8	Load ARL DP Master CI2	NO	—
8.2.10.5.9	Get ARL DP Master CI2	NO	—
8.2.10.5.10	Load CRL DP Slave	YES	—
8.2.10.5.11	Load CRL DXB Link Entries	NO	—
8.2.10.5.12	Get CRL DP Slave	YES	—
8.2.10.5.13	Load CRL DP Master CI1	NO	—
8.2.10.5.14	Get CRL DP Master CI1	NO	—
8.2.10.5.15	CRL Slave Activate	NO	—
8.2.10.5.16	CRL Slave New Prm	NO	—
8.2.10.5.17	CRL Slave New Prm Data	NO	—
8.2.10.5.18	Load CRL DP Master CI2	NO	—
8.2.10.5.19	Get CRL DP Master CI2	NO	—

7.2.3.1.4.2 DP-V1

Table 185 specifies CP 3/1 and CP 3/2: ASEs, which are part of DP-Slave and using features named DP-V1 and Options (see 7.2.3.2.5).

NOTE If a device supports DP-V1 features and Options, then it is to specify within the communication feature list of this device type (GSD-file).

Table 185 – CP 3/1, 3/2: AL service selection of Clause 8

Clause	Header	Presence	Constraints
8.1	Type 3 Fieldbus DP Concepts	YES	—
8.2	Type 3 Fieldbus ASEs	—	—
8.2.1	Process Data ASE	Partial	See Table 186 and 7.2.3.2.5.1
8.2.2	I/O Data ASE	Partial	See Table 187
8.2.3	Diagnosis ASE	Partial	See Table 188
8.2.4	Alarm ASE	Partial	See Table 189 and 7.2.3.2.5.2
8.2.5	Context ASE	Partial	See Table 190
8.2.6	Management ASE	NO	—
8.2.7	Load Region ASE	Partial	See Table 191 and 7.2.3.2.5.8
8.2.8	Function Invocation ASE	Partial	See Table 192 and 7.2.3.2.5.9
8.2.9	Time ASE	Partial	See Table 193 and 7.2.3.2.5.10
8.2.10	AR ASE	Partial	See Table 194 and
8.3	Summary of Type 3 Fieldbus AL Classes	YES	—
8.4	Permitted AL Type 3 Fieldbus Services by AREP	YES	—
8.5	Conformance Classes	YES	—
8.6	Application Characteristics	YES	—

Table 186 – CP 3/1, 3/2: AL service selection of Process data ASE

Clause	Header	Presence	Constraints
8.2.1.1	Overview	YES	—
8.2.1.2	Process Data Class Specification	YES	—
8.2.1.3	Access Protection on Process Data objects	YES	—
8.2.1.4	Process Data Service Specification	—	—
8.2.1.4.1	Read	YES	Only indication and response primitives
8.2.1.4.2	Write	YES	Only indication and response primitives
8.2.1.4.3	Data Transport	YES	Only indication and response primitives

Table 187 – CP 3/1, 3/2: AL service selection of I/O data ASE

Clause	Header	Presence	Constraints
8.2.2.1	Overview	YES	—
8.2.2.2	I/O Data Class Specification	YES	—
8.2.2.3	I/O Data Service Specification	—	—
8.2.2.3.1	Set Input	YES	—
8.2.2.3.2	Read Input	NO	—
8.2.2.3.3	Get Input	NO	—
8.2.2.3.4	New Input	NO	—
8.2.2.3.5	Set Output	NO	—
8.2.2.3.6	Read Output	NO	—
8.2.2.3.7	Get Output	YES	—
8.2.2.3.8	New Output	YES	—
8.2.2.3.9	Global Control	YES	Only indication primitive
8.2.2.3.10	New Publisher Data	YES	—
8.2.2.3.11	Get Publisher Data	YES	—
8.2.2.3.12	SYNCH	NO	—
8.2.2.3.13	SYNCH Delayed	NO	—
8.2.2.3.14	DX Finished	NO	—
8.2.2.3.15	SYNCH Event	YES	—
8.2.2.4	Behaviour of I/O Data Objects	YES	see also 7.2.3.2.5.5

Table 188 – CP 3/1, 3/2: AL service selection of diagnosis ASE

Clause	Header	Presence	Constraints
8.2.3.1	Overview	YES	—
8.2.3.2	Diagnosis Class Specification	—	—
8.2.3.2.1	Device Related Diagnosis Class Specification	NO	—
8.2.3.2.2	Identifier Related Diagnosis Class Specification	YES	—
8.2.3.2.3	Channel Related Diagnosis Class Specification	YES	—
8.2.3.2.4	Status Class Specification	YES	—
8.2.3.2.5	Module Status Class Specification	YES	—
8.2.3.2.6	DXB-Link Status Class Specification	YES	—
8.2.3.3	Diagnosis Service Specification	—	—
8.2.3.3.1	Set Slave Diag	YES	—
8.2.3.3.2	Get Slave Diag	NO	—
8.2.3.3.3	Read Slave Diag	NO	—
8.2.3.3.4	New Slave Diag	NO	—

Table 189 – CP 3/1, 3/2: AL service selection of Alarm ASE

Clause	Header	Presence	Constraints
8.2.4.1	Overview	YES	—
8.2.4.2	Alarm Class Specification	YES	—
8.2.4.3	Alarm Service Specification	—	—
8.2.4.3.1	Alarm Notification	YES	Only request and confirm primitives
8.2.4.3.2	Alarm Ack	YES	Only indication and response primitives

Table 190 – CP 3/1, 3/2: AL service selection of Context ASE

Clause	Header	Presence	Constraints
8.2.5.1	Overview	YES	—
8.2.5.2	Context Class Specification	—	—
8.2.5.2.1	MS0 User Parameter Class Specification	YES	—
8.2.5.2.2	MS0 Structured User Parameter Class Specification	YES	See also 7.2.3.2.5.7
8.2.5.2.3	DXB-Linktable Class Specification	YES	—
8.2.5.2.4	DXB-Subscribertable Class Specification	YES	—
8.2.5.2.5	IsoM ParameterClass Specification	YES	—
8.2.5.2.6	MS0 Configuration Elements Class Specification	YES	—
8.2.5.2.7	Remanent Parameter Class Specification	YES	—
8.2.5.2.8	MS2 User Parameter Class Specification	YES	—
8.2.5.3	Context Service Specification	—	—
8.2.5.3.1	Check User Prm	YES	—
8.2.5.3.2	Check User Prm Result	YES	—
8.2.5.3.3	Check Ext User Prm	YES	—
8.2.5.3.4	Check Ext User Prm Result	YES	—
8.2.5.3.5	Check Cfg	YES	—
8.2.5.3.6	Check Cfg Result	YES	—
8.2.5.3.7	Set Cfg	YES	—
8.2.5.3.8	Get Cfg	NO	—
8.2.5.3.9	Set Slave Add	YES	Only indication primitive
8.2.5.3.10	Initiate	YES	Only indication and response primitives
8.2.5.3.11	Abort	YES	—
8.2.5.3.12	MS0 Init DP Slave	YES	—
8.2.5.3.13	MS1 Init DP Slave	YES	—
8.2.5.3.14	M2 Init DP Slave	YES	—
8.2.5.3.15	DP Slave Started	YES	—
8.2.5.3.16	DP Slave Stopped	YES	—
8.2.5.3.17	Reset DP Slave	YES	—
8.2.5.3.18	DP Slave Fault	YES	—
8.2.5.3.19	Application Ready DP Slave	YES	—
8.2.5.3.20	Start Subscriber	YES	—
8.2.5.3.21	Stop Subscriber	YES	—
8.2.5.3.22	Publisher Active	YES	—
8.2.5.3.23	Init DP Master Cl1	NO	—
8.2.5.3.24	DP Master Cl1 Started	NO	—
8.2.5.3.25	DP Master Cl1 Stopped	NO	—
8.2.5.3.26	Reset DP Master Cl1	NO	—
8.2.5.3.27	DP Master Cl1 Fault	NO	—
8.2.5.3.28	DP Master Cl1 Reject	NO	—
8.2.5.3.29	Set Mode DP Master Cl1	NO	—
8.2.5.3.30	DP Master Cl1 Mode Changed	NO	—
8.2.5.3.31	Load Bus Par DP Master Cl1	NO	—
8.2.5.3.32	Mark DP Master Cl1	NO	—
8.2.5.3.33	Abort DP Master Cl1	NO	—
8.2.5.3.34	Read Value DP Master Cl1	NO	—
8.2.5.3.35	Delete SC DP Master Cl1	NO	—
8.2.5.3.36	DP Master Cl1 Event	NO	—
8.2.5.3.37	Init DP Master Cl2	NO	—
8.2.5.3.38	Reset DP Master Cl2	NO	—
8.2.5.3.39	DP Master Cl2 Fault	NO	—
8.2.5.3.40	DP Master Cl2 Reject	NO	—
8.2.5.3.41	DP Master Cl2 Closed	NO	—
8.2.5.3.42	DP Master Cl2 Event	NO	—

Table 191 – CP 3/1, 3/2: AL service selection of Load region ASE

Clause	Header	Presence	Constraints
8.2.7.1	Overview	YES	—
8.2.7.2	Load Region Class Specification	YES	—
8.2.7.3	Load Region Service Specification	—	—
8.2.7.3.1	Initiate Load	YES	Only indication and response primitives
8.2.7.3.2	Push Segment	YES	Only indication and response primitives
8.2.7.3.3	Pull Segment	YES	Only indication and response primitives
8.2.7.3.4	Terminate Load	YES	Only indication and response primitives
8.2.7.4	Behaviour of the Load Region object	YES	—

Table 192 – CP 3/1, 3/2: AL service selection of Function invocation ASE

Clause	Header	Presence	Constraints
8.2.8.1	Overview	YES	—
8.2.8.2	Function Invocation Model Class Specification	YES	—
8.2.8.3	Function Invocation Service Specification	—	—
8.2.8.3.1	Start	YES	Only indication and response primitives
8.2.8.3.2	Stop	YES	Only indication and response primitives
8.2.8.3.3	Resume	YES	Only indication and response primitives
8.2.8.3.4	Reset	YES	Only indication and response primitives
8.2.8.3.5	Get FI State	YES	Only indication and response primitives
8.2.8.3.6	Call	YES	Only indication and response primitives
8.2.8.4	Behaviour of the Function Invocation object	YES	—

Table 193 – CP 3/1, 3/2: AL service selection of Time ASE

Clause	Header	Presence	Constraints
8.2.9.1	Overview	YES	—
8.2.9.2	Time Class Specification	—	—
8.2.9.2.1	Slave Time Class Specification	YES	—
8.2.9.2.2	Link Time Class Specification	NO	—
8.2.9.3	Time Service Specification	—	—
8.2.9.3.1	Set Time	YES	Only indication primitive
8.2.9.3.2	Sync Interval Violation	YES	—

Table 194 – CP 3/1, 3/2: AL service selection of AR ASE

Clause	Header	Presence	Constraints
8.2.10.1	Overview	YES	—
8.2.10.2	Type 3 Fieldbus ARs	—	—
8.2.10.2.1	MS0 Application Relationship	YES	—
8.2.10.2.2	MS1 Application Relationship	YES	—
8.2.10.2.3	MS2 Application Relationship	YES	—
8.2.10.2.4	MS3 Application Relationship	YES	—
8.2.10.2.5	MM1 Application Relationship	NO	—
8.2.10.2.6	MM2 Application Relationship	NO	—
8.2.10.3	Application Relationship Class Specification	—	—
8.2.10.3.1	ARL DP-Slave Class Specification	YES	See 7.2.3.2.5.4
8.2.10.3.2	ARL DP-Master (Class 1) Class Specification	NO	—
8.2.10.3.3	ARL DP-Master (Class 2) Class Specification	NO	—
8.2.10.4	Communication Relationship Class Specification	—	—
8.2.10.4.1	CRL DP-Slave Class Specification	YES	—
8.2.10.4.2	CRL DP-Master (Class 1) Class Specification	NO	—
8.2.10.4.3	CRL DP-Master (Class 2) Class Specification	NO	—
8.2.10.5	AR Service Specification	—	—
8.2.10.5.1	DLL Init DP Slave	YES	—
8.2.10.5.2	Load ARL DP Slave	YES	—
8.2.10.5.3	Get ARL DP Slave	YES	—
8.2.10.5.4	Set ARL Isochronous Mode	YES	—
8.2.10.5.5	Load ARL DP Master Cl1	NO	—
8.2.10.5.6	Get ARL DP Master Cl1	NO	—
8.2.10.5.7	ARL Slave Update DP Master Cl1	NO	—
8.2.10.5.8	Load ARL DP Master Cl2	NO	—
8.2.10.5.9	Get ARL DP Master Cl2	NO	—
8.2.10.5.10	Load CRL DP Slave	YES	—
8.2.10.5.11	Load CRL DXB Link Entries	YES	—
8.2.10.5.12	Get CRL DP Slave	YES	—
8.2.10.5.13	Load CRL DP Master Cl1	NO	—
8.2.10.5.14	Get CRL DP Master Cl1	NO	—
8.2.10.5.15	CRL Slave Activate	NO	—
8.2.10.5.16	CRL Slave New Prm	NO	—
8.2.10.5.17	CRL Slave New Prm Data	NO	—
8.2.10.5.18	Load CRL DP Master Cl2	NO	—
8.2.10.5.19	Get CRL DP Master Cl2	NO	—

7.2.3.2 AL protocol selection

7.2.3.2.1 General selection

Table 195 specifies the selection of the Application Layer protocol within IEC 61158-6.

Table 195 – CP 3/1, 3/2: AL protocol selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	Partial	Used when applicable
4	Type 1	NO	—
5	Type 2	NO	—
6	Type 3	Partial	See 7.2.3.2.2, 7.2.3.2.3, and 7.2.3.2.47.2.3.2.5
7	Type 4	NO	—
8	Type 5	NO	—
9	Type 6	NO	—
10	Type 7	NO	—
11	Type 8	NO	—
12	Type 9	NO	—
13	Type 10	NO	—

7.2.3.2.2 DP-master (Class 1)

7.2.3.2.2.1 DP-V0

Table 196 specifies the AL protocol selection of Clause 6

Table 196 – CP 3/1, 3/2: AL protocol selection of Clause 6

Clause	Header	Presence	Constraints
6.1	FAL Syntax Description	Partial	See Table 197
6.2	Transfer Syntax	Partial	Apply 6.2.1, 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.2.6, 6.2.8, 6.2.9, 6.2.10, 6.2.11, 6.2.12, 6.2.13
6.3	FAL Protocol State Machines	Partial	Apply 6.3.1(AR MS0,MM1,MM2), 6.3.2, 6.3.4(FSPMM1, MSCY1M, MMAC1, DMPMM1), 6.3.6, 6.3.7, 6.3.9(MS0)
6.4	AP Context State Machine	YES	—
6.5	FAL Service Protocol Machines (FSPMs)	Partial	Apply 6.5.2 partial (see Table 198)
6.6	Application Relationship Protocol Machines (ARPMs)	Partial	Apply 6.6.7, 6.6.10
6.7	DLL Mapping Protocol Machines (DMPMs)	Partial	Apply 6.7.2 partial (see Table 199)
6.8	Parameters for a DP-Slave	YES	—

Table 197 – CP 3/1, 3/2: AL protocol selection of APDUs

Service name	Usage
DataExchange-REQ-PDU	E
DataExchange-RES-PDU	D
Chk_Cfg-REQ-PDU	E
Set_Prm-REQ-PDU	E
Diagnosis-RES-PDU	D
Global_Control-REQ-PDU	E
Get_Master_Diag-REQ-PDU	OE
Get_Master_Diag-RES-PDU	OD
Start_Seq-REQ-PDU	OE
Start_Seq-RES-PDU	OD
Download-REQ-PDU	OE
Download-RES-PDU	OD
Upload-REQ-PDU	OE
Upload-RES-PDU	OD
End_Seq-REQ-PDU	OE
End_Seq-RES-PDU	OD
Act_Para_Brct-REQ-PDU	OE
Act_Param-REQ-PDU	OD
Act_Param-RES-PDU	OE

NOTE The abbreviations means
O = Optional; M = Mandatory (default, if not marked as optional);
D = Decode E = Encode

Table 198 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives

Service name	Usage
Init.req/cnf	M
Reset.req/cnf	M
Abort.req	M
Mark.req/cnf	M
Set Mode.req/cnf	M
Load Bus Par.req/cnf	M
Delete SC.req/cnf	O
Read Value.req/cnf	O
CRL Slave Activate.req/cnf	M
CRL Slave New Prm Data.req/cnf	M
CRL Slave New Prm.req/cnf	M
Get Slave Diag.req/cnf	M
Set Output.req/cnf	M
Get Input.req/cnf	M
Global Control.req/cnf	M
Get Master Diag.ind/rsp	O
Start Seq.ind/rsp	O
Download.ind/rsp	O
Upload.ind/rsp	O
End Seq.ind/rsp	O
Act Param.ind/rsp	O
Mode Changed.ind	M
Started.ind	M
Stopped.ind	M
Abort.ind	M
Reject.ind	M
Fault.ind	M
New Slave Diag.ind	M
New Input.ind	M
Act Para Brct.ind	M
Event.ind	M

Table 199 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives

Service Primitive Name	Usage
MInit DLL.req/cnf	M
Reset.req/cnf	M
Global Control.req/cnf	M
Set Bus Par.req/cnf	M
Delete SC.req/cnf	O
Read Value.req/cnf	O
Fault.ind	M
Event.ind	M
Slave Diag.req/cnf	M
Set Prm.req/cnf	M
Chk Cfg.req/cnf	M
Data Exchange.req/cnf	M
RSAP ACTIVATE.req/cnf	O
REPLY UPDATE.req/cnf	O
DATA REPLY.req/cnf/ind	O
DATA.ind	O

7.2.3.2.2.2 DP-V1

Table 200 specifies AL protocol, which is part of DP-Master (Class 1) and using features named DP-V1 and Options.

NOTE If a device supports DP-V1 features, then it is to specify within the communication feature list of this device type (GSD-file).

Table 200 – CP 3/1, 3/2: AL protocol selection of Clause 6

Clause	Header	Presence	Constraints
6.1	FAL Syntax Description	Partial	See Table 201
6.2	Transfer Syntax	YES	Except 6.2.14, 6.2.15
6.3	FAL Protocol State Machines	Partial	Apply 6.3.1, 6.3.2, 6.3.4, 6.3.6, 6.3.7, 6.3.8, 6.3.9
6.4	AP Context State Machine	YES	—
6.5	FAL Service Protocol Machines (FSPMs)	Partial	Apply 6.5.2 and Table 202
6.6	Application Relationship Protocol Machines (ARPMs)	Partial	Apply 6.6.7, 6.6.8, 6.6.9, 6.6.10, 6.6.11
6.7	DLL Mapping Protocol Machines (DMPMs)	Partial	Apply 6.7.2 and Table 203
6.8	Parameters for a DP-Slave	NO	—

Table 201 – CP 3/1, 3/2: AL protocol selection of APDUs

APDU Name	Decode / Encode
DataExchange-REQ-PDU	E
DataExchange-RES-PDU	D
Chk_Cfg-REQ-PDU	E
Set_Prm-REQ-PDU	E
Set_Ext_Prm-REQ-PDU	OE
Diagnosis-RES-PDU	D
Global_Control-REQ-PDU	E
Clock-Value-PDU	OD
Read-REQ-PDU	OE
Read-RES-PDU	OD
Read-NRS-PDU, Pull-NRS-PDU	OD
Write-REQ-PDU	OE
Write-RES-PDU	OD
Write-, Initiate_Load-, Push-, Terminate_Load, Start-, Stop-,Resume-, Reset-, Call-, Get_FI_State-NRS-PDU	OD
Alarm_Ack-REQ-PDU	OE
Alarm_Ack-RES-PDU	OD
Alarm_Ack-NRS-PDU	OD
Data_Transport-REQ-PDU	OE
Data_Transport-RES-PDU	OD
Data_Transport-NRS-PDU	OD
Initiate_Load-REQ-PDU	OE
Initiate_Load-RES-PDU	OD
Push-REQ-PDU	OE
Pull-REQ-PDU	OE
Pull-RES-PDU	OD
Terminate_Load-REQ-PDU	OE
Start-REQ-PDU	OE
Stop-REQ-PDU	OE
Resume-REQ-PDU	OE
Reset-REQ-PDU	OE
Call-REQ-PDU	OE
Call-RES-PDU	OD
Get_FI_State-REQ-PDU	OE
Get_FI_State-RES-PDU	OD
Push-, Terminate_Load-, Start-,Stop-, Resume-, Reset-RES-PDU	OD
Get_Master_Diag-REQ-PDU	OE
Get_Master_Diag-RES-PDU	OD
Start_Seq-REQ-PDU	OE
Start_Seq-RES-PDU	OD
Download-REQ-PDU	OE
Download-RES-PDU	OD
Upload-REQ-PDU	OE
Upload-RES-PDU	OD
End_Seq-REQ-PDU	OE
End_Seq-RES-PDU	OD
Act_Para_Brct-REQ-PDU	OE
Act_Param-REQ-PDU	OD
Act_Param-RES-PDU	OE

NOTE The abbreviations means:
O = Optional; M = Mandatory (default, if not marked as optional);
D = Decode, E = Encode;

Table 202 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives

Service name	Usage
Init.req/cnf	M
Reset.req/cnf	M
Abort.req	M
Mark.req/cnf	M
Set Mode.req/cnf	M
Load Bus Par.req/cnf	M
Delete SC.req/cnf	O
Read Value.req/cnf	O
CRL Slave Activate.req/cnf	M
CRL Slave New Prm Data.req/cnf	M
CRL Slave New Prm.req/cnf	M
Get Slave Diag.req/cnf	M
Set Output.req/cnf	M
Get Input.req/cnf	M
Read.req/cnf	O
Write.req/cnf	O
Alarm Ack.req/cnf	O
Set Time.req/cnf	O
Initiate Load.req/cnf	O
Push Segment.req/cnf	O
Pull Segment.req/cnf	O
Terminate Load.req/cnf	O
Start.req/cnf	O
Stop.req/cnf	O
Resume.req/cnf	O
Reset.req/cnf	O
Call.req/cnf	O
Get FI State.req/cnf	O
Global Control.req/cnf	O
Get Master Diag.ind/rsp	O
Start Seq.ind/rsp	O
Download.ind/rsp	O
Upload.ind/rsp	O
End Seq.ind/rsp	O
Act Param.ind/rsp	O
SYNCH.ind	O
SYNCH Delayed.ind	O
DX Finished.ind	O
Set Time.ind	O
Sync Interval Violation.ind	O
Mode Changed.ind	O
Started.ind	O
Stopped.ind	O
Abort.ind	O
Reject.ind	O
Fault.ind	O
New Slave Diag.ind	M
New Input.ind	M
Act Para Brct.ind	O
Event.ind	M
Alarm Notification.ind	O

Table 203 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives

Service name	Usage
MInit DLL.req/cnf	M
Reset.req/cnf	M
Global Control.req/cnf	M
Set Bus Par.req/cnf	M
Delete SC.req/cnf	O
Read Value.req/cnf	O
Fault.ind	M
Event.ind	M
SYNCH.ind	O
SYNCH Delayed.ind	O
Slave Diag.req/cnf	M
Set Prm.req/cnf	M
Chk Cfg.req/cnf	M
Data Exchange.req/cnf	M
RSAP ACTIVATE.req/cnf	O
REPLY UPDATE.req/cnf	O
DATA REPLY.req/cnf/ind	O
DATA.ind	O
CS TIME EVENT.req/cnf	O
CS CLOCK VALUE.req/cnf/ind	O

7.2.3.2.3 DP-master (Class 2)

7.2.3.2.3.1 DP-V0

Table 204 specifies AL protocol, which is part of DP-Master (Class 1) and using features named DP-V0.

Table 204 – CP 3/1, 3/2: AL protocol selection of Clause 6

Clause	Header	Presence	Constraints
6.1	FAL Syntax Description	Partial	See Table 205
6.2	Transfer Syntax	Partial	Apply 6.2.1, 6.2.2, 6.2.3, 6.2.5, 6.2.8, 6.2.9, 6.2.10, 6.2.11, 6.2.12, 6.2.13, 6.2.14
6.3	FAL Protocol State Machines	Partial	Apply 6.3.1(AR MS0,MM1, MM2), 6.3.2, 6.3.5(FSPMM2, MMAC2, DMPMM2), 6.3.7
6.4	AP Context State Machine	YES	—
6.5	FAL Service Protocol Machines (FSPMs)	Partial	Apply 6.5.3 partial (see Table 206)
6.6	Application Relationship Protocol Machines (ARPMs)	Partial	Apply 6.6.13
6.7	DLL Mapping Protocol Machines (DMPMs)	Partial	Apply 6.7.3 partial (see Table 207)
6.8	Parameters for a DP-Slave	NO	—

Table 205 – CP 3/1, 3/2: AL protocol selection of APDUs

APDU Name	Decode / Encode
RD_Output-RES-PDU	OD
RD_Output-REQ-PDU	OE
RD_Input-RES-PDU	OD
RD_Input-REQ-PDU	OE
Get_Cfg-REQ-PDU	OE
Get_Cfg-RES-PDU	OD
Diagnosis-RES-PDU	OD
Diagnosis-REQ-PDU	OE
Set_Slave_Add-REQ-PDU	OE
Get_Master_Diag-REQ-PDU	OE
Get_Master_Diag-RES-PDU	OD
Start_Seq-REQ-PDU	OE
Start_Seq-RES-PDU	OD
Download-REQ-PDU	OE
Download-RES-PDU	OD
Upload-REQ-PDU	OE
Upload-RES-PDU	OD
End_Seq-REQ-PDU	OE
End_Seq-RES-PDU	OD
Act_Para_Brct-REQ-PDU	OE
Act_Param-REQ-PDU	OE
Act_Param-RES-PDU	OD

Table 206 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives

Service name	Usage
MInit.req/cnf	M
Reset.req/cnf	M
Abort.req	M
Read Slave Diag.req/cnf	M
Read Input.req/cnf	M
Read Output.req/cnf	M
Get Cfg.req/cnf	M
Set Slave Add.req/cnf	O
Get Master Diag.ind/rsp	O
Start Seq.ind/rsp	O
Download.ind/rsp	O
Upload.ind/rsp	O
End Seq.ind/rsp	O
Act Param.ind/rsp	O
Act Para Brct.ind	O
Abort.ind	M
Reject.ind	M
Fault.ind	M
Event.ind	M

Table 207 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives

Service name	Usage
MInit DLL.req/cnf	M
Reset.req/cnf	M
Read Slave Diag.req/cnf	O
Read Input.req/cnf	O
Read Output.req/cnf	O
Get Cfg.req/cnf	O
Set Slave Add.req/cnf	O
DATA.req/cnf	O
DATA REPLY.req/cnf	O

7.2.3.2.3.2 DP-V1

Table 208 specifies AL protocol, which is part of DP-Master (Class 2) and using features named DP-V1 and Options.

NOTE If a device supports DP-V1 features, then it is to specify within the communication feature list of this device type (GSD-file).

Table 208 – CP 3/1, 3/2: AL protocol selection of Clause 6

Clause	Header	Presence	Constraints
6.1	FAL Syntax Description	Partial	See Table 209
6.2	Transfer Syntax	YES	—
6.3	FAL Protocol State Machines	Partial	Apply 6.3.1, 6.3.2, 6.3.4, 6.3.6, 6.3.7, 6.3.8, 6.3.9
6.4	AP Context State Machine	YES	—
6.5	FAL Service Protocol Machines (FSPMs)	Partial	Apply 6.5.2 Table 210
6.6	Application Relationship Protocol Machines (ARPMs)	Partial	Apply 6.6.7, 6.6.8, 6.6.9, 6.6.10, 6.6.11
6.7	DLL Mapping Protocol Machines (DMPMs)	Partial	Apply 6.7.2 Table 211
6.8	Parameters for a DP-Slave	YES	—

Table 209 – CP 3/1, 3/2: AL protocol selection of APDUs

APDU Name	Decode / Encode
RD_Output-RES-PDU	OD
RD_Output-REQ-PDU	OE
RD_Input-RES-PDU	OD
RD_Input-REQ-PDU	OE
Get_Cfg-REQ-PDU	OE
Get_Cfg-RES-PDU	OD
Diagnosis-RES-PDU	OD
Diagnosis-REQ-PDU	OE
Set_Slave_Add-REQ-PDU	OE
Start_Seq-REQ-PDU	OE
Start_Seq-RES-PDU	OD
Download-REQ-PDU	OE
Download-RES-PDU	OD
Upload-REQ-PDU	OE
Upload-RES-PDU	OD
End_Seq-REQ-PDU	OE
End_Seq-RES-PDU	OD
Act_Para_Brct-REQ-PDU	OE
Act_Param-REQ-PDU	OE
Act_Param-RES-PDU	OD
Initiate-REQ-PDU	OE

APDU Name	Decode / Encode
Initiate-RES-PDU	OD
Initiate-NRS-PDU	OD
Abort-REQ-PDU	OE
Read-REQ-PDU	OE
Read-RES-PDU	OD
Read-NRS-PDU, Pull-NRS-PDU	OD
Write-REQ-PDU	OE
Write-RES-PDU	OD
Write-, Initiate_Load-, Push-, Terminate_Load-, Start-, Stop-, Resume-, Reset-, Call-, Get_FI_State-NRS-PDU	OD
Idle-REQ-PDU	OE
Idle-RES-PDU	OD
Data_Transport-REQ-PDU	OE
Data_Transport-RES-PDU	OD
Data_Transport-NRS-PDU	OD
Initiate_Load-REQ-PDU	OE
Initiate_Load-RES-PDU	OD
Push-REQ-PDU	OE
Pull-REQ-PDU	OE
Pull-RES-PDU	OD
Terminate_Load-REQ-PDU	OE
Start-REQ-PDU	OE
Stop-REQ-PDU	OE
Resume-REQ-PDU	OE
Reset-REQ-PDU	OE
Call-REQ-PDU	OE
Call-RES-PDU	OD
Get_FI_State-REQ-PDU	OE
Get_FI_State-RES-PDU	OD
Push-, Terminate_Load-, Start-,Stop-, Resume-, Reset-RES-PDU	OD
RM-REQ-PDU	OD
Get_Master_Diag-REQ-PDU	OE
Get_Master_Diag-RES-PDU	OD
Start_Seq-REQ-PDU	OE
Start_Seq-RES-PDU	OD
Download-REQ-PDU	OE
Download-RES-PDU	OD
Upload-REQ-PDU	OE
Upload-RES-PDU	OD
End_Seq-REQ-PDU	OE
End_Seq-RES-PDU	OD
Act_Para_Brct-REQ-PDU	OE
Act_Param-REQ-PDU	OD
Act_Param-RES-PDU	OE

Table 210 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives

Service Primitive Name	Usage
MInit.req/cnf	M
Reset.req/cnf	M
Abort.req	M
Read Slave Diag.req/cnf	O
Read Input.req/cnf	O
Read Output.req/cnf	O
Get Cfg.req/cnf	O
Set Slave Add.req/cnf	O
Initiate.req/cnf	O
Read.req/cnf	O
Write.req/cnf	O
Data Transport.req/cnf	O
Get Master Diag.ind/rsp	O
Start Seq.ind/rsp	O
Download.ind/rsp	O
Upload.ind/rsp	O
End Seq.ind/rsp	O
Act Param.ind/rsp	O
Act Para Brct.ind	O
Initiate Load.req/cnf	O
Push Segment.req/cnf	O
Pull Segment.req/cnf	O
Terminate Load.req/cnf	O
Start.req/cnf	O
Stop.req/cnf	O
Resume.req/cnf	O
Reset.req/cnf	O
Call.req/cnf	O
Get FI State.req/cnf	O
Event.ind	O
Reject.ind	O
Abort.ind	O
Fault.ind	M
Closed.ind	M

Table 211 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives

Service name	Usage
MInit DLL.req/cnf	M
Reset.req/cnf	M
Read Slave Diag.req/cnf	O
Read Input.req/cnf	O
Read Output.req/cnf	O
Get Cfg.req/cnf	O
Set Slave Add.req/cnf	O
DATA.req/cnf	O
DATA REPLY.req/cnf	O

7.2.3.2.4 DP-slave

7.2.3.2.4.1 DP-V0

Table 212 specifies AL protocol, which is part of a DP-Slave and using features named DP-V0.

Table 212 – CP 3/1, 3/2: AL protocol selection of Clause 6

Clause	Header	Presence	Constraints
6.1	FAL Syntax Description	Partial	See Table 213
6.2	Transfer Syntax	Partial	Apply 6.2.1, 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.2.6
6.3	FAL Protocol State Machines	Partial	Apply 6.3.1(AR MS0), 6.3.2, 6.3.4(FSPMS, MSCY1S, DMPMS), 6.3.6, 6.3.9(MS0)
6.4	AP Context State Machine	YES	—
6.5	FAL Service Protocol Machines (FSPMs)	Partial	Apply 6.5.1 partial (see Table 214)
6.6	Application Relationship Protocol Machines (ARPMs)	Partial	Apply 6.6.1
6.7	DLL Mapping Protocol Machines (DMPMs)	Partial	Apply 6.7.1 partial (see Table 215)
6.8	Parameters for a DP-Slave	YES	—

Table 213 – CP 3/1, 3/2: AL protocol selection of APDU selection

APDU Name	Decode / Encode
DataExchange-REQ-PDU	D
DataExchange-RES-PDU	E
Chk_Cfg-REQ-PDU	D
Set_Prm-REQ-PDU	D
Diagnosis-RES-PDU	E
Global_Control-REQ-PDU	D
RD_Output-RES-PDU	OE
RD_Input-RES-PDU	OE
Get_Cfg-REQ-PDU	OE
Set_Slave_Add-REQ-PDU	OD

Table 214 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives

Service name	Usage
DLL Init.req/cnf	M
Init MS0.req/cnf	M
Reset.req/cnf	M
Abort.req	M
CheckUserPrmResult.req/cnf	M
Check Cfg Result.req/cnf	M
Set Cfg.req/cnf	M
Set Slave Diag.req/cnf	M
Set Input.req/cnf	M
Get Output.req/cnf	M
Started.ind	M
Stopped.ind	M
Abort.ind	M
Fault.ind	M
Set Slave Add.ind	O
Check Cfg.ind	M
CheckUserPrm.ind	M
New Output.ind	M
Global Control.ind	M

Table 215 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives

Service Primitive Name	Usage
SInit DLL.req/cnf	M
Reset.req/cnf	M
Fault.ind	M
Slave Init.req/cnf	M
Enter.req	M
Leave.req	M
Slave Deact.req/cnf	M
Set min Tsdr req	M
Slave Diag Upd.req	M
Data Exchange Upd.req	M
RD Outp Upd.req	M
RD Inp Upd.req	M
Set Slave Add.ind	O
Slave Diag.ind	M
Set Prm.ind	M
Chk Cfg.ind	M
Data Exchange.ind	M
Global Control.ind	M

7.2.3.2.4.2 DP-V1

Table 216 specifies AL protocol, which is part of a DP-Slave and using features named DP-V1 and Options.

NOTE If a device supports DP-V1 features, then it is to specify within the communication feature list of this device type (GSD-file).

Table 216 – CP 3/1, 3/2: AL protocol selection of Clause 6

Clause	Header	Presence	Constraints
6.1	FAL Syntax Description	Partial	See Table 217
6.2	Transfer Syntax	YES	Apply 6.2.1 through 6.2.8, and 6.2.15 through 6.2.17
6.3	FAL Protocol State Machines	Partial	Apply 6.3.1, 6.3.2, 6.3.3, 6.3.6, 6.3.8, 6.3.9
6.4	AP Context State Machine	YES	—
6.5	FAL Service Protocol Machines (FSPMs)	Partial	Apply 6.5.1 (see Table 218
6.6	Application Relationship Protocol Machines (ARPMs)	Partial	Apply 6.6.1 through 6.6.6
6.7	DLL Mapping Protocol Machines (DMPMs)	Partial	Apply 6.7.1 (see Table 219
6.8	Parameters for a DP-Slave	YES	—

Table 217 – CP 3/1, 3/2: AL protocol selection of APDUs

APDU Name	Decode/Encode
DataExchange-REQ-PDU	D
DataExchange-RES-PDU	E
Chk_Cfg-REQ-PDU	D
Set_Prm-REQ-PDU	D
Set_Ext_Prm-REQ-PDU	OD
RD_Output-RES-PDU	OE
RD_Input-RES-PDU	OE
Get_Cfg-REQ-PDU	OE
Set_Slave_Add-REQ-PDU	OD
Diagnosis-RES-PDU	E
Global_Control-REQ-PDU	D
Clock-Value-PDU	OE
Initiate-REQ-PDU	OD
Initiate-RES-PDU	OE
Initiate-NRS-PDU	OE
Abort-REQ-PDU	OD
Read-REQ-PDU	OD
Read-RES-PDU	OE
Read-NRS-PDU, Pull-NRS-PDU	OE
Write-REQ-PDU	OD
Write-RES-PDU	OE
Write-, Initiate_Load-, Push-, Terminate_Load, Start-, Stop-, Resume-, Reset-, Call-, Get_FI_State-NRS-PDU	OE
Alarm_Ack-REQ-PDU	OD
Alarm_Ack-RES-PDU	OE
Alarm_Ack-NRS-PDU	OE
Idle-REQ-PDU	OD
Idle-RES-PDU	OE
Data_Transport-REQ-PDU	OD
Data_Transport-RES-PDU	OE
Data_Transport-NRS-PDU	OE
Initiate_Load-REQ-PDU	OD
Initiate_Load-RES-PDU	OE
Push-REQ-PDU	OD
Pull-REQ-PDU	OD
Pull-RES-PDU	OE
Terminate_Load-REQ-PDU	OD
Start-REQ-PDU	OD
Stop-REQ-PDU	OD
Resume-REQ-PDU	OD
Reset-REQ-PDU	OD
Call-REQ-PDU	OD
Call-RES-PDU	OE
Get_FI_State-REQ-PDU	OD
Get_FI_State-RES-PDU	OE
Push-, Terminate_Load-, Start-,Stop-, Resume-, Reset-RES-PDU	OE
RM-REQ-PDU	OE

Table 218 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives

Service name	Usage
DLL Init.req/cnf	M
Init MS0.req/cnf	M
Reset.req/cnf	M
Abort.req	M
Reset.req/cnf	M
Abort.req	M
CheckUserPrmResult.req/cnf	M
CheckExtUserPrmResult.req/cnf	M
Check Cfg Result.req/cnf	M
Set Cfg.req/cnf	M
Set Slave Diag.req/cnf	M
Set Input.req/cnf	M
Get Output.req/cnf	M
Started.ind	M
Stopped.ind	M
Abort.ind	M
Fault.ind	M
Set Slave Add.ind	O
Check Cfg.ind	M
CheckUserPrm.ind	M
CheckExtUserPrm.ind	M
New Output.ind	M
Global Control.ind	M
Initiate.ind/rsp	O
Read.ind/rsp	O
Write.ind/rsp	O
Data Transport.ind/rsp	O
Alarm Ack.ind/rsp	O
LR Initiate Load.ind/rsp	O
LR Push Segment.ind/rsp	O
LR Pull Segment.ind/rsp	O
LR Terminate Load.ind/rsp	O
FI Start.ind/rsp	O
FI Stop.ind/rsp	O
FI Resume.ind/rsp	O
FI Reset.ind/rsp	O
FI Call.ind/rsp	O
Get FI State.ind/rsp	O
SYNCH_Event.ind	O
Set Time.ind	O
SyncIntervalViolation.ind	O
New Publisher Data.ind	O
Publisher Active.ind	O
GetPublisherData.req/cnf	O
Start Subscriber.req/cnf	O
Stop Subscriber.req/cnf	O
Load CRL DXB-Linktable Entries.req/cnf	O
Set ARL Isochron Mode.req/cnf	O
Alarm Notification.req/cnf	O
Application Ready.req	O

Table 219 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives

Service Primitive Name	Usage
SInit DLL.req/cnf	M
Reset.req/cnf	M
Fault.ind	M
Slave Init.req/cnf	M
Enter.req	M
Leave.req	M
Slave Deact.req/cnf	M
Set minTsdr.req	M
Slave Diag Upd.req	M
Data Exchange Upd.req	M
RD Outp Upd.req	M
RD Inp Upd.req	M
Set Slave Add.ind	O
Slave Diag.ind	M
Set Prm.ind	M
Set Ext Prm.ind	O
Chk Cfg.ind	M
Data Exchange.ind	M
Global Control.ind	M
RSAP ACTIVATE.req/cnf	O
SAP DEACTIVATE.req/cnf	O
REPLY UPDATE.req/cnf	O
DATA REPLY.ind	O
DX Broadcast.ind	O
DX Entered.ind	O
CS CLOCK VALUE.ind	O

7.2.3.2.5 Options

7.2.3.2.5.1 Process data

Process data functionality (acyclic R/W-services) is described in IEC 61158-5:2003, 8.2.1 Process Data ASE. It is optional.

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2), DP-V1 – DP-Master (Class 2), (see 7.2.3.1.3.2) and DP-V1 – DP-Slaves (see 7.2.3.1.4.2).

7.2.3.2.5.2 Alarm

Alarm functionality is described in IEC 61158-5:2003, 8.2.4 Alarm ASE. It is optional.

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2), and DP-V1 – DP-Slaves (see 7.2.3.1.4.2).

7.2.3.2.5.3 Fail safe

Fail Safe functionality is described in IEC 61158-5:2003, 8.2.10.4.2.2.

This is optional for DP-V0 – DP-Master (Class 1), (see 7.2.3.1.2.1) and DP-V1 / DP-V0 – DP-Slaves (see 7.2.3.1.4.2 / 7.2.3.1.4.1).

This functionality shall be supported by DP-V1 - DP-Master (Class 1), (see 7.2.3.1.2.2).

7.2.3.2.5.4 Synch / freeze

Synch / freeze functionality is described in IEC 61158-5:2003, 8.2.2, I/O Data ASE.

This option may be used for DP-V1 / DP-V0 – DP-Master (Class 1), (see 7.2.3.1.2.2 / 7.2.3.1.2.1), and DP-V1 / DP-V0 – DP-Slaves (see 7.2.3.1.4.2 / 7.2.3.1.4.1) (see). It is specified for DP-V1 / DP-V0 – DP-Master (Class 1) in IEC 61158-5:2003, 8.2.2.3.9, and for DP-V1 / DP-V0 – DP-Slaves in IEC 61158-5:2003, 8.2.10.3.1.2.

7.2.3.2.5.5 Isochronous mode

Isochronous mode functionality is described in IEC 61158-5:2003, 8.2.2 I/O Data ASE especially see 8.2.2.4.2.

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2) and DP-V1 – DP Slaves (see 7.2.3.1.4.2).

7.2.3.2.5.6 Publisher/Subscriber

Publisher/Subscriber functionality is described in IEC 61158-5:2003, 8.2.2 I/O Data ASE.

The Publisher option may be used for DP-V1 / DP-V0 – DP-Slaves (see 7.2.3.1.4.2 / 7.2.3.1.4.1).

The Subscriber option may be used only for DP-V1 – DP-Slaves (see 7.2.3.1.4.2).

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2).

7.2.3.2.5.7 Extended Parametrisation(ExtPrm)

Extended Parametrisation (ExtPrm) functionality is described in IEC 61158-5:2003, 8.2.5, context ASE especially see 8.2.5.2.2 and for Master (Class 1) see 8.2.6.2.2 with Ext User Prm Data and for Master (Class 2) see 8.2.6.3.3.

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2), DP-V1 – DP-Master (Class 2), (see 7.2.3.1.3.2) and DP-V1 – DP-Slaves (see 7.2.3.1.4.2).

7.2.3.2.5.8 Load region

Load region functionality is described in IEC 61158-5:2003, 8.2.7 Load region ASE. It is optional.

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2), DP-V1 – DP-Master (Class 2), (see 7.2.3.1.3.2), and DP-V1 – DP-Slaves (see 7.2.3.1.4.2).

7.2.3.2.5.9 Function invocation

Function invocation functionality is described in IEC 61158-5:2003, 8.2.8 Function invocation ASE. It is optional.

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2), DP-V1 – DP-Master (Class 2), (see 7.2.3.1.3.2) and DP-V1 – DP-Slaves (see 7.2.3.1.4.2).

7.2.3.2.5.10 Clock synchronization

Clock synchronization functionality is described in IEC 61158-5:2003, 8.2.9 Time ASE. It is optional.

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2), DP-V1 – DP-Master (Class 2), (see 7.2.3.1.3.2) and DP-V1 – DP-Slaves (see 7.2.3.1.4.2).

7.2.3.2.5.11 Redundancy

Redundancy functionality is described in IEC 61158-5:2003, 8.1.4. It is optional.

This option may be used for DP-V1 – DP-Master (Class 1), (see 7.2.3.1.2.2), DP-V1 – DP-Slaves (see 7.2.3.1.4.2).

7.3 Profile 3/2

7.3.1 Physical Layer

7.3.1.1 PhL selection

Table 220 specifies the selection of the IEC 61158-2 for devices of all types of this profile. Subclause 7.2.1.2 specifies additional considerations.

Table 220 – CP 3/2: PhL selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	Partial	See Table 113
4	Symbols and abbreviations	Partial	See Table 114
5	Data Link Layer - Physical Layer interface	—	—
5.1	General	YES	—
5.2 – 5.3	---	NO	—
5.4	Type 3: Required services	—	—
5.4.1	Synchronous Transmission	YES	—
5.4.2	Asynchronous Transmission	NO	—
5.5 – 5.7	---	NO	—
6	Station Management – Physical Layer interface	—	—
6.1	General	YES	—
6.2	—	NO	—
6.3	Type 3: Station Management – Physical Layer interface	—	—
6.3.1	Synchronous Transmission	YES	—
6.3.2	Asynchronous Transmission	NO	—
6.4 - 6.6	—	NO	—
7	DCE Independent Sublayer (DIS)	—	—
7.1	General	YES	—
7.2	Type 1: DIS	YES	—
7.3	Type 3: DIS	—	—
7.3.1	Synchronous Transmission	YES	—
7.3.2	Asynchronous Transmission	NO	—
7.4 – 7.5	—	NO	—
8	DTE – DCE interface	—	—
8.1	General	YES	—
8.2	—	NO	—
8.3	Type 3: DTE — DCE interface	YES	—
8.4	—	NO	—

Clause	Header	Presence	Constraints
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	YES	—
9.2	Type 1: MDS: Wire and optical media	YES	—
9.3 – 9.4	—	NO	—
9.5	Type 3: MDS: Wire and optical media	—	—
9.5.1	Synchronous Transmission	YES	—
9.5.2	Asynchronous Transmission	NO	—
9.6 – 9.8	—	—	—
10	MDS – MAU interface		—
10.1	General	YES	—
10.2	Type 1: MDS - MAU interface: wire and optical media	YES	—
10.3 – 10.4	—	NO	—
10.5	Type 3: MDS - MAU interface: Wire and optical media	—	—
10.5.1	Synchronous Transmission	YES	—
10.5.3	Asynchronous Transmission	NO	—
10.6	—	NO	—
11	Type 1 and 7: Medium Attachment Unit: voltage mode, linear-bus-topology 150 Ω twisted-pair wire medium	Partial	See Clause 12 and Clause 21
12	Type 1 and 3 synchronous Transmission: Medium Attachment Unit: 31,25 kbit/s, voltage-mode with low-power option, bus- and tree-topology, 100 Ω wire medium	Partial	Only for MBP-LP, see 7.3.1.2
13 - 20	—	NO	—
21	Type 3: Medium Attachment Unit: Synchronous Transmission, 31,25 kbit/s, voltage mode, wire medium	YES	only for MBP and MBP-IS, see 7.3.1.3
22 - 28	—	NO	—
Annex A	(normative) Type 1: Connector specification	—	—
A.1	Internal connector for wire medium	YES	The connector is optional
A.2	External connectors for wire medium	NO	See Annex H
A.3	External connectors for optical medium	NO	—
Annex A	—	NO	—
Annex B	Type 1: Cable specifications and trunk and spur lengths for the 31,25 kbit/s voltage-mode MAU	YES	—
Annex C–H	—	NO	—
Annex I	(normative) Type 3: Connector specification	—	—
I.1	Connector for synchronous transmission	YES	For CP 1 of Table 111
I.2	Connector for asynchronous transmission	NO	—
I.3	Connector for fibre optic cable	NO	—
Annex J	(normative) Type 3: Redundancy of Physical Layer and Medium	YES	Redundancy is optional
Annex K – M	—	NO	—

7.3.1.2 MAU selection for MBP-LP

Table 221 specifies the constraints for the optional MAU CP 1 named MBP-LP.

Table 221 – CP 3/2: PhL selection of Clause 12 for devices and their MAUs

Clause	Header	Presence	Constraints
12.1–12.7	---	YES	—
12.2	Transmitted bit rate	YES	—
12.3	Network specifications	NO	—
12.4	MAU transmit circuit specifications	YES	—
12.5	MAU receive circuit specifications	YES	See **5.2.1.1.3.2** for recommended receive filters
12.6	Jabber inhibit	YES	—
12.7	Power distribution	—	—
12.7.1	General	Partial	IEC 61158-2, Table 63, applies only to FF device classes 121, 123 and 511. All else applies except IEC 61158-2, Table 64
12.7.2	Supply voltage	YES	—
12.7.3	Powered via signal conductors	YES	Applies only to FF device classes 121, 123 and 511
12.7.4	Power supply impedance	NO	—
12.7.5	Powered separately from signal conductors	Partial	Applies only to FF device class 122, 124 and 512, which do not require power on the bus. However, these devices shall be suitable for use on a powered bus. For example, a transformer-coupled device requires a DC-blocking capacitor in series with the transformer
12.7.6	Electrical isolation	YES	—
12.8	Medium specifications	—	—
12.8.1	Connector	YES	See **5.2.1.1.3.3** for labeling of the connector
12.8.2	Cable (standard test cable)	NO	—
12.8.3	Coupler	YES	—
12.8.4	Splices	NO	—
12.8.5	Terminator	NO	—
12.8.6	Shielding rules	NO	—
12.8.7	Grounding (earthing) rules	YES	—
12.9	Intrinsic safety	NO	See 5.2.1.1.3.4 for the IS device parameters for FF device classes 121, 122, 511 and 512
12.10	Galvanic isolators	NO	—

7.3.1.3 MAU selection for MBP and MBP-IS

Table 222 specifies the constraints for the optional MAU CP 1 named MBP and MBP-IS. For MBP-IS apply the standard IEC 60079-27.

Table 222 – CP 3/2: PhL selection of Clause 21 for devices and their MAUs

Clause	Header	Presence	Constraints
21.1	General	YES	—
21.2	Transmitted bit rate	YES	—
21.3	Network specifications	NO	YES 21.3.1 -> 12.3.1, 21.3.2 NO
21.4	MAU transmit circuit specifications	Partial	Signal polarity is not specified – see **5.2.1.1.3.1**
21.5	MAU receive circuit specifications	YES	See **5.2.1.1.3.2** for recommended receive filters
21.6	Jabber inhibit	YES	—
21.7	Power distribution	—	—
21.7.1	General	Partial	IEC 61158-2, Table 97, applies only to FF device classes 111 and 113. All else applies except IEC 61158-2, Table 98
21.7.2	Supply voltage	Partial	For FF device classes 111 and 113, the paragraphs after the first do not apply
21.7.3	Powered via signal conductors	Partial	Applies only to FF device classes 111 and 113
(12.7.5)	Powered separately from signal conductors	Partial	Applies only to FF device classes 112 and 114, which do not require power on the bus. However, these devices shall be suitable for use on a powered bus. For example, a transformer-coupled device requires a DC-blocking capacitor in series with the transformer.
21.7.4	Electrical isolation	YES	—
21.8	Medium specifications	—	—
21.8.1	Connector	YES	See **5.2.1.1.3.3** for labeling of the connector
21.8.2	Cable (standard test cable)	NO	Applies only to device test configuration
21.8.3	Coupler	YES	—
21.8.4	Splices	NO	—
21.8.5	Terminator	NO	—
21.8.6	Shielding rules	NO	—
21.8.7	Grounding (earthing) rules	YES	
21.9	Intrinsic safety	NO	See 5.2.1.1.3.4 for the IS device parameters for FF device classes 111 and 112
21.10	Galvanic isolators	NO	—

7.3.2 Data Link Layer

7.3.2.1 DLL service selection

The CP 3/2 uses the same DLL service selection as CP 3/1, which is specified in 7.2.2.1.

7.3.2.2 DLL protocol selection

7.3.2.2.1 General selection

Table 223Table 227 specifies the selection of the Data Link services within IEC 61158-4.

Table 223 – CP 3/2: General DLL protocol selection

Clause	Header	Presence	Constraints
1	Scope and object	YES	—
2	Normative references	—	—
2.1	Common normative references	Partial	Used if needed
2.2 – 2.3	—	NO	—
2.4	Type 3: Additional normative references	YES	—
2.5 – 2.9	—	NO	—
3	Terms and definitions	—	—
3.1	Reference model terms and definitions	Partial	Used when applicable
3.2	Service convention terms and definitions	Partial	Used when applicable
3.3	Common terms and definitions	Partial	Used when applicable
3.4 – 3.5	—	NO	—
3.6	Type 3: Additional terms and definitions	YES	—
3.7 – 3.11	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Common symbols and abbreviations	Partial	Used when applicable
4.2 – 4.3	—	NO	—
4.4	Type 3: Additional symbols and abbreviations	YES	—
4.5 – 4.9	—	NO	—
5	DL-protocol elements common to multiple DL-protocol Types	Partial	See Table 224
6 - 19	—	NO	—
20	Type 3: Overview of the DL-protocol	Partial	See Table 225 and 7.3.2.2.2, 7.3.2.2.3, and 7.3.2.2.4
21	Type 3: General structure and encoding of DLPDUs, and related elements of procedure	Partial	See Table 226 and 7.3.2.2.2, 7.3.2.2.3, and 7.3.2.2.4
22	Type 3: DLPDU-specific structure, encoding and elements of procedure	Partial	See 7.3.2.2.2, 7.3.2.2.3, and 7.3.2.2.4
23	Type 3: Other DLE elements of procedure	Partial	See 7.3.2.2.2, 7.3.2.2.3, and 7.3.2.2.4
24 – 32	—	NO	—
Annex A – D	—	NO	—
Annex E	Type 3: DL-protocol state machines	YES	—
Annex F	Type 3: Exemplary token procedure and message cycles	YES	—
Annex G – J	—	NO	—

Table 224 – CP 3/2: DLL protocol selection of Clause 5

Clause	Header	Presence	Constraints
5.1	Frame check sequence	—	—
5.1.1	At the sending DLE	YES	—
5.1.2	At the receiving DLE	YES	—
5.1.3	Modification within bridges	NO	—

Table 225 – CP 3/2: DLL protocol selection of Clause 20

Clause	Header	Presence	Constraints
20.1	General	YES	—
20.2	Overview of the medium access control and transmission protocol	YES	—
20.3	Transmission mode and DL-entity	YES	—
20.4	Service assumed from the PhL	—	—
20.4.1	Asynchronous transmission	NO	—
20.4.2	Synchronous transmission	YES	—
20.5	Operation elements	—	—
20.5.1	Overview	YES	—
20.5.2	Bit time t_{BIT}	YES	—
20.5.3	Asynchronous transmission	NO	—
20.5.4	Synchronous transmission	YES	—
20.5.5	Timers and counters	—	—
20.5.5.1	Asynchronous transmission	NO	—
20.5.5.2	Synchronous transmission	YES	—
20.6	Cycle and system reaction times	—	—
20.6.1	Asynchronous transmission	NO	—
20.6.2	Synchronous transmission	YES	—

Table 226 – CP 3/2: DLL protocol selection of Clause 21

Clause	Header	Presence	Constraints
21.1	DLPDU character	—	—
21.1.1	Asynchronous transmission – UART character	NO	—
21.1.2	Synchronous transmission	YES	—
21.2	Length octet (LE, LEr)	YES	—
21.3	Address octet	YES	—
21.4	Control octet (FC)	YES	—
21.5	DLPDU check	—	—
21.5.1	Asynchronous transmission - frame check sequence (FCS)	NO	—
21.5.2	Synchronous transmission - cyclic redundancy check (CRC)	YES	—
21.6	DATA_UNIT	YES	—
21.7	Error control procedures	—	—
21.7.1	Asynchronous transmission	NO	—
21.7.2	Synchronous transmission	YES	—

Table 227 – CP 3/2: DLL protocol selection of Clause 22

Clause	Header	Presence	Constraints
22.1	DLPDUs of fixed length with no data field	—	—
22.1.1	Asynchronous transmission	NO	—
22.1.2	Synchronous transmission	YES	—
22.2	DLPDUs of fixed length with data field	—	—
22.2.1	Asynchronous transmission	NO	—
22.2.2	Synchronous transmission	YES	—
22.3	DLPDUs with variable data field length	—	—
22.3.1	Asynchronous transmission	NO	—
22.3.2	Synchronous transmission	YES	—
22.4	Token DLPDU	—	—
22.4.1	Asynchronous transmission	NO	—
22.4.2	Synchronous transmission	YES	—
22.5	ASP DLPDU	YES	—
22.6	SYNCH DLPDU	YES	—
22.7	Time Event (TE) DLPDU	YES	—
22.8	Clock Value (CV) DLPDU	YES	—
22.9	Transmission procedures	—	—
22.9.1	Asynchronous transmission	NO	—
22.9.2	Synchronous transmission	YES	—

7.3.2.2.2 Selection for DP-master (class 1)

7.3.2.2.2.1 DP-V0 master (class 1)

The Table 228 specifies the CP 3/2 selection of the time parameters of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0.

Table 228 – CP 3/2: Time variable selection for DP-V0 master (class 1)

Clause	Variable name	Usage	Constraint
20.5.4.1	Synchronisation time (T_{SYN})	M	—
20.5.4.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.4.3	Station delay time (T_{SDx})	M	—
20.5.4.4	Quiet time (T_{QUI})	M	—
20.5.4.5	Ready time (T_{RDY})	M	—
20.5.4.6	Safety margin (T_{SM})	M	—
20.5.4.7	Idle time (T_{Idx})	M	—
20.5.4.8	Transmission delay time (T_{TD})	M	—
20.5.4.9	Slot time (T_{SL})	M	—
20.5.4.10	Time-out T_{TO})	M	—
20.5.4.11	GAP update time (T_{GUD})	—	—
20.5.4.12	Isochronous cycle time (T_{CT})	—	—
20.5.4.13	IsoM synchronisation message time (T_{SYNCH})	—	—
20.5.4.14	Active spare time message time (T_{ASM})	—	—
20.5.4.15	Real isochronous cycle time (T_{RCT})	—	—
20.5.4.16	Spare time (T_{RES})	—	—
20.5.4.17	Passive spare time (T_{PSP})	—	—
20.5.4.18	Time shift (T_{SH})	—	—
20.5.4.19	Send delay time (T_{SD})	—	—
20.5.4.20	Receive delay time (T_{RD})	—	—
20.5.4.21	Clock synchronisation interval time (T_{CSI})	—	—

The Table 229 specifies the CP 3/2 selection of the timers and counters of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0.

Table 229 – CP 3/2: Timer and counter selection for DP-V0 master (class 1)

Clause	Timer or counter	Usage	Constraint
20.5.5.2.1	token-rotation-timer	M	—
20.5.5.2.1	idle-timer	M	—
20.5.5.2.1	slot-timer	M	—
20.5.5.2.1	time-out-timer	M	—
20.5.5.2.1	syn-interval-timer	M	—
20.5.5.2.1	GAP-update-timer	M	—
20.5.5.2.1	isochronous-cycle-timer	—	—
20.5.5.2.1	passive-spare-timer	—	—
20.5.5.2.1	send-delay-timer	—	—
20.5.5.2.1	receive-delay-timer	—	—
20.5.5.2.2	DLPDU_sent_count	O	—
20.5.5.2.2	Retry_count	O	—
20.5.5.2.2	DLPDU_sent_count_sr	O	—
20.5.5.2.2	Error_count	O	—
20.5.5.2.2	SD_count	O	—
20.5.5.2.2	SD_error_count	O	—

The Table 230 specifies the CP 3/2 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0.

Table 230 – CP 3/2: DLPDU selection for DP-V0 master (class 1)

Clause	DLPDU	Usage	Constraint
22.1.2	Frames of fixed length with no data field	M	—
22.2.2	Frames of fixed length with data field	M	Option for sending
22.3.2	Frames with variable data field length	M	—
22.4.2	Token frame	M	—
22.5	ASP DLPDU	—	—
22.6	SYNCH DLPDU	—	—
22.7	Time Event (TE) DLPDU	—	—
22.8	Clock Value (CV) DLPDU	—	—

For Clause 23 the following constraints apply:

a) The CP 3/2 selection of states of the media access, which are part of DP-master (class 1) and using features named DP-V0, are the same as specified for CP 3/1 DP-V0-master (class 1) in Table 133.

b) The CP 3/2 selection of the clock synchronisation protocol of the DL-entity of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V0, is empty.

7.3.2.2.2.2 DP-V1 master (class 1)

The Table 231 specifies the CP 3/2 selection of the time parameters of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 231 – CP 3/2: Time variable selection for DP-V1 master (class 1)

Clause	Variable name	Usage	Constraint
20.5.4.1	Synchronisation time (T_{SYN})	M	—
20.5.4.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.4.3	Station delay time (T_{SDx})	M	—
20.5.4.4	Quiet time (T_{QUI})	M	—
20.5.4.5	Ready time (T_{RDY})	M	—
20.5.4.6	Safety margin (T_{SM})	M	—
20.5.4.7	Idle time (T_{IDx})	M	—
20.5.4.8	Transmission delay time (T_{TD})	M	—
20.5.4.9	Slot time (T_{SL})	M	—
20.5.4.10	Time-out T_{TO})	M	—
20.5.4.11	GAP update time (T_{GUD})	M	—
20.5.4.12	Isochronous cycle time (T_{CT})	O	—
20.5.4.13	IsoM synchronisation message time (T_{SYNCH})	O	—
20.5.4.14	Active spare time message time (T_{ASM})	O	—
20.5.4.15	Real isochronous cycle time (T_{RCT})	O	—
20.5.4.16	Spare time (T_{RES})	O	—
20.5.4.17	Passive spare time (T_{PSP})	O	—
20.5.4.18	Time shift (T_{SH})	O	—
20.5.4.19	Send delay time (T_{SD})	O	—
20.5.4.20	Receive delay time (T_{RD})	O	—
20.5.4.21	Clock synchronisation interval time (T_{CSI})	O	—

The Table 232 specifies the CP 3/2 selection of the timers and counters of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 232 – CP 3/2: Timer and counter selection for DP-V1 master (class 1)

Clause	Timer or counter	Usage	Constraint
20.5.5.2.1	token-rotation-timer	M	—
20.5.5.2.1	idle-timer	M	—
20.5.5.2.1	slot-timer	M	—
20.5.5.2.1	time-out-timer	M	—
20.5.5.2.1	syn-interval-timer	M	—
20.5.5.2.1	GAP-update-timer	M	—
20.5.5.2.1	isochronous-cycle-timer	O	—
20.5.5.2.1	passive-spare-timer	O	—
20.5.5.2.1	send-delay-timer	O	—
20.5.5.2.1	receive-delay-timer	O	—
20.5.5.2.2	DLPDU_sent_count	O	—
20.5.5.2.2	Retry_count	O	—
20.5.5.2.2	DLPDU_sent_count_sr	O	—
20.5.5.2.2	Error_count	O	—
20.5.5.2.2	SD_count	O	—
20.5.5.2.2	SD_error_count	O	—

The Table 233 specifies the CP 3/2 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-master (class 1) and using features named DP-V1 and Options.

Table 233 – CP 3/2: DLPDU selection for DP-V1 master (class 1)

Clause	DLPDU	Usage	Constraint
22.1.2	Frames of fixed length with no data field	M	—
22.2.2	Frames of fixed length with data field	M	Option for sending
22.3.2	Frames with variable data field length	M	—
22.4.2	Token frame	M	—
22.5	ASP DLPDU	O	—
22.6	SYNCH DLPDU	O	—
22.7	Time Event (TE) DLPDU	O	—
22.8	Clock Value (CV) DLPDU	O	—

For Clause 23 the following constraints apply:

The CP 3/2 selection of states of the media access and of clock synchronisation protocol, which are part of DP-master (class 1) and using features named DP-V0, are the same as specified for CP 3/1 DP-V1-master (class 1) in Table 137 and Table 138.

7.3.2.2.3 Selection for DP-master (class 2)

7.3.2.2.3.1 DP-V0 master (class 2)

The CP 3/2 selection of the time parameters, of timers and counters, of DLPDUs, of states of the media access control and of the clock synchronisation protocol, which are part of DP-master (class 2) and using features named DP-V0, are the same as specified for DP-V0-master (class 1) in 7.3.2.2.2.1.

7.3.2.2.3.2 DP-V1 master (class 2)

The Table 234 specifies the CP 3/2 selection of the time parameters of the Data Link protocol, which are part of DP-master (class 2) and using features named DP-V1 and Options.

Table 234 – CP 3/2: Time variable selection for DP-V1 master (class 2)

Clause	Variable name	Usage	Constraint
20.5.4.1	Synchronisation time (T_{SYN})	M	—
20.5.4.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.4.3	Station delay time (T_{SDx})	M	—
20.5.4.4	Quiet time (T_{QUI})	M	—
20.5.4.5	Ready time (T_{RDY})	M	—
20.5.4.6	Safety margin (T_{SM})	M	—
20.5.4.7	Idle time (T_{IDx})	M	—
20.5.4.8	Transmission delay time (T_{TD})	M	—
20.5.4.9	Slot time (T_{SL})	M	—
20.5.4.10	Time-out T_{TO})	M	—
20.5.4.11	GAP update time (T_{GUD})	M	—
20.5.4.12	Isochronous cycle time (T_{CT})	—	—
20.5.4.13	IsoM synchronisation message time (T_{SYNCH})	—	—
20.5.4.14	Active spare time message time (T_{ASM})	—	—
20.5.4.15	Real isochronous cycle time (T_{RCT})	—	—
20.5.4.16	Spare time (T_{RES})	—	—
20.5.4.17	Passive spare time (T_{PSP})	—	—
20.5.4.18	Time shift (T_{SH})	—	—
20.5.4.19	Send delay time (T_{SD})	O	—
20.5.4.20	Receive delay time (T_{RD})	O	—
20.5.4.21	Clock synchronisation interval time (T_{CSI})	O	—

The Table 235 specifies the CP 3/2 selection of the timers and counters of the Data Link protocol, which are part of DP-master (class 2) and using features named DP-V1 and Options.

Table 235 – CP 3/2: Timer and counter selection for DP-V1 master (class 2)

Clause	Timer or counter	Usage	Constraint
20.5.5.2.1	token-rotation-timer	M	—
20.5.5.2.1	idle-timer	M	—
20.5.5.2.1	slot-timer	M	—
20.5.5.2.1	time-out-timer	M	—
20.5.5.2.1	syn-interval-timer	M	—
20.5.5.2.1	GAP-update-timer	M	—
20.5.5.2.1	isochronous-cycle-timer	—	—
20.5.5.2.1	passive-spare-timer	—	—
20.5.5.2.1	send-delay-timer	O	—
20.5.5.2.1	receive-delay-timer	O	—
20.5.5.2.2	DLPDU_sent_count	O	—
20.5.5.2.2	Retry_count	O	—
20.5.5.2.2	DLPDU_sent_count_sr	O	—
20.5.5.2.2	Error_count	O	—
20.5.5.2.2	SD_count	O	—
20.5.5.2.2	SD_error_count	O	—

The Table 236 specifies the CP 3/2 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-master (class 2) and using features named DP-V1 and Options.

Table 236 – CP 3/2: DLPDU selection for DP-V1 master (class 2)

Clause	DLPDU	Usage	Constraint
22.1.2	Frames of fixed length with no data field	M	—
22.2.2	Frames of fixed length with data field	M	Option for sending
22.3.2	Frames with variable data field length	M	—
22.4.2	Token frame	M	—
22.5	ASP DLPDU	—	—
22.6	SYNCH DLPDU	—	—
22.7	Time Event (TE) DLPDU	O	—
22.8	Clock Value (CV) DLPDU	O	—

For Clause 23 the following constraints apply:

a) The CP 3/2 selection of states of the media access, which are part of DP-master (class 2) and using features named DP-V1 and Options, are the same as specified for CP 3/1 DP-V0-master (class 1) in Table 133.

b) The CP 3/1 selection of the clock synchronisation protocol, which are part of DP-master (class 2) and using features named DP-V1 and Options, are the same as specified for CP 3/1 DP-V1-master (class 1) in Table 138

7.3.2.2.4 Selection for DP-slave

7.3.2.2.4.1 DP-V0 slave

The Table 237 specifies the CP 3/2 selection of the time parameters of the Data Link protocol, which are part of DP-slave and using features named DP-V0.

Table 237 – CP 3/2: Time variable selection for DP-V0 slave

Clause	Variable name	Usage	Constraint
20.5.4.1	Synchronisation time (T_{SYN})	M	—
20.5.4.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.4.3	Station delay time (T_{SDx})	M	—
20.5.4.4	Quiet time (T_{QUI})	—	—
20.5.4.5	Ready time (T_{RDY})	—	—
20.5.4.6	Safety margin (T_{SM})	—	—
20.5.4.7	Idle time (T_{IDx})	M	—
20.5.4.8	Transmission delay time (T_{TD})	—	—
20.5.4.9	Slot time (T_{SL})	M	—
20.5.4.10	Time-out T_{TO})	M	—
20.5.4.11	GAP update time (T_{GUD})	—	—
20.5.4.12	Isochronous cycle time (T_{CT})	—	—
20.5.4.13	IsoM synchronisation message time (T_{SYNCH})	—	—
20.5.4.14	Active spare time message time (T_{ASM})	—	—
20.5.4.15	Real isochronous cycle time (T_{RCT})	—	—
20.5.4.16	Spare time (T_{RES})	—	—
20.5.4.17	Passive spare time (T_{PSP})	—	—
20.5.4.18	Time shift (T_{SH})	—	—
20.5.4.19	Send delay time (T_{SD})	—	—
20.5.4.20	Receive delay time (T_{RD})	—	—
20.5.4.21	clock synchronisation interval time (T_{CSI})	—	—

The Table 238 specifies the CP 3/2 selection of the timers and counters of the Data Link protocol, which are part of DP-slave and using features named DP-V0.

Table 238 – CP 3/2: Timer and counter selection for DP-V0 slave

Clause	Timer or counter	Usage	Constraint
20.5.5.2.1	token-rotation-timer	—	—
20.5.5.2.1	idle-timer	M	—
20.5.5.2.1	slot-timer	—	—
20.5.5.2.1	time-out-timer	M	—
20.5.5.2.1	syn-interval-timer	M	—
20.5.5.2.1	GAP-update-timer	—	—
20.5.5.2.1	isochronous-cycle-timer	—	—
20.5.5.2.1	passive-spare-timer	—	—
20.5.5.2.1	send-delay-timer	—	—
20.5.5.2.1	receive-delay-timer	—	—
20.5.5.2.2	DLPDU_sent_count	—	—
20.5.5.2.2	Retry_count	—	—
20.5.5.2.2	DLPDU_sent_count_sr	—	—
20.5.5.2.2	Error_count	—	—
20.5.5.2.2	SD_count	O	—
20.5.5.2.2	SD_error_count	O	—

The Table 239 specifies the CP 3/2 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-slave and using features named DP-V0.

Table 239 – CP 3/2: DLPDU selection for DP-V0 slave

Clause	DLPDU	Usage	Constraint
22.1.2	Frames of fixed length with no data field	M	—
22.2.2	Frames of fixed length with data field	M	Option for sending
22.3.2	Frames with variable data field length	M	—
22.4.2	Token frame	M	Only for receiving
22.5	ASP DLPDU	—	—
22.6	SYNCH DLPDU	—	—
22.7	Time Event (TE) DLPDU	—	—
22.8	Clock Value (CV) DLPDU	—	—

For Clause 23 the following constraints apply:

a) The CP 3/2 selection of states of the media access, which are part of DP-slave and using features named DP-V0, are the same as specified for CP 3/1 DP-V0-slave in Table 145.

b) The CP 3/2 selection of the clock synchronisation protocol of the DL-entity of the Data Link protocol, which are part of DP-slave and using features named DP-V0, is empty.

7.3.2.2.4.2 DP-V1 slave

The Table 240 specifies the CP 3/2 selection of the time parameters of the Data Link protocol, which are part of DP-slave and using features named DP-V1 and Options.

Table 240 – CP 3/2: Time variable selection for DP-V1 slave

Clause	Variable name	Usage	Constraint
20.5.4.1	Synchronisation time (T_{SYN})	M	—
20.5.4.2	Synchronisation interval time (T_{SYNI})	M	—
20.5.4.3	Station delay time (T_{SDx})	M	—
20.5.4.4	Quiet time (T_{QUI})	—	—
20.5.4.5	Ready time (T_{RDY})	—	—
20.5.4.6	Safety margin (T_{SM})	—	—
20.5.4.7	Idle time (T_{IDx})	M	—
20.5.4.8	Transmission delay time (T_{TD})	—	—
20.5.4.9	Slot time (T_{SL})	M	—
20.5.4.10	Time-out T_{TO})	M	—
20.5.4.11	GAP update time (T_{GUD})	—	—
20.5.4.12	Isochronous cycle time (T_{CT})	—	—
20.5.4.13	IsoM synchronisation message time (T_{SYNCH})	—	—
20.5.4.14	Active spare time message time (T_{ASM})	—	—
20.5.4.15	Real isochronous cycle time (T_{RCT})	—	—
20.5.4.16	Spare time (T_{RES})	—	—
20.5.4.17	Passive spare time (T_{PSP})	—	—
20.5.4.18	Time shift (T_{SH})	—	—
20.5.4.19	Send delay time (T_{SD})	—	—
20.5.4.20	Receive delay time (T_{RD})	O	—
20.5.4.21	clock synchronisation interval time (T_{CSI})	O	—

The Table 241 specifies the CP 3/2 selection of the timers and counters of the Data Link protocol, which are part of DP-slave and using features named DP-V1 and Options.

Table 241 – CP 3/2: Timer and counter selection for DP-V1 slave

Clause	Timer or counter	Usage	Constraint
20.5.5.2.1	token-rotation-timer	—	—
20.5.5.2.1	idle-timer	M	—
20.5.5.2.1	slot-timer	—	—
20.5.5.2.1	time-out-timer	M	—
20.5.5.2.1	syn-interval-timer	M	—
20.5.5.2.1	GAP-update-timer	—	—
20.5.5.2.1	isochronous-cycle-timer	—	—
20.5.5.2.1	passive-spare-timer	—	—
20.5.5.2.1	send-delay-timer	—	—
20.5.5.2.1	receive-delay-timer	O	—
20.5.5.2.2	DLPDU_sent_count	—	—
20.5.5.2.2	Retry_count	—	—
20.5.5.2.2	DLPDU_sent_count_sr	—	—
20.5.5.2.2	Error_count	—	—
20.5.5.2.2	SD_count	O	—
20.5.5.2.2	SD_error_count	O	—

The Table 242 specifies the CP 3/2 selection of the types of DLPDUs of the Data Link protocol, which are part of DP-slave and using features named DP-V1 and Options.

Table 242 – CP 3/2: DLPDU selection for DP-V1 slave

Clause	DLPDU	Usage	Constraint
22.1.2	Frames of fixed length with no data field	M	—
22.2.2	Frames of fixed length with data field	M	Option for sending
22.3.2	Frames with variable data field length	M	—
22.4.2	Token frame	M	Only for receiving
22.5	ASP DLPDU	O	Only for receiving
22.6	SYNCH DLPDU	O	Only for receiving
22.7	Time Event (TE) DLPDU	O	Only for receiving
22.8	Clock Value (CV) DLPDU	O	Only for receiving

For Clause 23 the following constraints apply:

a) The CP 3/2 selection of states of the media access, which are part of DP-slave and using features named DP-V1, are the same as specified for CP 3/1 DP-V0-slave in Table 145.

b) The CP 3/2 selection of states of the clock synchronisation protocol, which are part of DP-slave and using features named DP-V1 and Options, are the same as specified for CP 3/1 DP-V1-slave in Table 149.

7.3.3 Application Layer

7.2.3 applies to CP 3/2. In Application Layer there is no difference to CP 3/1.

7.4 Profile 3/3 (PROFInet)

7.4.1 Physical Layer

The Physical Layer of the PROFInet profile is according to ISO/IEC 8802-3.

7.4.2 Data Link Layer

7.4.2.1 DLL service selection

The Data Link Layer of the PROFInet profile is according to ISO/IEC 8802-3.

7.4.2.2 DLL protocol selection

The Data Link Layer of the PROFInet profile is according to ISO/IEC 8802-3.

7.4.3 Application Layer

7.4.3.1 AL service selection

Application Layer services are defined in IEC 61158-5, Table 243 specifies the subclauses included in this profile.

Table 243 – CP 3/3: AL service selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	Partial	Used when applicable
4	CONCEPTS	NO	—
5	DATA TYPE ASE	Partial	Only those of Type 10, see 15.2 of IEC 61158-5
6 – 14	—	NO	—
15	COMMUNICATION MODEL TYPE 10 SPECIFICATION	YES	—
Annex A	(informative) Model for Service Error Reporting	NO	—

NOTE 1 In addition AL services are deploying the DCOM*/DCE-RPC technology for the Type 10 abstract ORPC model, as defined in DCE-RPC (CAE Specification) and DCOM (The Component Object Model Specification).

NOTE 2 Furthermore, DCOM*/DCE-RPC technology is mapped onto the TCP/UDP/IP protocol suite, as defined in RFC 793, RFC 768 and RFC 791,RFC 0826, RFC 0894,.RFC 0826, RFC 1122, and RFC 1123.

** DCOM is a trade name of Microsoft Corporation. This implementation example is given for the convenience of the user of this international Standard and does not constitute an endorsement by IEC of DCOM.*

7.4.3.2 AL protocol selection

The Application Layer protocol is defined in IEC 61158-6, Table 244 specifies the subclauses included in this profile.

Table 244 – CP 3/3: AL protocol selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	Partial	Used when applicable
4 – 12	—	NO	—
13	Type 10	YES	—

NOTE 1 In addition AL protocol utilises the DCOM*/DCE-RPC wire-protocol, as in DCE-RPC (CAE Specification) and DCOM* (The Component Object Model Specification), to convey the AL service parameter and user data. The APDUs are formed by DCOM/DCE-RPC data marshalling of the IDL description defined in 13.1 of IEC 61158-6 (see 7.1 note 4).

NOTE 2 Furthermore, DCOM*/DCE-RPC protocol is mapped onto the TCP/UDP/IP protocol suite, as defined in RFC 793, RFC 768, RFC 791, RFC 0826, RFC 0894,.RFC 0826, RFC 1122, and RFC 1123 (see 7.1 note 4).

** DCOM is a trade name of Microsoft Corporation. This implementation example is given for the convenience of the user of this international Standard and does not constitute an endorsement by IEC of DCOM.*

8 Communication Profile Family 4 (P-NET®[11])

8.1 General overview

Communication Profile Family 4 defines profiles based on IEC 61158-2 through IEC 61158-6, Type 4, which corresponds to parts of a communication system commonly known as P-NET.

– Profile 4/1 P-NET RS-485
This profile contains AL, DLL and PhL services and protocol references with an IEC 61158 compliant application access. Profile 4/1 is based on ANSI TIA/EIA-485-A, and allows up to 125 devices of normal or simple class to communicate on the same physical link, in half duplex mode.

– Profile 4/2 P-NET RS-232
This profile contains AL, DLL and PhL services and protocol references with an IEC 61158 compliant application access. Profile 4/2 is based on ANSI TIA/EIA-232F, and allows two devices of normal class to communicate on the same physical link, in full duplex mode.

NOTE See Annex A.1 for a longer overview of FOUNDATION Fieldbus communications concepts.

8.2 Profile 4/1, P-NET RS-485

8.2.1 Physical Layer

Table 245 holds the Physical Layer service and protocol selections from IEC 61158-2 for this profile.

11 P-NET is the trade name of International P-NET User Organisation ApS (IPUO). This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name P-NET. Use of the trade name P-NET requires permission of the trade name holder.

Table 245 – CP 4/1: PhL selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	Partial	Used when applicable
4	Symbols and abbreviations	Partial	Used when applicable
5	Data Link Layer - Physical Layer Interface	—	—
5.1	General	YES	—
5.2 – 5.4	—	NO	—
5.5	Type 4: Required services	YES	See text following this table
5.6 – 5.7	—	NO	—
6	Station Management – Physical Layer Interface	—	—
6.1	General	YES	—
6.2	Type 1: Station Management - Physical Layer interface	Partial	Only Ph-SETVALUE and Ph-GETVALUE
6.3	—	NO	—
6.4	Type 4: Station Management - Physical Layer interface	YES	At least, Baud rate 76800 shall be supported. Only half duplex mode shall be supported
6.5 – 6.6	—	NO	—
7 – 8	—	NO	—
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	YES	—
9.2 – 9.5	—	NO	—
9.6	Type 4: MDS: Wire medium	—	—
9.6.1	Half Duplex	YES	—
9.6.2	Full Duplex	NO	—
9.7 – 9.8	—	NO	—
10 – 23	—	NO	—
24	Type 4: Medium Attachment Unit: RS-485	YES	—
25 – 28	—	NO	—
Annex A – M	—	NO	—

Simple class devices shall only support:

a) Ph-Data request, classes start-of-activity-11, data and end-of-activity.

b) Ph-DATA indication, classes START-OF-ACTIVITY and DATA.

8.2.2 Data Link Layer

8.2.2.1 DLL service selection

Table 246 holds the Data Link Layer service selections from IEC61158-3 for this profile.

Table 246 – CP 4/1: DLL service selection

Clause	Header	Presence	Constraints
1	Scope and object	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	Partial	Used when applicable
4	Symbols and abbreviations	Partial	Used when applicable
5	Conventions	Partial	Used when applicable
6 – 10	—	NO	—
11	Types 1 and 4: DL-management Service	—	—
11.1	Scope and inheritance	NO	—
11.2	Facilities of the DL-management service	Partial	Bullets a) and b)
11.3	Model of the DL_management service	YES	—
11.4	Constraints on sequence of primitives	Partial	Only the parts referring to DLM-SET and DLM-GET
11.5	DL-SET	YES	—
11.6	DL-GET	YES	—
11.7 – 11.8	—	NO	—
12 – 15	—	NO	—
16	Type 4: Data Link Service and concepts	YES	—
17 – 20	—	NO	—

8.2.2.2 DLL protocol selection

Table 247 holds the Data Link Layer protocol selections from IEC 61158-4 for this profile.

Table 247 – CP 4/1: DLL protocol selection

Clause	Header	Presence	Constraints
1	Scope and object	YES	—
2	Normative references	Partial	Used for type 4 if needed
3	Terms and definitions	Partial	Used in type 4 when applicable
4	Symbols and abbreviations	Partial	Used in type 4 when applicable
5 – 23	—	NO	—
24	Type 4: Data Link Protocol definition	YES	[a]
25 – 32	—	NO	—
Annex A – K	—	NO	—

[a] A device shall provide at least the necessary protocol options to fulfil the supported services.

For this profile, only half duplex transmission, as defined in 21.1.2.2 of IEC 61158-4, should be supported.

Simple class devices should support responder functionality only, as defined in 24.1.1 of IEC 61158-4.

8.2.3 Application Layer

8.2.3.1 AL service selection

Table 248 holds the Application Layer service selections from IEC 61158-5 for this profile.

Table 248 – CP 4/1: AL service selection

Clause	Header	Presence	Constraints
1	SCOPE	YES	—
2	NORMATIVE REFERENCES	Partial	Used for type 4 if needed
3	DEFINITIONS	Partial	Used in type 4 when applicable
4	CONCEPTS	—	—
4.1	Architectural relationships	YES	—
4.2	Fieldbus Application Layer Structure	—	—
4.2.1	Overview	YES	—
4.2.2	Fundamental Concepts	YES	—
4.2.3	Fieldbus Application Processes	YES	—
4.2.4	Application Objects	YES	—
4.2.5 – 4.2.7	—	NO	—
4.3 – 4.8	—	NO	—
5 – 9	—	NO	—
10	COMMUNICATION MODEL TYPE 4 SPECIFICATION	—	—
10.1	Type 4 Concepts	YES	—
10.2	Type 4 Variable ASE	YES	—
10.3	Type 4 Route Endpoint ASE	YES	—
10.4	Type 4 Application relationship ASE	—	—
10.4.1	Overview	YES	—
10.4.2	Application Relationship Class Specification	—	—
10.4.2.1	Application Relationship Formal Model	YES	At least, BaudRate 76800 shall be supported
10.4.3	Application Relationship ASE Service Specifications	YES	—
11 – 14	—	NO	—
Annex A	(informative) Model for Service Error Reporting	NO	—

Simple class devices shall only support Real Variable Objects (not Proxy Variable Objects) and only the objects needed for the variable types, which are actually present in the device.

Normal class devices shall support the Real Variable Objects needed for the variable types, which are actually present in the device, and Proxy Variable Objects for all of the variable types listed in 10.2 of IEC 61158-5.

Simple class devices shall not support the RESPONSE Service, defined in 10.3.3.2 of IEC 61158-5.

8.2.3.2 AL protocol selection

Table 249 holds the Application Layer protocol selections from IEC 61158-6 for this profile.

Table 249 – CP 4/1: AL protocol selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used for type 4 if needed
3	Terms and definitions	Partial	Used in type 4 when applicable
4 – 6	—	NO	—
7	Type 4	YES	[a]
8 – 11	—	NO	—

[a] A device shall provide at least the necessary protocol options to fulfil the supported services.

8.3 Profile 4/2, P-NET RS-232

8.3.1 Physical Layer

Table 250 holds the Physical Layer service and protocol selections from IEC61158-2 for this profile.

Table 250 – CP 4/2: PhL selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used for type 4 if needed
3	Terms and definitions	Partial	Used in type 4 when applicable
4	Symbols and abbreviations	Partial	Used in type 4 when applicable
5	Data Link Layer - Physical Layer Interface	—	—
5.1	General	YES	—
5.2 – 5.4	—	NO	
5.5	Type 4: Required services	YES	See text following this table
5.6 – 5.7	—	NO	
6	Station Management – Physical Layer Interface	—	—
6.1	General	YES	—
6.2	Type 1: Station Management – Physical Layer interface	Partial	Only Ph-SETVALUE and Ph-GETVALUE
6.3	—	NO	
6.4	Type 4: Station Management – Physical Layer interface	YES	Supported Baud rates depend on implementation. Only full duplex mode shall be supported
6.5 – 6.6	—	NO	
7 – 8	—	NO	
9	Medium Dependent Sublayer (MDS)	—	
9.1	General	YES	—
9.2 – 9.5	—	NO	
9.6	Type 4: MDS: Wire medium	—	
9.6.1	Half Duplex	NO	
9.6.2	Full Duplex	YES	
9.7 – 9.8	—	NO	
10 – 24	—	NO	
25	Type 4: Medium Attachment Unit: RS-232	YES	—
26 – 28	—	NO	
Annex A – M	—	NO	

Devices communicating in full duplex mode must be of normal class. For Normal class devices in full duplex mode, only the following service primitives shall be supported:

a) Ph-Data request, classes start-of-activity-2, data and end-of-activity.

b) Ph-DATA indication, classes START-OF-ACTIVITY and DATA.

8.3.2 Data Link Layer

Same as for profile 4/1, except that for this profile, only full duplex transmission, as defined in 21.1.2.2 of IEC 61158-4, should be supported. Communicating in full duplex mode is only possible for Normal class devices.

8.3.3 Application Layer

Same as for profile 4/1, except that for this profile there is no constraint on supported BaudRate.

9 Communication Profile 5 (WorldFIP®[12])

9.1 General overview

The WorldFIP network is a very flexible and versatile transmission system. The range of functions and performances permit the definition of a large number of profiles to match exactly the requirements of the applications. As a practical approach, the three most popular profiles are developed in this International Standard; they address both time critical context and mission critical functions. Other profiles will be defined for purpose specific application by selecting the appropriate services and protocols in the IEC 61158 series, but respecting the minimum core which is necessary to set up, operate and monitor the network.

All the terms are defined in the base standards IEC 61158-2 through IEC 61158-6.

All the defined profiles are composed of a selection of services and protocols from the IEC 61158 series, Type 7, and tuned by a selection of particular parameters within each service or protocol.

All the WorldFIP profiles are based on a common core set of services of MPS, to which is added an appropriated selection of services providing from one or more selected appropriated features.

The following table summarizes the element selection of the relative profiles.

Table 251 – CPF 5: overview of profile sets

	Profile 5/1	Profile 5/2	Profile 5/3
Application	Type 7 (MPS, MCS) of IEC 61158-5, -6	Type 7 (MPS, MCS, SubMMS) of IEC 61158-5, -6	Type 7 (MPS) of IEC 61158-5, -6
Data link	Type 7 of IEC 61158-3, -4	Type 7 of IEC 61158-3, -4	Type 7 of IEC 61158-3, -4
Physical	Type 1 of IEC 61158-2	Type 1 of IEC 61158-2	Type 1 of IEC 61158-2

The selection defined in the Table 251 represents the most frequently basic used profiles. The distinctive features of the different profiles in the basic version are the following:

– Profile 5/1, long messages, wide network topology, loose time-critical purpose-built Application Layer;

– Profile 5/2, large messages, tight time-critical exchanges, mission-critical application, IEC 61158-5 and IEC 61158-6 (Application Layer);

– Profile 5/3, open WorldFIP interface for other purpose-built or standardized tight time-critical Application Layers (segmented or not).

NOTE See A.5 for an overview of WorldFIP communications concepts.

It should be emphasized that profile 5/3 may be fitted with web type upper stack profile containing TCP/IP, BSD sockets, HTTP over DLL access point. The addition of this side stack does not impact the profile definition. This important feature permits a TRANSPARENT access of Fieldbus device from remote browser, as long as the field devices implement an EMBEDDED SERVER. This is an additional integration provided by the profiles to federate intelligent Field device into distributed Control Systems.

12 WorldFIP is the trade name of the WorldFIP organization. This information is given for the convenience of users of the International Standard and does not constitute an endorsement by ISO or IEC 61784 of the product named. Equivalent products may be used if they can be shown to lead to the same results.