BS EN 61158-3-3:2014

BSI Standards Publication

# Industrial communication networks — Fieldbus specifications

## Part 3-3: Data-link layer service definition — Type 3 elements

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## National foreword

This British Standard is the UK implementation of EN 61158-3-3:2014. It is identical to IEC 61158-3-3:2014. It supersedes BS EN 61158-3-3:2008 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AMT/7, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.



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# Industrial communication networks - Fieldbus specifications - Part 3-3: Data-link layer service definition - Type 3 elements (IEC 61158-3-3:2014)

Réseaux de communication industriels - Spécifications des bus de terrain - Partie 3-3: Définition des services de la couche liaison de données - Éléments de type 3 (CEI 61158-3-3:2014)

Industrielle Kommunikationsnetze - Feldbusse - Teil 3-3: Dienstfestlegungen des Data Link Layer (Sicherungsschicht) - Typ 3-Elemente (IEC 61158-3-3:2014)

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## Foreword

The text of document 65C/759/FDIS, future edition 2 of IEC 61158-3-3, prepared by SC 65C "Industrial networks" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61158-3-3:2014.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-06-17
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-09-17

This document supersedes EN 61158-3-3:2008.

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

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## Endorsement notice

The text of the International Standard IEC 61158-3-3:2014 was approved by CENELEC as a European Standard without any modification.

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

| | | |
|---|---|---|
| IEC 61158-2 | NOTE | Harmonized as EN 61158-2. |
| IEC 61158-4-3 | NOTE | Harmonized as EN 61158-4-3. |
| IEC 61158-5-3 | NOTE | Harmonized as EN 61158-5-3. |
| IEC 61158-6-3 | NOTE | Harmonized as EN 61158-6-3. |

# Annex ZA
(normative)

## Normative references to international publications with their corresponding European publications

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

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

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

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 61158-1 | - | Industrial communication networks - Fieldbus specifications - Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series | EN 61158-1 | - |
| ISO/IEC 7498-1 | - | Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model | - | - |
| ISO/IEC 7498-3 | - | Information technology - Open Systems Interconnection - Basic Reference Model: Naming and addressing | - | - |
| ISO/IEC 10731 | - | Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI services | - | - |

# CONTENTS

# INTRODUCTION

This part of IEC 61158 is one of a series produced to facilitate the interconnection of automation system components. It is related to other standards in the set as defined by the “three-layer” fieldbus reference model described in IEC 61158-1.

Throughout the set of fieldbus standards, the term “service” refers to the abstract capability provided by one layer of the OSI Basic Reference Model to the layer immediately above. Thus, the data-link layer service defined in this standard is a conceptual architectural service, independent of administrative and implementation divisions.

# INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

# Part 3-3: Data-link layer service definition – Type 3 elements

## 1 Scope

### 1.1 General

This part of IEC 61158 provides common elements for basic time-critical messaging communications between devices in an automation environment. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This standard defines in an abstract way the externally visible service provided by the Type 3 fieldbus data-link layer in terms of

a) the primitive actions and events of the service;

b) the parameters associated with each primitive action and event, and the form which they take; and

c) the interrelationship between these actions and events, and their valid sequences.

The purpose of this standard is to define the services provided to

– the Type 3 fieldbus application layer at the boundary between the application and data-link layers of the fieldbus reference model, and

– systems management at the boundary between the data-link layer and systems management of the fieldbus reference model.

### 1.2 Specifications

The principal objective of this standard is to specify the characteristics of conceptual data-link layer services suitable for time-critical communications, and thus supplement the OSI Basic Reference Model in guiding the development of data-link protocols for time-critical communications. A secondary objective is to provide migration paths from previously existing industrial communications protocols.

This specification may be used as the basis for formal DL-Programming-Interfaces. Nevertheless, it is not a formal programming interface, and any such interface will need to address implementation issues not covered by this specification, including

a) the sizes and octet ordering of various multi-octet service parameters, and

b) the correlation of paired request and confirm, or indication and response, primitives.

### 1.3 Conformance

This standard does not specify individual implementations or products, nor do they constrain the implementations of data-link entities within industrial automation systems.

There is no conformance of equipment to this data-link layer service definition standard. Instead, conformance is achieved through implementation of the corresponding data-link protocol that fulfills the Type 1 data-link layer services defined in this standard.

## 2 Normative references

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

NOTE All parts of the IEC 61158 series, as well as IEC 61784-1 and IEC 61784-2 are maintained simultaneously. Cross-references to these documents within the text therefore refer to the editions as dated in this list of normative references.

IEC 61158-1, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

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

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

ISO/IEC 10731, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

## 3 Terms, definitions, symbols, abbreviations and conventions

For the purposes of this document, the following terms, definitions, symbols, abbreviations and conventions apply.

### 3.1 Reference model terms and definitions

This standard is based in part on the concepts developed in ISO/IEC 7498-1 and ISO/IEC 7498-3, and makes use of the following terms defined therein.

**3.1.1 DL-address** [7498-3]

**3.1.2 DL-address-mapping** [7498-1]

**3.1.3 called-DL-address** [7498-3]

**3.1.4 calling-DL-address** [7498-3]

**3.1.5 centralized multi-end-point-connection** [7498-1]

**3.1.6 DL-connection** [7498-1]

**3.1.7 DL-connection-end-point** [7498-1]

**3.1.8 DL-connection-end-point-identifier** [7498-1]

**3.1.9 DL-connection-mode transmission** [7498-1]

**3.1.10 DL-connectionless-mode transmission** [7498-1]

**3.1.11 correspondent (N)-entities** [7498-1]
**correspondent DL-entities (N=2)**
**correspondent Ph-entities (N=1)**

**3.1.12 DL-duplex-transmission** [7498-1]

**3.1.13 (N)-entity** [7498-1]
**DL-entity (N=2)**
**Ph-entity (N=1)**

**3.1.14 DL-facility** [7498-1]

**3.1.15 flow control** [7498-1]

**3.1.16 (N)-layer** [7498-1]
**DL-layer (N=2)**
**Ph-layer (N=1)**

**3.1.17 layer-management** [7498-1]

**3.1.18 DL-local-view** [7498-3]

**3.1.19 DL-name** [7498-3]

**3.1.20 naming-(addressing)-domain** [7498-3]

**3.1.21 peer-entities** [7498-1]

**3.1.22 primitive name** [7498-3]

**3.1.23 DL-protocol** [7498-1]

**3.1.24 DL-protocol-connection-identifier** [7498-1]

**3.1.25 DL-protocol-data-unit** [7498-1]

**3.1.26 DL-relay** [7498-1]

**3.1.27 reset** [7498-1]

**3.1.28 responding-DL-address** [7498-3]

**3.1.29 routing** [7498-1]

**3.1.30 segmenting** [7498-1]

**3.1.31 (N)-service** [7498-1]
**DL-service (N=2)**
**Ph-service (N=1)**

**3.1.32 (N)-service-access-point** [7498-1]
**DL-service-access-point (N=2)**
**Ph-service-access-point (N=1)**

**3.1.33 DL-service-access-point-address** [7498-3]

**3.1.34 DL-service-connection-identifier** [7498-1]

**3.1.35 DL-service-data-unit** [7498-1]

**3.1.36 DL-simplex-transmission** [7498-1]

**3.1.37 DL-subsystem** [7498-1]

**3.1.38 systems-management** [7498-1]

**3.1.39 DLS-user-data** [7498-1]

### 3.2 Service convention terms and definitions

This standard also makes use of the following terms defined in ISO/IEC 10731 as they apply to the data-link layer:

**3.2.1 acceptor**

**3.2.2 asymmetrical service**

**3.2.3 confirm (primitive);**
**requestor.deliver (primitive)**

**3.2.4 deliver (primitive)**

**3.2.5 DL-confirmed-facility**

**3.2.6 DL-facility**

**3.2.7 DL-local-view**

**3.2.8 DL-mandatory-facility**

**3.2.9 DL-non-confirmed-facility**

**3.2.10 DL-provider-initiated-facility**

**3.2.11 DL-provider-optional-facility**

**3.2.12 DL-service-primitive;**
**primitive**

**3.2.13 DL-service-provider**

**3.2.14 DL-service-user**

**3.2.15 DLS-user-optional-facility**

**3.2.16 indication (primitive);**
**acceptor.deliver (primitive)**

**3.2.17 multi-peer**

**3.2.18 request (primitive);**
**requestor.submit (primitive)**

**3.2.19 requestor**

**3.2.20 response (primitive);**
**acceptor.submit (primitive)**

**3.2.21 submit (primitive)**

**3.2.22 symmetrical service**

### 3.3 Common data-link service terms and definitions

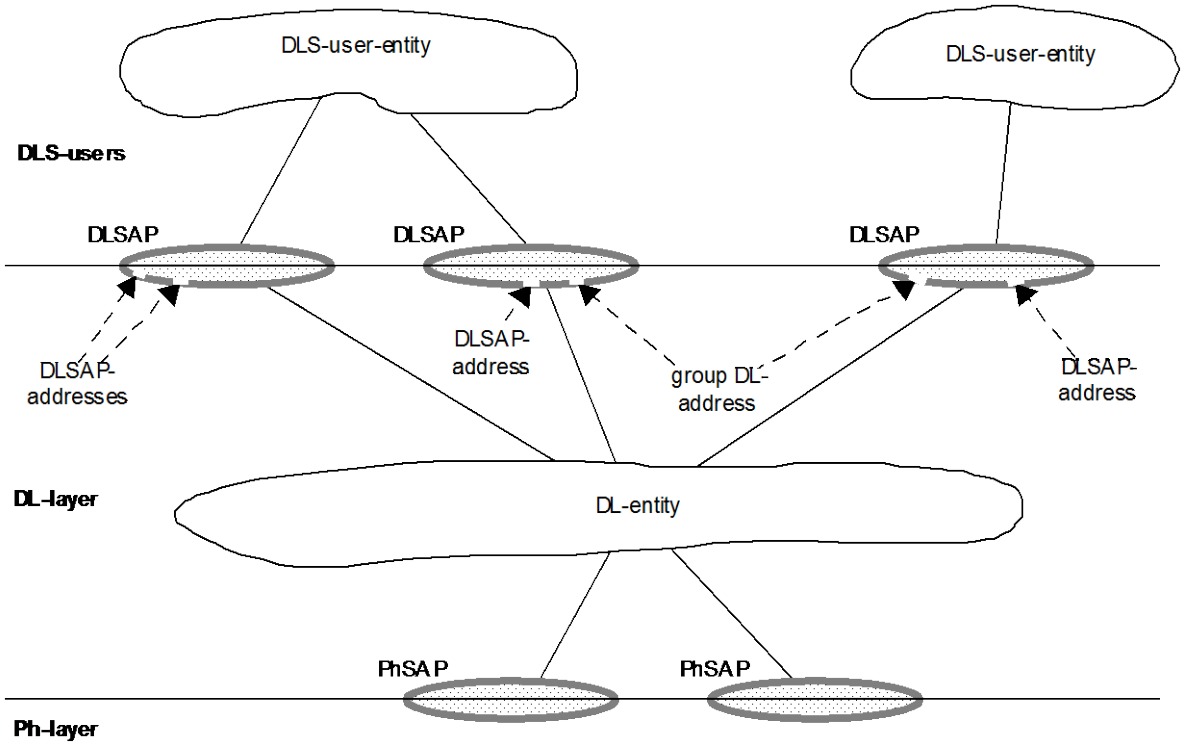
For the purposes of this document, the following terms and definitions apply.

NOTE Many definitions are common to more than one protocol Type; they are not necessarily used by all protocol Types.

**3.3.1**
**DL-segment,**
**link,**
**local link**
single DL-subnetwork in which any of the connected DLEs may communicate directly, without any intervening DL-relaying, whenever all of those DLEs that are participating in an instance of communication are simultaneously attentive to the DL-subnetwork during the period(s) of attempted communication

**3.3.2**
**DLSAP**
distinctive point at which DL-services are provided by a single DL-entity to a single higher-layer entity

Note 1 to entry: This definition, derived from ISO/IEC 7498-1, is repeated here to facilitate understanding of the critical distinction between DLSAPs and their DL-addresses.




NOTE 1 DLSAPs and PhSAPs are depicted as ovals spanning the boundary between two adjacent layers.

NOTE 2 DL-addresses are depicted as designating small gaps (points of access) in the DLL portion of a DLSAP.

NOTE 3 A single DL-entity may have multiple DLSAP-addresses and group DL-addresses associated with a single DLSAP.

**Figure 1 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses**

**3.3.3**
**DL(SAP)-address**
either an individual DLSAP-address, designating a single DLSAP of a single DLS-user, or a group DL-address potentially designating multiple DLSAPs, each of a single DLS-user

Note 1 to entry: This terminology is chosen because ISO/IEC 7498-3 does not permit the use of the term DLSAP-address to designate more than a single DLSAP at a single DLS-user.

**3.3.4**
**(individual) DLSAP-address**
DL-address that designates only one DLSAP within the extended link

Note 1 to entry: A single DL-entity may have multiple DLSAP-addresses associated with a single DLSAP.

**3.3.5**
**extended link**
DL-subnetwork, consisting of the maximal set of links interconnected by DL-relays, sharing a single DL-name (DL-address) space, in which any of the connected DL-entities may communicate, one with another, either directly or with the assistance of one or more of those intervening DL-relay entities

Note 1 to entry: An extended link may be composed of just a single link.

**3.3.6**
**frame**
denigrated synonym for DLPDU

**3.3.7**
**group DL-address**
DL-address that potentially designates more than one DLSAP within the extended link

Note 1 to entry: A single DL-entity can have multiple group DL-addresses associated with a single DLSAP.

Note 2 to entry: A single DL-entity also can have a single group DL-address associated with more than one DLSAP.

**3.3.8**
**node**
single DL-entity as it appears on one local link

**3.3.9**
**receiving DLS-user**
DL-service user that acts as a recipient of DLS-user-data

Note 1 to entry: A DL-service user can be concurrently both a sending and receiving DLS-user.

**3.3.10**
**sending DLS-user**
DL-service user that acts as a source of DLS-user-data

### 3.4 Additional Type 3 data-link specific definitions

For the purposes of this document, the following terms and definitions apply.

**3.4.1**
**acknowledgement DLPDU**
reply DLPDU that contains no DLSDU

**3.4.2**
**bit time**
time to transmit one bit

**3.4.3**
**clock synchronization**
represents a sequence of interactions to synchronize the clocks of all time receivers by a time master

**3.4.4**
**controller_type**
hardware class of the communications entity

**3.4.5**
**data DLPDU**
DLPDU that carries a DLSDU from a local DLS-user to a remote DLS-user

**3.4.6**
**DL_status, DLM_status**
status that specifies the result of the execution of the associated request

**3.4.7**
**GAP**
range of station (DLE) DL-addresses from this station (TS) to its successor (NS) in the logical token ring, excluding stations above HSA

**3.4.8**
**isochronous mode**
special operational mode that implies both a constant (isochronous) cycle with a fixed schedule of high and low priority messages, and the synchronization of the DLS-users with this constant (isochronous) cycle

**3.4.9**
**local DLE**
DLE in a current master station that initiates the current transaction

**3.4.10**
**local DLS-user**
DLS-user that initiates the current service

**3.4.11**
**publisher**
transmitter of messages for consumption by subscribers

**3.4.12**
**region/segment address**
address extension that identifies a particular fieldbus subnetwork

Note 1 to entry: This supports DL-routing between fieldbuses.

**3.4.13**
**remote DLE**
addressed DLE of a service request (that is, the intended receiving DLE of any resulting request DLPDU)

**3.4.14**
**remote DLS-user**
addressed DLS-user of a service request (that is, the intended receiver of any resulting indication primitive)

**3.4.15**
**reply DLPDU**
DLPDU transmitted from a remote DLE to the initiating (local) DLE, and possibly other DLEs

Note 1 to entry: When the remote DLE is a Publisher, the reply DLPDU also can be sent to several remote DLEs.

**3.4.16**
**request DLPDU**
DLPDU that carries either a request for data or a DLSDU or both from a local DLS-user to a remote DLS-user

**3.4.17**
**response DLPDU**
reply DLPDU that carries a DLSDU from a remote DLS-user to local DLS-user

**3.4.18**
**station**
master or slave device containing a DLE

**3.4.19**
**subscriber**
receiver of messages produced by a publisher

**3.4.20**
**time event**
message that represents a trigger for a moment of time

**3.4.21**
**time master**
device which is able to send clock synchronization messages

Note 1 to entry: Link devices have time master functionality.

**3.4.22**
**time receiver**
fieldbus device able to be time synchronized by a time master

**3.4.23**
**token passing**
medium access method, in which the right to transmit is passed from master station to master station in a logical ring

### 3.5 Common symbols and abbreviations

NOTE Many symbols and abbreviations are common to more than one protocol Type; they are not necessarily used by all protocol Types.

| | | |
|---|---|---|
| **3.5.1** | **DL-** | data-link layer (as a prefix) |
| **3.5.2** | **DLC** | DL-connection |
| **3.5.3** | **DLCEP** | DL-connection-end-point |
| **3.5.4** | **DLE** | DL-entity (the local active instance of the data-link layer) |
| **3.5.5** | **DLL** | DL-layer |
| **3.5.6** | **DLPCI** | DL-protocol-control-information |

| | | |
|---|---|---|
| **3.5.7** | **DLPDU** | DL-protocol-data-unit |
| **3.5.8** | **DLM** | DL-management |
| **3.5.9** | **DLME** | DL-management Entity (the local active instance of DL-management) |
| **3.5.10** | **DLMS** | DL-management Service |
| **3.5.11** | **DLS** | DL-service |
| **3.5.12** | **DLSAP** | DL-service-access-point |
| **3.5.13** | **DLSDU** | DL-service-data-unit |
| **3.5.14** | **FIFO** | first-in first-out (queuing method) |
| **3.5.15** | **OSI** | open systems interconnection |
| **3.5.16** | **Ph-** | physical layer (as a prefix) |
| **3.5.17** | **PhE** | Ph-entity (the local active instance of the physical layer) |
| **3.5.18** | **PhL** | Ph-layer |
| **3.5.19** | **QoS** | quality of service |

### 3.6 Additional Type 3 symbols and abbreviations

| | | |
|---|---|---|
| **3.6.1** | **ACK** | acknowledge(ment) DLPDU |
| **3.6.2** | **cnf** | confirm primitive |
| **3.6.3** | **CS** | clock synchronization |
| **3.6.4** | **DA** | destination address of a DLPDU |
| **3.6.5** | **DAE** | destination address extension(s) of a DLPDU which conveys D_SAP_index or destination region/segment address or both |
| **3.6.6** | **DS** | DL/DLM_status: Disconnected station, local DL-entity not in logical token ring or disconnected from line |
| **3.6.7** | **D_SAP** | destination service access point, the DLSAP which identifies the remote DLS-user. |
| **3.6.8** | **D_SAP_index** | destination service access point index, that component of a DLSAP-address which designates a DLSAP and remote DLS-user within the remote DLE |
| **3.6.9** | **DXM** | data exchange multicast |
| **3.6.10** | **EXT** | address extension bit of a DLPDU |
| **3.6.11** | **FC** | frame control (DLPDU type) field of a DLPDU |
| **3.6.12** | **G** | GAP update factor, the number of token cycles between GAP maintenance (update) cycles |
| **3.6.13** | **HSA** | highest station address installed (configured) on this fieldbus |
| **3.6.14** | **ind** | indication primitive |
| **3.6.15** | **IsoM** | isochronous mode |

| | | |
|---|---|---|
| **3.6.16** | **LMS** | list of master stations |
| **3.6.17** | **LR** | DL/DLM_status: Local resource not available or not sufficient |
| **3.6.18** | **LS** | DL/DLM_status: Local service not activated at DLSAP or local DLSAP not activated |
| **3.6.19** | **MSRD** | send and request data with multicast reply (DL-service) |
| **3.6.20** | **NA** | DL/DLM_status: No acknowledgement/response |
| **3.6.21** | **NIL** | locally existing value, but not fixed |
| **3.6.22** | **NO** | DL/DLM_status: Not ok |
| **3.6.23** | **NR** | DL/DLM_status: No response, DL/DLM-data acknowledgement negative and send data ok |
| **3.6.24** | **NS** | Next station, the station to which this Master will pass the token |
| **3.6.25** | **OK** | DL/DLM_status: Service finished according to the rules |
| **3.6.26** | **RDH** | DL/DLM_status: Response DL-data high and no resource for send data |
| **3.6.27** | **RDL** | DL/DLM_status: Response DL/DLM-data low and no resource for send data |
| **3.6.28** | **req** | request primitive |
| **3.6.29** | **RR** | DL/DLM_status: No resource for send data and no response DL-data available (acknowledgement negative) |
| **3.6.30** | **RS** | DL/DLM_status: No service or no remote address activated at remote-service-access-point (acknowledgement negative) |
| **3.6.31** | **SA** | source address of a DLPDU |
| **3.6.32** | **SAE** | source address extension(s) of a DLPDU, which conveys S_SAP_index or source region/segment address or both |
| **3.6.33** | **SC** | single character acknowledge DLPDU |
| **3.6.34** | **SDA** | send data with acknowledge (DL-service) |
| **3.6.35** | **SDN** | send data with no acknowledge (DL-service) |
| **3.6.36** | **SRD** | send and request data with reply (DL-service) |
| **3.6.37** | **S_SAP** | source service access point, the DLSAP associated with the initiates local DLS-user |
| **3.6.38** | **S_SAP_index** | source service access point index, a component of a DLSAP-address which designates that DLSAP within the DLE at which the transaction is being initiated |
| **3.6.39** | **SYN** | synchronizing bits of a DLPDU (period of IDLE), which guarantees the specified DLPDU integrity and facilitates receiver synchronization |
| **3.6.40** | **SYNCHT** | synchronization telegram, indicates the start of a new cycle in IsoM |
| **3.6.41** | **tBIT** | bit time, DL-symbol period, the time to transmit one bit on the fieldbus: 1/(data signaling rate in bit/s) |

**3.6.42 TCSI** clock synchronization interval time

**3.6.43 TCT** Isochronous cycle time, the requested duration for one cycle in IsoM

**3.6.44 TQUI** quiet time, transmitter fall time (line state uncertain time) or repeater switch time or both. The time a transmitting station needs to wait after the end of a DLPDU before enabling its receiver.

**3.6.45 TRDY** ready time, the time after which the transmitting master will expect a reply DLPDU

**3.6.46 TRR** real rotation time, the time between the last successive receptions of the token by the observing master station

**3.6.47 TS** This Station

**3.6.48 TSDI** station delay of initiator, the time a master station will wait before sending successive DLPDUs

**3.6.49 TSDR** station delay of responder, the actual time a responder needs to generate a reply DLPDU

**3.6.50 TSET** setup time, the time between an event (e.g. interrupt SYN timer expired) and the necessary reaction (e.g. enabling a receiver)

**3.6.51 TSH** time shift, the time a real isochronous cycle deviates from the requested duration for one cycle in IsoM

**3.6.52 TSL** slot time, the maximum time a master station waits for a reply DLPDU

**3.6.53 TSYN** synchronization time, the period of IDLE before the beginning of a DLPDU after which a station enables its receiver; the required minimum inter-DLPDU idle period to guarantee DLPDU integrity and a valid DLPDU

**3.6.54 TSYNI** synchronization interval time, the maximum time that a receiving station waits for the required inter-DLPDU idle period, of duration TSYN, to occur before it detects a bus fault

**3.6.55 TTR** Target rotation time, the anticipated time for one token cycle, including allowances for high and low priority transactions, errors and GAP maintenance

**3.6.56 UE** DL/DLM_status: Negative acknowledgement, remote user interface error

### 3.7 Common conventions

This standard uses the descriptive conventions given in ISO/IEC 10731.

The service model, service primitives, and time-sequence diagrams used are entirely abstract descriptions; they do not represent a specification for implementation.

Service primitives, used to represent service user/service provider interactions (see ISO/IEC 10731), convey parameters that indicate information available in the user/provider interaction.

This standard uses a tabular format to describe the component parameters of the DLS primitives. The parameters that apply to each group of DLS primitives are set out in tables

throughout the remainder of this standard. Each table consists of up to six columns, containing the name of the service parameter, and a column each for those primitives and parameter-transfer directions used by the DLS:

– the request primitive's input parameters;
– the request primitive's output parameters;
– the indication primitive's output parameters;
– the response primitive's input parameters; and
– the confirm primitive's output parameters.

NOTE The request, indication, response and confirm primitives are also known as requestor.submit, acceptor.deliver, acceptor.submit, and requestor.deliver primitives, respectively (see ISO/IEC 10731).

One parameter (or part of it) is listed in each row of each table. Under the appropriate service primitive columns, a code is used to specify the type of usage of the parameter on the primitive and parameter direction specified in the column:

**M** — parameter is mandatory for the primitive.

**U** — parameter is a User option, and may or may not be provided depending on the dynamic usage of the DLS-user. When not provided, a default value for the parameter is assumed.

**C** — parameter is conditional upon other parameters or upon the environment of the DLS-user.

**(blank)** — parameter is never present.

Some entries are further qualified by items in brackets. These may be

a) a parameter-specific constraint

(**=**) indicates that the parameter is semantically equivalent to the parameter in the service primitive to its immediate left in the table.

b) an indication that some note applies to the entry

(**n**) indicates that the following note n contains additional information pertaining to the parameter and its use.

In any particular interface, not all parameters need be explicitly stated. Some may be implicitly associated with the DLSAP at which the primitive is issued.

In the diagrams which illustrate these interfaces, dashed lines indicate cause-and-effect or time-sequence relationships, and wavy lines indicate that events are roughly contemporaneous.

### 3.8 Additional Type 3 conventions

In the diagrams which illustrate the DLS and DLM interfaces, dashed lines indicate cause-and-effect or time-sequence relationships between actions at different stations, while solid lines with arrows indicate cause-and-effect time-sequence relationships which occur within the DLE-provider at a single station.

The following notation, a shortened form of the primitive classes defined in 3.7, is used in the figures.

| | |
|---|---|
| **req** | request primitive |
| **ind** | indication primitive |
| **cnf** | confirm primitive (confirmation) |

# 4 Connectionless-mode data-link service

## 4.1 General

Clause 4 describes the interface between a DLE and a data-link service user (DLS-user). The services of this interface are typical of those needed in application fields such as process control, factory automation, power distribution, building automation and other primary process industries:

– general purpose data transfer service;

– time transfer service.

## 4.2 Model of the connectionless-mode data-link service

### 4.2.1 Overview

Subclause 4.2 describes the abstract model for data and time transfer services. The model defines interactions between the DLS-user and the DLL that take place at the DLSAPs. Information is passed between the DLS-user and the local DLE by DLS primitives and their associated parameters.

The DLS-user is provided with the following data and time transfer services:

– Acknowledged connectionless data transfer:
  Send Data with Acknowledge (SDA)

– Unacknowledged connectionless data transfer:
  Send Data with No Acknowledge (SDN)

– Two-way connectionless data exchange:
  Send and Request Data with Reply (SRD)

– M-way connectionless data exchange:
  Send and Request Data with Multicast Reply (MSRD)

– Unacknowledged connectionless time event and clock transfer:
  Clock Synchronization (CS).

These services permit a DLS-user in a master station, called the local DLS-user, to send DLS-user data or time information (a DLSDU) to a DLS-user, called the remote DLS-user, at either a single remote station (SDN, SDA, SRD, MSRD) or at all remote stations (SDN, CS).

Two of these services (SRD and MSRD) permit a DLSDU to be returned by that single remote station (in an immediate reply) as part of a single transaction. These same two services can be used to retrieve a DLSDU from that remote station without first sending a DLSDU. Additionally, the MSRD service permits a DLSDU to be returned by the remote station as a multicast message.

NOTE All of these services are considered optional.

### 4.2.2 Acknowledged connectionless data transfer: Send data with acknowledge (SDA)

This service permits the local DLS-user to send a DLSDU to a single remote station. At the remote station the DLSDU, if the respective DLPDU is transferred error-free, is delivered by the remote DLE to its local DLS-user. The originating local DLS-user receives a confirmation concerning the receipt or non-receipt of the DLSDU by the remote DLS-user. If an error occurred during the transfer, the originating DLE repeats the data transfer up to a configured maximum number of times.

#### 4.2.3 Unacknowledged connectionless data transfer: Send data with no acknowledge (SDN)

This service permits a local DLS-user to transfer a DLSDU to a single remote station (unicast), or to all other remote stations (Broadcast) at the same time. The local DLS-user receives a confirmation acknowledging the completion of the transfer, but not whether the DLPDU was duly received. At each addressed remote station this DLSDU, if the respective DLPDU is received error-free, is delivered to a single local DLS-user (Unicast), to the appropriate set of local DLS-users (Multicast), or to all local DLS-users (Broadcast). There is no confirmation to the sending DLS-user that such an intended delivery has taken place.

#### 4.2.4 Two-way connectionless data exchange: Send and request data with reply (SRD)

This service variant permits a local DLS-user to transfer a DLSDU to a DLS-user at a single remote station and as part of the same transaction, to transfer to the requesting DLS-user either a DLSDU that was previously made available by the remote DLS-user, or a status that a DLSDU is not available or that an error has been detected. At the remote station the received DLSDU, if the respective DLPDU is error-free, is delivered to the remote DLS-user. The service permits the local DLS-user to specify a null DLSDU, thereby requesting a DLSDU from the remote DLS-user without concurrently transferring a DLSDU to the remote DLS-user.

The local DLS-user receives either the requested DLSDU, or a notification that no DLSDU was available, or a notification of the type of error that was detected. The first two alternatives also confirm the receipt by the remote DLS-user of the DLSDU sent by the initiating local DLS-user.

If an error occurs during the transmission, the local DLE repeats (as part of the same transaction) the transmission of the initiator's DLSDU, if any, including the request for a returned DLSDU, up to a configured maximum number of times.

#### 4.2.5 M-way connectionless data exchange: Send and request data with multicast-reply (MSRD)

This service permits a local DLS-user to transfer a DLSDU to a DLS-user at a single remote station and as part of the same transaction, to transfer to the requesting DLS-user and to the appropriate set of remote DLS-users (Multicast-Reply) a DLSDU that was previously made available by the remote DLS-user. If a DLPDU is not available by the remote DLS-user, or an error has been detected the requesting DLS-user receives a status. At the addressed remote station the received DLSDU, if the respective DLPDU is error-free, is delivered to the remote DLS-user. The service permits the local DLS-user to specify a null DLSDU, thereby requesting a DLSDU from the remote DLS-user without concurrently transferring a DLSDU to the remote DLS-user.

The local DLS-user and the appropriate set of remote DLS-users receive the data requested by the local DLS-user, or the local DLS-user only receives either a notification that no data was available or a notification of the type of error that was detected. The first two alternatives also confirm the receipt by the remote DLS-user of the DLSDU sent by the initiating local DLS-user. There is no guarantee of correct receipt of the requested DLPDU (multicast-reply) at all other remote DLS-users; acknowledgement does not occur.

If an error occurs during the transmission, the local DLE repeats (as part of the same transaction) both the transmission of the initiator's DLSDU, if any, and the request for a returned DLSDU, up to a configured maximum number of times.

#### 4.2.6 Unacknowledged connectionless time event and clock transfer: Clock synchronization (CS)

This service sequence permits the local DLS-user of the time master to distribute a DLSDU to all remote time receivers.

As part of the service sequence the time master transmit a time event message at first. Upon reception of a CS time event request the local DLE of the time master measures the send delay time between reception of the request and transmitting of the appropriate DLPDU while the remote DLEs start the measurement of the receiving delay after reception of this DLPDU.

Upon reception of a positive CS time event confirmation together with the send delay time the DLS-user passes a CS clock value request to the local DLE as second part of the service sequence to distribute the DLSDU to all remote time receivers. If the respective DLPDU is transferred error-free the remote time receivers stop the receive delay measurement and deliver the DLSDU together with the receive delay time to their local DLS-user.

### 4.3 Sequence of primitives

#### 4.3.1 Constraints on services and primitives

These fieldbus services are realized through a number of DLS primitives. A request primitive is used by a DLS-user to request a service. A confirm primitive is returned to the DLS-user upon completion of the service.

An indication primitive is used to report a non-requested event to an appropriate DLS-user. Non-requested events include reception of DLS-user data from a local DLS-user addressed to the remote DLS-user.

The DLS and their primitives are summarized in Table 1.

**Table 1 – Summary of DL services and primitives**

| Service | Primitive | Possible for the following stations |
|---|---|---|
| Acknowledged connectionless data transfer:<br>Send Data with Acknowledge (SDA) | DL-DATA-ACK request<br>DL-DATA-ACK confirm | Master |
| | DL-DATA-ACK indication | Master and slave |
| Unacknowledged connectionless data transfer:<br>Send Data with No Acknowledge (SDN) | DL-DATA request<br>DL-DATA confirm | Master |
| | DL-DATA indication | Master and slave |
| Two-way connectionless data exchange:<br>Send and Request Data with Reply (SRD) | DL-DATA-REPLY request<br>DL-DATA-REPLY confirm | Master |
| | DL-DATA-REPLY indication | Master and slave |
| | DL-REPLY-UPDATE request<br>DL-REPLY-UPDATE confirm | Master and slave |
| M-way connectionless data exchange:<br>Send and Request Data with Multicast Reply (MSRD) | DL-MCT-DATA-REPLY request<br>DL-MCT-DATA-REPLY confirm | Master |
| | DL-MCT-DATA-REPLY indication | Master and slave |
| | DL-DXM-DATA-REPLY indication | Master and slave |
| | DL-REPLY-UPDATE request<br>DL-REPLY-UPDATE confirm | Master and slave |
| Unacknowledged connectionless time event and clock transfer:<br>Clock Synchronization (CS) | DL-CS-TIME-EVENT request<br>DL-CS-TIME-EVENT confirm | Master |
| | DL-CS-CLOCK-VALUE request<br>DL-CS-CLOCK-VALUE confirm | Master |
| | DL-CS-CLOCK-VALUE indication | Master and slave |

#### 4.3.2 Relation of primitives at the end-points of connectionless services

The major temporal relationships of service primitives are shown in Figure 2 to Figure 6.

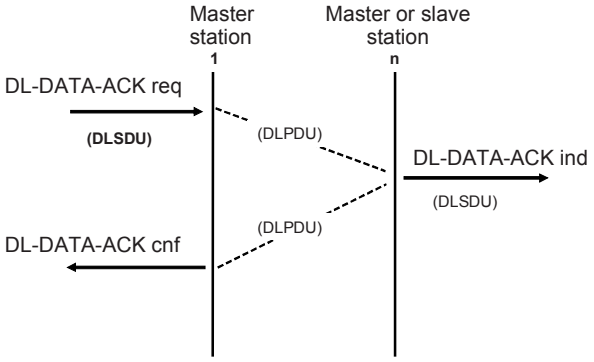



**Figure 2 – SDA service**

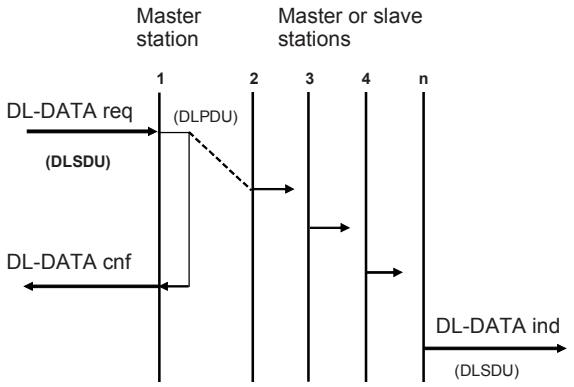



**Figure 3 – SDN service**

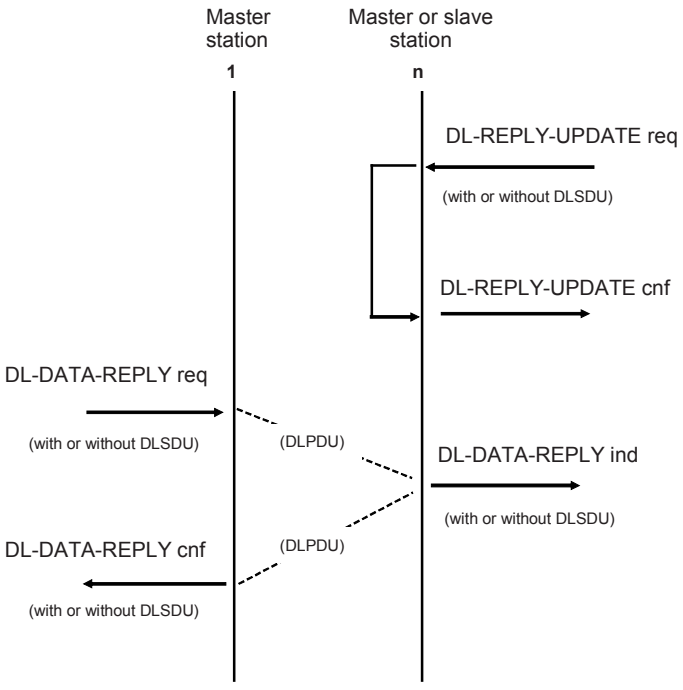



**Figure 4 – SRD service**

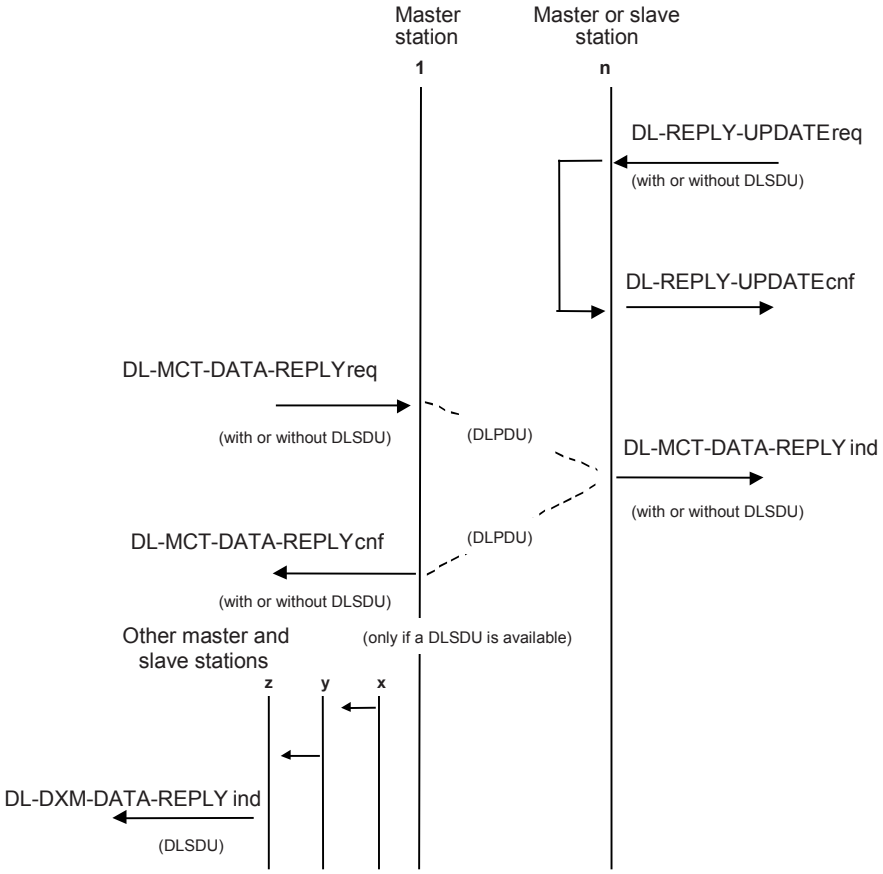



**Figure 5 – MSRD service**

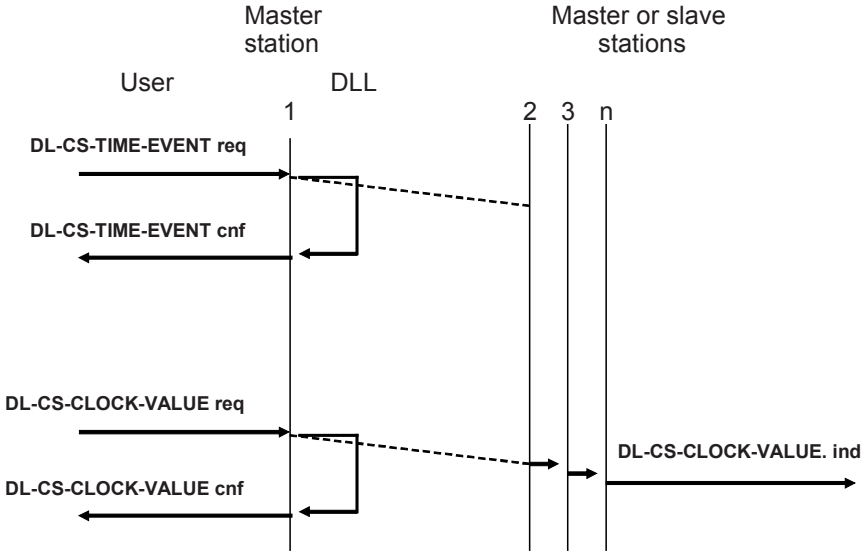



**Figure 6 – CS service**

### 4.3.3 Addressing

#### 4.3.3.1 Address (individual)

Each DL-entity on the link is designated by a DL-address. The range of individual DL-addresses is limited, from 0 to a maximum of 126. An extended link is designated by an

address extension (a region/segment address). The DL-address 127 is used for broadcast and multicast messages.

#### 4.3.3.2 DLSAP-index

The DLSAP-index designates the DLSAP, the point of communication with the DLS-user. The range of usable DLSAP-indexes is limited, from 0 to 63, CS and NIL. The DLSAP-index 63 is used for broadcast messages. The DLSAP-index NIL means that the default DLSAP is addressed. The DLSAP-index CS is reserved for clock synchronization only. If the DLSAP-indexes CS or NIL are used in a DL service request, then the corresponding DLPDU contains no DLSAP-index (DAE or SAE) for efficiency reasons.

The DLSAP-index serves both as

a) address of a DLSAP within the DL-entity, and

b) the DLSAP-identifier for the DLS-user.

#### 4.3.3.3 Global address

The global address is used to designate more than one DLS-user. A group of DLS users is addressed by the global address (127) in conjunction with a DLSAP-index with a value different from 63 whose interpretation throughout the link is that of a multicast address. All DLS users are addressed by the global address (127) in conjunction with the DLSAP-index 63 (see 4.4.2.3.2.3).

### 4.4 Detailed description of DL services

### 4.4.1 Send data with acknowledge (SDA)

#### 4.4.1.1 Function

The local DLS-user prepares a DLSDU for the remote DLS-user and passes it to the local DLE (DL-entity) as the DLSDU parameter of a DL-DATA-ACK request primitive. The local DLE accepts the service request, forms an appropriate DLPDU containing the DLSDU, and tries to send the DLPDU to the remote DLE.

Upon receiving the data DLPDU error-free, the remote DLE immediately starts transmitting the requested acknowledgement DLPDU to the initiating DLE.

The local DLE waits for an acknowledgement DLPDU from the remote DLE. If this acknowledgement DLPDU is not received within the slot time $T_{SL}$ or an erroneous DLPDU is received, the local DLE again transmits the data DLPDU to the remote DLE. If no error free acknowledgement DLPDU is received after a number of retransmissions equal to max_retry_limit, the local DLE reports the negative status in a confirm primitive which it issues to the local DLS-user.

When an error free acknowledgement DLPDU is received, the local DLE passes a completion status to the local DLS-user by means of a DL-DATA-ACK confirm primitive, conveying either successful completion of the requested service or the type of error detected.

During the transfer of the data and the receipt of the associated acknowledgement, no other traffic takes place on the fieldbus. If the data DLPDU was received error-free, the remote DLE passes the DLSDU and address information conveyed by the DLPDU to the remote DLS-user by means of a DL-DATA-ACK indication primitive. Retransmission does not result in duplicate DL-DATA-ACK indication primitives.

#### 4.4.1.2 Types of primitives and parameters

Table 2 indicates the primitives and parameters of the SDA service.

**Table 2 – SDA data ack primitives and parameters**

| DL-DATA-ACK Parameter name | Request | Indication | Confirm |
|---|---|---|---|
| | input | output | output |
| Service_class | M | M (=) | (see Note) |
| D_addr | M | M (=) | (see Note) |
| D_SAP_index | M | M (=) | (see Note) |
| S_addr | — | M | — |
| S_SAP_index | M | M (=) | (see Note) |
| DLSDU | M | M (=) | — |
| DL_status | — | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 4.4.1.3 SDA request primitive

##### 4.4.1.3.1 Use of the primitive

This primitive is passed from the local DLS-user to the local DLE to send DLS-user data to a remote DLS-user using the SDA service. Receipt of the primitive results in the transmittal of the DLSDU by the local DLE employing the procedure appropriate for the SDA service. While processing a SDA request (that is, while waiting for the acknowledgement) the DLE does not attempt to transmit any unrelated DLPDUs.

##### 4.4.1.3.2 Parameters of the primitive

###### 4.4.1.3.2.1 Service_class

This parameter specifies the priority for the data transfer. There are two priorities:

**High Priority** (**high**): Time-critical messages, such as alarms, synchronization and coordination data.

**Low Priority (low):** Less urgent messages, such as process, diagnostic and program data.

###### 4.4.1.3.2.2 D_addr

The D_addr (destination-address) parameter specifies the DL-address of the remote DLE. The value 127, designating the global address used for broadcast or multicast messages, is not permitted.

NOTE The Type 3 protocol defined in IEC 61158-4-3 further describes and restricts DL-addresses.

###### 4.4.1.3.2.3 D_SAP_index

The D_SAP_index (destination-service-access-point index) parameter specifies the destination service-access-point of the remote DLS-user within the remote DLE designated by the D_addr parameter. The D_SAP_index values 63, which specifies BROADCAST, and CS are not permitted.

NOTE It is possible for efficiency reasons to omit DLSAP indexes from DLPDUs. In that case the D_SAP_index parameter is set to NIL, which means that the default DLSAP in the receiving DLE is addressed.

#### 4.4.1.3.2.4 S_SAP_index

The S_SAP_index (source-service-access-point index) parameter specifies the source service-access-point of the local DLS-user. The S_SAP_index values 63, which specifies BROADCAST, and CS are not permitted.

NOTE It is possible for efficiency reasons to omit DLSAP indexes from DLPDUs. In that case the S_SAP_index parameter is set to NIL, which means that on reception the DLSDU is inferred to have been sent from the default DLSAP of the sending DLE.

#### 4.4.1.3.2.5 DLSDU

This parameter specifies the DLS-user data that is to be transferred by the DLE. The minimum size of the DLSDU is one octet. The maximum size is between 242 and 246 octets, depending on whether region/segment addresses and an explicit D_SAP_index and S_SAP_index are also provided.

### 4.4.1.4 SDA indication primitive

#### 4.4.1.4.1 Use of the primitive

This primitive is passed from the addressed remote DLE to the addressed remote DLS-user upon successful receipt of a SDA data DLPDU and transmission of an acknowledgement DLPDU. Receipt of a duplicate SDA data DLPDU (with no other intervening DLPDUs) does not cause the indication primitive to be repeated.

#### 4.4.1.4.2 Parameters of the primitive

##### 4.4.1.4.2.1 Service_class

This parameter specifies the priority of the received SDA request DLPDU.

##### 4.4.1.4.2.2 D_addr

This parameter specifies the destination DL-address of the received SDA data DLPDU. The global address (127) for broadcast or multicast messages is not permitted.

NOTE The Type 3 protocol defined in IEC 61158-4-3 further describes destination DL-addresses.

##### 4.4.1.4.2.3 S_addr

This parameter specifies the DL-address of the initiating DLE. S_addr specifies the source DL-address of the received SDA request DLPDU. S_addr is an individual address; the global address (127) for broadcast or multicast messages is not permitted.

NOTE The Type 3 protocol defined in IEC 61158-4-3 further describes source DL-addresses.

##### 4.4.1.4.2.4 D_SAP_index, S_SAP_index,

These parameters specify the source and destination service-access-points of the received SDA data DLPDU within their respective DLEs.

##### 4.4.1.4.2.5 DLSDU

This parameter specifies the DLS-user data sent by the remote DLS-user which initiated the service.

#### 4.4.1.5 SDA confirm primitive

##### 4.4.1.5.1 Use of the primitive

This primitive is passed from the local DLE to the local DLS-user upon completion of the corresponding service request.

When DL_status indicates a temporary error, the local DLS-user may assume that a subsequent repetition may be successful.

When DL_status indicates a permanent error, the local DLS-user may assume that a subsequent repetition may not be successful. Other method should be used to deal this type of error.

For the local errors LS, LR, DS and IV no attempt has been made to transmit the DLS-user data.

##### 4.4.1.5.2 Parameters of the primitive

###### 4.4.1.5.2.1 DL_status

This parameter indicates the success or failure of the corresponding SDA request and whether a temporary or a permanent error exists. Permitted values for this parameter are specified in Table 3.

**Table 3 – Values of DL_status for the SDA data ack service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | Service completed without error | — |
| **RR** | failure | Resources of the remote DLE not available or not sufficient | t |
| **UE** | failure | Remote DLS interface error | p |
| **RS** | failure | Service at remote DLSAP not activated, or D_addr not contained in the access parameter at the remote DLSAP | p |
| **LS** | failure | Service at local DLSAP not activated | p |
| **LR** | failure | Resources of the local DLE not available or not sufficient | t |
| **NA** | failure | No reaction, or no plausible reaction (ACK or RES), from remote DLE | t |
| **DS** | failure | Local DL-entity not in logical token ring or disconnected from line | p |
| **IV** | failure | Invalid parameters in request | — |

### 4.4.2 Send data with no acknowledge (SDN)

#### 4.4.2.1 Function

The local DLS-user prepares a DLSDU for a single remote DLS-user, for a group of remote DLS-users, or for all remote DLS-users. The DLSDU is passed to the local DLE via the DLS interface by means of a DL-DATA request primitive. The DLE accepts the service request and tries to send the data to the remote DLE or to all remote DLEs.

The sending DLE returns a local confirmation of transmittal to the local DLS-user by means of a DL-DATA confirm primitive. The receiving DLE(s) attempt to deliver the received DLSDU to the specified DLS-user(s).

There is no confirmation of correct receipt at the remote DLEs or of delivery to the intended DLS-user(s); acknowledgements do not occur. When the DLSDU is transmitted, it reaches all remote DLEs approximately concurrently (ignoring signal propagation delays). Each addressed remote DLE that has received the data DLPDU error-free passes the DLSDU and

associated addressing information to the local DLS-user by means of a DL-DATA indication primitive.

#### 4.4.2.2 Types of primitives and parameters

Table 4 indicates the primitives and parameters of the SDN service.

**Table 4 – SDN data primitives and parameters**

| DL-DATA / Parameter name | Request | Indication | Confirm |
|---|---|---|---|
| | input | output | output |
| Service_class | M | M (=) | (see Note) |
| D_addr | M | M (=) | (see Note) |
| D_SAP_index | M | M (=) | (see Note) |
| S_addr | — | M | — |
| S_SAP_index | M | M (=) | (see Note) |
| DLSDU | M | M (=) | — |
| DL_status | — | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 4.4.2.3 SDN request primitive

##### 4.4.2.3.1 Use of the primitive

This primitive is passed from the local DLS-user to the local DLE to send DLS-user data to a single, a group of, or all remote DLS-users using the SDN service. Receipt of the primitive results in the transmittal of the DLSDU by the local DLE employing the procedure appropriate for the SDN service.

##### 4.4.2.3.2 Parameters of the primitive

###### 4.4.2.3.2.1 Service_class, S_SAP_index, DLSDU

These parameters have the same meaning as described in 4.4.1.3.2.

###### 4.4.2.3.2.2 D_addr

This parameter specifies the destination DL-address of the SDN data DLPDU. The global address (127) for broadcast or multicast messages is permitted; it designates the set of all receiving DLEs.

NOTE See Note in 4.4.1.4.2.2.

###### 4.4.2.3.2.3 D_SAP_index

The parameter has a meaning similar to that described in 4.4.1.3.2.3. A value of 63 specifies BROADCAST; each receiving DLE delivers the received DLSDU to all local DLS-users if the BROADCAST DLSAP has been activated. The D_SAP_index value CS is not permitted.

A distinct dedicated D_SAP_index is required for each multicast group; each receiving DLE delivers the received DLSDU to the appropriate local DLS-user if that dedicated DLSAP has been activated.

#### 4.4.2.4 SDN indication primitive

##### 4.4.2.4.1 Use of the primitive

This primitive is passed from the remote DLE to the remote DLS-user upon receipt of a SDN data DLPDU.

##### 4.4.2.4.2 Parameters of the primitive

###### 4.4.2.4.2.1 Service_class, S_addr, S_SAP_index, DLSDU

These parameters have the same meaning as described in 4.4.1.4.2.

###### 4.4.2.4.2.2 D_addr

This parameter specifies the destination DL-address of the received SDN data DLPDU. The global address (127) for broadcast or multicast messages is permitted.

NOTE See Note in 4.4.1.4.2.2.

###### 4.4.2.4.2.3 D_SAP_index

This parameter specifies the destination service-access-point of the received SDN data DLPDU. A value of 63 specifies BROADCAST; each receiving DLE delivers the received DLSDU to all local DLS-users if the BROADCAST DLSAP has been activated. The D_SAP_index value CS is not permitted.

A distinct dedicated D_SAP_index is required for each multicast group; each receiving DLE delivers the received DLSDU to the appropriate local DLS-user if that dedicated DLSAP has been activated.

#### 4.4.2.5 SDN confirm primitive

##### 4.4.2.5.1 Use of the primitive

This primitive is passed from the local DLE to the local DLS-user upon completion of the corresponding service request.

When DL_status indicates a temporary error, the local DLS-user may assume that a subsequent repetition may be successful. When DL_status indicates a permanent error, the local DLS-user may assume that a subsequent repetition may not be successful. Other method should be used to deal this type of error.

For the local errors LS, LR, DS and IV no attempt has been made to transmit the DLS-user data.

##### 4.4.2.5.2 Parameters of the primitive

###### 4.4.2.5.2.1 DL_status

This parameter indicates the local success or failure of the associated SDN request. The possible values of this parameter are specified in Table 5.

**Table 5 – Values of DL_status for the SDN data service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | Transmission of data completed by local DL-entity | — |
| **LS** | failure | Service at local DLSAP or local DLSAP not activated | p |
| **LR** | failure | Resources of the local DLE not available or not sufficient | t |
| **DS** | failure | Local DL-entity not in logical token ring or disconnected from line | p |
| **IV** | failure | Invalid parameters in request | — |

### 4.4.3 Send and request data with reply (SRD)

#### 4.4.3.1 Function

The local DLS-user prepares a DLSDU for the remote DLS-user and passes it to the local DLE as the DLSDU parameter of a DL-DATA-REPLY request primitive, requesting data from the remote DLS-user at the same time. The local DLE accepts the service request, forms an appropriate DLPDU containing the DLSDU, and tries to send the DLPDU to the remote DLE, requesting that a DLSDU previously prepared by the remote DLS-user be sent in reply.

Alternatively, if the local DLS-user has no DLSDU to send, it passes the DL-DATA-REPLY request primitive to the DLE without a DLSDU parameter. In this case, the local DLE accepts the service request, forms an appropriate DLPDU not containing a DLSDU, and tries to send the DLPDU to the remote DLE, requesting that a DLSDU previously prepared by the remote DLS-user be sent in reply.

Upon receiving the request DLPDU, the remote DLE immediately starts transmitting a reply DLPDU to the initiating DLE, if the remote DLS-user had previously prepared a DLSDU for this reply (by means of a DL-REPLY-UPDATE request primitive). If no DLSDU is available for transmission, or if an error occurred, then an acknowledgement DLPDU with appropriate status information is returned instead addressed to the initiating DLE only.

The receiving DLE passes the DLSDU, if any, received from the initiating DLE, together with status concerning the transmitted reply, to its local DLS-user with a DL-DATA-REPLY indication primitive.

The local DLE waits for a reply DLPDU from the remote DLE. If this reply DLPDU is not received error-free within the slot time $T_{SL}$, the local DLE again transmits the request DLPDU to the remote DLE. If no reply DLPDU is received error-free after a number of retransmissions equal to max_retry_limit, the local DLE reports the negative status in a confirm primitive which it issues to the local DLS-user.

When a reply DLPDU is received, the local DLE passes the conveyed DLSDU, if any, together with a completion status to the local DLS-user by means of a DL-DATA-REPLY confirm primitive; this status conveys either successful completion of the requested service or the type of error detected.

The remote DLS-user is responsible for having prepared a valid DLSDU, ready for transmission by the remote DLE. The remote DLS-user passes a DL-REPLY-UPDATE request primitive to the remote DLE to convey the DLSDU to that DLE, where it awaits a remotely-initiated SRD transfer request. The DLE informs the DLS-user of the completion of this request by means of a DL-REPLY-UPDATE confirm primitive.

#### 4.4.3.2 Types of primitives and parameters of SRD data-reply

Table 6 indicates the primitives and parameters of the SRD data reply service.

**Table 6 – SRD data reply primitives and parameters**

| DL-DATA-REPLY / Parameter name | Request | Indication | Confirm |
|---|---|---|---|
| | input | output | output |
| Service_class | M | M | (see Note) |
| D_addr | M | M (=) | (see Note) |
| D_SAP_index | M | M (=) | (see Note) |
| S_addr | — | M | — |
| S_SAP_index | M | M (=) | (see Note) |
| DLSDU | U | U (=) | U |
| Reference | — | U | — |
| Update_status | — | M | — |
| DL_status | — | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 4.4.3.3 SRD data-reply request primitive

##### 4.4.3.3.1 Use of the primitive

This primitive is passed from the local DLS-user to the local DLE

a) optionally, to send DLS-user data to a remote DLS-user; and

b) simultaneously to request previously-prepared DLS-user data from that DLS-user

both through use of the SRD service.

Receipt of this primitive results in the transmittal of the DLSDU by the local DLE employing the procedure appropriate for the SRD service. While processing a SRD request (that is, while waiting for the reply and during any retry attempts) the DLE does not attempt to transmit any unrelated DLPDUs.

##### 4.4.3.3.2 Parameters of the primitive

###### 4.4.3.3.2.1 Service_class

This parameter has the same meaning as described in 4.4.1.3.2.1.

###### 4.4.3.3.2.2 D_addr, S_SAP_index, DLSDU

The D_addr, S_SAP_index and DLSDU parameters have the same meaning as described in 4.4.1.3.2.

###### 4.4.3.3.2.3 D_SAP_index

This parameter specifies the destination service-access-point of the remote DLS-user within the remote DLE designated by the D_addr parameter. The specified remote DLSAP can also have an associated DLSDU which has been prepared by that DLSAPs DLS-user. The D_SAP_index values 63, which specifies BROADCAST, and CS are not permitted.

NOTE It is possible for efficiency reasons to omit DLSAP indexes from DLPDUs. In that case the D_SAP_index parameter is set to NIL, which means that the default DLSAP in the receiving DLE is addressed.

#### 4.4.3.4 SRD data-reply indication primitive

##### 4.4.3.4.1 Use of the primitive

This primitive is passed from the addressed remote DLE to the remote DLS-user upon receipt of a SRD request DLPDU and transmission of a reply DLPDU. Receipt of a duplicate SRD request DLPDU (with no other intervening DLPDUs) does not cause the indication primitive to be repeated.

However, no indication primitive occurs when

a) both the received SRD request DLPDU and the reply DLPDU contain null (zero length) DLSDUs, and

b) the addressed remote DLS-user has configured the D_SAP to not signal such events.

NOTE 1 This behavior is configured through the Indication_mode parameter of the DL-management DLSAP Activate Responder primitive (see 5.5.8).

NOTE 2 This non-reporting does not affect the storage resources of the responding DLE.

##### 4.4.3.4.2 Parameters of the primitive

###### 4.4.3.4.2.1 Service_class, D_addr, D_SAP_index, S_addr, S_SAP_index, DLSDU

These parameters have the same meaning as described in 4.4.1.4.2.

###### 4.4.3.4.2.2 Reference

This optional parameter is used to identify the DLSDU that was passed upon receipt of a SRD request DLPDU.

###### 4.4.3.4.2.3 Update_status

This parameter indicates whether or not the response data (DLSDU) has been passed to the initiating local DLE. Permitted values for this parameter are specified in Table 7.

**Table 7 – Values of Update_status for the SRD data reply service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **NO** | failure | No reply data (DLSDU) transmitted | t |
| **LO** | success | Low priority reply data transmitted | — |
| **HI** | success | High priority reply data transmitted | — |

#### 4.4.3.5 SRD data-reply confirm primitive

##### 4.4.3.5.1 Use of the primitive

This primitive is passed from the local DLE to the local DLS-user upon completion of the corresponding service request. DL_status indicates the completion status of the request and, when successful, the presence or absence of a returned DLSDU.

When DL_status indicates a temporary error, the local DLS-user may assume that a subsequent repetition may be successful. When DL_status indicates a permanent error, the local DLS-user may assume that a subsequent repetition may not be successful. Other method should be used to deal this type of error.

#### 4.4.3.5.2 Parameters of the primitive

##### 4.4.3.5.2.1 DLSDU

This optional parameter returns the DLS-user data sent by the remote DLE, if any. This parameter will not appear, if the DL_status is different from DL, DH, RDL and RDH.

##### 4.4.3.5.2.2 DL_status

This parameter indicates the success or failure of the corresponding SRD request. The values UE, RS, LS, LR, NA, DS and IV as specified for SDA (see Table 3) are possible. Additional possible values are specified in Table 8.

**Table 8 – Additional values of DL_status for the SRD data reply service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **DL** | success | Positive acknowledgement for sent data, reply data (DLSDU) with low priority available | — |
| **DH** | success | Positive acknowledgement for sent data, reply data with high priority available | — |
| **NR** | success | Positive acknowledgement for sent data, negative acknowledgement for reply data, as not available in the remote DLE | t |
| **RDL** | failure | Negative acknowledgement for sent data, resources of the remote DLE not available or not sufficient, reply data with low priority available | t |
| **RDH** | failure | Negative acknowledgement for sent data, resources of the remote DLE not available or not sufficient, reply data with high priority available | t |
| **RR** | failure | Negative acknowledgement for sent data, resources of the remote DLE not available or not sufficient, reply data not available | t |

### 4.4.3.6 Types of primitives and parameters of SRD reply-update

Table 9 indicates the primitives and parameters of the SRD reply-update service.

**Table 9 – SRD reply-update primitives and parameters**

| **DL-REPLY-UPDATE** | **Request** | **Confirm** |
|---|---|---|
| **Parameter name** | input | output |
| Service_class | M | (see Note) |
| S_SAP_index | M | (see Note) |
| DLSDU | U | — |
| Transmit_strategy | M | — |
| Reference | U | — |
| DL_status | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 4.4.3.7 SRD reply-update request primitive

##### 4.4.3.7.1 Use of the primitive

This primitive is passed from the local DLS-user to the local DLE to convey a DLSDU which can be retrieved by a remotely-initiated invocation of the SRD service. The local DLE associates the DLSDU with the specified S_SAP_index in a way which avoids update concurrent with any ongoing SRD transaction at that S_SAP_index. This primitive is only useful in conjunction with remote invocation of the SRD service; of itself it does not cause any transmission of the conveyed DLSDU.

##### 4.4.3.7.2 Parameters of the primitive

###### 4.4.3.7.2.1 Service_class

This parameter has the same meaning as described in 4.4.3.3.2.1.

###### 4.4.3.7.2.2 S_SAP_index

This parameter specifies the service access point of the local DLS-user which makes the request. The S_SAP_index values 63, which specifies BROADCAST, and CS are not permitted.

###### 4.4.3.7.2.3 DLSDU

This optional parameter specifies the DLS-user data which is to be used to update the data associated with the specified S_SAP_index.

###### 4.4.3.7.2.4 Transmit_strategy

This parameter specifies whether the update is transmitted only once (SINGLE) or many times (MULTIPLE). In the case of "MULTIPLE" any DLSDU associated with the S_SAP_index is transferred with each subsequent SRD.

In the case of "SINGLE" the association of the DLSDU with the S_SAP_index is terminated after the first apparently-successful SRD exchange (and any immediately-following retries). This causes subsequent SRD exchanges do not return a DLSDU until the DLS-user associates a new DLSDU with the S_SAP_index.

###### 4.4.3.7.2.5 Reference

This optional parameter is used to identify the DLSDU that was passed by a DL-REPLY-UPDATE request primitive.

#### 4.4.3.8 SRD reply-update confirm primitive

##### 4.4.3.8.1 Use of the primitive

This primitive is passed from the local DLE to the local DLS-user upon completion of the corresponding service request.

When DL_status indicates a temporary error, the local DLS-user may assume that a subsequent repetition may be successful. When DL_status indicates a permanent error, the local DLS-user may assume that a subsequent repetition may not be successful. Other method should be used to deal this type of error.

#### 4.4.3.8.2 Parameters of the primitive

##### 4.4.3.8.2.1 DL_status

This parameter indicates the result of the corresponding DL-REPLY-UPDATE REQuest primitive. The possible values are specified in Table 10.

**Table 10 – Values of DL_status for the SRD reply-update service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | Update data (DLSDU) loaded | — |
| **LS** | failure | Service at local DLSAP or local DLSAP not activated | p |
| **LR** | failure | Resources of the local DLE not available or not sufficient | t |
| **IV** | failure | Invalid parameters in request | — |

### 4.4.4 Send and request data with multicast reply (MSRD)

#### 4.4.4.1 Function

The local DLS-user prepares a DLSDU for the remote DLS-user and passes it to the local DLE as the DLSDU parameter of a DL-MCT-DATA-REPLY request primitive, requesting data from the remote DLS-user (Publisher) at the same time. The local DLE accepts the service request, forms an appropriate DLPDU containing the DLSDU, and tries to send the DLPDU to the remote DLE (Publisher), requesting that a DLSDU previously prepared by the remote DLS-user be multicast in reply to the appropriate set of DLEs (Subscribers) which have configured their corresponding DLSAP in the intention to subscribe to this particular publisher (DLSAP activate subscriber service).

Alternatively, if the local DLS-user has no DLSDU to send, it passes the DL-MCT-DATA-REPLY request primitive to the DLE without a DLSDU parameter. In this case, the local DLE accepts the service request, forms an appropriate DLPDU not containing a DLSDU, and tries to send the DLPDU to the remote DLE (Publisher), requesting that a DLSDU previously prepared by the remote DLS-user be multicast in reply.

Upon receiving the request DLPDU error-free, the remote DLE (Publisher) immediately starts transmitting a reply DLPDU to the initiating DLE and the appropriate set of remote DLEs (Subscribers) by sending the response using the destination address DA = 127 (Broadcast) and a specified D_SAP_index if the remote DLS-user had previously prepared a DLSDU for this reply (by means of a DL-REPLY-UPDATE request primitive). If no DLSDU is available for transmission, or if an error occurred, then an acknowledgement DLPDU with appropriate status information is returned instead addressed to the initiating DLE only.

The receiving DLE (Publisher) passes the DLSDU, if any, received from the initiating DLE, together with status concerning the transmitted reply, to its local DLS-user with a DL-DATA-REPLY indication primitive.

The local DLE waits for a reply DLPDU from the remote DLE (Publisher). If this reply DLPDU is not received error-free within the slot time $T_{SL}$, the local DLE again transmits the request DLPDU to the remote DLE (Publisher). If no reply DLPDU is received error-free after a number of retransmissions equal to max_retry_limit, the local DLE reports the negative status in a confirm primitive which it issues to the local DLS-user.

When a reply DLPDU is received, the local DLE passes the conveyed DLSDU, if any, together with a completion status to the local DLS-user by means of a DL-MCT-DATA-REPLY confirm primitive; this status conveys either successful completion of the requested service or the type of error detected.

The DLEs (Subscribers) which receive the reply DLPDU addressed to the destination address DA = 127 (Broadcast) and the specified D_SAP_index indicate this to their DLS-user with a DL-DXM-REPLY indication primitive. The completion status of a DL-DXM-REPLY indication is always set to successful completion.

The remote DLS-user is responsible for having prepared a valid DLSDU, ready for transmission by the remote DLE (Publisher). The remote DLS-user passes a DL-REPLY-UPDATE request primitive to its local DLE to convey the DLSDU to that DLE, where it awaits a remotely-initiated MSRD transfer request. The DLE informs the DLS-user of the completion of this request by means of a DL-REPLY-UPDATE confirm primitive.

#### 4.4.4.2 Types of primitives and parameters of MSRD MCT-data-reply

Table 11 indicates the primitives and parameters of the MSRD MCT data reply service.

**Table 11 – MSRD MCT data reply primitives and parameters**

| DL-MCT-DATA-REPLY<br>Parameter name | Request<br>input | Indication<br>output | Confirm<br>output |
|---|---|---|---|
| Service_class | M | M | (see Note) |
| D_addr | M | M (=) | (see Note) |
| D_SAP_index | M | M (=) | (see Note) |
| S_addr | — | M | — |
| S_SAP_index | M | M (=) | (see Note) |
| DLSDU | U | U (=) | U |
| Update_status | — | M | — |
| Reference | — | U | — |
| DL_status | — | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 4.4.4.3 MSRD MCT-DATA-REPLY request primitive

##### 4.4.4.3.1 Use of the primitive

This primitive is passed from the local DLS-user to the local DLE

a) optionally, to send DLS-user data to a remote DLS-user, and

b) simultaneously to request previously-prepared DLS-user data to be published from that DLS-user

both through use of the MSRD service.

Receipt of this primitive results in the transmittal of the DLSDU by the local DLE employing the procedure appropriate for the MSRD service. While processing a MSRD request (that is, while waiting for the reply and during any retry attempts) the DLE does not attempt to transmit any unrelated DLPDUs.

##### 4.4.4.3.2 Parameters of the primitive

###### 4.4.4.3.2.1 Service_class

This parameter has the same meaning as described in 4.4.1.3.2.1.

#### 4.4.4.3.2.2 D_addr, S_SAP_index, DLSDU

The D_addr, S_SAP_index and DLSDU parameters have the same meaning as described in 4.4.1.3.2.

#### 4.4.4.3.2.3 D_SAP_index

This parameter specifies the DLSAP of the remote DLS-user within the remote DLE (Publisher) designated by the D_addr parameter. The specified remote DLSAP can also have an associated DLSDU which has been prepared by that DLSAPs DLS-user. The D_SAP_index values 63, which specifies Broadcast, and CS are not permitted.

### 4.4.4.4 MSRD MCT-data-reply indication primitive

#### 4.4.4.4.1 Use of the primitive

This primitive is passed from the addressed remote DLE (Publisher) to the remote DLS-user upon receipt of a MSRD request DLPDU and transmission of a reply DLPDU. Receipt of a duplicate MSRD request DLPDU (with no other intervening DLPDUs) does not cause the indication primitive to be repeated.

However, no indication primitive occurs when

a) both the received MSRD request DLPDU and the reply DLPDU contain null (zero length) DLSDUs, and
b) the addressed remote DLS-user has configured the D_SAP to not signal such events.

NOTE 1 This behavior is configured through the Indication_mode parameter of the DL-management DLSAP Activate Responder primitive (see 5.5.8).

NOTE 2 This non-reporting does not affect the storage resources of the responding DLE.

#### 4.4.4.4.2 Parameters of the primitive

##### 4.4.4.4.2.1 Service_class, D_addr, D_SAP_index, S_addr, S_SAP_index, DLSDU

These parameters have the same meaning as described in 4.4.3.4.2.

##### 4.4.4.4.2.2 Reference

This parameter has the same meaning as described in 4.4.3.4.2.2.

##### 4.4.4.4.2.3 Update_status

This parameter indicates whether or not the response data (DLSDU) has been passed to the initiating local DLE and to all other remote DLEs (Subscribers). Permitted values for this parameter are specified in Table 7 (see 4.4.3.4.2.3).

### 4.4.4.5 MSRD MCT-data-reply confirm primitive

#### 4.4.4.5.1 Use of the primitive

This primitive is passed from the local DLE to the local DLS-user upon completion of the corresponding service request. DL_status indicates the completion status of the request and, when successful, the presence or absence of a returned DLSDU.

When DL_status indicates a temporary error, the local DLS-user may assume that a subsequent repetition may be successful. When DL_status indicates a permanent error, the local DLS-user may assume that a subsequent repetition may not be successful. Other method should be used to deal this type of error.

#### 4.4.4.5.2 Parameters of the primitive

##### 4.4.4.5.2.1 DLSDU

This optional parameter returns the DLS-user data sent by the remote DLE, if any. This parameter will not appear, if the DL_status is different from DL, DH, RDL and RDH.

##### 4.4.4.5.2.2 DL_status

This parameter has the same meaning as described in 4.4.3.5.2.2.

### 4.4.4.6 Type of primitive and parameters of MSRD DXM data reply

Table 12 indicates the primitives and parameters of the MSRD DXM data reply service.

**Table 12 – MSRD DXM data reply primitive and parameters**

| DL-DXM-DATA-REPLY<br>Parameter name | Indication<br>output |
|---|---|
| Service_class | M |
| D_addr | M |
| D_SAP_index | M |
| S_addr | M |
| S_SAP_index | M |
| DLSDU | M |

### 4.4.4.7 MSRD DXM data reply indication primitive

#### 4.4.4.7.1 Use of the primitive

This primitive is passed from the remote DLE (Subscriber) to the remote DLS-user upon receipt of a reply DLPDU addressed to the DLE with the destination address DA = 127 (Broadcast) and the specified D_SAP_index to convey a DLSDU which has been retrieved by a remotely-initiated invocation of the MSRD service. This primitive is only possible in conjunction with remote invocation of the MSRD service.

#### 4.4.4.7.2 Parameters of the primitive

##### 4.4.4.7.2.1 Service_class

This parameter has the same meaning as described in 4.4.1.3.2.1.

##### 4.4.4.7.2.2 S_addr, S_SAP_index

These parameters have the same meaning as described in 4.4.3.4.2.

##### 4.4.4.7.2.3 DLSDU

This parameter returns the DLS-user data sent by the remote DLE (Publisher).

##### 4.4.4.7.2.4 D_addr

This parameter specifies the destination DL-address of the received reply DLPDU. The global address (127) is the only allowed value.

NOTE See Note of 4.4.1.4.2.2.

#### 4.4.4.7.2.5 D_SAP_index

This parameter specifies the destination service-access-point of the received reply DLPDU. The D_SAP_index value 63, which specifies Broadcast, and CS are not permitted. Each receiving remote DLE (Subscriber) delivers the received DLSDU to its DLS-user.

NOTE See Note of 4.4.1.3.2.3.

### 4.4.4.8 SRD reply-update request primitive

For a description of this primitive and its parameters, see 4.4.3.7.

### 4.4.4.9 SRD reply-update confirm primitive

For a description of this primitive and its parameters, see 4.4.3.8.

## 4.4.5 Clock Synchronization (CS)

### 4.4.5.1 Function

The local DLS-user passes a DL-CS-TIME-EVENT request primitive to the local DLE to start the clock synchronization sequence. The local DLE accepts the service request, forms an appropriate DLPDU to transmit a Time Event indicating the start of clock synchronization to all remote DLEs (time receivers) which support clock synchronization.

Upon reception of a DL-CS-TIME-EVENT request primitive the local DLE starts a send-delay-timer to measure the delay between the reception of the primitive and sending of the appropriate DLPDU. The remote DLEs (time receivers) start the receive-delay-timer after reception of such a DLPDU.

The local DLE passes a DL-CS-TIME-EVENT confirm primitive together with the send delay time and the status of transmission to the local DLS-user.

Upon a positive confirmation the local DLS-user passes a DL-CS-CLOCK-VALUE request primitive with a DLSDU which contains clock information to the local DLE. The local DLE accepts the service request, forms an appropriate DLPDU containing the DLSDU, and tries to send the DLPDU to all remote DLEs (time receivers) which support clock synchronization. When the DLPDU is sent, the local DLE passes a DL-CS-CLOCK-VALUE confirm primitive together with a completion status to the local DLS-user. The remote DLEs (time receivers) that receive the DLPDU error-free stop their receive-delay-timer. The receiving DLEs (time receivers) pass the DLSDU received from the initiating DLE (time master) together with the receive delay time and the status concerning the transmission to its local DLS-user by means of a DL-CS-CLOCK-VALUE indication primitive.

### 4.4.5.2 Types of primitives and parameters of the CS time event

Table 13 indicates the primitives and parameters of the CS time event service.

**Table 13 – CS time event primitives and parameters**

| DL-CS-TIME-EVENT<br>Parameter name | Request<br>input | Confirm<br>output |
|---|---|---|
| D_addr | M | (see Note) |
| D_SAP_index | M | (see Note) |
| S_SAP_index | M | (see Note) |
| Send_delay_time | — | C |
| DL_status | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 4.4.5.3 CS time event request primitive

##### 4.4.5.3.1 Use of the primitive

This primitive is passed to the local DLE (time master) to send an appropriate DLPDU to a group of remote DLEs (time receivers) which have activated the CS DLSAP. Upon reception of this primitive the local DLE (time master) starts its send-delay-timer to measure the internal delay between receiving the primitive and transmitting the appropriate DLPDU.

##### 4.4.5.3.2 Parameters of the primitive

###### 4.4.5.3.2.1 D_addr

The D_addr (destination-address) parameter specifies the DL-address of the remote DLE. The global address (127) is permitted; it designates the set of all receiving DLEs.

NOTE See Note in 4.4.1.4.2.2.

###### 4.4.5.3.2.2 D_SAP_index

The D_SAP_index parameter specifies the DLSAP of the remote DLS-user within the remote DLE designated by the D_addr parameter. The D_SAP_index value CS is the only allowed one.

###### 4.4.5.3.2.3 S_SAP_index

The S_SAP_index parameter specifies a DLSAP of the local DLS-user. The S_SAP_index value CS is the only allowed value.

#### 4.4.5.4 CS time event confirm primitive

##### 4.4.5.4.1 Use of the primitive

After successful transmission of the DLPDU initiated by the appropriate request primitive the local DLE stops its send-delay-timer and returns a local confirmation of transmittal together with the send delay time to the local DLS-user by means of a DL-CS-TIME-EVENT confirm primitive.

#### 4.4.5.4.2 Parameters of the primitive

##### 4.4.5.4.2.1 Send_delay_time

This conditional parameter specifies the delay time which elapses between the CS time event request and the transmitting of the appropriate DLPDU. This parameter is not present when the resulting DL_status is different from OK and SV.

##### 4.4.5.4.2.2 DL_status

This parameter indicates the success or failure of the associated request and whether a temporary or a permanent error exists. Table 14 specifies the permitted values.

**Table 14 – Values of DL_status for the CS time event service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | The parameter Send_delay_time is available | — |
| **LS** | failure | Service at local DLSAP or local DLSAP not activated (send-delay-timer has not been started) | p |
| **LR** | failure | Resources local not available or not sufficient (send-delay-timer has not been started) | p |
| **DS** | failure | Local DL/Ph Entity not in logical token ring or disconnected from line (send-delay-timer has not been started) | t |
| **SV** | failure | Sequence violation (subsequent CS time event services without CS clock value service in between) | p |
| **IV** | failure | Invalid parameters in request | — |

### 4.4.5.5 Types of primitives and parameters of the CS clock value

Table 15 indicates the primitives and parameters of the CS clock value service.

**Table 15 – CS clock value primitives and parameters**

| **DL-CS-CLOCK-VALUE** | **Request** | **Indication** | **Confirm** |
|---|---|---|---|
| **Parameter name** | input | output | output |
| D_addr | M | M(=) | (see Note) |
| D_SAP_index | M | M(=) | (see Note) |
| S_addr | — | M | — |
| S_SAP_index | M | M(=) | (see Note) |
| DLSDU | M | M(=) | — |
| Receive_delay_time | — | M | — |
| CS_status | — | M | v |
| DL_status | — | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 4.4.5.6 CS clock value request primitive

##### 4.4.5.6.1 Use of the primitive

The DLS-user passes a DLSDU by meaning of a CS clock value request primitive. The local DLE prepares an appropriate DLPDU and tries to transmit this DLPDU.

##### 4.4.5.6.2 Parameters of the primitive

###### 4.4.5.6.2.1 D_addr, D_SAP_index, S_SAP_index

These parameters have the same meaning as described in 4.4.5.3.2.

###### 4.4.5.6.2.2 DLSDU

This parameter specifies the DLS-user data that is to be transferred by the local DLE (time master). The size of this DLSDU is fixed to 18 octets.

#### 4.4.5.7 CS clock value indication primitive

##### 4.4.5.7.1 Use of the primitive

This primitive is passed from the remote DLE (time receiver) to the addressed DLS-user upon reception of a Clock Value DLPDU. If the Clock Value DLPDU was received error-free the local DLE stops their receive-delay-timer and calculate the receive delay time.

##### 4.4.5.7.2 Parameters of the primitive

###### 4.4.5.7.2.1 D_addr

This parameter specifies the destination DL-address of the received Clock Value DLPDU. The global address (127) is permitted; it designates the set of all receiving DLEs.

NOTE See Note in 4.4.1.4.2.2.

###### 4.4.5.7.2.2 S_addr

This parameter specifies the DL-address of the initiating DLE. The S_addr is an individual address; the global address (127) for broadcast or multicast messages is not permitted.

NOTE See Note in 4.4.1.4.2.3.

###### 4.4.5.7.2.3 D_SAP_index, S_SAP_index

These parameters specify the source and destination DLSAPs of the received Clock Value DLPDU within their respective DLEs.

###### 4.4.5.7.2.4 DLSDU

This parameter has the same meaning as described in 4.4.5.6.2.2.

###### 4.4.5.7.2.5 Receive_delay_time

This parameter specifies the receive delay time between the reception of a Time Event DLPDU and the end of the Clock Value DLPDU reception. In case of a sequence violation the value of this parameter is zero.

###### 4.4.5.7.2.6 CS_status

This parameter indicates the success or failure of the Clock Synchronization sequence. Table 16 specifies the parameter values.

**Table 16 – Values of CS_status for the CS clock value service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | clock synchronization sequence orderly executed | — |
| **SV** | failure | clock synchronization sequence not orderly executed | t/p |

#### 4.4.5.8 CS clock value confirm primitive

##### 4.4.5.8.1 Use of the primitive

The local DLE (time master) returns a local confirmation of transmittal to the local DLS-user by means of this primitive including a status information about the success or failure of the transmittal and the validity of the clock synchronization sequence.

##### 4.4.5.8.2 Parameters of the primitive

###### 4.4.5.8.2.1 DL_status

This parameter indicates success or failure of the associated request and whether a temporary or a permanent error exists. Table 17 specifies the parameter values.

**Table 17 – Values of DL_status for the CS clock value service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | Transmission of CS clock value completed by local DL-entity | — |
| **LS** | failure | Service at local DLSAP or local DLSAP not activated | p |
| **LR** | failure | Resources local not available or not sufficient | p |
| **DS** | failure | Local FDL/Ph Entity not in logical token ring or disconnected from line | t |
| **SV** | failure | Sequence violation | p |
| **IV** | failure | Invalid parameters in request | — |

## 5 DL-management Service

### 5.1 General

Clause 5 describes the interface between a DLE and a DL-management user (DLMS-user). The services of this interface are needed for the protocol which implements the DLS specified in Clause 4.

### 5.2 Facilities of the DLMS

DL-management organizes the initialization, configuration, event and error handling between the DLMS-user and the logical functions in the DLE. The following functions are provided to the DLMS-user.

a) Reset of the local DLE

b) Request for and modification of the actual operating parameters and of the counters of the local DLE

c) Notification of unexpected events, errors, and status changes, both local and remote

d) Request for identification and for the DLSAP configuration of the local DLE

e) Activation and deactivation of local DLSAPs

## 5.3 Services of the DL-management

### 5.3.1 Overview of services

DL-management provides the following services to the DLMS-user:

a) Reset

b) Set Value

c) Get Value

d) Event

e) Ident

f) DLSAP Status

g) DLSAP Activate

h) DLSAP Activate Responder

i) DLSAP Activate Subscriber

j) DLSAP Deactivate

The services Reset, Set Value, Event and DLSAP Activate are considered mandatory. The services Get Value, Ident, DLSAP Status, DLSAP Activate Subscriber and DLSAP Deactivate are considered optional. The service DLSAP Activate Responder is considered mandatory for slaves and optional for masters.

### 5.3.2 Reset

The DLMS-user employs this service to cause DL-management to reset the DLE. A reset is equivalent to power on. The DLMS-user receives a confirmation thereof.

### 5.3.3 Set value

The DLMS-user employs this service to assign new values to the variables of the DLE. The DLMS-user receives a confirmation whether the specified variables have been set to the new values.

### 5.3.4 Get value

This service enables DL-management to read variables of the DLE. The response of the DL-management returns the actual value of the specified variables.

### 5.3.5 Event

DL-management employs this service to inform the DLMS-user about certain events or errors in the DLL.

### 5.3.6 Ident

When requesting the identification service, a distinction is made between master and slave stations. By employing this service the DLMS-user of a slave station determines the version data of the local DLEs hardware and software. When employing this service in the case of a master station, the DLMS-user can additionally request the same type of information from a remote station.

#### 5.3.7 DLSAP status

The DLMS-user employs this service to inform itself about the configuration of DLSAPs of the local DLE.

#### 5.3.8 DLSAP activate

This service enables the DLMS-user to activate and to configure a local DLSAP for the reply services (SRD and MSRD). Excluded from this is the responder function for the reply services. The DLMS-user receives a confirmation on the execution of the service from DL-management.

#### 5.3.9 DLSAP activate responder

The DLMS-user employs this service to activate a local DLSAP for the responder function for the reply services (SRD and MSRD). The DLMS-user receives a confirmation of execution of the service from DL-management.

#### 5.3.10 DLSAP activate subscriber

The DLMS-user employs this service to activate a local DLSAP for the subscriber function of the MSRD service. The DLMS-user receives a confirmation of execution of the service from DL-management.

#### 5.3.11 DLSAP deactivate

The DLMS-user employs this service to cause DL-management to deactivate a local DLSAP. DL-management returns a confirmation thereof.

### 5.4 Overview of interactions

DL-management services and their primitives are summarized in Table 18.

**Table 18 – Summary of DL-management services and primitives**

| Service | Primitive | Possible for the following stations |
|---|---|---|
| Reset | DLM-RESET request<br>DLM-RESET confirm | local: master and slave |
| Set Value | DLM-SET-VALUE request<br>DLM-SET-VALUE confirm | local: master and slave |
| Get Value | DLM-GET-VALUE request<br>DLM-GET-VALUE confirm | local: master and slave |
| Event | DLM-EVENT indication | local: master and slave |
| Ident | DLM-IDENT request<br>DLM-IDENT confirm | local: master and slave<br>remote: master |
| DLSAP Status | DLM-DLSAP-STATUS request<br>DLM-DLSAP-STATUS confirm | local: master and slave |
| DLSAP Activate | DLM-DLSAP-ACTIVATE request<br>DLM-DLSAP-ACTIVATE confirm | local: master and slave |
| DLSAP Activate Responder | DLM-DLSAP-ACTIVATE-RESPONDER request<br>DLM-DLSAP-ACTIVATE-RESPONDER confirm | local: master and slave |
| DLSAP Activate Subscriber | DLM-DLSAP-ACTIVATE-SUBSCRIBER request<br>DLM-DLSAP-ACTIVATE-SUBSCRIBER confirm | local: master and slave |
| DLSAP Deactivate | DLM-DLSAP-DEACTIVATE request<br>DLM-DLSAP-DEACTIVATE confirm | local: master and slave |

The temporal relationships of the DL-management primitives are shown in Figure 7 through Figure 9.

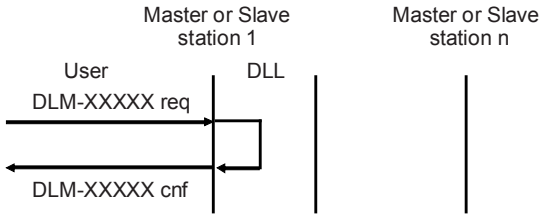



**Figure 7 – Reset, Set value, Get value, Ident (local), DLSAP status, DLSAP activate, DLSAP activate responder, DLSAP activate subscriber and DLSAP deactivate services**

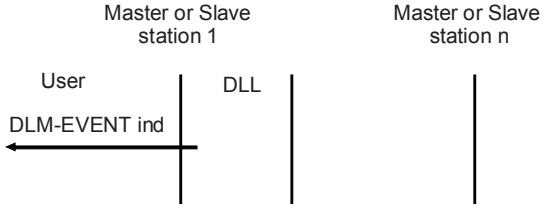



**Figure 8 – Event service**

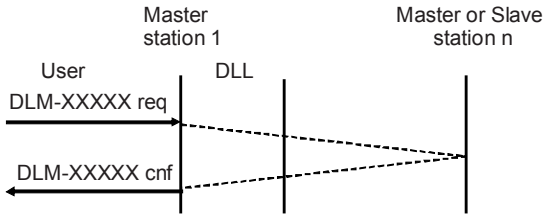



**Figure 9 – Ident (remote) service**

## 5.5 Detailed specification of services and interactions

### 5.5.1 Reset

#### 5.5.1.1 Function

The DLMS-user passes a DLM-RESET request primitive to DL-management causing it to reset the DLE. This is carried out in the same manner as at a Power On. The DLE assumes the "Offline"-status and all DLE variables (operational parameters/counters) are cleared. As a result DL-management passes a DLM-RESET confirm primitive to the DLMS-user to indicate the success or failure of the corresponding service request.

#### 5.5.1.2 Types of primitives and parameters

Table 19 indicates the primitives and parameters of the Reset service.

**Table 19 – Reset primitives and parameters**

| **DLM-RESET** | **Request** | **Confirm** |
|---|---|---|
| **Parameter name** | input | output |
| DLM_status | — | M |
| NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. | | |

#### 5.5.1.3 Parameters of the primitive

##### 5.5.1.3.1 DLM_status

This parameter indicates the success or failure of the associated reset service request. Permitted values for this parameter are specified in Table 20.

**Table 20 – Values of DLM_status for the reset service**

| **Short name** | **Status** | **Definition** | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | The Reset function was carried out successfully | — |
| **NO** | failure | The Reset function was not carried out successfully | t/p |
| **IV** | failure | Invalid parameters in request | — |

### 5.5.2 Set Value

#### 5.5.2.1 Function

The DLMS-user passes a DLM-SET-VALUE request primitive to DL-management to assign a desired value to one or more specified variables of the DLE. After receiving this primitive DL-management tries to select these variables and to set the new values. If the requested service was executed DL-management passes a DLM-SET-VALUE confirm primitive to the DLMS-user to indicate the success or failure of the corresponding service request.

#### 5.5.2.2 Types of primitives and parameters

Table 21 indicates the primitives and parameters of the Set Value service.

**Table 21 – Set value primitives and parameters**

| DLM-SET-VALUE | Request | Confirm |
|---|---|---|
| Parameter name | input | output |
| Variable_name (1 to n) | M | — |
| Index (1 to k) | C | — |
| Desired_value (1 to n) | M | — |
| DLM_status (1 to n) | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter.

#### 5.5.2.3 Parameters of the primitives

##### 5.5.2.3.1 Variable_name

This array parameter specifies one or more variables (1 to n) which are to be assigned values from the corresponding elements of the Desired_value parameter. The selectable variables are operating parameters and counters; they are specified in Table 22 and Table 23.

**Table 22 – Mandatory DLE-variables**

| Operating parameters | | |
|---|---|---|
| **Name** | | **Definition** |
| TS | | DL-address of this station |
| Data_rate | | Data signaling rate of this fieldbus |
| Medium_redundancy | | Availability of redundant media |
| HW-Release | | Hardware release number |
| SW-Release | | Software release number |
| $T_{SL}$ | | Slot time |
| min $T_{SDR}$ | | Smallest station delay time |
| max $T_{SDR}$ | (see Note 1) | Largest station delay time |
| $T_{QUI}$ | (see Note 1) | Transmitter fall time (line state uncertain time) or repeater switch time |
| $T_{SET}$ | (see Note 1) | Setup time |
| $T_{TR}$ | (see Note 1) | Target rotation time |
| G | (see Note 1) | GAP update factor |
| in_ring_desired | (see Note 1) | Request entry into or exit out of the logical token ring |
| HSA | (see Note 1) | Highest station address of a master station on this fieldbus |
| max_retry_limit | (see Note 1) | Maximum number of retries |
| $T_{CSI}$ | (see Note 2) | Clock synchronization interval |
| Isochronous_mode | | Selects the operation of the isochronous mode |
| SYNCHT | (see Note 3) | Contents of the SYNCH DLPDU |
| $T_{CT}$ | (see Note 3) | Isochronous cycle time |
| max$T_{SH}$ | (see Note 3) | Allowed maximal time shift |

NOTE 1 This applies only to master stations.

NOTE 2 This applies only to stations able to support clock synchronization.

NOTE 3 This applies only to master stations able to work in isochronous mode.

**Table 23 – Optional DLE-variables**

| Counters | | |
|---|---|---|
| **Name** | | **Definition** |
| DLPDU_sent_count | (see Notes 1, 2) | Number of DLPDUs sent |
| Retry_count | (see Notes 1, 2) | Number of DLPDU repeats |
| DLPDU_sent_count_sr | (see Notes 1, 2) | List of numbers of DLPDUs sent per station |
| Error_count | (see Notes 1, 2) | List of numbers of no or erroneous responses per station |
| SD_count | (see Note 2) | Number of correct start delimiters (from PhE) |
| SD_error_count | (see Note 2) | Number of defective start delimiters (from PhE) |

NOTE 1 This applies only to master stations.

NOTE 2 If a counter reaches its maximum value, then both this counter and its comparison counter are stopped. If a counter is reset to zero the related co-operative counter is also reset to zero, then these counters are free to count again.

#### 5.5.2.3.2 Index

This conditional parameter is a selector for one or more entries (1 to k), used when a variable contains an array or list of values. Possible values for each entry of the list are 0 to 126.

NOTE The parameter is only used for the counters DLPDU_sent_count_sr and Error_count.

#### 5.5.2.3.3 Desired_value

This array parameter specifies the actual value to be written to the variables (1 to n) that are specified by the Variable_name parameter. This parameter specifies a list of one or more (1 to n) new values for the specified DLE-variables. The permissible value or range of values for each of these variables is specified in Table 24 and Table 25.

**Table 24 – Permissible values of mandatory DLE-variables**

| Operating parameters | |
|---|---|
| **Variable** | **Range of values** |
| TS | one octet address field, DL-address value 0 to 126 |
| Data_rate | 9,6; 19,2; 31,25; 45,45; 93,75; 187,5; 500; 1 500, 3 000; 6 000; 12 000 kbit/s and others |
| Medium_redundancy | single; redundant |
| HW-Release | LE_HR; Visible String [length 0 to 32] |
| SW-Release | LE_SR; Visible String [length 0 to 32] |
| $T_{SL}$ | 52 to $2^{16}$-1 (bit times) |
| min $T_{SDR}$ | $2^{0}$ to $2^{16}$-1 (bit times) |
| max $T_{SDR}$ | $2^{0}$ to $2^{16}$-1 (bit times) |
| $T_{QUI}$ | 0 to $2^{8}$-1 (bit times) |
| $T_{SET}$ | $2^{0}$ to $2^{8}$-1 (bit times) |
| $T_{TR}$ | $2^{0}$ to $2^{24}$-1 (bit times) |
| G | 1 to 100 |
| in_ring_desired | TRUE; FALSE |
| HSA (see Note 1) | 2 to 126 |
| max_retry_limit | 0 to 8 (preferably 1) |
| $T_{CSI}$ | $2^{0}$ to $2^{32}$-1 (bit times) |
| Isochronous_mode | 0 to 3 (see Table 26) |
| SYNCHT (see Note 2) | 2 (octets) |
| $T_{CT}$ | $2^{0}$ to $2^{24}$-1 (bit times), not exceeding 32 ms |
| max$T_{SH}$ | 1 to 256 (bit times) |
| NOTE 1 Additionally the value 0 is possible for isochronous mode operation. | |
| NOTE 2 For further explanation, refer to IEC 61158-5-3. | |

**Table 25 – Permissible values of optional DLE-variables**

| Counters | |
|---|---|
| **Variable** | **Value** |
| DLPDU_sent_count | 0 |
| Retry_count | 0 |
| DLPDU_sent_count_sr[Index] | 0 |
| Error_count[Index] | 0 |
| SD_count | 0 |
| SD_error_count | 0 |

**Table 26 – Meaning of the values for the parameter isochronous_mode**

| Value | Meaning |
|---|---|
| 0 | No isochronous operation |
| 1 | Station works as isochronous master |
| 2 | Station works as isochronous master; delayed isochronous cycles are skipped |
| 3 | Station works as additional master in a fieldbus system working in isochronous mode |

Table 27 and Table 28 give an overview of the most important operating parameters and their default values in the fieldbus system. The chosen parameter values shall ensure that each master had the possibility to receive the token and if necessary react (send a request DLPDU or token) properly. In a multi-master environment some operating parameters may have to be set to higher values. In particular the TSL may be extended because of token passing.

**Table 27 – Default reaction times and operating parameters for a master station for asynchronous transmission**

| Operating parameters | Data rate (kbit/s) | | | | | |
|---|---|---|---|---|---|---|
| | **≤ 187,5** | **500** | **1 500** | **3 000** | **6 000** | **12 000** |
| $T_{RDY}$ ($t_{BIT}$) | < 11 | < 11 | < 11 | < 11 | < 11 | < 11 |
| $T_{SDI}$ ($t_{BIT}$) | ≤ 70 | ≤ 150 | ≤ 200 | ≤ 250 | ≤ 450 | ≤ 800 |
| default values | | | | | | |
| $T_{SL}$ ($t_{BIT}$) | 100 | 200 | 300 | 400 | 600 | 1 000 |
| min $T_{SDR}$ ($t_{BIT}$) | 11 | 11 | 11 | 11 | 11 | 11 |
| max $T_{SDR}$ ($t_{BIT}$) | 60 | 100 | 150 | 250 | 450 | 800 |
| $T_{SET}$ ($t_{BIT}$) | 1 | 1 | 1 | 4 | 8 | 16 |
| $T_{QUI}$ ($t_{BIT}$) | 0 | 0 | 0 | 3 | 6 | 9 |
| G | 10 | 10 | 10 | 10 | 10 | 10 |
| HSA | 126 | 126 | 126 | 126 | 126 | 126 |
| max_retry_limit | 1 | 1 | 1 | 2 | 3 | 4 |

**Table 28 – Default reaction times and operating parameters for a slave station with asynchronous transmission**

| Operating parameters | Data rate (kbit/s) | | | | | |
|---|---|---|---|---|---|---|
| | **≤ 187,5** | **500** | **1 500** | **3 000** | **6 000** | **12 000** |
| max $T_{SDR}$ ($t_{Bit}$) | ≤ 60 | ≤ 100 | ≤ 150 | ≤ 250 | ≤ 450 | ≤ 800 |
| default values | | | | | | |
| min $T_{SDR}$ ($t_{Bit}$) | 11 | 11 | 11 | 11 | 11 | 11 |

In process application areas, coupling between the synchronous transmission and the asynchronous transmission (according to IEC 61158-2, Type 3) is done by Ph-couplers. In the case of the synchronous data rate 31,25 kbit/s, the correlated data rate on the asynchronous side should be 45,45 kbit/s or 93,75 kbit/s. Table 29 and Table 30 indicate the required range of parameters.

**Table 29 – Default reaction times and operating parameters for master stations for coupling of synchronous and asynchronous transmission segments**

| Operating parameters | Data rate (kbit/s) | | |
|---|---|---|---|
| | Synchronous | Asynchronous | |
| | 31,25 | 45,45 | 93,75 |
| $T_{RDY}$ ($t_{BIT}$) | < 11 | < 11 | < 11 |
| $T_{SDI}$ ($t_{BIT}$) | ≤ 70 | ≤ 70 | ≤ 70 |
| default values | | | |
| Preamble_Extension (bit) | 1 | | |
| $T_{PTG}$ ($t_{BIT}$) | 0 | | |
| $T_{SL}$ ($t_{BIT}$) | 150 | 640 | 2 500 (7 200) (see Note) |
| min $T_{SDR}$ ($t_{BIT}$) | 11 | 11 | 11 |
| max $T_{SDR}$ ($t_{BIT}$) | 100 | 400 | 1 000 (3 800) (see Note) |
| $T_{SET}$ ($t_{BIT}$) | 30 | 95 | 95 |
| $T_{QUI}$ ($t_{BIT}$) | 0 | 0 | 0 |
| G | 10 | 10 | 10 |
| HSA | 126 | 126 | 126 |
| max_retry_limit | 1 | 1 | 1 |

NOTE The value within parentheses is for a maximum DLSDU length between 65 octets and 244 octets in request and acknowledge/response DLPDUs. The value before the parentheses is for a maximum DLSDU length of 64 octets or less in request and acknowledge/response DLPDUs.

**Table 30 – Default reaction times and operating parameter for slave stations for coupling of synchronous and asynchronous transmission segments**

| Operating parameters | Data rate (kbit/s) | | |
|---|---|---|---|
| | Synchronous | Asynchronous | |
| | 31,25 | 45,45 | 93,75 |
| max $T_{SDR}$ ($t_{BIT}$) | ≤ 100 | ≤ 250 | ≤ 250 |
| default values | | | |
| Preamble_Extension (bit) | 1 | — | — |
| $T_{PTG}$ ($t_{BIT}$) | 0 | — | — |
| min $T_{SDR}$ ($t_{BIT}$) | 11 | 11 | 11 |

The values for asynchronous transmission (45,45 kbit/s and 93,75 kbit/s) are valid only for slaves operating directly on an asynchronous transmission segment.

#### 5.5.2.3.4 DLM_status

This array parameter indicates for each variable in the corresponding request, the success or failure of that component of the associated Set Value service request. Permitted values for the individual components of this array parameter are specified in Table 31.

**Table 31 – Values of DLM_status for the set value service**

| Short name | Status | Definition | Temporary (t) or permanent (p)t |
|---|---|---|---|
| **OK** | success | The variable has been set to the new value | — |
| **NO** | failure | The variable does not exist or could not be set to the new value | t/p |
| **IV** | failure | Invalid parameters in request | — |

### 5.5.3 Get Value

#### 5.5.3.1 Function

The DLMS-user passes a DLM-GET-VALUE request primitive to DL-management to read the current value(s) of one or more variables of the DLE. After receipt of this primitive DL-management tries to select the specified variables and to deliver their current values and passes a DLM-GET-VALUE confirm primitive to the DLMS-user to indicate the success or failure of the corresponding service request. This primitive returns as a parameter one or more of the requested variable values.

#### 5.5.3.2 Types of primitives and parameters

Table 32 indicates the primitives and parameters of the Get Value service.

**Table 32 – Get value primitives and parameters**

| DLM-GET-VALUE<br>Parameter name | Request<br>input | Confirm<br>output |
|---|---|---|
| Variable_name (1 to n) | M | — |
| Index (1 to k) | C | — |
| Current_value (1 to n) | — | M |
| DLM_status (1 to n) | — | M |
| NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. | | |

#### 5.5.3.3 Parameters of the primitives

##### 5.5.3.3.1 Variable_name

This array parameter specifies one or more variables (1 to n) whose values are to be read. The selectable variables are specified in Table 22 and Table 23. In master stations, the additional variables specified in Table 33 also can be selected.

**Table 33 – Additional mandatory DLE-variables in master stations**

| Operating parameters (mandatory) | |
|---|---|
| **Name** | **Definition** |
| $T_{RR}$ | Real rotation time |
| LMS | List of master stations in the logical ring |
| GAPL | List all of stations in the own GAP |

##### 5.5.3.3.2 Index

This conditional parameter is a selector for one or more entries (1 to k), used when a variable contains an array or list of values. Possible values for each entry of the list are 0 to 126.

NOTE The parameter is only used in case of the variables "DLPDU_sent_count_sr" and "Error_count".

##### 5.5.3.3.3 Current_value

This array parameter specifies the actual value of the (1 to n) variables that were specified by the Variable_name parameter of the corresponding request. The permissible value or range of values for each of these variables is specified in Table 24, Table 25, and Table 34.

**Table 34 – Permissible values of the additional DLE-variables in master stations**

| Operating parameters | |
|---|---|
| **Variable** | **Range of values** |
| $T_{RR}$ | $2^0$ to $2^{24}$-1 (bit times) |
| LMS | preferably maximum 32 DL-addresses (0 to 126), optionally up to 127 DL-addresses |
| GAPL | max. 126 DL-addresses (0 to 126) inclusive DLE status |
| **Counters** | |
| **Variable** | **Range of values** |
| DLPDU_sent_count | 0 to $2^{32}$-1 |
| Retry_count | 0 to $2^{16}$-1 |
| SD_count | 0 to $2^{32}$-1 |
| SD_error_count | 0 to $2^{16}$-1 |
| DLPDU_sent_count_sr | max. 126 entries of 0 to $2^{32}$-1 |
| Error_count | max. 126 entries of 0 to $2^{16}$-1 |

The value of the parameter Current_value is not defined, if the value of the parameter DLM_status is different from OK.

#### 5.5.3.3.4 DLM_status

This array parameter indicates for each variable in the associated Get Value service request the success or failure of the execution of the service. Permitted values for this parameter are specified in Table 35.

**Table 35 – Values of DLM_status for the get value service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | The variable could be read | — |
| **NO** | failure | The variable does not exist or could not be read | t/p |
| **IV** | failure | Invalid parameters in request | — |

### 5.5.4 Event

#### 5.5.4.1 Function

The DLE informs DL-management that it has detected a faulty condition or an event. After that DL-management passes a DLM-EVENT indication primitive to the DLMS-user to inform it about important error conditions or events in the DLL.

#### 5.5.4.2 Types of primitives and parameters

Table 36 indicates the primitive and parameters of the Event service.

**Table 36 – Event primitive and parameters**

| **DLM-EVENT** | **Indication** |
|---|---|
| **Parameter name** | output |
| Event/Fault | M |
| $T_{SH}$ | C |

#### 5.5.4.3 Parameters of the primitives

##### 5.5.4.3.1 Event/Fault

This parameter specifies the event that took place or the fault type. The various events and faults are shown in Table 37.

**Table 37 – Mandatory DLL events and fault types**

| Name | | Definition |
|---|---|---|
| Time_out | | No bus activity |
| Not_synchronized | | Synchronization not detected within interval $T_{SYNI}$ |
| In_ring | (see Note 1) | This master stations has been taken into the logical token ring |
| Out_of_ring | (see Note 1) | This master station has been taken out of the logical token ring not on its own initiative |
| GAP_event | (see Note 1) | A change in the GAPL has occurred |
| Duplicate_address | (see Note 1) | A duplication of this station's DL-address exists in the logical token ring |
| Faulty_transceiver | (see Note 1) | The transmitter or receiver of this station is malfunctioning |
| Double_token | (see Note 1) | While waiting for a response the master station receives a request DLPDU or token DLPDU |
| HSA_error | (see Note 1) | master station receives a token DLPDU with DA or SA higher than local HSA |
| State_conflict | (see Note 1) | MAC of master station has detected an internal state conflict |
| Synch | (see Note 2) | Marks the beginning of an isochronous cycle |
| Synch_Delay | (see Note 2) | Synch delay has occurred |

NOTE 1 This event applies only to master stations.

NOTE 2 This event applies only to master stations in isochronous mode.

##### 5.5.4.3.2 $T_{SH}$

This conditional parameter is only present, if the parameter Event/Fault has the value “Synch_Delay”. It contains the time shift which marks the time difference between the end of an isochronous cycle and sending of a synch message. The permissible values are shown in Table 38.

**Table 38 – Permissible values of $T_{SH}$**

| Operating parameters | |
|---|---|
| **Variable** | **Range of values** |
| $T_{SH}$ | 0 to $2^{16}$-1 |

### 5.5.5 Ident

#### 5.5.5.1 Function

By means of a DLM-IDENT request primitive the DLMS-user requests DL-management to carry out a station identification.

If the user requests the identification of a remote station, the DLE issues a corresponding request DLPDU to this station by means of a request Ident with reply. The remote DLE immediately replies with a DLPDU containing the Ident data of the remote DLE. If the identification refers to the local DLE, the DLE immediately replies with the Ident data.

The DL-management returns the requested data to the DLMS-user by means of a DLM-IDENT confirm primitive to indicate the success or failure of the corresponding service request.

#### 5.5.5.2 Types of primitives and parameters

Table 39 indicates the primitives and parameters of the Ident service.

**Table 39 – Ident primitives and parameters**

| DLM-IDENT / Parameter name | Request: input | Confirm: output |
|---|---|---|
| DL-addr | M | (see Note) |
| Ident_list | — | M |
| DLM_status | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 5.5.5.3 Parameters of the primitives

##### 5.5.5.3.1 DL-addr

This parameter specifies in the case of a remote request the DL-address of the remote station. The global address is not permitted. In the case of local requests the parameter specifies the local DLEs own DL-address (TS).

##### 5.5.5.3.2 Ident_list

The value of the parameter Ident_list is not defined, if the value of the parameter DLM_status is different from OK. In all other cases the parameter specifies a list of values for the identification of a station as shown in Table 40.

**Table 40 – Ident_list for the ident service**

| Item number | Type | Meaning | Definition |
|---|---|---|---|
| 1 | Le_vn | Length of Vendor_name in octets | 0 to 196 |
| 2 | Le_ct | Length of Controller_type in octets | 0 to 196 |
| 3 | Le_hr | Length of HW_release in octets | 0 to 196 |
| 4 | Le_sr | Length of SW_release in octets | 0 to 196 |
| 5 | Vendor_name | Name of the vendor | Visible String [length 0 to 196] (ISO 7 bit code, b8=0) |
| 6 | Controller_type | Sort of the controller | Visible String [length 0 to 196] (ISO 7 bit code, b8=0) |
| 7 | HW_release | Version number of the hardware | Visible String [length 0 to 196] (ISO 7 bit code, b8=0) |
| 8 | SW_release | Version number of the software | Visible String [length 0 to 196] (ISO 7 bit code, b8=0) |

NOTE The overall length of the parameter Ident_list cannot exceed 200 octets.

##### 5.5.5.3.3 DLM_status

This parameter indicates the success or failure of the associated Ident request service. Permitted values for this parameter are specified in Table 41 and Table 42.

**Table 41 – Values of DLM_status for the ident service (local)**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | The Identification has been be carried out | — |
| **LR** | failure | Ident data not available at the local DLE | t |
| **IV** | failure | Invalid parameters in request | — |

**Table 42 – Values of DLM_status for the ident service (remote)**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p)**t** |
|---|---|---|---|
| **OK** | success | The Identification has been be carried out | — |
| **NA** | failure | No or no plausible reaction (ACK or RES) from remote station | t |
| **DS** | failure | Local DL-entity not in logical token ring or disconnected from line | p |
| **LR** | failure | Resources of the local DLE not available or not sufficient | t |
| **NR** | failure | Negative acknowledgement for Ident data, as not available in the remote DLE | p |
| **IV** | failure | Invalid parameters in request | — |

### 5.5.6 DLSAP Status

#### 5.5.6.1 Function

The DLMS-user passes a DLM-DLSAP-STATUS request primitive to DL-management to request the configuration of a DLSAP_index with respect to the DL-services. The DLE immediately responds by means of DLSAP status data of the addressed DLSAP_index.

DL-management passes the DLSAP configuration data to the DLMS-user by means of a DLM-DLSAP-STATUS confirm primitive to indicate the success or failure of the corresponding service request.

#### 5.5.6.2 Types of primitives and parameters

Table 43 indicates the primitives and parameters of the DLSAP Status service.

**Table 43 – DLSAP status primitives and parameters**

| **DLM-DLSAP-STATUS** | **Request** | **Confirm** |
|---|---|---|
| **Parameter name** | input | output |
| DLSAP_index | M | (see Note) |
| Access | — | M |
| Service_type (1 to n) | — | M |
| Role_in_service_list (1 to n) | — | M |
| DLM_status | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 5.5.6.3 Parameters of the primitives

##### 5.5.6.3.1 DLSAP_index

This parameter specifies the local DLSAP_index whose configuration is requested. All the DLSAP_index values 0 to 63, CS and NIL are permitted. If the configuration of the default DLSAP_index is to be requested, the parameter DLSAP_index has the value NIL.

##### 5.5.6.3.2 Access

This parameter with the values ALL or 0 to 126 specifies the access protection. "ALL" means that all remote stations have access to this DLSAP_index. A single remote station (value 0..126 and, if applicable, region/segment address) means that only the specified remote station has access.

##### 5.5.6.3.3 Service_type

This array parameter specifies the DL-services (1 to n) that are activated at the remote or local DLSAP_index. The following values are permissible:

SDA, SDN, SRD, MSRD and CS

##### 5.5.6.3.4 Role_in_service_list

This array parameter specifies the configuration for the activated DL-services (1 to n). The following values are permissible:

| | |
|---|---|
| Initiator | The station initiates the respective service, but does not respond to it. |
| Responder | The station responds to the respective service, but does not initiate it. |
| Both | The station both initiates and responds to the respective service. |

##### 5.5.6.3.5 DLM_status

This parameter indicates the success or failure of the associated DLM_status service request. Permitted values for this parameter are specified in Table 44.

**Table 44 – Values of DLM_status for the DLSAP status service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | The DLSAP Status could be read. | — |
| **LR** | failure | Ident data not available at the local DLE | t |
| **LS** | failure | The local DLSAP is not activated | d |
| **IV** | failure | Invalid parameters in request | — |

### 5.5.7 DLSAP Activate

#### 5.5.7.1 Function

This service provides the DLMS-user with the ability to activate and to configure a local DLSAP for individual DL-services other than the responder functions for the reply services (SRD and MSRD). The responder function for the SRD reply service is activated by means of the DLSAP Activate Responder service, while the responder function for the MSRD reply service is activated by means of the DLSAP Activate Subscriber service.

After receipt of the DLM-DLSAP-ACTIVATE request primitive from the DLMS-user, DL-management activates and configures the corresponding local DLSAP. Then DL-management passes a DLM-DLSAP-ACTIVATE confirm primitive to the DLMS-user to indicate the success or failure of the corresponding service request.

#### 5.5.7.2 Types of primitives and parameters

Table 45 indicates the primitives and parameters of the DLSAP Activate service.

**Table 45 – DLSAP activate primitives and parameters**

| DLM-DLSAP-ACTIVATE<br>Parameter name | Request<br>input | Confirm<br>output |
|---|---|---|
| S_SAP_index | M | (see Note) |
| Access | M | (see Note) |
| Service_list | M | — |
| DLM_status | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 5.5.7.3 Parameters of the primitives

##### 5.5.7.3.1 S_SAP_index

This parameter specifies the local DLSAP that is to be activated and configured. The S_SAP_index values 0 to 63, CS and NIL are permissible.

##### 5.5.7.3.2 Access

This parameter with the values ALL or 0 to 126 is used for access protection and specifies whether all remote stations (ALL) or only an individual remote station (0 to 126 and, if applicable, Region or Segment address) can have access to the DLSAP to send or request data. The parameter is only valid for the responder function(s), that is, when a component of a Role_in_service_list has a value of RESPONDER or BOTH.

##### 5.5.7.3.3 Service_list

This compound parameter specifies a list of subparameters, see Table 46.

**Table 46 – DLSAP activate service_list**

| Item number | Name |
|---|---|
| 1 | Service_list_length (4 to 3n+1) |
| 2 | First service_activate |
| 3 | First role_in_service |
| 4 | First DLSDU_length_list |
| 5 | Second service_activate |
| 6 | Second role_in_service |
| 7 | Second DLSDU_length_list |
| . | … |
| n | n-th service_activate |
| n+1 | n-th role_in_service |
| n+2 | n-th DLSDU_length_list |

NOTE $1 \leq n \leq 4$.

#### 5.5.7.3.4 Service_activate

This subparameter specifies the DL-service that is to be activated for this DLSAP. The following values can be specified:

SDA, SDN, SRD, MSRD and CS.

NOTE The values SRD, MSRD and CS for the parameter Service_activate is allowed for master stations only.

#### 5.5.7.3.5 Role_in_service

This subparameter specifies the configuration for the service to be activated. The following values can be specified:

| | |
|---|---|
| Initiator | The station initiates the respective service, but does not respond to it. |
| Responder | The station responds to the respective service, but does not initiate it. Not permitted for SRD and MSRD. |
| Both | The station both initiates and responds to the respective service. Not permitted for SRD and MSRD. |

#### 5.5.7.3.6 DLSDU_length_list

This compound subparameter specifies a list of maximum DLSDU lengths. Its structure is dependent on the DL-service activated as specified in 5.5.7.3.4.

For the SDA, SDN, SRD, MSRD and CS services the list has a fixed structure as shown in Table 47.

**Table 47 – DLSAP activate DLSDU_length_list (SDA, SDN, SRD, MSRD and CS)**

| Item number | Name |
|---|---|
| 1 | Max_DLSDU_length_req_low |
| 2 | Max_DLSDU_length_req_high |
| 3 | Max_DLSDU_length_ind/cnf_low |
| 4 | Max_DLSDU_length_ind/cnf_high |

Max_DLSDU_length_req_low and Max_DLSDU_length_req_high specify the maximum length of the low or high priority DLSDU, respectively, that can be passed to the initiator by means of the request primitive for the SDA, SDN, SRD, MSRD and CS services.

Max_DLSDU_length_ind/cnf_low and Max_DLSDU_length_ind/cnf_high specify the maximum length of the DLSDU to be received at an indication of the SDA, SDN and CS services at the responder, or at a confirmation of the SRD and MSRD service at the initiator.

The length of the DLSDU can be 0 to 246 octets. When using S_SAP_index, D_SAP_index and region/segment addresses a maximum of 242 octets is permissible.

Depending on the Service_activate and Role_in_service the combinations of DLSDU lengths, shown as columns, in Table 48 through Table 50, are permissible.

**Table 48 – DLSDU lengths of SDA and SDN as used in the DLSAP activate service**

| Service: SDA and SDN | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Length** | **Initiator** | | | **Responder** | | | **Both** | | | | | | | | |
| 1 | x | – | x | – | – | – | x | – | x | – | x | – | x | x | x |
| 2 | – | x | x | – | – | – | – | x | – | x | – | x | x | x | x |
| 3 | – | – | – | x | – | x | x | – | – | x | x | x | x | – | x |
| 4 | – | – | – | – | x | x | – | x | x | – | x | x | – | x | x |

NOTE 1 1 to 4 denote the item numbers of lengths as in Table 47.

NOTE 2 x means length > 0; – means length = 0.

**Table 49 – DLSDU lengths of SRD and MSRD as used in the (master station) DLSAP activate service**

| Service: SRD and MSRD | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Length** | **Initiator** (see Note 1) | | | | | | | | | | | |
| 1 | – | – | – | x | – | – | x | x | x | x | – | x |
| 2 | – | – | – | – | x | x | – | x | x | – | x | x |
| 3 | x | – | x | x | – | x | – | x | – | x | x | x |
| 4 | – | x | x | – | x | – | x | – | x | x | x | x |

NOTE 1 Responder only with DLSAP Activate Responder. Both not allowed.

NOTE 2 1 to 4 denote the item numbers of lengths as in Table 47.

NOTE 3 x means length > 0; – means length = 0.

**Table 50 – DLSDU lengths of CS as used in the DLSAP activate service**

| Service: CS | | | |
|---|---|---|---|
| **Length** | **Initiator** | **Responder** | **Both** |
| 1 | x | – | x |
| 2 | – | – | – |
| 3 | – | x | x |
| 4 | – | – | – |

NOTE 1 1 to 4 denote the item numbers of lengths as in Table 47.

NOTE 2 x means length > 0; – means length = 0.

#### 5.5.7.3.7 DLM_status

This parameter indicates the success or failure of the associated DLSAP Activate service request. Permitted values for this parameter are specified in Table 51.

**Table 51 – Values of DLM_status for the DLSAP activate service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | The S_SAP is activated as requested | — |
| **NO** | failure | The S_SAP is not activated (already activated or resources not available or not sufficient) | t/p |
| **IV** | failure | Invalid parameters in request | — |

### 5.5.8 DLSAP Activate Responder

#### 5.5.8.1 Function

The DLMS-user passes a DLM-DLSAP-ACTIVATE-RESPONDER request primitive to DL-management to activate and to configure a local DLSAP for the responder function of the reply services (SRD and MSRD). DL-management activates and configures the corresponding local DLSAP as "Responder" and passes a DLM-DLSAP-ACTIVATE-RESPONDER confirm primitive to the DLMS-user to indicate the success or failure of the corresponding service request.

#### 5.5.8.2 Types of primitives and parameters

Table 52 indicates the primitives and parameters of the DLSAP Activate Responder service.

**Table 52 – DLSAP activate responder primitives and parameters**

| DLM-DLSAP-ACTIVATE-RESPONDER | Request | Confirm |
|---|---|---|
| Parameter name | input | output |
| S_SAP_index | M | (see Note) |
| Access | M | (see Note) |
| DLSDU_length_list | M | — |
| Indication_mode | M | — |
| Publisher_enabled | M | — |
| DLM_status | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 5.5.8.3 Parameters of the primitives

##### 5.5.8.3.1 S_SAP_index

This parameter specifies the local DLSAP for which the Responder functions are to be activated. Any SRD or MSRD service instance which designates this local DLSAP will cause a corresponding SRD or MSRD service indication to be passed to the associated DLS-user. The S_SAP_index values 0 to 62 and NIL are permitted.

##### 5.5.8.3.2 Access

This parameter has the same meaning as described in 5.5.7.3.2.

##### 5.5.8.3.3 DLSDU_length_list

This compound parameter specifies a list of maximum DLSDU lengths. The structure of this list is shown in Table 53; it is identical to that shown in Table 47 but the semantics of the list components are slightly different.

**Table 53 – DLSDU_length_list for the DLSAP activate responder service**

| Item number | Name |
|---|---|
| 1 | Max_DLSDU_length_req_low |
| 2 | Max_DLSDU_length_req_high |
| 3 | Max_DLSDU_length_ind_low |
| 4 | Max_DLSDU_length_ind_high |

Max_DLSDU_length_req_low and Max_DLSDU_length_req_high specify the maximum length of the low or high priority DLSDU, respectively, that can be associated with the specified local DLSAP by a Reply-update request primitive.

Max_DLSDU_length_ind_low and Max_DLSDU_length_ind_high specify the maximum length of the DLSDU that can be received at the specified local DLSAP during an instance of the SRD and MSRD service respectively.

Each of these maximum lengths can be specified as 0 to 246 octets. When using S_SAP_index, D_SAP_index, and region/segment addresses a maximum of 242 octets is permissible.

The permissible combinations of DLSDU lengths, shown as columns, as a responder are specified in Table 54.

**Table 54 – DLSDU length of SRD and MSRD as used in the DLSAP activate responder service**

| Service: SRD or MSRD | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Length** | **Responder** | | | | | | | | | | | |
| 1 | x | – | x | x | – | – | x | x | x | x | – | x |
| 2 | – | x | x | – | x | x | – | x | x | – | x | x |
| 3 | – | – | – | x | – | x | – | x | – | x | x | x |
| 4 | – | – | – | – | x | – | x | – | x | x | x | x |
| NOTE 1 1 to 4 denote the item numbers of lengths as in Table 53. | | | | | | | | | | | | |
| NOTE 2 x means length > 0; – means length = 0. | | | | | | | | | | | | |

#### 5.5.8.3.4 Indication_mode

The parameter Indication_mode with the values ALL/DATA/UNCHANGED specifies whether, in the case of the SRD or MSRD service, the DL-DATA-REPLY indication primitive is always generated (ALL), or whether it is omitted (DATA) when both the received DLPDU (request) and the corresponding reply DLPDU contain null (zero length) DLSDUs.

The update of the access configuration of a local DLSAP is performed by setting this parameter to the value "UNCHANGED". In this case, only the parameter "Access" is overwritten and all other parameters are unchanged.

#### 5.5.8.3.5 Publisher_enabled

The parameter Publisher_enabled with the value TRUE specifies that in the case of the MSRD DLPDU the response DLPDU is sent as multicast. In case of the parameter Publisher_enabled has the value FALSE, the MSRD DLPDU is ignored.

#### 5.5.8.3.6 DLM_status

This parameter indicates the success or failure of the associated DLSAP activate responder service request. Permitted values for this parameter are shown in Table 55.

**Table 55 – Values of DLM_status for the DLSAP activate responder service**

| Short name | Status | Definition | Temporary (t) or permanent (p) |
|---|---|---|---|
| **OK** | success | The local DLSAP is activated as requested | — |
| **NO** | failure | Indication_mode "ALL/DATA":<br>the local DLSAP is not activated successfully (already activated or resources not available or not sufficient)<br>Indication_mode "UNCHANGED":<br>the Access parameter of the local DLSAP is not overwritten, because the DLSAP was not activated before | <br>t/p<br><br>t/p |
| **IV** | failure | Invalid parameters in request | — |

### 5.5.9 DLSAP Activate Subscriber

#### 5.5.9.1 Function

The DLMS-user passes a DLM-DLSAP-ACTIVATE-SUBSCRIBER request primitive to DL-management to activate and to configure a local DLSAP for the subscriber function of the MSRD service. DL-management activates and configures the corresponding local DLSAP as Subscriber and passes a DLM-DLSAP-ACTIVATE-SUBSCRIBER confirm primitive to the DLMS-user to indicate the success or failure of the corresponding service request.

#### 5.5.9.2 Types of primitives and parameters

Table 56 indicates the primitives and parameters of the DLSAP Activate Subscriber service.

**Table 56 – DLSAP activate subscriber primitives and parameters**

| DLM-DLSAP-ACTIVATE-SUBSCRIBER | Request | Confirm |
|---|---|---|
| **Parameter name** | input | output |
| S_SAP_index | M | (see Note) |
| DLSDU_length_list | M | — |
| DLM_status | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 5.5.9.3 Parameters of the primitives

##### 5.5.9.3.1 S_SAP_index

This parameter specifies the local DLSAP for which the Subscriber functions are to be activated. Any MSRD service instance which designates this local DLSAP will cause a corresponding MSRD service primitive DL-DXM-DATA-REPLY indication to be passed to the associated DLS-user. The S_SAP_index values 0 to 62 and NIL are permitted.

##### 5.5.9.3.2 DLSDU_length_list

This compound parameter specifies a list of maximum DLSDU lengths. The structure of this list is shown in Table 57.

**Table 57 – DLSDU_length_list for the DLSAP activate subscriber service**

| Item number | Name |
|---|---|
| 1 | Max_DLSDU_DXM_length_ind_low |
| 2 | Max_DLSDU_DXM_length_ind_high |

Max_DLSDU_DXM_length_ind_low and Max_DLSDU_DXM_length_ind_high specify the maximum length of the DLSDU that can be received at the specified local DLSAP during an instance of the MSRD service.

Each of these maximum lengths can be specified as 0 to 246 octets. When using S_SAP_index, D_SAP_index, and region/segment addresses a maximum of 242 octets is permissible.

The permissible combination of DLSDU lengths, shown as columns, as a subscriber are specified in Table 58.

**Table 58 – DLSDU lengths of MSRD as used in the DLSAP activate subscriber service (master and slave stations)**

| Service: MSRD | | | |
|---|---|---|---|
| **Length** | **Subscriber** | | |
| 1 | x | – | x |
| 2 | – | x | x |
| NOTE 1 1 to 4 denote the item numbers of lengths as in Table 57. | | | |
| NOTE 2 x means length > 0; – means length = 0. | | | |

#### 5.5.9.3.3 DLM_status

This parameter indicates the success or failure of the associated DLSAP activate subscriber service request. Permitted values for this parameter are specified in Table 59.

**Table 59 – Values of DLM_status for the DLSAP activate subscriber service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | The local DLSAP is activated as requested | — |
| **NO** | failure | The local DLSAP is not activated (already activated or resources not available or not sufficient) | t/p |
| **IV** | failure | Invalid parameters in request | — |

### 5.5.10 DLSAP Deactivate

#### 5.5.10.1 Function

The DLMS-user employs this service to deactivate all DL-services for a local DLSAP. After receipt of a DLM-DLSAP-DEACTIVATE request primitive from the DLMS-user, DL-management tests whether a reply DLPDU is still pending and deactivates the specified DLSAP for all services either directly (if no reply is pending) or after receipt of the pending reply. Immediately after this DL-management passes a DLM-DLSAP-DEACTIVATE confirm primitive to the DLMS-user to indicate the success or failure of the corresponding service request.

#### 5.5.10.2 Types of primitives and parameters

Table 60 indicates the primitives and parameters of the DLSAP Deactivate service.

**Table 60 – DLSAP deactivate primitives and parameters**

| DLM-DLSAP-DEACTIVATE<br>Parameter name | Request<br>input | Confirm<br>output |
|---|---|---|
| S_SAP_index | M | (see Note) |
| DLM_status | — | M |

NOTE The method by which a confirm primitive is correlated with its corresponding preceding request primitive is a local matter. The descriptions in IEC 61158-4-3 and IEC 61158-5-3 assume that the indicated input parameter values of the request primitive are returned as output parameter values of the corresponding confirm primitive.

#### 5.5.10.3 Parameters of the primitives

##### 5.5.10.3.1 S_SAP_index

This parameter specifies the local DLSAP that is to be deactivated for all DL-services. The S_SAP_index values 0 to 63, CS and NIL are permitted.

##### 5.5.10.3.2 DLM_status

This parameter indicates the success or failure of the associated DLSAP-deactivate service request. Permitted values for this parameter are specified in Table 61.

**Table 61 – Values of DLM_status for the DLSAP deactivate service**

| Short name | Status | Definition | **Temporary** (t) or **permanent** (p) |
|---|---|---|---|
| **OK** | success | The local DLSAP is deactivated | — |
| **NO** | failure | The local DLSAP has not been activated | P |
| **IV** | failure | Invalid parameters in request | — |

## Bibliography

IEC 61158-2, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-4-3, *Industrial communication networks – Fieldbus specifications – Part 4-3: Data-link layer protocol specification – Type 3 elements*

IEC 61158-5-3, *Industrial communication networks – Fieldbus specifications – Part 5-3: Application layer service definition – Type 3 elements*

IEC 61158-6-3, *Industrial communication networks – Fieldbus specifications – Part 6-3: Application layer protocol specification – Type 3 elements*

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