IEC 61158-4-4

Edition 2.0   2014-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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

IEC 61158-4-4:2014-08(en-fr)

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-4: Data-link layer protocol specification – Type 4 elements

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NOTE   Combinations of protocol types are specified in IEC 61784-1 and IEC 61784-2.

International Standard IEC 61158-4-4 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes an editorial revision with only minor editorial changes.

This edition includes the following significant changes with respect to the previous edition:

a) editorial improvements;
b) editorial corrections.

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/762/FDIS	65C/772/RVD

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

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

A list of all the parts of the IEC 61158 series, under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under http://webstore.iec.ch in the data related to the specific publication. At this date, the publication will be:

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• withdrawn;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

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.

The data-link protocol provides the data-link service by making use of the services available from the physical layer. The primary aim of this standard is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer data-link entities (DLEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

a) as a guide for implementors and designers;

b) for use in the testing and procurement of equipment;

c) as part of an agreement for the admittance of systems into the open systems environment;

d) as a refinement to the understanding of time-critical communications within OSI.

This standard is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this standard together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –**

**Part 4-4: Data-link layer protocol specification –
Type 4 elements**

1 Scope

1.1 General

The data-link layer provides basic time-critical messaging communications between devices in an automation environment.

This protocol provides a means of connecting devices through a partial mesh network, such that most failures of an interconnection between two devices can be circumvented. In common practice the devices are interconnected in a non-redundant hierarchical manner reflecting application needs

1.2 Specifications

This standard specifies

a) procedures for the timely transfer of data and control information from one data-link user entity to a peer user entity, and among the data-link entities forming the distributed data-link service provider;

b) the structure of the fieldbus DLPDUs used for the transfer of data and control information by the protocol of this standard, and their representation as physical interface data units.

1.3 Procedures

The procedures are defined in terms of

a) the interactions between peer DL-entities (DLEs) through the exchange of fieldbus DLPDUs;

b) the interactions between a DL-service (DLS) provider and a DLS-user in the same system through the exchange of DLS primitives;

c) the interactions between a DLS-provider and a Ph-service provider in the same system through the exchange of Ph-service primitives.

1.4 Applicability

These procedures are applicable to instances of communication between systems which support time-critical communications services within the data-link layer of the OSI or fieldbus reference models, and which require the ability to interconnect in an open systems interconnection environment.

Profiles provide a simple multi-attribute means of summarizing an implementation's capabilities, and thus its applicability to various time-critical communications needs.

1.5 Conformance

This standard also specifies conformance requirements for systems implementing these procedures. This standard does not contain tests to demonstrate compliance with such requirements.

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.

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*

3   Terms, definitions, symbols and abbreviations

For the purposes of this document, the following terms, definitions, symbols and abbreviations 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	**called-DL-address**	[7498-3]
3.1.2	**calling-DL-address**	[7498-3]
3.1.3	**centralized multi-end-point-connection**	[7498-1]
3.1.4	**correspondent (N)-entities** **correspondent DL-entities (N=2)** **correspondent Ph-entities (N=1)**	[7498-1]
3.1.5	**demultiplexing**	[7498-1]
3.1.6	**DL-address**	[7498-3]
3.1.7	**DL-address-mapping**	[7498-1]
3.1.8	**DL-connection**	[7498-1]
3.1.9	**DL-connection-end-point**	[7498-1]
3.1.10	**DL-connection-end-point-identifier**	[7498-1]
3.1.11	**DL-connection-mode transmission**	[7498-1]
3.1.12	**DL-connectionless-mode transmission**	[7498-1]
3.1.13	**DL-data-sink**	[7498-1]
3.1.14	**DL-data-source**	[7498-1]

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

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

3.1.43 **Ph-interface-control-information**   [7498-1]

3.1.44 **Ph-interface-data**   [7498-1]

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

3.1.46 **reassembling**   [7498-1]

3.1.47 **recombining**   [7498-1]

3.1.48 **reset**   [7498-1]

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

3.1.50 **routing**   [7498-1]

3.1.51 **segmenting**   [7498-1]

3.1.52 **sequencing**   [7498-1]

3.1.53 **splitting**   [7498-1]

3.1.54 **synonymous name**   [7498-3]

3.1.55 **systems-management**   [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 DL-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 Terms and definitions

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

**3.3.1
broadcast-Node-address**
address used to send broadcasts to all DLEs on a Link

Note 1 to entry: All DLEs on a Link receive all DLPDUs where the first Node-address is equal to the Broadcast-Node-Address. Such DLPDUs are always Unconfirmed, and their receipt is never acknowledged. The value of a Broadcast-Node-address is 126.

**3.3.2
destination-DL-route**
holds a sequence of DL-route-elements, describing the complete route to the destination

Note 1 to entry: This includes both the destination DLSAP and a local component meaningful to the destination DLS-user.

**3.3.3
DL-route**
combination of a Destination-DL-route and a Source-DL-route

**3.3.4
DL-route-element**
octet holding a Node-address or an address used by the DLS-user

**3.3.5
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.

**3.3.6
DL(SAP)-address**
an individual DLSAP-address, designating a single DLSAP of a single DLS-user

**3.3.7
(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.

3.3.8
frame
denigrated synonym for DLPDU

3.3.9
IPNetID
identification of a unique IP network

Note 1 to entry: An IPNetID is translated into an IP-address and a UPD port number.

3.3.10
IPNetTable
definition of the relation between IPNetID, IP address, UPD port number and Router NodeAddress, where IPNetID is used as index in the table

3.3.11
IP Range net
defines use for local access, where nodes can be accessed directly on the same subnet as the client, or through a local Router where the subnets are configured in the local Router

3.3.12
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

3.3.13
no-Confirm-Node-address
address used to indicate that a request or response is Unconfirmed

Note 1 to entry: The value of a No-Confirm-Node-address is 0.

3.3.14
node
single DL-entity as it appears on one local link

3.3.15
node-address
address which uniquely identifies a DLE on a Link

Note 1 to entry: The value of a Node-address can be in the range of 0 to 127, with the values 0, 126 and 127 reserved for special purposes.

3.3.16
normal class device
device which replies to requests from other normal class devices, and initiates transmissions

Note 1 to entry: Such a device can act as a server (responder) and as a client (requestor) - this is also called a peer.

3.3.17
Type 4-route
holds a sequence of Type 4-route-elements

Note 1 to entry: A Type 4-route is defined as an encoded DL-route, with one of the formats used when transmitting the DLPDU on the Link. The Type 4-route format can be Simple, Extended, Complex, Immediate or IP.