

**DIN EN IEC 61784-2**

ICS 35.100.20; 35.160

Ersatz für  
DIN EN 61784-2:2015-02  
Siehe Anwendungsbeginn

**Industrielle Kommunikationsnetze –  
Profile –****Teil 2: Zusätzliche Feldbusprofile für Echtzeitnetzwerke basierend auf  
ISO/IEC 8802-3****(IEC 61784-2:2019);****Englische Fassung EN IEC 61784-2:2019, nur auf CD-ROM**

Industrial communication networks –

Profiles –

Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC/IEEE 8802-3  
(IEC 61784-2:2019);

English version EN IEC 61784-2:2019, only on CD-ROM

Réseaux de communication industriels –

Profils –

Partie 2: Profils de bus de terrain supplémentaires pour les réseaux en temps réel basés  
sur l'ISO/CEI 8802-3

(IEC 61784-2:2019);

Version anglaise EN IEC 61784-2:2019, seulement en CD-ROM

Gesamtumfang 390 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE

## **Anwendungsbeginn**

Anwendungsbeginn für die von CENELEC am 2019-05-15 angenommene Europäische Norm als DIN-Norm ist 2020-07-01.

Für DIN EN 61784-2:2015-02 besteht eine Übergangsfrist bis 2022-05-15.

## **Nationales Vorwort**

*Vorausgegangener Norm-Entwurf: E DIN EN 61784-2:2018-02.*

Für dieses Dokument ist das nationale Arbeitsgremium K 956 „Industrielle Kommunikation“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE ([www.dke.de](http://www.dke.de)) zuständig.

Die enthaltene IEC-Publikation wurde vom SC 65C „Industrial networks“ erarbeitet.

Das IEC-Komitee hat entschieden, dass der Inhalt dieses Dokuments bis zu dem Datum (stability date) unverändert bleiben soll, das auf der IEC-Website unter „<http://webstore.iec.ch>“ zu diesem Dokument angegeben ist. Zu diesem Zeitpunkt wird entsprechend der Entscheidung des Komitees das Dokument

- bestätigt,
- zurückgezogen,
- durch eine Folgeausgabe ersetzt oder
- geändert.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf ein Dokument ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils aktuellste Ausgabe des in Bezug genommenen Dokuments.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe des Dokuments.

Der Zusammenhang der zitierten Dokumente mit den entsprechenden deutschen Dokumenten ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der EN IEC 61784-2:2019 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und Teilen des Abschnitts 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für die meisten der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Das Original-Dokument enthält Bilder in Farbe, die in der Papierversion in einer Graustufen-Darstellung wiedergegeben werden. Elektronische Versionen dieses Dokuments enthalten die Bilder in der originalen Farbdarstellung.

## Änderungen

Gegenüber DIN EN 61784-2:2015-02 wurden folgende Änderungen vorgenommen:

- a) Im gesamten Dokument Aktualisierung der datierten Verweisungen bezüglich der Reihe IEC 61158, IEC 61784-1, Reihe IEC 61784-3, Reihe IEC 61784-5 und der IEC 61918;
- b) Aktualisierung der Auswahltablette CPF 2, CPF 3, CPF 4, CPF 8 und CPF 17;
- c) CPF 3: Aktualisierung der Anforderungen aller Konformitätsklassen;
- d) CPF 3 Aktualisierung der Timing-Anforderungen für IO-Geräte;
- e) CPF 3: Verfeinerung der hinzugefügten Anwendungsklassen;
- f) Ergänzung einer neuen Kommunikationsprofilfamilie CPF 20 in Abschnitt 21;
- g) Ergänzung einer neuen Kommunikationsprofilfamilie CPF 21 in Abschnitt 22.

## Frühere Ausgaben

DIN EN 61784-2: 2008-10, 2011-04, 2015-02

## Nationaler Anhang NA (informativ)

### Auszugsweise Übersetzung

Reihenfolge und Inhalt der folgenden Abschnitte sind identisch mit denen in den jeweiligen Abschnitten der Englischen Fassung.

## 1 Anwendungsbereich

Dieser Teil der IEC 61784 legt Folgendes fest:

- Leistungskennzahlen zur Unterstützung von Klassifizierungsschemata für Anforderungen an das Echtzeit-Ethernet;
- Profile und verwandte Netzwerkkomponenten auf Grundlage von ISO/IEC 8802-3 oder IEEE 802.3, der IEC 61158 Normenreihe und IEC 61784-1;
- RTE-Lösungen, die parallel zu Anwendungen nach ISO/IEC 8802-3 oder IEEE 802.3 laufen können.

Diese Kommunikationsprofile werden als Echtzeit-Ethernet-Kommunikationsprofile bezeichnet.

**ANMERKUNG** Die RTE-Kommunikationsprofile nutzen Kommunikationsnetzwerke und verwandte Netzwerkkomponenten nach ISO/IEC 8802-3 oder IEEE 802.3 oder IEC 61588. In einigen Fällen kann eine Anpassung dieser Normen erfolgt sein, um RTE-Merkmale zu erhalten.

## 3 Begriffe, Abkürzungen und Vereinbarungen

### 3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die Begriffe nach ISO/IEC/IEEE 8802-3, IEEE 802, IEEE 802.1AB, IEEE 802.1AS, IEEE 802.1D, IEEE 802.1Q und die folgenden Begriffe.

ISO und IEC stellen terminologische Datenbanken für die Verwendung in der Normung unter den folgenden Adressen bereit:

- IEC Electropedia: verfügbar unter <http://www.electropedia.org/>
- ISO Online Browsing Platform: verfügbar unter <http://www.iso.org/obp>

#### 3.1.1

##### **aktives Netz**

(en: active network)

Netz, in dem die Datenübertragung zwischen nicht direkt verbundenen Geräten von aktiven Elementen in den Geräten abhängt, die die Verbindung herstellen

[QUELLE: IEC 61918:2018, 3.1.3]

#### 3.1.2

##### **Kommunikationszyklus**

(en: communication cycle)

<CPF 16>

festgelegte Zeitdauer zwischen zwei Master-Synchronisationstelegrammen

#### 3.1.3

##### **zyklisch**

(en: cyclic)

sich regelmäßig wiederholend

**3.1.4****Domäne**

(en: domain)

&lt;CPF 10&gt;

Teil des Netzwerks, der aus einem oder zwei Subnetzen besteht

Anmerkung 1 zum Begriff: Zwei Subnetze sind für ein zweifach redundantes Netzwerk erforderlich und jede Endstation in der Domäne ist mit beiden Subnetzen verbunden.

**3.1.5****Endstation**

(en: end-station)

an ein Netzwerk angeschlossenes System, das eine erste Quelle oder ein letztes Ziel von MAC-Rahmen, die über dieses Netzwerk übertragen werden, ist

Anmerkung 1 zum Begriff: Aus der Sicht des Netzwerks ist ein Router der Netzwerkschicht eine Endstation. Ein Switch stellt in seiner Funktion zur Weiterleitung von MAC-Rahmen von einem Verbindungszweig auf einen anderen Verbindungszweig keine Endstation dar.

**3.1.6****Feldbereich**

(en: field area)

Bereich am Ort der Produktion oder des Prozesses, in dem Feldgeräte angeordnet sind

**3.1.7****Rahmen**

(en: frame)

Datenübertragungseinheit auf der MAC-Unterschicht (en: media access control), basierend auf ISO/IEC 8802-3, die eine Protokolldateneinheit (en: protocol data unit; PDU) zwischen MAC-Dienstbenutzern übermittelt

[QUELLE: IEEE 802.1Q]

**3.1.8****Identifikationsnummer**

(en: identification number; IDN)

&lt;CPF 16&gt;

Kennzeichnung von Betriebsdaten, unter der ein Datenblock mit seinem Attribut, seinem Namen, seiner Einheit, seinen minimalen und maximalen Eingabewerten und den Daten aufbewahrt wird

**3.1.9****IP-Kanal**

(en: IP channel)

&lt;CPF 16&gt;

festgelegtes Zeitfenster innerhalb des Kommunikationszyklus, in dem Ethernet-Protokollrahmen, basierend auf ISO/IEC 8802-3, weitergegeben werden (Nicht-Echtzeit-Kommunikation)

**3.1.10****Jitter**

(en: jitter)

zeitliche Veränderung des Taktsignals oder zeitliche Veränderung eines anderen regelmäßigen Ereignisses

**3.1.11****lineare Topologie**

(en: linear topology)

Topologie, in der die Knoten hintereinander geschaltet sind, wobei zwei Knoten lediglich mit jeweils einem weiteren Knoten und alle anderen Knoten jeweils mit zwei weiteren Knoten verbunden sind (entspricht einer Verbindung in Form einer Linie)

[QUELLE: IEC 61918:2018, 3.1.44]

### 3.1.12

#### **Verbindung**

(en: link)

Übertragungspfad zwischen zwei benachbarten Knoten

[QUELLE: abgeleitet von ISO/IEC 11801:2002]

### 3.1.13

#### **logische Doppellinie**

(en: logical double line)

<CPF 18>

Reihung des Root-Gerätes und sämtlicher gewöhnlicher Geräte, die die Kommunikations-DLPDU in Vorwärts- und Rückwärtsrichtung verarbeiten

### 3.1.14

#### **Master**

(en: master)

<CPF 16>

Knoten, der den anderen Knoten das Recht zur Übertragung zuweist

### 3.1.15

#### **Nachricht**

(en: message)

geordnete Folge von Oktetten für die Übermittlung von Informationen

Anmerkung 1 zum Begriff: Nachrichten werden normalerweise für die Übermittlung von Informationen zwischen Peers auf dem Application Layer verwendet.

[QUELLE: IEC 61158-1]

### 3.1.16

#### **MDT0-Telegramm**

(MDT0 telegram)

<CPF 16>

Telegramm, mit dem der Master seine Synchronisationsdaten sowie alle seine Echtzeitdaten oder Teile davon an die Slaves überträgt

### 3.1.17

#### **Knoten**

(en: node)

Netzwerkeinheit, die mit einem oder mehreren Verbindungszweigen verbunden ist

Anmerkung 1 zum Begriff: Ein Knoten kann entweder ein Switch, eine Endstation oder eine RTE-Endstation sein.

### 3.1.18

#### **Paket**

(en: packet)

logische Gruppierung von Informationen, die zur Beschreibung einer Dateneinheit auf einer beliebigen Schicht verwendet wird, um die Benutzerdaten der höheren Schicht an die entsprechende Peer-Schicht zu übermitteln

Anmerkung 1 zum Begriff: Im Sinne des OSI-Referenzmodells entspricht ein Paket auf jeder Schicht der PDU. Ein Data-Link Layer Paket ist ein Rahmen.

### 3.1.19

#### **Echtzeit**

(en: real-time)

Fähigkeit eines Systems, ein erforderliches Ergebnis in einer begrenzten Zeit bereitzustellen

### 3.1.20

#### **Echtzeit-Kommunikation**

(en: real-time communication)

Transfer von Daten in Echtzeit

**3.1.21****Echtzeit-Ethernet**

(en: real-time ethernet; RTE)

Netzwerk, das auf ISO/IEC 8802-3 oder IEEE 802.3 basiert und Echtzeit-Kommunikation unterstützt

Anmerkung 1 zum Begriff: Sofern die Echtzeit-Kommunikation nicht beeinträchtigt wird, können andere Kommunikationsarten unterstützt werden.

Anmerkung 2 zum Begriff: Diese Definition bezieht sich auf ISO/IEC 8802-3, ist aber nicht darauf beschränkt. Sie könnte auch auf andere IEEE-802-Spezifikationen, z. B. IEEE 802.11, anwendbar sein.

**3.1.22****RTFL**

(en: real time frame line)

&lt;CPF 18&gt;

Kommunikationsmodell mit Geräten, die in einer logischen Doppellinie kommunizieren

**3.1.23****RTFN**

(en: real time frame network)

&lt;CPF 18&gt;

Kommunikationsmodell mit Geräten, die in einem vermittelten Netzwerk kommunizieren

**3.1.24****Ring**

(en: ring)

aktives Netz, in dem jeder Knoten mit zwei weiteren Knoten in Reihe geschaltet ist

Anmerkung 1 zum Begriff: Ein Ring kann auch als Schleife bezeichnet werden.

[QUELLE: IEC 61918:2018, 3.1.63, geändert – Die Anmerkung zum Eintrag wurde hinzugefügt.]

**3.1.25****Router**

(en: router)

&lt;CPF 10&gt;

Zwischeneinrichtung, die zwei oder mehr Subnetze mittels einer Netzwerkschicht-Relais-Funktion verbindet

**3.1.26****RTE-Endgerät**

(en: RTE end device)

Gerät mit mindestens einer RTE-Endstation

**3.1.27****RTE-Endstation**

(en: RTE end-station)

Endstation mit RTE-Funktion

**3.1.28****Plan**

(en: schedule)

zeitliche Einteilung einer Menge von in Beziehung stehenden Operationen

**3.1.29****Stern**

(en: star)

Netz aus drei oder mehr Geräten, bei dem alle Geräte an einem zentralen Punkt angeschlossen sind

[QUELLE: IEC 61918:2018, 3.1.69, modifiziert – „der aktiv oder passiv sein kann“ wurde gelöscht.]

### 3.1.30

#### Subnetz

(en: subnetwork)

<CPF 10>

Teil des Netzwerks, der keine Router umfasst

Anmerkung 1 zum Begriff: Ein Subnetz besteht aus Endstationen, Bridges und Segmenten.

Anmerkung 2 zum Begriff: Jede in ein Subnetz eingeschlossene Endstation hat dieselbe IP-Netzwerkadresse.

### 3.1.31

#### Switch

(en: switch)

MAC-Bridge nach der Definition in IEEE 802.1Q

### 3.1.32

#### Telegramm

(en: telegram)

<CPF 16>

Rahmen

## 3.2 Abkürzungen

|         |                                                                   |
|---------|-------------------------------------------------------------------|
| AL      | Application Layer                                                 |
| APDU    | Application Protocol Data Unit                                    |
| API     | Application Process Identifier                                    |
| AR      | Application Relationship                                          |
| ARP     | Address Resolution Protocol                                       |
| ASE     | Application Service Element                                       |
| CP      | Kommunikationsprofil [nach IEC 61784-1]                           |
| CPF     | Kommunikationsprofilfamilie [nach IEC 61784-1]                    |
| CRC     | Cyclic Redundancy Check                                           |
| CSMA-CD | Carrier Sense Multiple Access with Collision Detection            |
| DA      | Destination MAC Address                                           |
| DCP     | Discovery and basic Configuration Protocol (siehe IEC 61158-6-10) |
| DHCP    | Dynamic Host Configuration Protocol (siehe IETF RFC 2131)         |
| DL      | Data-Link layer (as a prefix)                                     |
| DLL     | DL-Layer                                                          |
| DNS     | Domain Name Service (siehe IETF RFC 1034)                         |
| DUT     | Prüfling                                                          |
| ECSME   | EPA Communication Scheduling Management Entity                    |
| FA      | Fabrik Automation                                                 |
| FCS     | Frame check sequence                                              |
| FrameID | Frame Identifier (siehe IEC 61158-6-10)                           |
| GSD     | General station description                                       |
| HW      | Hardware                                                          |
| IANA    | Internet Assigned Numbers Authority                               |
| ICMP    | Internet Control Message Protocol (siehe IETF RFC 792)            |
| ID      | Identifier                                                        |
| IDN     | IDentification Number                                             |

|             |                                                                                        |
|-------------|----------------------------------------------------------------------------------------|
| IETF        | Internet Engineering Task Force                                                        |
| IO          | Input Output                                                                           |
| IP          | Internetprotokoll (siehe IETF RFC 791)                                                 |
| IPv4        | Internetprotokoll Version 4 (siehe IETF RFC 791)                                       |
| IRT         | Isochronous RT                                                                         |
| LAN         | Local Area Network                                                                     |
| LLC         | Logical Link Control                                                                   |
| LLDP        | Link Layer Discovery Protocol (siehe IEEE 802.1AB)                                     |
| MAC         | Media Access Control                                                                   |
| MAC         | Media Access Control (siehe ISO/IEC/IEEE 8802-3)                                       |
| Mbit/s      | Millionen Bits je Sekunde                                                              |
| Moctets/s   | Millionen Bytes je Sekunde                                                             |
| MCR         | Multicast communication relation                                                       |
| MIB         | Management Information base                                                            |
| MRP         | Medium redundancy protocol (siehe IEC 62439-2)                                         |
| MRPD        | Media redundancy for planned duplication                                               |
| ms          | Millisekunden                                                                          |
| n.a.        | Nicht anwendbar                                                                        |
| NoS         | Number of Switches                                                                     |
| NRT         | Nicht-Echtzeit                                                                         |
| PDU         | Protocol Data Unit                                                                     |
| PI          | Performance Indikator                                                                  |
| ns          | Nanosekunde                                                                            |
| OID         | Object Identifier (siehe IETF RFC 1157)                                                |
| PDU         | Protocol Data Unit                                                                     |
| PhL         | Physical Layer                                                                         |
| Phy         | PHY Physical layer entity sublayer (siehe ISO/IEC/IEEE 8802-3 )                        |
| pps         | Pakete je Sekunde                                                                      |
| PTCP        | Precision Transparent Clock Protocol                                                   |
| PTP         | Precision Time Protocol [IEC 61588]                                                    |
| RPC         | Remote Procedure Call (siehe The Open Group – Publication C706)                        |
| RSTP        | Rapid Spanning Tree Algorithm and Protocol (siehe IEEE 802.1Q)                         |
| RT          | Echtzeit                                                                               |
| RTA         | Echtzeit-Protokoll azyklisch                                                           |
| RTE         | Echtzeit-Ethernet                                                                      |
| RT-Ethernet | Echtzeit-Ethernet                                                                      |
| RTFL        | Echtzeit-Rahmen-Linie                                                                  |
| RTFN        | Echtzeit-Rahmen-Netz                                                                   |
| RTO         | Retransmission Time Out<br>[nach IETF RFC 2988 – Computing TCP's Retransmission Timer] |
| RTPS        | Real-Time Publish-Subscribe                                                            |
| SERCOS      | SERial Real time COmmunication System                                                  |

|      |                                                          |
|------|----------------------------------------------------------|
| SNMP | Simple Network Management Protocol (siehe IETF RFC 1157) |
| TCC  | Time-Critical Cyclic                                     |
| TCP  | Transmission Control Protocol (siehe IETF RFC 793)       |
| TOS  | Type of Service                                          |
| UDP  | User Datagram Protocol (siehe IETF RFC 768)              |
| VLAN | Virtual LAN                                              |

### 3.4 Vereinbarungen

#### 3.4.1 Allgemeine Vereinbarungen für alle Schichten

##### 3.4.1.1 (Unter-)Abschnitt Auswahl-Tabellen

Die (Unter-)Abschnitt-Auswahl für alle Schichten ist in Tabellen definiert, wie in Tabelle 1 und Tabelle 2 dargestellt. Die ausgewählten Basisspezifikationen werden kurz vor der/den Auswahltable(n) angezeigt. Die Auswahl erfolgt auf der höchstmöglichen (Unter-)Abschnittsebene, um die Profilauswahl eindeutig zu definieren.

**Tabelle 1 – Layout für Profile (Unter-)Abschnitt-Auswahl-Tabellen**

| Abschnitt | Kopfzeile | Vorhanden sein | Einschränkungen |
|-----------|-----------|----------------|-----------------|
|           |           |                |                 |

**Tabelle 2 – Inhalt der (Unter-)Abschnitt-Auswahl-Tabellen**

| Spalte          | Text               | Bedeutung                                                                                                                           |
|-----------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Abschnitt       | <#>                | (Unter-)Abschnittnummer der Basisspezifikationen                                                                                    |
|                 | Nächster Abschnitt | alle folgenden Abschnitte bis zum letzten Abschnitt der Basisspezifikation                                                          |
|                 | Nächste Anhänge    | alle folgenden Anhänge bis zum letzten Anhang der Basisspezifikation                                                                |
| Kopfzeile       | <text>             | (Unter-)Abschnittstitel der Basisspezifikationen                                                                                    |
| Vorhandensein   | NO                 | Dieser (Unter-)Abschnitt ist nicht im Profil enthalten                                                                              |
|                 | YES                | Dieser (Unter-)Abschnitt ist vollständig (100 %) im Profil enthalten.<br>In diesem Fall werden keine weiteren Details angegeben.    |
|                 | —                  | Das Vorhandensein wird in den folgenden Unterabschnitten definiert                                                                  |
|                 | Partiell           | Teile dieses (Unter-)Abschnitts sind im Profil enthalten                                                                            |
|                 | Optional           | Dieser (Unter-)Abschnitt kann zusätzlich in das Profil aufgenommen werden                                                           |
| Einschränkungen | Siehe <#>          | Einschränkungen/Bemerkungen sind in dem angegebenen (Unter-)Abschnitt, in der Tabelle oder im Bild dieses Profildokuments definiert |
|                 | —                  | Keine anderen Einschränkungen als die im Referenzdokument-(Unter-)Abschnitt angegeben, oder nicht anwendbar                         |
|                 | <text>             | Der Text definiert die Einschränkung direkt, bei längerem Text können Fußnoten oder Tabellennotizen verwendet werden                |

Wenn Sequenzen von (Unter-)Abschnitten nicht mit dem Profil übereinstimmen, werden die Zahlen verkettet.

BEISPIEL Verkettete Unterabschnitte

|           |   |      |   |
|-----------|---|------|---|
| 3.4 – 3.7 | — | Nein | — |
|-----------|---|------|---|

### 3.4.1.2 Dienst-Auswahl-Tabellen

Wenn die Auswahl der Dienste in einer Tabelle definiert ist, wird das Format der Tabelle 3 verwendet. Die Tabelle identifiziert die ausgewählten Dienste und enthält Dienst-Einschränkungen, wie in Tabelle 4 erläutert.

**Tabelle 3 – Layout der Dienst-Auswahl-Tabellen**

| Dienst ref. | Dienst-Name | Verwendung | Einschränkung |
|-------------|-------------|------------|---------------|
|             |             |            |               |

**Tabelle 4 – Inhalte der Dienst-Auswahl-Tabellen**

| Spalte          | Text      | Bedeutung                                                                                                                           |
|-----------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------|
| Dienst ref.     | <#>       | (Unter-)Abschnittnummer der Basisspezifikationen, in denen der Dienst definiert ist                                                 |
|                 | —         | Nicht anwendbar                                                                                                                     |
| Dienst-Name     | <text>    | Der Name des Dienstes                                                                                                               |
| Verwendung      | M         | Mandatory                                                                                                                           |
|                 | O         | Optional                                                                                                                            |
|                 | —         | Dienst wird nie genutzt                                                                                                             |
| Einschränkungen | Siehe <#> | Einschränkungen/Bemerkungen sind in dem angegebenen (Unter-)Abschnitt, in der Tabelle oder im Bild dieses Profildokuments definiert |
|                 | —         | Keine anderen Einschränkungen als die im Referenzdokument-(Unter-)Abschnitt angegeben, oder nicht anwendbar                         |
|                 | <text>    | Der Text definiert die Einschränkung direkt, bei längerem Text können Fußnoten oder Tabellennotizen verwendet werden.               |

Wenn die Auswahl der Serviceparameter in einer Tabelle definiert ist, wird das Format der Tabelle 5 verwendet. Jede Tabelle identifiziert die ausgewählten Parameter und enthält Parametereinschränkungen, wie in Tabelle 6 erläutert.

**Tabelle 5 – Layout der Parameter-Auswahl-Tabelle**

| Parameter ref. | Parameter Name | Verwendung | Einschränkung |
|----------------|----------------|------------|---------------|
|                |                |            |               |

**Tabelle 6 – Inhalte der Parameter-Auswahl-Tabelle**

| Spalte          | Text      | Bedeutung                                                                                                                           |
|-----------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------|
| Parameter ref.  | <#>       | (Unter-)Abschnittnummer der Basisspezifikationen, in denen der Dienst definiert ist                                                 |
|                 | —         | Nicht anwendbar                                                                                                                     |
| Parameter Name  | <text>    | Der Name des Dienstparameters                                                                                                       |
| Verwendung      | M         | Obligatorisch                                                                                                                       |
|                 | O         | Optional                                                                                                                            |
|                 | —         | Attribut ist nie vorhanden                                                                                                          |
| Einschränkungen | Siehe <#> | Einschränkungen/Bemerkungen sind in dem angegebenen (Unter-)Abschnitt, in der Tabelle oder im Bild dieses Profildokuments definiert |
|                 | —         | Keine anderen Einschränkungen als die im Referenzdokument (Unter-)Abschnitt angegeben, oder nicht anwendbar                         |
|                 | <text>    | Der Text definiert die Einschränkung direkt, bei längerem Text können Fußnoten oder Tabellennotizen verwendet werden.               |

### 3.4.2 Physical layer

Keine zusätzlichen Vereinbarungen sind definiert.

### 3.4.3 Data-link layer

#### 3.4.3.1 Dienst-Profil-Vereinbarungen

Keine zusätzlichen Vereinbarungen sind definiert.

#### 3.4.3.2 Dienste- und Parameter-Auswahl

Diese werden mit den üblichen Vereinbarungen beschrieben, siehe 3.4.1.2.

### 3.4.4 Application layer

#### 3.4.4.1 Dienst-Profil-Vereinbarungen

Das ASE und die Klassenauswahl wird durch (Unter-)Abschnitt-Auswahl-Tabellen beschrieben, siehe 3.4.1.1. Wenn die Verwendung ausgewählter ASE und Klassen weiter eingeschränkt ist, wird dies im Profil angegeben (z. B. ist ein optionales Element der Basisnorm im Profil obligatorisch).

Wenn die Auswahl der Klassenattribute in einer Tabelle definiert ist, wird das Format der Tabelle 7 verwendet. Die Tabelle identifiziert die ausgewählten Klassenattribute und beinhaltet deren Einschränkungen, wie in Tabelle 8 erläutert.

**Tabelle 7 – Layout der Klassenattribut-Auswahltabellen**

| Attribut | Attribut Name | Verwendung | Einschränkung |
|----------|---------------|------------|---------------|
|          |               |            |               |

**Tabelle 8 – Inhalt der Klassenattribut-Auswahl-Tabellen**

| Spalte         | Text      | Bedeutung                                                                                                                           |
|----------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------|
| Attribute      | <#>       | Attributsnummer der Basisspezifikationsklasse                                                                                       |
|                | –         | Nicht anwendbar                                                                                                                     |
| Attributs-Name | <text>    | Der Name des Attributs                                                                                                              |
| Verwendung     | M         | Obligatorisch                                                                                                                       |
|                | O         | Optional                                                                                                                            |
|                | –         | Attribut ist nie vorhanden                                                                                                          |
| Einschränkung  | Siehe <#> | Einschränkungen/Bemerkungen sind in dem angegebenen (Unter-)Abschnitt, in der Tabelle oder im Bild dieses Profildokuments definiert |
|                | –         | Keine anderen Einschränkungen als die im Referenzdokument (Unter-)Abschnitt angegeben, oder nicht anwendbar                         |
|                | <text>    | Der Text definiert die Einschränkung direkt, bei längerem Text können Fußnoten oder Tabellennotizen verwendet werden                |

#### 3.4.4.2 Dienste- und Parameter-Auswahl

Diese werden mit den üblichen Vereinbarungen beschrieben, siehe 3.4.1.2.

– Leerseite –

English Version

**Industrial communication networks - Profiles - Part 2: Additional  
fieldbus profiles for real-time networks based on ISO/IEC/IEEE  
8802-3  
(IEC 61784-2:2019)**

Réseaux de communication industriels - Profils - Partie 2:  
Profils de bus de terrain supplémentaires pour les réseaux  
en temps réel basés sur l'ISO/CEI 8802-3  
(IEC 61784-2:2019)

Industrielle Kommunikationsnetze - Profile - Teil 2:  
Zusätzliche Feldbusprofile für Echtzeitnetzwerke basierend  
auf ISO/IEC 8802-3  
(IEC 61784-2:2019)

This European Standard was approved by CENELEC on 2019-05-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## **European foreword**

The text of document 65C/943/FDIS, future edition 4 of IEC 61784-2, 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 IEC 61784-2:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by (dop) 2020-02-15  
publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2022-05-15  
document have to be withdrawn

This document supersedes EN 61784-2:2014.

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

## **Endorsement notice**

The text of the International Standard IEC 61784-2:2019 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:

|                       |      |                                        |
|-----------------------|------|----------------------------------------|
| ISO/IEC 9646 (series) | NOTE | Harmonized as EN ISO/IEC 9646 (series) |
|-----------------------|------|----------------------------------------|

## Annex ZA (normative)

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

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where 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](http://www.cenelec.eu).

| Publication    | Year   | Title                                                                                                                              | EN/HD             | Year   |
|----------------|--------|------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------|
| IEC 61158      | series | Industrial communication networks – Fieldbus specifications                                                                        | –                 | series |
| IEC 61158-1    | 2019   | Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series | EN IEC 61158-1    | 2019   |
| IEC 61158-2    | 2014   | Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition          | EN 61158-2        | 2014   |
| IEC 61158-3-2  | 2014   | Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements       | EN 61158-3-2      | 2014   |
| IEC 61158-3-4  | 2019   | Industrial communication networks – Fieldbus specifications – Part 3-4: Data-link layer service definition – Type 4 elements       | EN IEC 61158-3-4  | 2019   |
| IEC 61158-3-11 | 2007   | Industrial communication networks – Fieldbus specifications – Part 3-11: Data-link layer service definition – Type 11 elements     | EN 61158-3-11     | 2008   |
| IEC 61158-3-12 | 2019   | Industrial communication networks – Fieldbus specifications – Part 3-12: Data-link layer service definition – Type 12 elements     | –                 | –      |
| IEC 61158-3-13 | 2014   | Industrial communication networks – Fieldbus specifications – Part 3-13: Data link layer service definition – Type 13 elements     | EN 61158-3-13     | 2014   |
| IEC 61158-3-14 | 2014   | Industrial communication networks – Fieldbus specifications – Part 3-14: Data-link layer service definition – Type 14 elements     | EN 61158-3-14     | 2014   |
| IEC 61158-3-17 | 2007   | Industrial communication networks – Fieldbus specifications – Part 3-17: Data-link layer service definition – Type 17 elements     | EN 61158-3-17     | 2008   |
| IEC 61158-3-19 | 2019   | Industrial communication networks – Fieldbus specifications – Part 3-19: Data-link layer service definition – Type 19 elements     | EN IEC 61158-3-19 | 2019   |

|                |      |                                                                                                                                     |                   |      |
|----------------|------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------|------|
| IEC 61158-3-21 | 2019 | Industrial communication networks – Fieldbus specifications – Part 3-21: Data-link layer service definition – Type 21 elements      | EN IEC 61158-3-21 | 2019 |
| IEC 61158-3-22 | 2014 | Industrial communication networks – Fieldbus specifications – Part 3-22: Data-link layer service definition – Type 22 elements      | EN 61158-3-22     | 2014 |
| IEC 61158-3-25 | 2019 | Industrial communication networks – Fieldbus specifications – Part 3-25: Data-link layer service definition – Type X elements       | EN IEC 61158-3-25 | 2019 |
| IEC 61158-4-2  | 2019 | Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements    | EN IEC 61158-4-2  | 2019 |
| IEC 61158-4-4  | 2019 | Industrial communication networks – Fieldbus specifications – Part 4-4: Data-link layer protocol specification – Type 4 elements    | EN IEC 61158-4-4  | 2019 |
| IEC 61158-4-11 | 2014 | Industrial communication networks – Fieldbus specifications – Part 4-11: Data-link layer protocol specification – Type 11 elements  | EN 61158-4-11     | 2014 |
| IEC 61158-4-12 | 2019 | Industrial communication networks – Fieldbus specifications – Part 4-12: Data-link layer protocol specification – Type 12 elements  | EN IEC 61158-4-12 | 2019 |
| IEC 61158-4-13 | 2014 | Industrial communication networks – Fieldbus specifications – Part 4-13: Data-link layer protocol specification – Type 13 elements  | EN 61158-4-13     | 2014 |
| IEC 61158-4-14 | 2014 | Industrial communication networks – Fieldbus specifications – Part 4-14: Data-link layer protocol specification – Type 14 elements  | EN 61158-4-14     | 2014 |
| IEC 61158-4-17 | 2007 | Industrial communication networks – Fieldbus specifications – Part 4-17: Data-link layer protocol specification – Type 17 elements  | EN 61158-4-17     | 2008 |
| IEC 61158-4-19 | 2019 | Industrial communication networks – Fieldbus specifications – Part 4 -19: Data-link layer protocol specification – Type 19 elements | EN IEC 61158-4-19 | 2019 |
| IEC 61158-4-21 | 2019 | Industrial communication networks – Fieldbus specifications – Part 4-21: Data-link layer protocol specification – Type 21 elements  | EN IEC 61158-4-21 | 2019 |
| IEC 61158-4-22 | 2014 | Industrial communication networks – Fieldbus specifications – Part 4-22: Data-link layer protocol specification – Type 22 elements  | EN 61158-4-22     | 2014 |
| IEC 61158-4-25 | 2019 | Industrial communication networks – Fieldbus specifications – Part 4-25: Data-link layer protocol specification – Type 25 elements  | EN IEC 61158-4-25 | 2019 |
| IEC 61158-5-2  | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements      | EN IEC 61158-5-2  | 2019 |
| IEC 61158-5-4  | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-4: Application layer service definition – Type 4 elements      | EN IEC 61158-5-4  | 2019 |
| IEC 61158-5-10 | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-10: Application layer service definition – Type 10 elements    | EN IEC 61158-5-10 | 2019 |

|                |      |                                                                                                                                      |                   |      |
|----------------|------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------|------|
| IEC 61158-5-11 | 2007 | Industrial communication networks – Fieldbus specifications – Part 5-11: Application layer service definition – Type 11 elements     | EN 61158-5-11     | 2008 |
| IEC 61158-5-12 | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-12: Application layer service definition – Type 12 elements     | EN IEC 61158-5-12 | 2019 |
| IEC 61158-5-13 | 2014 | Industrial communication networks – Fieldbus specifications – Part 5-13: Application layer service definition – Type 13 elements     | EN 61158-5-13     | 2014 |
| IEC 61158-5-14 | 2014 | Industrial communication networks – Fieldbus specifications – Part 5-14: Application layer service definition – Type 14 elements     | EN 61158-5-14     | 2014 |
| IEC 61158-5-15 | 2010 | Industrial communication networks – Fieldbus specifications – Part 5-15: Application layer service definition – Type 15 elements     | EN 61158-5-15     | 2012 |
| IEC 61158-5-17 | 2007 | Industrial communication networks – Fieldbus specifications – Part 5-17: Application layer service definition – Type 17 elements     | EN 61158-5-17     | 2008 |
| IEC 61158-5-19 | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-19: Application layer service definition – Type 19 elements     | EN IEC 61158-5-19 | 2019 |
| IEC 61158-5-21 | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-21: Application layer service definition – Type 21 elements     | EN IEC 61158-5-21 | 2019 |
| IEC 61158-5-22 | 2014 | Industrial communication networks – Fieldbus specifications – Part 5-22: Application layer service definition – Type 22 elements     | EN 61158-5-22     | 2014 |
| IEC 61158-5-23 | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-23: Application layer service definition – Type 23 elements     | EN IEC 61158-5-23 | 2019 |
| IEC 61158-5-25 | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-25: Application layer service definition – Type 25 elements     | EN IEC 61158-5-25 | 2019 |
| IEC 61158-5-26 | 2019 | Industrial communication networks – Fieldbus specifications – Part 5-26: Application layer service definition – Type 26 elements     | EN IEC 61158-5-26 | 2019 |
| IEC 61158-6-2  | 2019 | Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements   | EN IEC 61158-6-2  | 2019 |
| IEC 61158-6-4  | 2019 | Industrial communication networks – Fieldbus specifications – Part 6-4: Application layer protocol specification – Type 4 elements   | EN IEC 61158-6-4  | 2019 |
| IEC 61158-6-10 | 2019 | Industrial communication networks – Fieldbus specifications – Part 6-10: Application layer protocol specification – Type 10 elements | –                 | –    |
| IEC 61158-6-11 | 2007 | Industrial communication networks – Fieldbus specifications – Part 6-11: Application layer protocol specification – Type 11 elements | EN 61158-6-11     | 2008 |
| IEC 61158-6-12 | 2019 | Industrial communication networks – Fieldbus specifications – Part 6-12: Application layer protocol specification – Type 12 elements | EN IEC 61158-6-12 | 2019 |

|                |        |                                                                                                                                      |                   |        |
|----------------|--------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------|
| IEC 61158-6-13 | 2014   | Industrial communication networks – Fieldbus specifications – Part 6-13: Application layer protocol specification – Type 13 elements | EN 61158-6-13     | 2014   |
| IEC 61158-6-14 | 2014   | Industrial communication networks – Fieldbus specifications – Part 6-14: Application layer protocol specification – Type 14 elements | EN 61158-6-14     | 2014   |
| IEC 61158-6-15 | 2010   | Industrial communication networks – Fieldbus specifications – Part 6-15: Application layer protocol specification – Type 15 elements | EN 61158-6-15     | 2012   |
| IEC 61158-6-17 | 2007   | Industrial communication networks – Fieldbus specifications – Part 6-17: Application layer protocol specification – Type 17 elements | EN 61158-6-17     | 2008   |
| IEC 61158-6-19 | 2019   | Industrial communication networks – Fieldbus specifications – Part 6-19: Application layer protocol specification – Type 19 elements | EN IEC 61158-6-19 | 2019   |
| IEC 61158-6-21 | 2019   | Industrial communication networks – Fieldbus specifications – Part 6-21: Application layer protocol specification – Type 21 elements | EN IEC 61158-6-21 | 2019   |
| IEC 61158-6-22 | 2014   | Industrial communication networks – Fieldbus specifications – Part 6-22: Application layer protocol specification – Type 22 elements | EN 61158-6-22     | 2014   |
| IEC 61158-6-23 | 2019   | Industrial communication networks – Fieldbus specifications – Part 6-23: Application layer protocol specification – Type 23 elements | EN IEC 61158-6-23 | 2019   |
| IEC 61158-6-25 | 2019   | Industrial communication networks – Fieldbus specifications – Part 6-25: Application layer protocol specification – Type 25 elements | EN IEC 61158-6-25 | 2019   |
| IEC 61588      | 2009   | Precision clock synchronization protocol for networked measurement and control systems                                               | –                 | –      |
| IEC 61784-1    | 2019   | Industrial communication networks – Profiles Part 1: Fieldbus profiles                                                               | –                 | –      |
| IEC 61784-5-2  | 2018   | Industrial communication networks – Profiles – Part 5-2: Installation of fieldbuses – Installation profiles for CPF 2                | EN IEC 61784-5-2  | 2018   |
| IEC 61784-5-3  | 2018   | Industrial communication networks – Profiles – Part 5-3: Installation of fieldbuses – Installation profiles for CPF 3                | EN IEC 61784-5-3  | 2018   |
| IEC 61784-5-6  | 2018   | Industrial communication networks – Profiles – Part 5-6: Installation of fieldbuses – Installation profiles for CPF 6                | EN IEC 61784-5-6  | 2018   |
| IEC 61784-5-8  | 2018   | Industrial communication networks – Profiles – Part 5-8: Installation of fieldbuses – Installation profiles for CPF 8                | EN IEC 61784-5-8  | 2018   |
| IEC 61784-5-11 | 2013   | Industrial communication networks – Profiles – Part 5-11: Installation of fieldbuses – Installation profiles for CPF 11              | EN 61784-5-11     | 2013   |
| IEC 61784-5-21 | 2018   | Industrial communication networks – Profiles – Part 5-21: Installation of fieldbuses – Installation profiles for CPF 21              | EN IEC 61784-5-21 | 2018   |
| IEC 61800      | series | Adjustable speed electrical power drive systems                                                                                      | EN IEC 61800      | series |

|                     |      |                                                                                                                                                                                                                                                 |                              |      |
|---------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------|
| IEC 61918           | 2018 | Industrial communication networks – Installation of communication networks in industrial premises                                                                                                                                               | EN IEC 61918                 | 2018 |
| -                   | –    |                                                                                                                                                                                                                                                 | EN IEC 61918:2018/AC:2019-03 |      |
| IEC 62439-2         | –    | Industrial communication networks – High availability automation networks – Part 2: Media Redundancy Protocol (MRP)                                                                                                                             | EN 62439-2                   | –    |
| ISO/IEC 7498-1      | –    | Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model                                                                                                                                                  | –                            | –    |
| ISO/IEC 8802-2      | –    | Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control                                                              | –                            | –    |
| ISO/IEC/IEEE 8802-3 | 2017 | Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet                                                             | –                            | –    |
| ISO/IEC 8802-11     | –    | Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications | –                            | –    |
| ISO/IEC 9834-8      | –    | Information technology – Procedures for the operation of object identifier registration authorities – Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers                                          | –                            | –    |
| ISO/IEC 11801       | 2002 | Information technology – Generic cabling for customer premises                                                                                                                                                                                  | –                            | –    |
| + 1                 | 2008 |                                                                                                                                                                                                                                                 | –                            | –    |
| + 2                 | 2010 |                                                                                                                                                                                                                                                 | –                            | –    |
| ISO 15745-3         | –    | Industrial automation systems and integration – Open systems application integration framework – Part 3: Reference description for IEC 61158 based control systems                                                                              | –                            | –    |
| ISO 15745-4         | 2003 | Industrial automation systems and integration – Open systems application integration framework – Part 4: Reference description for Ethernet-based control systems                                                                               | –                            | –    |
| + A1                | 2006 |                                                                                                                                                                                                                                                 | –                            | –    |
| IEEE 802            | 2001 | Local and metropolitan area networks: Overview and architecture                                                                                                                                                                                 | –                            | –    |
| IEEE 802.1AB        | –    | IEEE Standard for Local and metropolitan area networks – Station and Media Access Control Connectivity Discovery                                                                                                                                | –                            | –    |

|               |      |                                                                                                                                                                                                                                                                                                             |   |   |
|---------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|
| IEEE 802.1AS  | –    | IEEE Standard for Local and Metropolitan Area Networks – Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks                                                                                                                                                          | – | – |
| IEEE 802.1D   | 2004 | IEEE Standard for local and metropolitan area networks – Media Access Control (MAC) Bridges                                                                                                                                                                                                                 | – | – |
| IEEE 802.1Q   | –    | IEEE Standard for Local and metropolitan area networks – Bridges and Bridged Networks                                                                                                                                                                                                                       | – | – |
| IEEE 802.11   | –    | IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications                                           | – | – |
| IEEE 802.15.1 | –    | IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 15.1: Wireless medium access control (MAC) and physical layer (PHY) specifications for wireless personal area networks (WPANs) | – | – |
| IETF RFC 768  | –    | User Datagram Protocol                                                                                                                                                                                                                                                                                      | – | – |
| IETF RFC 791  | –    | INTERNET PROTOCOL DARPA INTERNET PROGRAM PROTOCOL SPECIFICATION                                                                                                                                                                                                                                             | – | – |
| IETF RFC 792  | –    | Internet Control Message Protocol                                                                                                                                                                                                                                                                           | – | – |
| IETF RFC 793  | –    | TRANSMISSION CONTROL PROTOCOL DARPA INTERNET PROGRAM PROTOCOL SPECIFICATION                                                                                                                                                                                                                                 | – | – |
| IETF RFC 826  | –    | Ethernet Address Resolution Protocol: Or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware                                                                                                                                                             | – | – |
| IETF RFC 894  | –    | Standard for the Transmission of IP Datagrams over Ethernet Networks                                                                                                                                                                                                                                        | – | – |
| IETF RFC 919  | –    | Broadcasting Internet Datagrams                                                                                                                                                                                                                                                                             | – | – |
| IETF RFC 922  | –    | Broadcasting Internet datagrams in the presence of subnets                                                                                                                                                                                                                                                  | – | – |
| IETF RFC 950  | –    | Internet Standard Subnetting Procedure                                                                                                                                                                                                                                                                      | – | – |
| IETF RFC 1034 | –    | Domain names – concepts and facilities                                                                                                                                                                                                                                                                      | – | – |
| IETF RFC 1112 | –    | Host Extensions for IP multicasting                                                                                                                                                                                                                                                                         | – | – |
| IETF RFC 1122 | –    | Requirements for Internet Hosts – Communication Layers                                                                                                                                                                                                                                                      | – | – |
| IETF RFC 1123 | –    | Requirements for Internet Hosts – Application and Support                                                                                                                                                                                                                                                   | – | – |
| IETF RFC 1127 | –    | A Perspective on the Host Requirements RFCs                                                                                                                                                                                                                                                                 | – | – |
| IETF RFC 1157 | –    | Simple Network Management Protocol (SNMP)                                                                                                                                                                                                                                                                   | – | – |
| IETF RFC 1213 | –    | Management Information Base for Network Management of TCP/IP-based Internets: MIB-II                                                                                                                                                                                                                        | – | – |

|               |   |                                                                                |   |   |
|---------------|---|--------------------------------------------------------------------------------|---|---|
| IETF RFC 1305 | – | Network Time Protocol (Version 3) – Specification, Implementation and Analysis | – | – |
| IETF RFC 2131 | – | Dynamic Host Configuration Protocol                                            | – | – |
| IETF RFC 2236 | – | Internet Group Management Protocol, Version 2                                  | – | – |
| IETF RFC 2544 | – | Benchmarking Methodology for Network Interconnect Devices                      | – | – |
| IETF RFC 2988 | – | Computing TCP's Retransmission Timer                                           | – | – |
| IETF RFC 4836 | – | Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)   | – | – |

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## INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

### Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC/IEEE 8802-3

#### INTRODUCTION

This document provides additional Communication Profiles (CP) to the existing Communication Profile Families (CPF) of IEC 61784-1 and additional CPFs with one or more CPs. These profiles meet the industrial automation market objective of identifying Real-Time Ethernet (RTE) communication networks coexisting with ISO/IEC/IEEE 8802-3 – commonly known as Ethernet. These RTE communication networks use provision from ISO/IEC/IEEE 8802-3 for the lower communication stack layers and additionally provide more predictable and reliable real-time data transfer and means for support of precise synchronization of automation equipment.

More specifically, these profiles help to correctly state the compliance of RTE communication networks with ISO/IEC/IEEE 8802-3, and to avoid the spreading of divergent implementations.

Adoption of Ethernet technology for industrial communication between controllers and even for communication with field devices promotes use of Internet technologies in the field area. This availability would be unacceptable if it causes the loss of features required in the field area for industrial communication automation networks, such as:

- real-time,
- synchronized actions between field devices like drives,
- efficient, frequent exchange of very small data records.

These new RTE profiles may take advantage of the improvements of Ethernet networks in terms of transmission bandwidth and network span.

Another implicit but essential requirement is that the typical Ethernet communication capabilities, as used in the office world, are fully retained, so that the software involved remains applicable.

The market is in need of several network solutions, each with different performance characteristics and functional capabilities, matching the diverse application requirements. RTE performance indicators (see Clause 5), which values will be provided with RTE devices based on communication profiles specified in this document, enable the user to match network devices with application-dependent performance requirements of an RTE network.

Subclause 5.1 specifies basic principles of performance indicators required to express RTE performance of a CP. Subclause 5.2 describes the view of application requirements. An application-dependent class could be used to find out a suitable CP. Clause 4 specifies how conformance of a device to the CPF or CP should be stated.

## 1 Scope

This part of IEC 61784 specifies

- performance indicators supporting classification schemes for Real-Time Ethernet (RTE) requirements;
- profiles and related network components based on ISO/IEC/IEEE 8802-3, IEC 61158 series, and IEC 61784-1;
- RTE solutions that are able to run in parallel with ISO/IEC/IEEE 8802-3 based applications.

These communication profiles are called Real-Time Ethernet communication profiles.

NOTE The RTE communication profiles use ISO/IEC/IEEE 8802-3 communication networks and its related network components or IEC 61588 and may in some cases amend those standards to obtain RTE features.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61158-1:2019, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

IEC 61158-2:2014, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-2:2014, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*  
IEC 61158-3-2:2014/AMD1:2019

IEC 61158-3-4:2019, *Industrial communication networks – Fieldbus specifications – Part 3-4: Data-link layer service definition – Type 4 elements*

IEC 61158-3-11:2007, *Industrial communication networks – Fieldbus specifications – Part 3-11: Data-link layer service definition – Type 11 elements*

IEC 61158-3-12:2019, *Industrial communication networks – Fieldbus specifications – Part 3-12: Data-link layer service definition – Type 12 elements*

IEC 61158-3-13:2014, *Industrial communication networks – Fieldbus specifications – Part 3-13: Data-link layer service definition – Type 13 elements*

IEC 61158-3-14:2014, *Industrial communication networks – Fieldbus specifications – Part 3-14: Data-link layer service definition – Type 14 elements*

IEC 61158-3-17:2007, *Industrial communication networks – Fieldbus specifications – Part 3-17: Data-link layer service definition – Type 17 elements*

IEC 61158-3-19:2019, *Industrial communication networks – Fieldbus specifications – Part 3-19: Data-link layer service definition – Type 19 elements*

IEC 61158-3-21:2019, *Industrial communication networks – Fieldbus specifications – Part 3-21: Data-link layer service definition – Type 21 elements*

IEC 61158-3-22:2014, *Industrial communication networks – Fieldbus specifications – Part 3-22: Data-link layer service definition – Type 22 elements*

IEC 61158-3-25:2019, *Industrial communication networks – Fieldbus specifications – Part 3-25: Data-link layer service definition – Type 25 elements*

IEC 61158-4-2:2019, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

IEC 61158-4-4:2019, *Industrial communication networks – Fieldbus specifications – Part 4-4: Data-link layer protocol specification – Type 4 elements*

IEC 61158-4-11:2014, *Industrial communication networks – Fieldbus specifications – Part 4-11: Data-link layer protocol specification – Type 11 elements*

IEC 61158-4-12:2019, *Industrial communication networks – Fieldbus specifications – Part 4-12: Data-link layer protocol specification – Type 12 elements*

IEC 61158-4-13:2014, *Industrial communication networks – Fieldbus specifications – Part 4-13: Data-link layer protocol specification – Type 13 elements*

IEC 61158-4-14:2014, *Industrial communication networks – Fieldbus specifications – Part 4-14: Data-link layer protocol specification – Type 14 elements*

IEC 61158-4-17:2007, *Industrial communication networks – Fieldbus specifications – Part 4-17: Data-link layer protocol specification – Type 17 elements*

IEC 61158-4-19:2019, *Industrial communication networks – Fieldbus specifications – Part 4-19: Data-link layer protocol specification – Type 19 elements*

IEC 61158-4-21:2019, *Industrial communication networks – Fieldbus specifications – Part 4-21: Data-link layer protocol specification – Type 21 elements*

IEC 61158-4-22:2014, *Industrial communication networks – Fieldbus specifications – Part 4-22: Data-link layer protocol specification – Type 22 elements*

IEC 61158-4-25:2019, *Industrial communication networks – Fieldbus specifications – Part 4-25: Data-link layer protocol specification – Type 25 elements*

IEC 61158-5-2:2019, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-5-4:2019, *Industrial communication networks – Fieldbus specifications – Part 5-4: Application layer service definition – Type 4 elements*

IEC 61158-5-10:2019, *Industrial communication networks – Fieldbus specifications – Part 5-10: Application layer service definition – Type 10 elements*

IEC 61158-5-11:2007, *Industrial communication networks – Fieldbus specifications – Part 5-11: Application layer service definition – Type 11 elements*

IEC 61158-5-12:2019, *Industrial communication networks – Fieldbus specifications – Part 5-12: Application layer service definition – Type 12 elements*

IEC 61158-5-13:2014, *Industrial communication networks – Fieldbus specifications – Part 5-13: Application layer service definition – Type 13 elements*

IEC 61158-5-14:2014, *Industrial communication networks – Fieldbus specifications – Part 5-14: Application layer service definition – Type 14 elements*

IEC 61158-5-15:2010, *Industrial communication networks – Fieldbus specifications – Part 5-15: Application layer service definition – Type 15 elements*

IEC 61158-5-17:2007, *Industrial communication networks – Fieldbus specifications – Part 5-17: Application layer service definition – Type 17 elements*

IEC 61158-5-19:2019, *Industrial communication networks – Fieldbus specifications – Part 5-19: Application layer service definition – Type 19 elements*

IEC 61158-5-21:2019, *Industrial communication networks – Fieldbus specifications – Part 5-21: Application layer service definition – Type 21 elements*

IEC 61158-5-22:2014, *Industrial communication networks – Fieldbus specifications – Part 5-22: Application layer service definition – Type 22 elements*

IEC 61158-5-23:2019, *Industrial communication networks – Fieldbus specifications – Part 5-23: Application layer service definition – Type 23 elements*

IEC 61158-5-25:2019, *Industrial communication networks – Fieldbus specifications – Part 5-25: Application layer service definition – Type 25 elements*

IEC 61158-5-26:2019, *Industrial communication networks – Fieldbus specifications – Part 5-26: Application layer service definition – Type 26 elements*

IEC 61158-6-2:2019, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

IEC 61158-6-4:2019, *Industrial communication networks – Fieldbus specifications – Part 6-4: Application layer protocol specification – Type 4 elements*

IEC 61158-6-10:2019, *Industrial communication networks – Fieldbus specifications – Part 6-10: Application layer protocol specification – Type 10 elements*

IEC 61158-6-11:2007, *Industrial communication networks – Fieldbus specifications – Part 6-11: Application layer protocol specification – Type 11 elements*

IEC 61158-6-12:2019, *Industrial communication networks – Fieldbus specifications – Part 6-12: Application layer protocol specification – Type 12 elements*

IEC 61158-6-13:2014, *Industrial communication networks – Fieldbus specifications – Part 6-13: Application layer protocol specification – Type 13 elements*

IEC 61158-6-14:2014, *Industrial communication networks – Fieldbus specifications – Part 6-14: Application layer protocol specification – Type 14 elements*

IEC 61158-6-15:2010, *Industrial communication networks – Fieldbus specifications – Part 6-15: Application layer protocol specification – Type 15 elements*

IEC 61158-6-17:2007, *Industrial communication networks – Fieldbus specifications – Part 6-17: Application layer protocol specification – Type 17 elements*

IEC 61158-6-19:2019, *Industrial communication networks – Fieldbus specifications – Part 6-19: Application layer protocol specification – Type 19 elements*

IEC 61158-6-21:2019, *Industrial communication networks – Fieldbus specifications – Part 6-21: Application layer protocol specification – Type 21 elements*

IEC 61158-6-22:2014, *Industrial communication networks – Fieldbus specifications – Part 6-22: Application layer protocol specification – Type 22 elements*

IEC 61158-6-23:2019, *Industrial communication networks – Fieldbus specifications – Part 6-23: Application layer protocol specification – Type 23 elements*

IEC 61158-6-25:2019, *Industrial communication networks – Fieldbus specifications – Part 6-25: Application layer protocol specification – Type 25 elements*

IEC 61158-6-26:2019, *Industrial communication networks – Fieldbus specifications – Part 6-26: Application layer protocol specification – Type 26 elements*

IEC 61588:2009, *Precision clock synchronization protocol for networked measurement and control systems*

IEC 61784-1:2019, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 61784-5-2:2018, *Industrial communication networks – Profiles – Part 5-2: Installation of fieldbuses – Installation profiles for CPF 2*

IEC 61784-5-3:2018, *Industrial communication networks – Profiles – Part 5-3: Installation of fieldbuses – Installation profiles for CPF 3*

IEC 61784-5-6:2018, *Industrial communication networks – Profiles – Part 5-6: Installation of fieldbuses – Installation profiles for CPF 6*

IEC 61784-5-8:2018, *Industrial communication networks – Profiles – Part 5-8: Installation of fieldbuses – Installation profiles for CPF 8*

IEC 61784-5-11:2013, *Industrial communication networks – Profiles – Part 5-11: Installation of fieldbuses – Installation profiles for CPF 11*

IEC 61784-5-21:2018, *Industrial communication networks – Profiles – Part 5-21: Installation of fieldbuses – Installation profiles for CPF 21*

IEC 61918:2018, *Industrial communication networks – Installation of communication networks in industrial premises*

IEC 61800 (all parts), *Adjustable speed electrical power drive systems*

IEC 62439-2, *Industrial communication networks – High availability automation networks – Part 2: Media Redundancy Protocol (MRP)*

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

ISO/IEC 8802-2, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control*

ISO/IEC/IEEE 8802-3:2017, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet*

ISO/IEC 8802-11, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN medium access control (MAC) and physical layer (PHY) specifications*

ISO/IEC 9834-8, *Information technology – Procedures for the operation of object identifier registration authorities – Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers*

ISO/IEC 11801:2002<sup>1</sup>, *Information technology – Generic cabling for customer premises*<sup>2</sup>  
ISO/IEC 11801:2002/AMD1: 2008  
ISO/IEC 11801:2002/AMD 2:2010

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

ISO 15745-4:2003, *Industrial automation systems and integration – Open systems application integration framework – Part 4: Reference description for Ethernet-based control systems*  
ISO 15745-4:2003/AMD1:2006, *PROFINET profiles*

IEEE 802-2001, *IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture*

IEEE 802.1AB, *IEEE Standard for Local and metropolitan area networks – Station and Media Access Control Connectivity Discovery*

IEEE 802.1AS, *IEEE standard for Local and metropolitan area networks – Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks*

IEEE 802.1D-2004, *IEEE Standard for Local and Metropolitan Area Networks – Media access control (MAC) Bridges*

IEEE 802.1Q, *IEEE Standard for Local and metropolitan area networks – Bridges and Bridged Networks*

IEEE Std 802.11, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks– Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*

IEEE Std 802.15.1, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 15.1: Wireless medium access control (MAC) and physical layer (PHY) specifications for wireless personal area networks (WPANs)*

IETF RFC 768, *User Datagram Protocol*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 791, *Internet Protocol*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 792, *Internet Control Message Protocol*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 793, *Transmission Control Protocol*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 826, *Ethernet Address Resolution Protocol*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 894, *A standard for the Transmission of IP Datagrams over Ethernet Networks*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 919, *Broadcasting Internet Datagrams*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 922, *Broadcasting Internet datagrams in the presence of subnets*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

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<sup>1</sup> Withdrawn.

<sup>2</sup> There exists a consolidated edition 2.2:2011 that comprises ISO/IEC 11801:2002, its Amendment 1:2008 and its Amendment 2:2010.

ietf RFC 950, *Internet Standard Subnetting Procedure*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 1034, *Domain names – Concepts and facilities*; available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 1112, *Host Extensions for IP Multicasting*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 1122, *Requirements for Internet Hosts – Communication Layers*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 1123, *Requirements for Internet Hosts – Application and Support*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 1127, *A Perspective on the Host Requirements RFCs*, available at <<http://www.ietf.org>> [viewed 2017-05-29]

ietf RFC 1157, *Simple Network Management Protocol (SNMP)*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 1213, *Management Information Base for Network Management of TCP/IP-based internets: MIB-II*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 1305, *Network Time Protocol (Version 3)*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 2131, *Dynamic Host Configuration Protocol*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 2236, *Internet Group Management Protocol, Version 2*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 2544, *Benchmarking Methodology for Network Interconnect Devices*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 2988, *Computing TCP's Retransmission Timer*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

ietf RFC 4836, *Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)*, available at <<http://www.ietf.org>> [viewed 2018-09-03]

The Open Group – Publication C706, *Technical standard DCE1.1: Remote Procedure Call*, available at <<http://www.opengroup.org/onlinepubs/9629399/toc.htm>> [viewed 2018-09-03]

### **3 Terms, definitions, abbreviated terms, acronyms, and conventions**

#### **3.1 Terms and definitions**

For the purposes of this document, the terms and definitions given in ISO/IEC/IEEE 8802-3, IEEE 802, IEEE 802.1AB, IEEE 802.1AS, IEEE 802.1D, IEEE 802.1Q, and the following, apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1.1

#### **active network**

network in which data transmission between non-immediately-connected devices is dependent on active elements within those intervening devices that form the connection path

[SOURCE: IEC 61918:2018, 3.1.3]

### 3.1.2

#### **communication cycle**

<CPF 16>

fixed time period between two master synchronization telegrams

### 3.1.3

#### **cyclic**

repetitive in a regular manner

### 3.1.4

#### **domain**

<CPF 10>

part of the network consisting of one or two subnetwork(s)

Note 1 to entry: Two subnetworks are required to compose a dual-redundant network, and each end-station in the domain is connected to both of the subnetworks.

### 3.1.5

#### **end-station**

system attached to a network that is an initial source or a final destination of MAC frames transmitted across that network

Note 1 to entry: A network layer router is, from the perspective of the network, an end-station. A switch, in its role of forwarding MAC frames from one link to another, is not an end-station.

### 3.1.6

#### **field area**

place in a manufacturing or process site where field devices are located

### 3.1.7

#### **frame**

a unit of data transmission on an ISO/IEC/IEEE 8802-3 MAC (Media Access Control) that conveys a protocol data unit (PDU) between MAC service users

[SOURCE: IEEE 802.1Q]

### 3.1.8

#### **identification number**

IDN

<CPF 16>

designation of operating data under which a data block is preserved with its attribute, name, unit, minimum and maximum input values, and the data

### 3.1.9

#### **IP channel**

<CPF 16>

defined time slot within the communication cycle, which passes ISO/IEC/IEEE 8802-3 Ethernet protocol frames (non-real-time communication)

### 3.1.10

#### **jitter**

temporal change in clock signal or temporal change in otherwise regular event

### 3.1.11

#### **linear topology**

topology where the nodes are connected in series, with two nodes each connected to only one other node and all others each connected to two other nodes (that is, connected in the shape of a line)

[SOURCE: IEC 61918:2018, 3.1.44]

### 3.1.12

#### **link**

transmission path between two adjacent nodes

[SOURCE: derived from ISO/IEC 11801:2002]

### 3.1.13

#### **logical double line**

<CPF 18>

sequence of root device and all ordinary devices processing the DLPDU in forward and backward direction

### 3.1.14

#### **master**

<CPF 16>

node which assigns the other nodes the right to transmit

### 3.1.15

#### **message**

ordered series of octets intended to convey information

Note 1 to entry: Normally used to convey information between peers at the application layer.

[SOURCE: IEC 61158-1]

### 3.1.16

#### **MDT0 telegram**

<CPF 16>

telegram, in which the master transmits its synchronization data, as well as parts or all of its real-time data, to the slaves

### 3.1.17

#### **node**

network entity connected to one or more links

Note 1 to entry: A node may be either a switch, an end-station or an RTE end-station.

### 3.1.18

#### **packet**

logical grouping of information used to describe a unit of data at any layer to convey the upper layer user data to its peer layer

Note 1 to entry: A packet is identical to the PDU at each layer in terms of the OSI reference model. A data-link layer packet is a frame.

### 3.1.19

#### **real-time**

ability of a system to provide a required result in a bounded time

### 3.1.20

#### **real-time communication**

transfer of data in real time

### 3.1.21

#### **Real-Time Ethernet**

##### **RTE**

ISO/IEC/IEEE 8802-3 based network that includes real-time communication

Note 1 to entry: Other communication can be supported, providing the real-time communication is not compromised.

Note 2 to entry: This definition is dedicated but not limited to ISO/IEC/IEEE 8802-3. It could be applicable to other IEEE 802 specifications, for example IEEE 802.11.

### 3.1.22

#### **real time frame line**

##### **RTFL**

<CPF 18>

communication model with devices communicating in a logical double line

### 3.1.23

#### **real time frame network**

##### **RTFN**

<CPF 18>

communication model with devices communicating in a switched network

### 3.1.24

#### **ring**

active network where each node is connected in series to two other nodes

Note 1 to entry: Ring may also be referred to as loop.

[SOURCE: IEC 61918:2018, 3.1.63, modified – The note to entry has been added]

### 3.1.25

#### **router**

<CPF 10>

intermediate equipment that connects two or more subnetworks using a network layer relay function

### 3.1.26

#### **RTE end device**

device with at least one RTE end-station

### 3.1.27

#### **RTE end-station**

end-station with RTE capability

### 3.1.28

#### **schedule**

temporal arrangement of a number of related operations

### 3.1.29

#### **star**

network of three or more devices where all devices are connected to a central point

[SOURCE: IEC 61918:2018, 3.1.69, modified – "which may be active or passive" has been suppressed]

### 3.1.30

#### **subnetwork**

<CPF 10>

part of a network that does not contain any routers

Note 1 to entry: A subnetwork consists of end-stations, bridges and segments.

Note 2 to entry: Every end-station included in a subnetwork has the same IP network address.

### 3.1.31

#### **switch**

MAC bridge as defined in IEEE 802.1Q

### 3.1.32

#### **telegram**

<CPF 16>

frame

## 3.2 Abbreviated terms and acronyms

|         |                                                                 |
|---------|-----------------------------------------------------------------|
| AL      | Application Layer                                               |
| APDU    | Application Protocol Data Unit                                  |
| API     | Application Process Identifier                                  |
| AR      | Application Relationship                                        |
| ARP     | Address Resolution Protocol                                     |
| ASE     | Application Service Element                                     |
| CP      | Communication Profile [according to IEC 61784-1]                |
| CPF     | Communication Profile Family [according to IEC 61784-1]         |
| CRC     | Cyclic Redundancy Check                                         |
| CSMA-CD | Carrier Sense Multiple Access with Collision Detection          |
| DA      | Destination MAC Address                                         |
| DCP     | Discovery and basic Configuration Protocol (see IEC 61158-6-10) |
| DHCP    | Dynamic Host Configuration Protocol (see IETF RFC 2131)         |
| DL      | Data-Link layer (as a prefix)                                   |
| DLL     | DL-Layer                                                        |
| DNS     | Domain Name Service (see IETF RFC 1034)                         |
| DUT     | Device under test                                               |
| ECSME   | EPA Communication Scheduling Management Entity                  |
| FA      | Factory Automation                                              |
| FCS     | Frame check sequence                                            |
| FrameID | Frame Identifier (see IEC 61158-6-10)                           |
| GSD     | General station description                                     |
| HW      | Hardware                                                        |
| IANA    | Internet Assigned Numbers Authority                             |
| ICMP    | Internet Control Message Protocol (see IETF RFC 792)            |
| ID      | Identifier                                                      |
| IDN     | IDentification Number                                           |
| IETF    | Internet Engineering Task Force                                 |