

DIN EN 61800-7-1

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Ersatzvermerk
siehe unten

**Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl –
Teil 7-1: Generisches Interface und Nutzung von Profilen für
Leistungsantriebssysteme (PDS) –
Schnittstellendefinition (IEC 61800-7-1:2007);
Englische Fassung EN 61800-7-1:2008**

Adjustable speed electrical power drive systems –
Part 7-1: Generic interface and use of profiles for power drive systems –
Interface definition (IEC 61800-7-1:2007);
English version EN 61800-7-1:2008

Entraînements électriques de puissance à vitesse variable –
Partie 7-1: Interface et utilisation génériques de profils pour les entraînements électriques
de puissance –
Définition de l'interface (CEI 61800-7-1:2007);
Version anglaise EN 61800-7-1:2008

Ersatzvermerk

Mit DIN EN 61158-2:2008-09, DIN EN 61158-3-16:2008-09, DIN EN 61158-4-16:2008-09,
DIN EN 61158-5-16:2008-09, DIN EN 61158-6-16:2008-09, DIN EN 61784-1:2008-10,
DIN EN 61800-7-204:2008-11 und DIN EN 61800-7-304:2008-11 Ersatz für DIN EN 61491:1999-11
Siehe jedoch Beginn der Gültigkeit

Gesamtumfang 104 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

Beginn der Gültigkeit

Die von CENELEC am 2008-02-01 angenommene EN 61800-7-1 gilt als DIN-Norm ab 2008-11-01.

Daneben darf DIN EN 61491:1999-11 noch bis 2011-02-01 angewendet werden.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN IEC 61800-7-1:2006-06.

Für diese Norm ist das nationale Arbeitsgremium K 226 „Ausrüstung von Starkstromgeräten und -anlagen mit elektronischen Betriebsmitteln“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (www.dke.de) zuständig.

Die enthaltene IEC-Publikation wurde vom SC 22G „Semiconductor power converters for adjustable speed electric drive systems“ erarbeitet.

Diese Norm erscheint ausschließlich in der englischsprachigen Originalfassung.

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Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen 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.

Änderungen

Gegenüber DIN EN 61491:1999-11 wurden folgende Änderungen vorgenommen:

- a) Aufnahme neuer Betriebsarten und Betriebsartenparameter;
- b) Erweiterung des Zustandsgraphen;
- c) Erweiterung der Funktionen zum Referenzieren;
- d) Erweiterung der Diagnosefunktionen;
- e) Anpassung der Koordinatensysteme;
- f) Hinzufügung weiterer Grenzwerte;
- g) Streichung der Funktionen zum elektronischen Getriebe.

Frühere Ausgaben

DIN EN 61491: 1999-11

**Adjustable speed electrical power drive systems –
Part 7-1: Generic interface and use of profiles for power drive systems –
Interface definition
(IEC 61800-7-1:2007)**

Entraînements électriques de puissance
à vitesse variable –
Partie 7-1: Interface et utilisation
génériques de profils pour les
entraînements électriques de puissance –
Définition de l'interface
(CEI 61800-7-1:2007)

Elektrische Leistungsantriebssysteme
mit einstellbarer Drehzahl –
Teil 7-1: Generisches Interface
und Nutzung von Profilen
für Leistungsantriebssysteme (PDS) –
Schnittstellendefinition
(IEC 61800-7-1:2007)

This European Standard was approved by CENELEC on 2008-02-01. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 22G/183/FDIS, future edition 1 of IEC 61800-7-1, prepared by SC 22G, Adjustable speed electric drive systems incorporating semiconductor power converters, of IEC TC 22, Power electronic systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61800-7-1 on 2008-02-01.

This European Standard, together with its companion parts for Profile type 4 (SERCOS), partially replaces EN 61491:1998 which is at present being revised (to be issued as a Technical Report).

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2008-11-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2011-02-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61800-7-1:2007 was approved by CENELEC as a European Standard without any modification.

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

IEC 61131-3	NOTE	Harmonized as EN 61131-3:2003 (not modified).
IEC 61158	NOTE	Harmonized in EN 61158 series (not modified).
IEC 61158-5-12	NOTE	Harmonized as EN 61158-5-12:2008 (not modified).
IEC 61158-5-13	NOTE	Harmonized as EN 61158-5-13:2008 (not modified).
IEC 61158-5-16	NOTE	Harmonized as EN 61158-5-16:2008 (not modified).
IEC 61158-5-19	NOTE	Harmonized as EN 61158-5-19:2008 (not modified).
IEC 61158-6-12	NOTE	Harmonized as EN 61158-6-12:2008 (not modified).
IEC 61158-6-13	NOTE	Harmonized as EN 61158-6-13:2008 (not modified).
IEC 61158-6-16	NOTE	Harmonized as EN 61158-6-16:2008 (not modified).
IEC 61158-6-19	NOTE	Harmonized as EN 61158-6-19:2008 (not modified).
IEC 61491	NOTE	Harmonized as EN 61491:1998 (modified).
IEC 61499-1	NOTE	Harmonized as EN 61499-1:2005 (not modified).
IEC 61784-1	NOTE	Harmonized as EN 61784-1:2008 (not modified).
IEC 61784-2	NOTE	Harmonized as EN 61784-2:2008 (not modified).
IEC 61800	NOTE	Harmonized in EN 61800 series (not modified).
ISO/IEC 7498-1	NOTE	Harmonized as EN ISO/IEC 7498-1:1995 (not modified).

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INTRODUCTION

The IEC 61800 series is intended to provide a common set of specifications for adjustable speed electrical power drive systems.

IEC 61800-7 describes a generic interface between control systems and power drive systems. This interface can be embedded in the control system. The control system itself can also be located in the drive (sometimes known as "smart drive" or "intelligent drive").

A variety of physical interfaces is available (analogue and digital inputs and outputs, serial and parallel interfaces, fieldbuses and networks). Profiles based on specific physical interfaces are already defined for some application areas (e.g. motion control) and some device classes (e.g. standard drives, positioner). The implementations of the associated drivers and application programmers interfaces are proprietary and vary widely.

IEC 61800-7 defines a set of common drive control functions, parameters, and state machines or description of sequences of operation to be mapped to the drive profiles.

IEC 61800-7 provides a way to access functions and data of a drive that is independent of the used drive profile and communication interface. The objective is a common drive model with generic functions and objects suitable to be mapped on different communication interfaces. This makes it possible to provide common implementations of motion control (or velocity control or drive control applications) in controllers without any specific knowledge of the drive implementation.

There are several reasons to define a generic interface:

For a drive device manufacturer

- Less effort to support system integrators
- Less effort to describe drive functions because of common terminology
- The selection of drives does not depend on availability of specific support

For a control device manufacturer

- No influence of bus technology
- Easy device integration
- Independent of a drive supplier

For a system integrator

- Less integration effort for devices
- Only one understandable way of modeling
- Independent of bus technology

Much effort is needed to design a motion control application with several different drives and a specific control system. The tasks to implement the system software and to understand the functional description of the individual components may exhaust the project resources. In some cases, the drives do not share the same physical interface. Some control devices just support a single interface which will not be supported by a specific drive. On the other hand, the functions and data structures are often specified with incompatibilities. This requires the system integrator to write special interfaces for the application software and this should not be his responsibility.

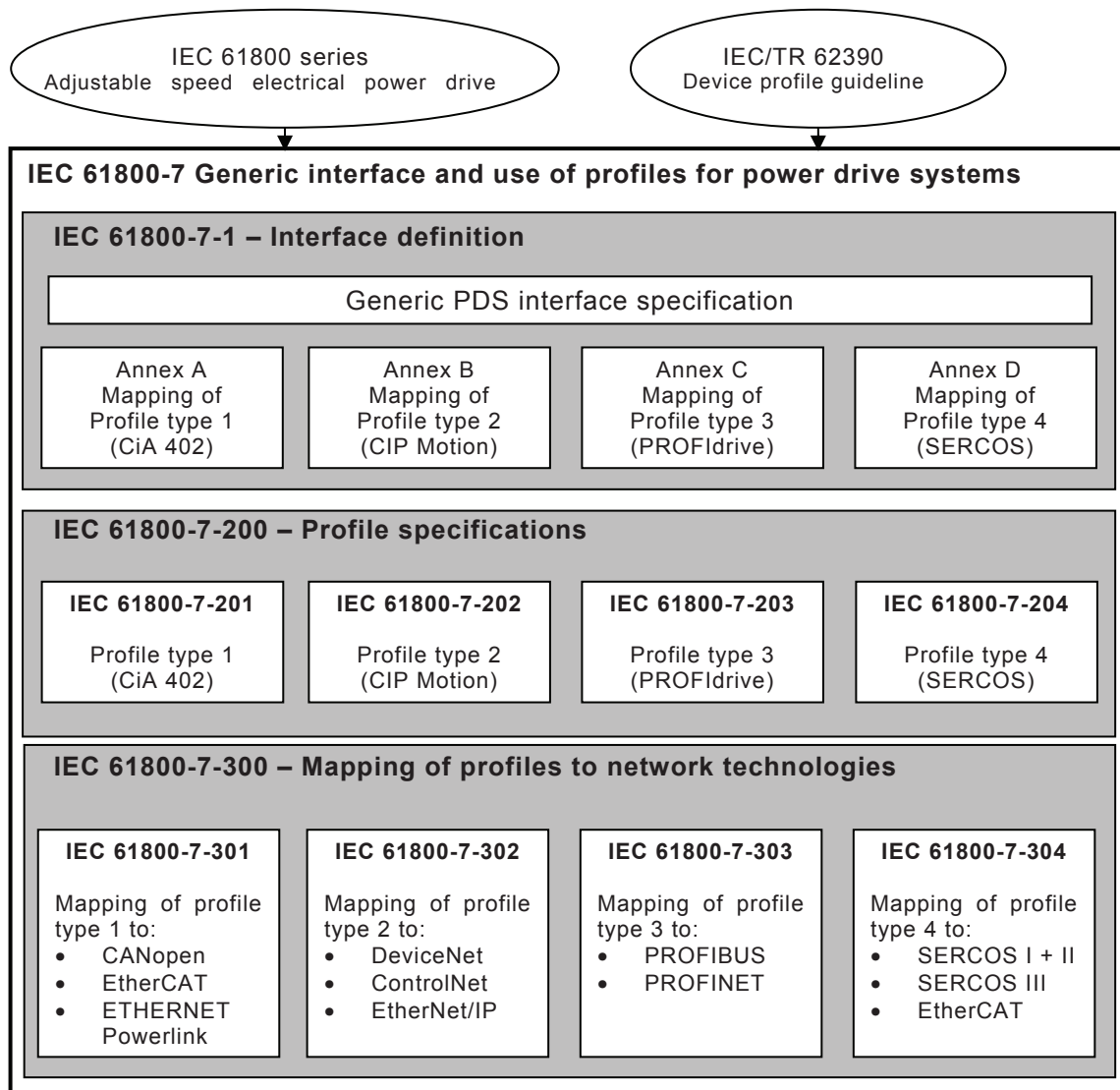
Some applications need device exchangeability or integration of new devices in an existing configuration. They are faced with different incompatible solutions. The efforts to adopt a solution to a drive profile and to manufacturer specific extensions may be unacceptable. This will reduce the degree of freedom to select a device best suited for this application to the selection of the unit which will be available for a specific physical interface and supported by the controller.

This part of IEC 61800-7 is divided into a generic part and several annexes as shown in Figure 1. The drive profiles types for CiA 402¹, CIP Motion^{TM2}, PROFIdrive³ and SERCOS interface^{TM4} are mapped to the generic interface in the corresponding annex. The annexes have been submitted by open international network or fieldbus organizations which are responsible for the content of the related annex and use of the related trademarks.

The different profile types 1, 2, 3 and 4 are specified in IEC 61800-7-201, IEC 61800-7-202, IEC 61800-7-203 and IEC 61800-7-204.

IEC 61800-7-301, IEC 61800-7-302, IEC 61800-7-303 and IEC 61800-7-304 specify how the profile types 1, 2, 3 and 4 are mapped to different network technologies (such as CANopen⁵, EtherCAT^{TM6}, Ethernet Powerlink^{TM7}, DeviceNet^{TM8}, ControlNet^{TM9}, EtherNet/IP^{TM10}, PROFIBUS¹¹, PROFINET¹² and SERCOS interface).

-
- 1 CiA 402 is a trade name of CAN in Automation, e.V. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade name holder or any of its products. Compliance to this profile does not require use of the trade name CiA 402.
 - 2 CIP MotionTM is a trade name of Open DeviceNet Vendor Association, Inc. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name CIP MotionTM. Use of the trade name CIP MotionTM requires permission of Open DeviceNet Vendor Association, Inc.
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 - 6 EtherCATTM is a trade name of Beckhoff, Verl. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name EtherCATTM. Use of the trade name EtherCATTM requires permission of the trade name holder.
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IEC 2106/07

Figure 1 – Structure of IEC 61800-7

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-1: Generic interface and use of profiles for power drive systems – Interface definition

1 Scope

IEC 61800-7 specifies profiles for power drive systems (PDS) and their mapping to existing communication systems by use of a generic interface model.

The functions specified in this part of IEC 61800-7 are not intended to ensure functional safety. This requires additional measures according to the relevant standards, agreements and laws.

This part of IEC 61800-7 specifies a generic interface between power drive system(s) (PDS) and the application control program in a controller. The generic PDS interface is not specific to any particular communication network technology. Annexes of this part of IEC 61800-7 specify the mapping of the different drive profiles types onto the generic PDS interface.

2 Normative references

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

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

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

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

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

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

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

IEC 61800-7 (all parts), *Adjustable speed electrical power drive systems – Generic interface and use of profiles for power drive systems*

IEC 61800-7-1, *Adjustable speed electrical power drive systems – Part 7-1: Generic interface and use of profiles for power drive systems – Interface definition*

IEC 61800-7-201, *Adjustable speed electrical power drive systems – Part 7-201: Generic interface and use of profiles for power drive systems – Profile type 1 specification*

IEC 61800-7-202, *Adjustable speed electrical power drive systems – Part 7-202: Generic interface and use of profiles for power drive systems – Profile type 2 specification*

IEC 61800-7-203, *Adjustable speed electrical power drive systems – Part 7-203: Generic interface and use of profiles for power drive systems – Profile type 3 specification*

IEC 61800-7-204, *Adjustable speed electrical power drive systems – Part 7-204: Generic interface and use of profiles for power drive systems – Profile type 4 specification*

IEC 61800-7-301, *Adjustable speed electrical power drive systems – Part 7-301: Generic interface and use of profiles for power drive systems – Mapping of profile type 1 to network technologies*

IEC 61800-7-302, *Adjustable speed electrical power drive systems – Part 7-302: Generic interface and use of profiles for power drive systems – Mapping of profile type 2 to network technologies*

IEC 61800-7-303, *Adjustable speed electrical power drive systems – Part 7-303: Generic interface and use of profiles for power drive systems – Mapping of profile type 3 to network technologies*

IEC 61800-7-304, *Adjustable speed electrical power drive systems – Part 7-304: Generic interface and use of profiles for power drive systems – Mapping of profile type 4 to network technologies*

IEC/TR 62390:2005, *Common automation device – Profile guideline*

EN 50325-4, *Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces – Part 4: CANopen*

3 Terms, definitions and abbreviated terms

3.1 Preamble

A Power Drive System (PDS) consists of a motor and the Complete Drive Module (CDM). The complete drive module may include converter, control and self-protection functions and also some auxiliaries (for example ventilation). The PDS does not include the equipment driven by the motor.

NOTE This definition is adapted from IEC 61800-1, IEC 61800-2, IEC 61800-3 and IEC 61800-4.

A logical power drive system consists of the PDS and an interface (e.g. communication network, fieldbus or software interface) and is accessed by an application control program over the generic PDS interface as described in Figure 3 to Figure 5.

3.2 General definitions

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

3.2.1

algorithm

completely determined finite sequence of operations by which the values of the output data can be calculated from the values of the input data

[IEV 351-21-37, modified]

3.2.2

application

software functional element specific to the solution of a problem in industrial-process measurement and control

NOTE An application may be distributed among resources, and may communicate with other applications.

[IEC/TR 62390:2005, 3.1.2, modified]

3.2.3

attribute

property or characteristic of an entity

[IEC/TR 62390:2005, 3.1.3]

3.2.4

axis

logical element inside an automation system (e.g. a motion control system) that represents some form of movement

NOTE Axes can be rotary or linear, physical or virtual, controlled or simply observed.

3.2.5

class

description of a set of objects that share the same attributes, operations, methods, relationships, and semantics

[ISO/IEC 19501, modified]

3.2.6

control

purposeful action on or in a process to meet specified objectives

[IEV 351-21-29]

3.2.7

control device

physical unit that contains – in a module/subassembly or device – an application program to control the PDS

3.2.8

data type

set of values together with a set of permitted operations

[ISO/IEC 2382-15, 15.04.01, modified]

3.2.9

device

field device

networked independent physical entity of an industrial automation system capable of performing specified functions in a particular context and delimited by its interfaces

[IEC 61499-1, 3.30, modified]

entity that performs control, actuating and/or sensing functions and interfaces to other such entities within an automation system

[ISO 15745-1, 3.11]

3.2.10

device profile

representation of a device in terms of its parameters and behaviour according to a device model that describes the device's data and behaviour as viewed through a network, independent from any network technology

NOTE This is a definition from IEC/TS 61915 which is extended by the addition of the device functional structure.
[IEC/TR 62390:2005, 3.1.9, modified]

3.2.11

feedback variable

variable which represents a controlled variable and which is returned to a comparing element

[IEV 351-27-03]

3.2.12

functional element

entity of software or software combined with hardware, capable of accomplishing a specified function of a device

NOTE 1 A functional element has an interface, associations to other functional elements and functions.

NOTE 2 A functional element can be made out of function block(s), object(s) or parameter list(s).

[IEC/TR 62390:2005, 3.1.12]

3.2.13

input data

data transferred from an external source into a device, resource or functional element

[IEC/TR 62390:2005, 3.1.14]

3.2.14

interface

shared boundary between two entities defined by functional characteristics, signal characteristics, or other characteristics as appropriate

[IEV 351-21-35, modified]

3.2.15

logical power drive system

model which includes PDS and communication network accessible through the generic PDS interface

3.2.16

model

mathematical or physical representation of a system or a process, based with sufficient precision upon known laws, identification or specified suppositions

[IEV 351-21-36]

3.2.17

operating mode

characterization of the way and the extent to which the human operator intervenes in the control equipment

[IEV 351-31-01]

3.2.18

output data

data originating in a device, resource or functional element and transferred from them to external systems

[IEC/TR 62390:2005, 3.1.21]

3.2.19

parameter

data element that represents device information that can be read from or written to a device, for example through the network or a local HMI

NOTE 1 Adapted from IEC/TS 61915.

NOTE 2 A parameter is typically characterized by parameter name, data type, physical unit and access direction.

[IEC/TR 62390:2005, 3.1.22]

3.2.21

profile

representation of a PDS interface in terms of its parameters, parameter assemblies and behaviour according to a communication profile and a device profile

NOTE Used in this part of IEC 61800 as a synonym for the specifications referenced in the annexes.

3.2.22

reference variable

input variable to a comparing element in a controlling system which sets the desired value of the controlled variable and is deducted from the command variable

[IEV 351-27-02]

3.2.23

type

hardware or software element which specifies the common attributes shared by all instances of the type

[IEC/TR 62390:2005, 3.1.25]

3.2.24

use case

class specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system

[IEC/TR 62390:2005, 3.1.26]

3.2.25

variable

software entity that may take different values, one at a time

[IEC/TR 62390:2005, 3.1.27]

NOTE The values of a variable as well as of a parameter are usually restricted to a certain data type.

3.3 Specific definitions

3.3.1 Common definitions

For the purposes of this document, the following terms and definitions apply and should be mapped by the different profiles to their specific terms.

3.3.1.1

actual value

value of a variable at a given instant

[IEV 351-21-02]

NOTE Actual value are used in this document as input data of the application control program to monitor variables of the PDS (e.g. feedback variables).

3.3.1.2

application mode

type of application that can be requested from a PDS

NOTE The different application modes reflect the control loop for torque control, velocity control, position control or other applications such as homing.

3.3.1.3

commands

set of commands from the application control program to the PDS to control the behaviour of the PDS or functional elements of the PDS

NOTE 1 The behaviour is reflected by states or operating modes.

NOTE 2 The different commands may be represented by one bit each.

3.3.1.4

I/O data

input data and output data that would typically need to be updated on a regular basis (e.g. periodic change of state), such as commands, set-points, status and actual values

3.3.1.5

set-point

value or variable used as output data of the application control program to control the PDS

3.3.1.6

status

set of information from the PDS to the application control program reflecting the state or mode of the PDS or a functional element of the PDS

NOTE The different status information may be coded with one bit each.

3.3.2 Definitions for Annex A

For the purposes of Annex A, the following terms and definitions apply.

3.3.2.1

CANopen

application layer protocol as defined in EN 50325-4

3.3.2.2

object dictionary

list of objects with unique 16-bit index and 8-bit sub-index as defined in EN 50325-4

3.3.2.3

process data object

communication object with real-time capability

3.3.3 Definitions for Annex B

For the purposes of Annex B, the terms and definitions given in IEC 61158 and referenced in IEC 61784-1 CPF 2 and the following apply.

3.3.3.1

CIP Motion™¹³

extensions to the CIP services and protocol to support motion control over CIP networks

3.3.3.2

CIP Motion drive

any CIP compliant drive device containing one or more Motion Axis Object instances that can communicate to a CIP controller via a CIP Motion I/O connection

3.3.3.3

CIP Motion I/O connection

periodic bi-directional, class 1, CIP connection between a controller and a drive defined as part of the CIP Motion specification, and that is dynamic both in size and content and consists of three prioritised data channels for transfer of cyclic, event, and service data

3.3.3.4

CIP Sync™¹³

extensions to the CIP services and protocol to encapsulate IEC 61588:2004 time synchronization functionality over a CIP Network (see Time Sync Object in IEC 61158-5-2 and IEC 61158-6-2)

3.3.3.5

CIP controller

any CIP compliant controller containing a Motion Control Axis object that can interface to a CIP Motion drive via a CIP Motion I/O connection.

NOTE A description of the Motion Control Axis object is beyond the scope of IEC 61800-7.

3.3.3.6

cyclic data

high priority real-time data that is transferred by a CIP Motion connection on a periodic basis

NOTE This data would be considered I/O Data as defined in IEC 61800-7.

3.3.3.7

event data

medium priority real-time data that is transferred by a CIP Motion connection only after a specified event occurs

NOTE Registration and marker input transitions are typical drive events.

3.3.3.8

motion

any aspect of the dynamics of an axis

NOTE In the context of this part of IEC 61800, it is not limited to servo drives but encompasses all forms of drive based motor control.

¹³ CIP Motion™ and CIP Sync™ are trade names of Open DeviceNet Vendor Association, Inc. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade names CIP Motion™ or CIP Sync™. Use of the trade names CIP Motion™ or CIP Sync™ requires permission of Open DeviceNet Vendor Association, Inc.

3.3.3.9

Motion Axis Object

object that defines the attributes, services, and behaviour of a motion device based axis (or PDS) according to the CIP Motion specification, including Communications, Device Control, and Basic Drive FE elements as defined in IEC 61800-7

3.3.3.10

service data

lower priority real-time data associated with a service message from the controller that is transferred by a CIP Motion connection on a periodic basis

NOTE Service data includes service request messages to access Motion Axis Object attributes or perform various drive diagnostics.

3.3.3.11

synchronised

condition where the local clock value on the drive is locked onto the master clock of the distributed System Time

NOTE When synchronised, the drive and controller devices may utilise time stamps associated with CIP Motion connection data.

3.3.3.12

System Time

absolute time value as defined in the CIP Sync specification in the context of a distributed time system where all devices have a local clock that is synchronised with a common master clock

NOTE In the context of CIP Motion, System Time is a 64-bit integer value in units of nanoseconds with a value of 0 corresponding to the date 1970-01-01.

3.3.3.13

time stamp

System Time stamp value associated with the CIP Motion connection data that conveys the absolute time when the associated data was captured, or that can also be used to determine when the associated data shall be applied

NOTE CIP time stamps are always in the context of a distributed time system where all nodes on the CIP control network have clocks that are synchronized with a master clock source using CIP Sync.

3.3.4 Definitions for Annex C

For the purposes of Annex C, the following terms and definitions apply.

3.3.4.1

application class

configuration of a Drive Object with a set of functional objects and supported by standard telegrams.

3.3.4.2

controller

controlling device which is associated with one or more drives (axes) a host for the overall automation

3.3.4.3

Drive Object

functional element of a Drive Unit

3.3.4.4

Drive Unit

logical device which comprises all functional elements related to one central processing unit

3.3.4.5

host

device that covers the automation functionality of an automation device

3.3.4.6

P-Device

field device and the host for the Drive Objects

3.3.4.7

standard telegram

set of input data and output data for an application mode

3.3.4.8

supervisor

engineering device which manages provisions of configuration data (parameter sets) and collections of diagnosis data from P-Devices and/or controllers

3.3.5 Definitions for Annex D

For the purposes of Annex D, the following terms and definitions apply.

3.3.5.1

acknowledge telegram

AT

telegram, in which each slave inserts its data

3.3.5.2

communication cycle

accumulation of all telegrams between two master synchronization telegrams

3.3.5.3

control unit

control device

3.3.5.4

control word

two adjacent bytes inside the master data telegram containing commands for the addressed drive

3.3.5.5

cycle time

time span between two consecutive cyclically recurring events

3.3.5.6

cyclic data

part of the telegram which does not change its meaning during cyclic operation of the interface

3.3.5.7

data exchange

demand dependent; non cyclic transmission (service channel)

3.3.5.8

feed forward

command value used to compensate the lag in the control loop

3.3.5.9

identification number

IDN

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

3.3.5.10

master

node, which assigns the other nodes the right to transmit

3.3.5.11

master data telegram

MDT

telegram, in which the master inserts its data

3.3.5.12

operating cycle

period of the control loop within the drive or the control unit

3.3.5.13

protocol

convention about the data formats, time sequences, and error correction in the data exchange of communication systems

3.3.5.14

slave

node, which is assigned the right to transmit by the master

3.3.5.15

status word

two adjacent bytes inside the drive telegram containing status information

3.3.5.16

telegram

message

3.3.5.17

topology

physical network architecture with respect to the connection between the stations of the communication system

3.4 Abbreviated terms

3.4.1 Common abbreviations

CDM	Complete Drive Module
DCS	Distributed Control System
ERP	Enterprise Resource Planning
FE	Functional Element
HMI	Human Machine Interface
I/O	Input/Output
ID	Identifier
MES	Manufacturing Execution System
NC	Numerical control system with a numeric control command set

PDS	Power Drive System
PLC	Programmable logic controller without a motion control command set
SCADA	Supervisory Control And Data Acquisition
UML	Unified Modeling Languages
URL	Universal Resource Locator

3.4.2 Abbreviations for Annex A

CiA	CAN in Automation
FSA	Finite State Automaton
NMT	Network Management
PDO	Process Data Object

3.4.3 Abbreviations for Annex B

Attr ID	Attribute Identifier
CIP™	Common Industrial Protocol (see IEC 61158 Type 2, IEC 61784-1 and IEC 61784-2 CPF2)

3.4.4 Abbreviations for Annex C

AC x	Application Class x, where x is the number of the AC
DO	Drive Object
DU	Drive Unit
I&M	Identification and maintenance functions
P-Device	Peripheral Device
PROFIdrive	PROcess Fieldbuss for drives
STW	Control word
ZSW	Status word

3.4.5 Abbreviations for Annex D

AT	Acknowledge Telegram
C1D	Class 1 Diagnostic
C2D	Class 2 Diagnostic
C3D	Class 3 Diagnostic
CP	Communication Phase (CP0 ... to CP6 – communication phases 0 ... 6)
IDN	Identification Number
MDT	Master Data Telegram
SERCOS	SErial Real time COmmunication System
SVC	Service Channel

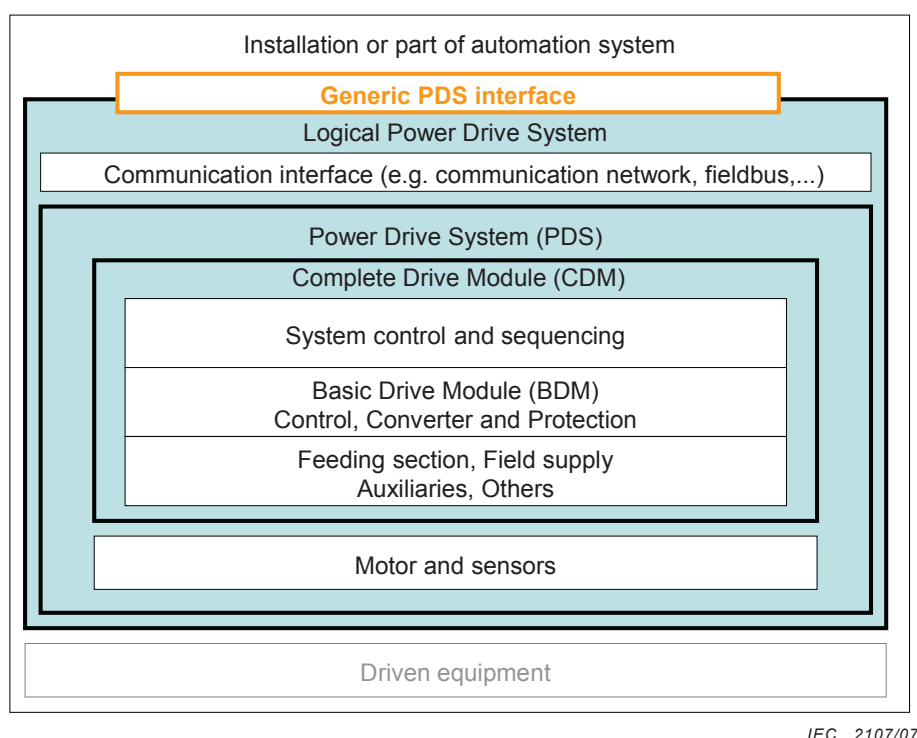
3.5 Conventions

Hexadecimal numbers shall be represented by 0xnn, nn_{hex} or nn_h.

4 General architecture

4.1 Generic PDS interface

This part of IEC 61800-7 specifies a generic interface between power drive systems (PDS) and the application control program in a controller. The generic PDS interface is not specific to any particular communication network technologies. The generic PDS interface supports only single axis control. Any functions for coordination of multiple axis are outside the scope of this part of IEC 61800-7. This might be a part of the logical controller.



NOTE In this part of IEC 61800-7, the drive device corresponds to the Complete Drive Module (CDM).

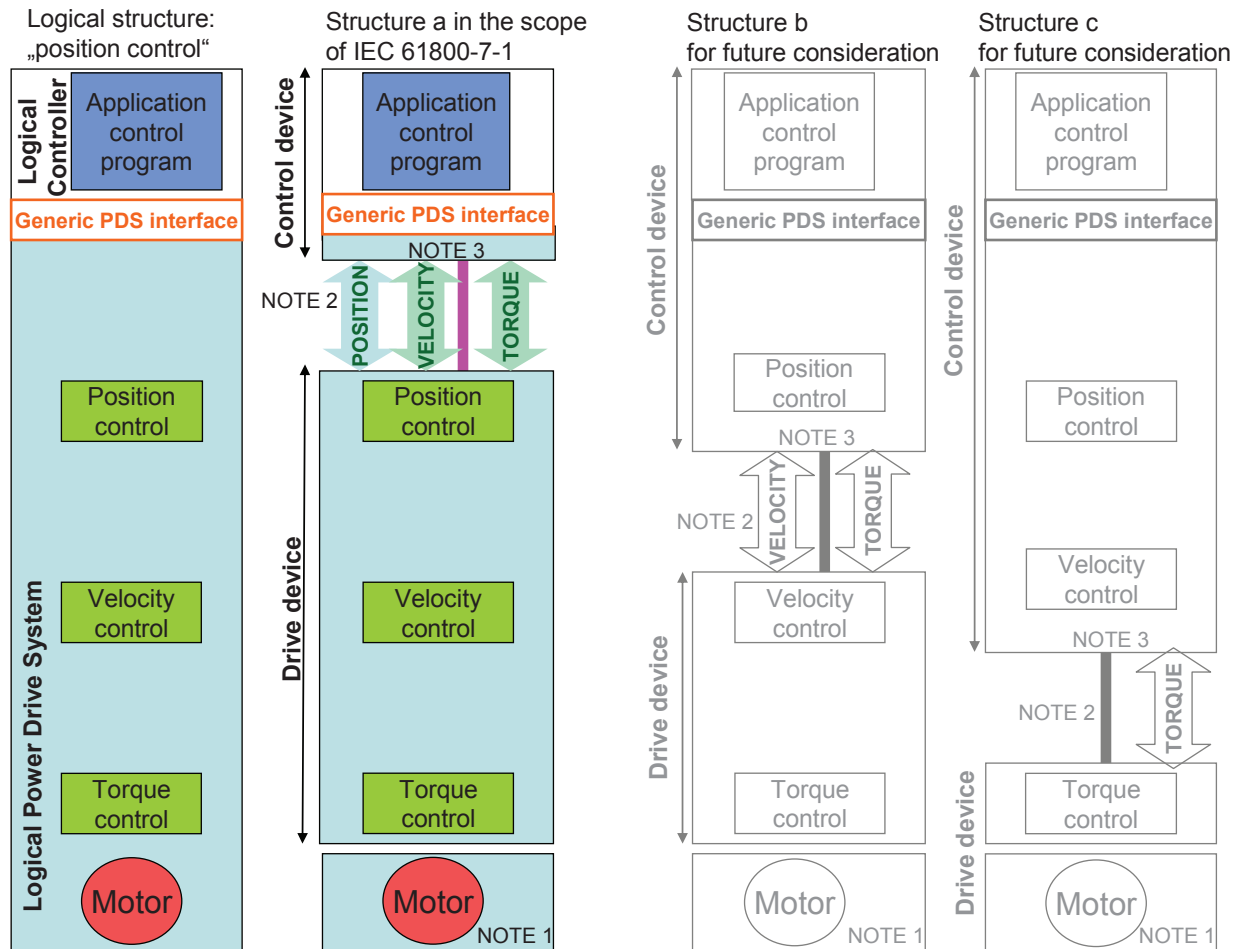
Figure 2 – Definition of power drive system

The PDS includes the drive device (or complete drive module) and the motor and sensors as shown in Figure 2.

The logical PDS is controlled by one or more logical controllers. The functions of the logical controller are performed by the application control program. The functionality of the logical PDS may be differentiated by position-control, velocity-control and torque-control applications. Figure 3 shows a subset of possible structures for position-control, Figure 4 shows a subset of possible structures for velocity-control and Figure 5 shows a subset of possible structures for torque-control applications.

NOTE 1 Possible velocity control types are listed in IEC 61800-4 Annex B, and not covered by this part of IEC 61800-7.

NOTE 2 “Velocity” is used throughout this part of IEC 61800 to mean speed (e.g. movement of a motor) as well as velocity (e.g. movement of mechanical equipment). However “speed” is retained in the title to be consistent with common usage.



IEC 2108/07

NOTE 1 In general, the PDS model includes the motor.

NOTE 2 Between the control device and the drive device is a network or fieldbus to transmit the data values such as position, velocity and torque.

NOTE 3 Mapping or adaptation as needed for specific network or fieldbus technology.

Figure 3 – Example of system structures for position-control applications

Structure a in Figure 3 shows a position-control application where all three control loops are implemented inside the drive device. In structure b, the velocity- and torque-control loops are inside the drive device and the position-control loop is in the control device. In structure c, only the torque-control is inside the drive device and the other control loops of the complete logical PDS are implemented inside the control device. In all three examples, the generic PDS interface is identical.

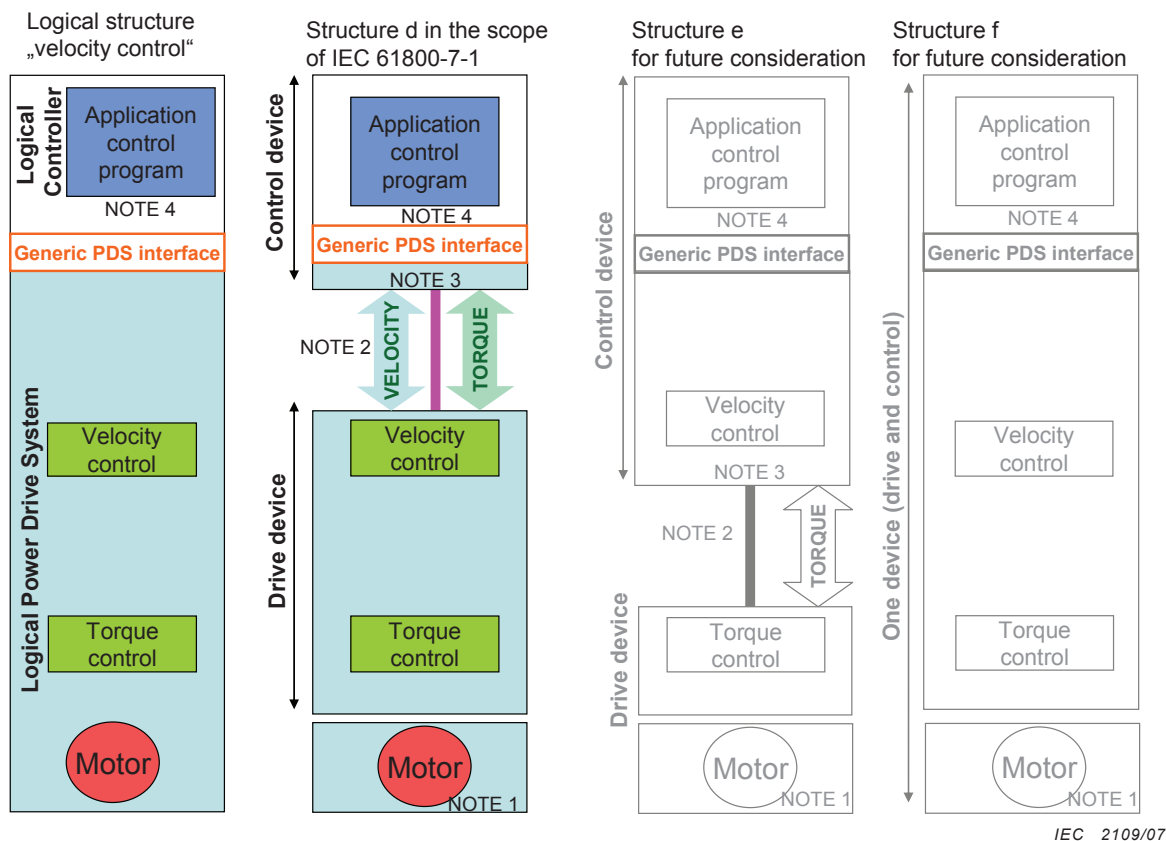
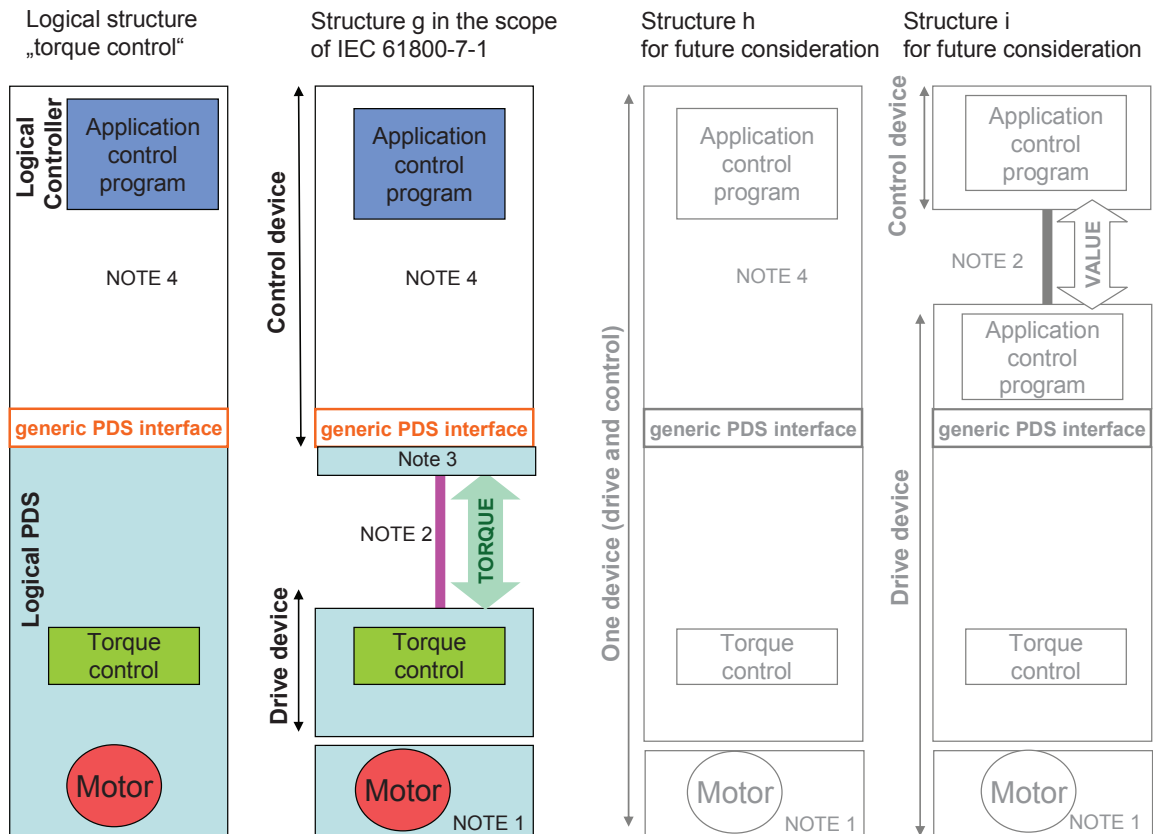


Figure 4 – Examples of system structures for velocity-control applications

Structure d in Figure 4 shows a velocity-control application where all the control loops are implemented in the drive device. In structure e, the velocity-control loop is implemented in the control device and the torque-control in the drive device. Structure f shows an implementation where all the functionality is implemented in one single device. In fact, in structure f, the network or fieldbus is missing. In all three structures of Figure 4, the generic PDS interface is identical.

It is possible that the generic PDS interface be used in velocity-control and the application control program includes also position-control functionality.



IEC 2110/07

NOTE 1 In general, the PDS model includes the motor.

NOTE 2 Between the control device and the drive device is a network or fieldbus to transmit the data values for torque.

NOTE 3 Mapping or adaptation as needed for specific network or fieldbus technology.

NOTE 4 The application control program may include also position control and velocity control functionality.

Figure 5 – Examples of system structures for torque-control applications

In Figure 5, possible implementations of torque-control applications are listed. The torque-control may be in the control device as in structure g. In structure h, all the functionality is in one device and the network or fieldbus is missing. It is always possible that the generic PDS interface be used for torque-control and the application program includes velocity-control and position-control functionality. In structure i, this generic interface is inside the “smart” drive device.

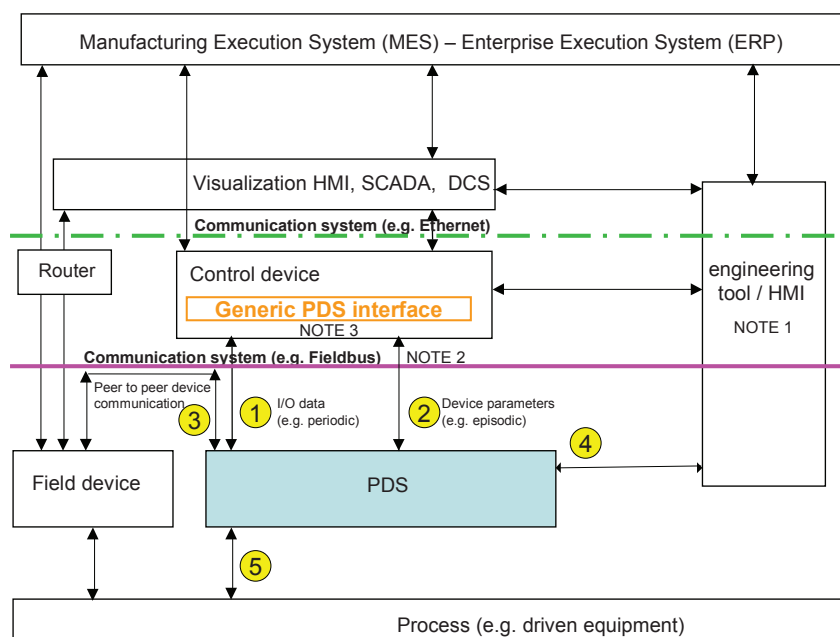
The specification of functionalities for the control device is beyond the scope of this part of IEC 61800-7. Table 1 lists the structures within the scope of this part of IEC 61800-7.

Table 1 – Structures within the scope of this part of IEC 61800-7

Structure	Application	In the Scope of the document
a	Position control	Yes
b	Position control	No, for future consideration
c	Position control	No, for future consideration
d	Velocity control	Yes
e	Velocity control	No, for future consideration
f	Velocity control	No, for future consideration
g	Torque control	Yes
h	Torque control	No, for future consideration
i	Torque control	No, for future consideration

4.2 Typical structure of automation systems

The modelling of a device is done according to IEC device profile guideline (see IEC/TR 62390). An automation system including PDS typically has the structure defined in Figure 6.



IEC 2111/07

NOTE 1 The engineering tool may be one tool connected to one of the different communication networks or three different tools depending on the type of communication network connected to.

NOTE 2 Communication systems may be redundant as required; this has no influence to the generic PDS interface.

NOTE 3 Mapping or adaptation as needed for specific network or fieldbus technology.

Figure 6 – Typical structure of automation systems (adapted from IEC/TR 62390)

The PDS has different logical interfaces to the outside world numbered 1) to 5) in Figure 6.

1) I/O data (generic PDS interface)

This interface is part of the generic PDS interface. It provides the control and monitoring interface between the control device and the PDS (see 3.3.1.4).

2) Device parameters (generic PDS interface)

This interface provides parameter access to the control device and remote engineering tools for identification, configuration, adjustment, monitoring or data logging. The device parameters are available for transfer via the communication system through the generic PDS interface.

3) Peer to peer device communication

The use of peer to peer communication service among other devices is a function of specific fieldbus technology and is not covered by the generic PDS interface.

4) Device parameters (local or other interface)

The local access and interface of an engineering tool or HMI to the PDS is not covered in this part of IEC 61800-7.

NOTE HMI or engineering tools may use the generic PDS interface or the fieldbus communication services which support the PDS interface. If any HMI sharing of the fieldbus results in changes to performance of PDS data, this should be notified to the application.

5) Interface to the process

The interface to the process – the driven equipment – is not covered by this part of IEC 61800-7.

4.3 Structure of the logical PDS

A logical PDS is composed of different Functional Elements (FE) according to Figure 7.

Each FE has parameters and algorithms or functions to describe the behavior.

The parameters are used to define

- a unique name and identifier,
- state of operation,
- one or several inputs and output variables, and
- the behavior on algorithms and/or functions

of the FE.

The relation of the different states is described in a state-chart diagram.

Parameters may be structured in additional parameter lists depending on the operating mode of the FE or the application mode of the PDS.

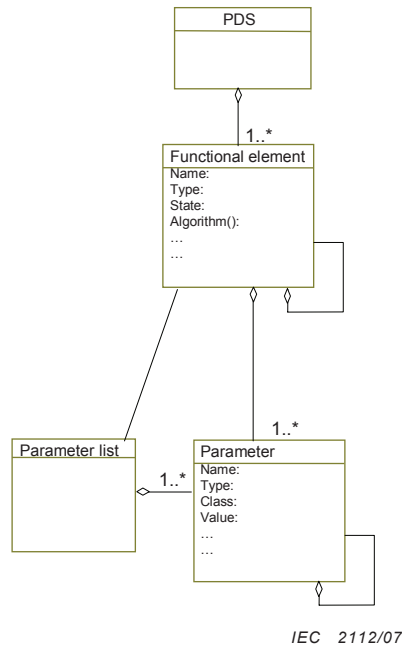


Figure 7 – Structure of the PDS with functional elements

For a logical PDS, the following FE are recognized (see Figure 8):

Device identification FE

The device identification FE contains the parameters needed to identify the physical device(s). Possible devices are drive device and control device according to Clause 1.

The device identification FE is defined in 5.1.

Device control FE

The device control FE includes the state machine for the control of the drive device.

The device control FE is defined in 5.2.

Communication FE

The communication FE of the logical PDS is composed of the communication specific parameters of the network between the control device and the drive device. It includes the communication state machine of the connected devices.

NOTE 1 Most of these parameters and states of the communication FE are network or fieldbus specific.

NOTE 2 One profile can use different communication FE's.

The generic communication FE is defined in 5.3.

Basic drive FE

The different control loop functions like position-control, velocity-control and torque-control are the basic drive functions.

The basic drive FE's are defined in 5.4.

Optional application FE

The possibility exists for the logical PDS to include additional – optional – application functions. A typical optional application FE is the management of additional inputs or outputs for example the connections to a separated encoder device, brake control, limit switch etc. These functions are not further specified in this part of IEC 61800-7.

Other interface FE

The possibility exists for the logical PDS to have local interfaces or to support other protocols over the network to HMI or tools. These functions are not further specified in this part of IEC 61800-7.

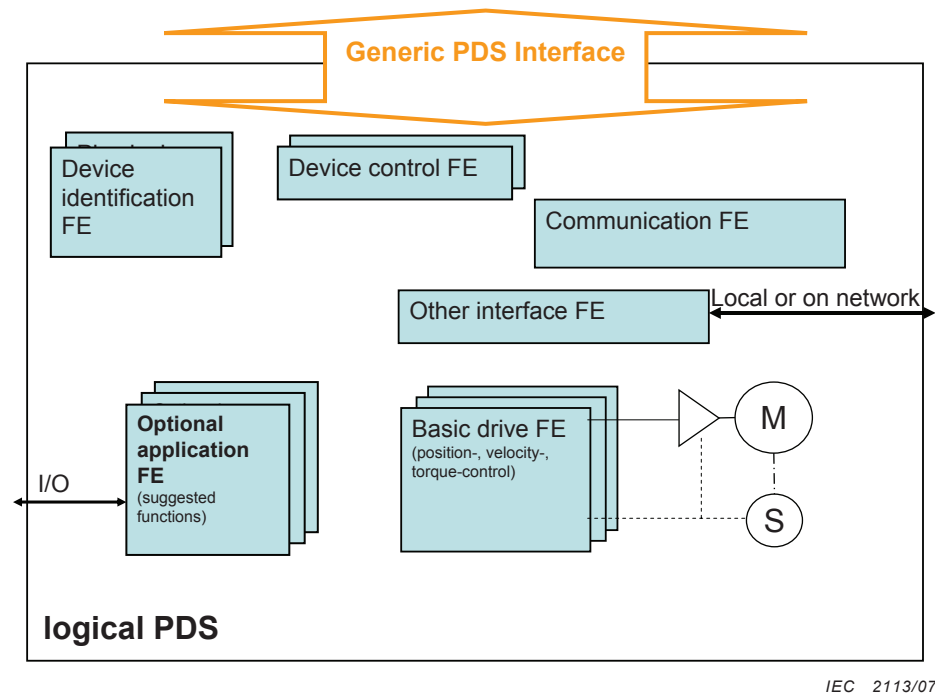


Figure 8 – Functional Elements (FE) in the logical PDS

The detailed characteristics of the parameters in the different FE's in the PDS should be described according to IEC/TR 62390:2005, Annex B.

Data flow and timing

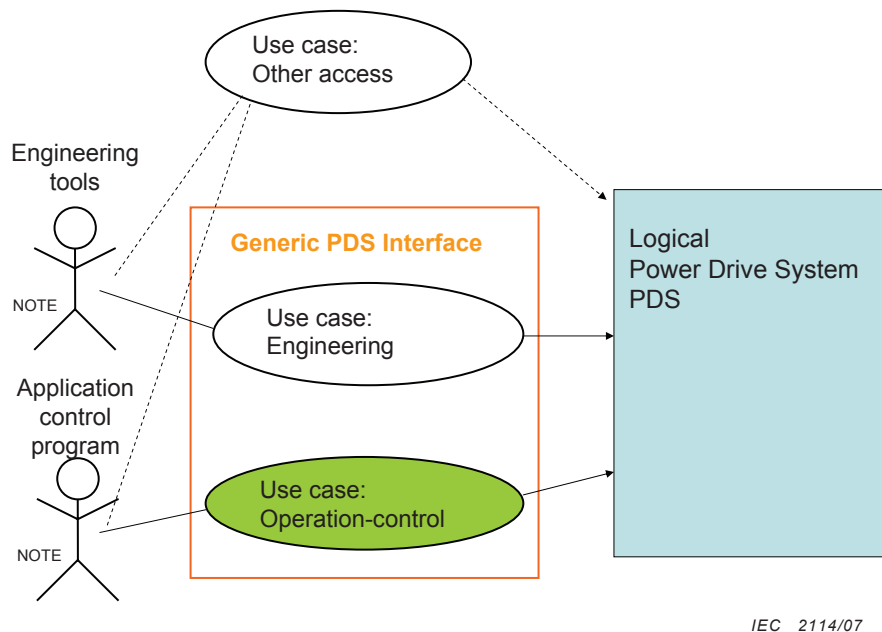
Commands and set-points are outputs from an application program and inputs to a logical PDS. Status information and actual values are outputs from a logical PDS and inputs to an application program.

One of the characteristics of a parameter or a parameters list is the access timing (see IEC/TR 62390:2005, Annex B). This access timing depends on the need of the application program and the capabilities of the technology solutions.

4.4 Use cases of the PDS

4.4.1 General

The generic PDS interface is used by two different actors: the access by an application control program and the access by an engineering tool. The application control program uses the PDS for control-operation and the engineering tool uses the PDS for engineering. Local or other access methods to the PDS are beyond the scope of this part of IEC 61800-7. This relation is shown in Figure 9.



NOTE This UML symbol represents an “actor”. It can be an operator or a device.

Figure 9 – Use case for the generic PDS interface

4.4.2 Use case engineering

The use case engineering occurs in different phases of the life cycle of the system.

- Commissioning
- Maintenance

In this use case, different types of operation are needed.

- Identification
- Configuration
- Adjustment
- Command
- Give set-point(s)
- Monitoring
- Read data logging

4.4.3 Use case operation-control

In the use case operation-control, the generic PDS interface for I/O data is used as follows.

- The application control program issues the commands (see 3.3.1.3) to the PDS.
- The application control program sets the set-point(s) (see 3.3.1.5) to the PDS.
- The PDS signals its status (see 3.3.1.6) to the application control program.
- The PDS may signal actual values (see 3.3.1.1) to the application control program.

The commands, the set-points, the status and the actual values form the I/O data of the PDS.