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Vorgesehen als Ersatz für
DIN EN 61800-7-201:2008-11**Entwurf**

**Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl –
Teil 7-201: Generisches Interface und Nutzung von Profilen für
Leistungsantriebssysteme (PDS) – Spezifikation von Profil-Typ 1
(IEC 22G/268/CDV:2014);
Englische Fassung FprEN 61800-7-201:2014**

Adjustable speed electrical power drive systems –
Part 7-201: Generic interface and use of profiles for power drive systems –
Profile type 1 specification
(IEC 22G/268/CDV:2014);
English version FprEN 61800-7-201:2014

Entraînements électriques de puissance à vitesse variable –
Partie 7-201: Interface générique et utilisation de profils pour les entraînements
électriques de puissance – Spécification du profil de type 1
(CEI 22G/268/CDV:2014);
Version anglaise FprEN 61800-7-201:2014

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2015-01-23 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfes besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise online im Norm-Entwurfs-Portal des DIN unter www.entwuerfe.din.de bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwuerfe.normenbibliothek.de, sofern dort wiedergegeben;
- oder als Datei per E-Mail an dke@vde.com möglichst in Form einer Tabelle. Die Vorlage dieser Tabelle kann im Internet unter www.din.de/stellungnahme oder für Stellungnahmen zu Norm-Entwürfen der DKE unter www.dke.de/stellungnahme abgerufen werden;
- oder in Papierform an die DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE, Stresemannallee 15, 60596 Frankfurt am Main.

Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 182 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE

Nationales Vorwort

Die Englische Fassung des europäischen Dokuments FprEN 61800-7-201:2014 „Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl – Teil 7-201: Generisches Interface und Nutzung von Profilen für Leistungsantriebssysteme (PDS) – Spezifikation von Profil-Typ 1“ (Entwurf in der Umfrage) ist unverändert in diesen Norm-Entwurf übernommen worden.

Die Internationale Elektrotechnische Kommission (IEC) und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dem entsprechend ist das internationale Dokument IEC 22G/268/CDV:2014 „Adjustable speed electrical power drive systems – Part 7-201: Generic interface and use of profiles for power drive systems – Profile type 1 specification“ unverändert in den Entwurf FprEN 61800-7-201:2014 übernommen worden.

Das internationale Dokument wurde vom SC 22G „Adjustable speed electric drive systems incorporating semiconductor power converters“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet.

Bei der Abstimmung zu dem Europäischen Schluss-Entwurf bei CENELEC und dem Internationalen Schluss-Entwurf bei IEC [Final Draft International Standard (FDIS)] sind jeweils nur „JA/NEIN“-Entscheidungen möglich, wobei „NEIN“-Entscheidungen fundiert begründet werden müssen. Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

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

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

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

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.

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 des vorliegenden Normentwurfs der englischen Sprache als Fachsprache bedienen, wird die englische Fassung der FprEN 61800-7-201 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und deren Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA des vorliegenden Normentwurfs hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Dieser Normentwurf steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Es ist vorgesehen, auch bei der entsprechenden zukünftigen Deutschen Norm auf die deutsche Sprachfassung zu verzichten und diese in der englischsprachigen Fassung zu veröffentlichen.

Es wird auf die Möglichkeit hingewiesen, dass einige Elemente dieses Dokuments Patentrechte berühren können. ISO [und/oder] IEC sind nicht dafür verantwortlich, einige oder alle diesbezüglichen Patentrechte zu identifizieren.

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 61800-7-201:2008-11 wurden folgende Änderungen vorgenommen:

- a) Redaktionelle Überarbeitung des gesamten Dokumentes.

Nationaler Anhang NA (informativ)

Die deutschen Übersetzungen haben Empfehlungscharakter und können nur die ungefähre Begrifflichkeit in Deutsch wiedergeben. Unter Experten wird empfohlen, ausschließlich die englischen Fachbegriffe zu verwenden, um die Gefahr von Missverständnissen zu reduzieren.

1 Anwendungsbereich

IEC 61800-7 beschreibt Profile für Leistungsantriebssysteme (en: Power Drive Systems, PDS) und ihre Abbildung auf bestehende Kommunikationssysteme unter Verwendung eines generischen Schnittstellenmodells.

Es ist nicht Zweck der in diesem Teil der IEC 61800-7 beschriebenen Funktionen, funktionale Sicherheit zu gewährleisten. Dies erfordert zusätzliche Maßnahmen nach den maßgeblichen Normen, Vereinbarungen und Gesetzen.

Dieser Teil der IEC 61800-7 beschreibt den Profil-Typ 1 für Leistungsantriebssysteme (PDS). Profil-Typ 1 kann auf verschiedene Technologien für Kommunikationsnetzwerke abgebildet werden.

3 Begriffe und Abkürzungen

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

3.1.1

Istwert

(en: **actual value**)

Wert einer variablen Größe zu einem gegebenen Zeitpunkt

Anmerkung 1 zum Begriff: Istwerte oder Ist-Größen werden in diesem Teil der Reihe IEC 61800-7 als Eingangsdaten des Programms zur Steuerung der Anwendung verwendet, um Rückführgrößen oder andere Prozessgrößen des PDS zu überwachen.

[Quelle: IEC 351-21-02]

3.1.2

Algorithmus

(en: **algorithm**)

vollständig bestimmte endliche Folge von Anweisungen, nach denen die Werte der Ausgangsgrößen aus den Werten der Eingangsgrößen berechnet werden können

[Quelle: IEC 351-21-37]

3.1.3**Anwendung****(en: application)**

funktionales Element der Software, spezifisch für die Problemlösung beim Messen und Steuern in industriellen Prozessen

Anmerkung 1 zum Begriff: Eine Anwendung kann über Ressourcen verteilt sein und kann mit anderen Anwendungen kommunizieren.

[Quelle: IEC/TR 62390:2005, 3.1.2, modifiziert]

3.1.4**Anwendungsmodus****(en: application mode)**

Art der Anwendung, die von einem PDS angefordert werden kann

Anmerkung 1 zum Begriff: Die verschiedenen Anwendungsmodi spiegeln den Regelkreis für die Regelung des Drehmoments, der Geschwindigkeit, der Position oder andere Anwendungen, wie Referenzieren, wider.

3.1.5**Attribut****(en: attribute)**

Eigenschaft oder Charakteristik einer Einheit

[Quelle: IEC/TR 62390:2005, 3.1.3]

3.1.6**Klasse****(en: class)**

Beschreibung einer Menge von Objekten, die dieselben Attribute, Operationen, Methoden, Beziehungen und Bedeutungen haben

[Quelle: ISO/IEC 19501, modifiziert]

3.1.7**Befehle****(en: commands)**

Menge an Befehlen von dem Programm zur Steuerung der Anwendung an das PDS, um das Verhalten des PDS oder der funktionalen Elemente des PDS zu steuern

Anmerkung 1 zum Begriff: Das Verhalten wird durch Zustände oder Betriebsarten wiedergegeben.

Anmerkung 2 zum Begriff: Die verschiedenen Befehle können jeweils durch ein Bit dargestellt werden.

3.1.8**Leiten****(en: control)**

zweckmäßige Maßnahmen an oder in einem Prozess, um vorgegebene Ziele zu erreichen

[Quelle: IEC 351-21-29]

3.1.9**Steuergerät****(en: control device)**

physikalische Einheit, die – innerhalb eines Moduls/einer Baugruppe oder eines Gerätes – ein Anwendungsprogramm zur Steuerung des PDS enthält

3.1.10**Datentyp****(en: data type)**

Menge von Werten mit einer Menge zulässiger Operationen

[Quelle: ISO/IEC 2382-15:1999, 15.04.01, modifiziert]

3.1.11

Gerät

(en: device)

Feldgerät

vernetzte unabhängige physikalische Einheit eines industriellen Automatisierungssystems, die fähig ist, spezifische Funktionen in einem bestimmten Kontext auszuführen und die durch ihre Schnittstellen begrenzt ist

[Quelle: IEC 61499-1:2005, 3.30, modifiziert]

Einheit, die Steuerungs- und Regelfunktionen sowie Aktor- und/oder Sensorfunktionen ausführt und Schnittstellen zu anderen derartigen Einheiten innerhalb eines Automatisierungssystems hat

[Quelle: ISO 15745-1:2003, 3.11]

3.1.12

Geräteprofil

(en: device profile)

Darstellung eines Gerätes bezüglich seiner Parameter, seiner Parametergruppen und seines Verhaltens nach einem Gerätemodell, das die Daten und das Verhalten des Gerätes beschreibt, wie es durch ein Netzwerk gesehen wird

Anmerkung 1 zum Begriff: Dies ist eine Definition aus IEC/TS 61915, die durch das Hinzufügen der funktionalen Gerätestruktur erweitert ist.

[Quelle: IEC/TR 62390:2005, 3.1.9, modifiziert]

3.1.13

Rückführgröße

(en: feedback variable)

variable Größe, die die Regelgröße abbildet und die zu einem Vergleichsglied zurückgeführt wird

[Quelle: IEC 351-27-03]

3.1.14

funktionales Element

(en: functional element)

Einheit von Software oder von Software, die mit Hardware kombiniert ist, fähig, eine festgelegte Funktion eines Gerätes zu erfüllen

Anmerkung 1 zum Begriff: Ein funktionales Element hat eine Schnittstelle zu anderen funktionalen Elementen und Funktionen.

Anmerkung 2 zum Begriff: Ein funktionales Element kann aus einem oder mehreren Funktionsbausteinen, Objekten oder Parameterlisten erstellt werden.

[Quelle: IEC/TR 62390:2005, 3.1.12]

3.1.15

Hochleistung

(en: high-level power)

Hauptstromversorgung des Antriebsgerätes

3.1.16

Eingangsdaten

(en: input data)

Daten, die von einer externen Quelle in ein Gerät, eine Ressource oder ein funktionales Element übertragen werden

[Quelle: IEC/TR 62390:2005, 3.1.14]

3.1.17**Schnittstelle****(en: interface)**

Grenze zwischen zwei Einheiten, die durch funktionale Merkmale, Signal-Eigenschaften oder andere geeignete charakteristische Merkmale festgelegt ist

[Quelle: IEC 351-21-35, modifiziert]

3.1.18**logisches Leistungsantriebssystem****(en: logical power drive system)**

Modell, welches das PDS und das Kommunikationsnetzwerk umfasst und über die generische PDS-Schnittstelle zugänglich ist

3.1.19**Niedrigleistung****(en: low-level power)**

Stromversorgung für den Steuerabschnitt des Antriebsgerätes

3.1.20**Modell****(en: model)**

mathematische oder physikalische Darstellung eines Systems oder Prozesses, die das System oder den Prozess aufgrund bekannter Gesetzmäßigkeiten, einer Identifikation oder getroffener Annahmen genügend genau abbildet

[Quelle: IEC 351-21-36]

3.1.21**Betriebsart****(en: operating mode)**

Kennzeichnung von Art und Umfang, wie der Mensch als Bediener in eine Leiteinrichtung eingreift

[Quelle: IEC 351-31-01]

3.1.22**Ausgangsdaten****(en: output data)**

Daten, die von einem Gerät, einer Ressource oder einem funktionalen Element in externe Systeme übertragen werden

[Quelle: IEC/TR 62390:2005, 3.1.21]

3.1.23**Parameter****(en: parameter)**

Datenelement, das Geräteinformationen darstellt, die aus einem Gerät gelesen oder in ein Gerät geschrieben werden können; z. B. durch ein Netzwerk oder ein lokales Bediengerät

Anmerkung 1 zum Begriff: Aus IEC/TS 61915, angepasst.

Anmerkung 2 zum Begriff: Ein Parameter ist typischerweise durch einen Parameternamen, einen Datentyp und eine Zugriffsrichtung gekennzeichnet.

[Quelle: IEC/TR 62390:2005, 3.1.22, modifiziert]

3.1.24**Profil****(en: profile)**

Darstellung einer PDS-Schnittstelle hinsichtlich ihrer Parameter, Parametergruppierung und ihres Verhaltens nach einem Kommunikations- und einem Geräteprofil

3.1.25

Führungsgröße

(en: **reference variable**)

aus der Zielgröße abgeleitete, den Sollwert der Regelgröße festlegende Eingangsgröße eines Vergleichsgliedes einer Regeleinrichtung

[Quelle: IEC 351-27-02]

3.1.26

Sollwert

(en: **set-point**)

Wert oder Variable, der/die als Ausgangsdatenwert bzw. -variable von dem Programm zur Steuerung der Anwendung verwendet wird, um das PDS zu steuern

3.1.27

Zustand

(en: **status**)

Menge an Informationen von dem PDS an das Programm zur Steuerung der Anwendung, die den Zustand oder die Betriebsart des PDS oder eines funktionalen Elementes des PDS wiedergibt

Anmerkung 1 zum Begriff: Die verschiedenen Zustandsinformationen können jeweils mit einem Bit kodiert werden.

3.1.28

Typ

(en: **type**)

Hardware- oder Software-Element, das die gemeinsamen Attribute festlegt, die von allen Instanzen des Typs gemeinsam genutzt werden

[Quelle: IEC/TR 62390:2005, 3.1.25]

3.1.29

Anwendungsfall

(en: **use case**)

Festlegung der Klasse einer Folge von Aktionen, einschließlich Varianten, die ein System (oder eine andere Einheit) durchführen kann, wobei sie mit Aktoren des Systems zusammenwirken

[Quelle: IEC/TR 62390:2005, 3.1.26]

3.1.30

Variable

(en: **variable**)

Software-Einheit, die jeweils verschiedene Werte zu einer Zeit annehmen kann

Anmerkung 1 zum Begriff: Die Werte sowohl einer Variablen als auch eines Parameters sind üblicherweise auf einen bestimmten Datentyp festgelegt.

[Quelle: IEC/TR 62390:2005, 3.1.27, modifiziert]

3.2 Abkürzungen

AC Wechselstrom (en: Alternating Current)

BL bürstenlos (en: Brush-Less)

c Konstante (en: Constant)

CiA CAN in Automation

COB Kommunikationsobjekt (en: Communication Object)

csp Modus „Cyclic Synchronous Profile“

cst	Modus „Cyclic Synchronous Torque“
csv	Modus „Cyclic Synchronous Velocity“
DC	Gleichstrom (en: Direct Current)
DIV	Teiler (en: Divisor)
FC	Frequenzumrichter (en: Frequency Converter)
FE	funktionales Element (en: Functional Element)
FIFO	First In, First Out
FSA	Automatisierung mit endlichen Zuständen (en: Finite State Automation)
hm	Homing Mode
HMI	Mensch-Maschine-Schnittstelle (en: Human Machine Interface)
I/O	Eingang/Ausgang (en: Input/Output)
ip	Modus „Interpolated Position“
LSB	niedrigstwertiges Bit/Byte (en: Less Significant Bit/Byte)
MSB	höchstwertiges Bit/Byte (en: Most Significant Bit/Byte)
MUL	Multiplikation
NMT	Netzwerkmanagement (en: Network Management)
PDS	Leistungsantriebssystem (en: Power Drive System)
PM	Dauermagnet (en: Permanent Magnet)
pp	Modus „Profile Position“
pv	Modus „Velocity Position“
r	reserviert
r.m.s.	Effektivwert (en: Root Mean Square)
ro	nur Lesezugriff (en: Read-Only)
rw	Lese- und Schreibzugriff (en: Read-Write)
tq	Torque Mode
vl	Velocity Mode

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

**Part 7-201: Generic interface and use
of profiles for power drive systems –
Profile type 1 specification**

FOREWORD

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The International Standard IEC 61800-7-201 has been prepared by subcommittee SC 22G: Adjustable speed electric drive systems incorporating semiconductor power converters, of IEC technical committee TC 22: Power electronic systems and equipment.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below.

- Updates, clarifications and enhancements
- Editorial adjustments in relation with the new version of IEC Directive Part 2.

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

FDIS	Report on voting
22G/XX/FDIS	22G/XX/RVD

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

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

A list of all parts of the IEC 61800 series, under the general title *Adjustable speed electrical power drive systems*, can be found on the IEC website.

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

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

The National Committees are requested to note that for this publication the stability date is 2019.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

77

INTRODUCTION

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

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

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

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

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

96 There are several reasons to define a generic interface:

97 **For a drive device manufacturer**

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

101 **For a control device manufacturer**

- 102 – No influence of bus technology
- 103 – Easy device integration
- 104 – Independent of a drive supplier

105 **For a system integrator**

- 106 – Less integration effort for devices
- 107 – Only one understandable way of modeling
- 108 – Independent of bus technology

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

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

123 IEC 61800-7-1 is divided into a generic part and several annexes as shown in Figure 1. The
124 drive profiles types for CiA® 402¹, CIP Motion^{TM2}, PROFIdrive³ and SERCOS®⁴ are mapped

¹ CiA® 402 is a registered trade mark of CAN in Automation e.V. (CiA). This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade

- 125 to the generic interface in the corresponding annex. The annexes have been submitted by
 126 open international network or fieldbus organizations which are responsible for the content of
 127 the related annex and use of the related trade marks.
- 128 This part of IEC 61800-7 specifies the profile type 1 (CiA® 402).
- 129 The profile types 2, 3 and 4 are specified in IEC 61800-7-202, IEC 61800-7-203 and
 130 IEC 61800-7-204.
- 131 IEC 61800-7-301, IEC 61800-7-302, IEC 61800-7-303 and IEC 61800-7-304 specify how the
 132 profile types 1, 2, 3 and 4 are mapped to different network technologies (such as CANopen®⁵,
 133 CC-Link IE® Field Network⁶, EPA™⁷, EtherCAT®⁸, Ethernet Powerlink™⁹, DeviceNet™¹⁰,
 134 ControlNet™¹¹, EtherNet/IP™¹², PROFIBUS¹³, PROFINET¹⁴ and SERCOS®).

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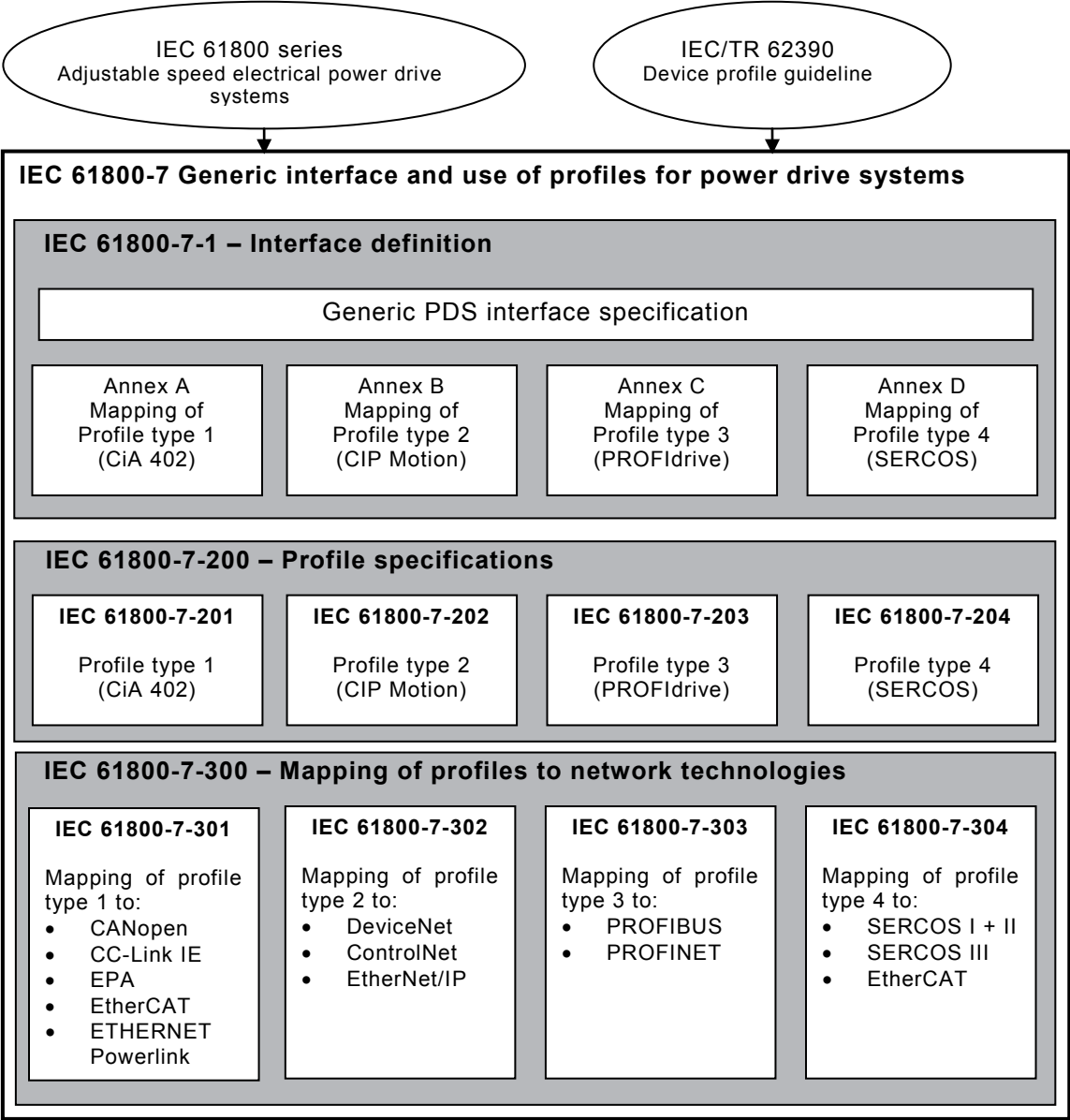


Figure 1 – Structure of IEC 61800-7

¹⁴ PROFINET is a trade name of PROFIBUS & PROFINET International. 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 PROFINET. Use of the trade name PROFINET requires permission of PROFIBUS & PROFINET International.

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –**Part 7-201: Generic interface and use
of profiles for power drive systems –
Profile type 1 specification****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 profile type 1 for Power Drive Systems (PDS). Profile type 1 can be mapped onto different communication network technologies.

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

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*

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 Terms and definitions**

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

3.1.1**actual value**

value of a variable at a given instant

Note 1 to entry: Actual value or actual variable are used in this part of the IEC 61800-7 series as input data of the application control program to monitor feedback variables or other process variables of the PDS.

[Source: IEC 351-21-02]

3.1.2**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

[Source: IEC 351-21-37]

3.1.3**application**

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

Note 1 to entry: An application may be distributed among resources, and may communicate with other applications.

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

185 **3.1.4**186 **application mode**

187 type of application that can be requested from a PDS

188 Note 1 to entry: The different application modes reflect the control loop for torque control, velocity control, position
189 control or other applications like homing.190 **3.1.5**191 **attribute**

192 property or characteristic of an entity

193 [Source: IEC/TR 62390:2005, 3.1.3]

194 **3.1.6**195 **class**196 description of a set of objects that share the same attributes, operations, methods,
197 relationships, and semantics

198 [Source: ISO/IEC 19501, modified]

199 **3.1.7**200 **commands**201 set of commands from the application control program to the PDS to control the behaviour of
202 the PDS or functional elements of the PDS

203 Note 1 to entry: The behaviour is reflected by states or operating modes.

204 Note 2 to entry: The different commands may be represented by one bit each.

205 **3.1.8**206 **control**

207 purposeful action on or in a process to meet specified objectives

208 [Source: IEC 351-21-29]

209 **3.1.9**210 **control device**211 physical unit that contains – in a module/subassembly or device – an application program to
212 control the PDS213 **3.1.10**214 **data type**

215 set of values together with a set of permitted operations

216 [Source: ISO/IEC 2382-15:1999, 15.04.01, modified]

217 **3.1.11**218 **device**

219 field device

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

222 [Source: IEC 61499-1:2005, 3.30, modified]

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

225 [Source: ISO 15745-1:2003, 3.11]

226 **3.1.12**227 **device profile**228 representation of a device in terms of its parameters, parameter assemblies and behaviour
229 according to a device model that describes the device's data and behaviour as viewed
230 through a network231 Note 1 to entry: This is a definition from IEC/TS 61915 which is extended by the addition of the device functional
232 structure.

233 [Source: IEC/TR 62390:2005, 3.19, modified]

- 234 **3.1.13**
235 **feedback variable**
236 variable which represents a controlled variable and which is returned to a comparing element
237 [Source: IEC 351-27-03]
- 238 **3.1.14**
239 **functional element**
240 entity of software or software combined with hardware, capable of accomplishing a specified
241 function of a device
242 Note 1 to entry: A functional element has an interface, associations to other functional elements and functions.
243 Note 2 to entry: A functional element can be made out of function block(s), object(s) or parameter list(s).
244 [Source: IEC/TR 62390:2005, 3.1.12]
- 245 **3.1.15**
246 **high-level power**
247 main electric power supply of the drive device
- 248 **3.1.16**
249 **input data**
250 data transferred from an external source into a device, resource or functional element
251 [Source: IEC/TR 62390:2005, 3.1.14]
- 252 **3.1.17**
253 **interface**
254 shared boundary between two entities defined by functional characteristics, signal
255 characteristics, or other characteristics as appropriate
256 [Source: IEC 351-21-35, modified]
- 257 **3.1.18**
258 **logical power drive system**
259 model which includes PDS and communication network accessible through the generic PDS
260 interface
- 261 **3.1.19**
262 **low-level power**
263 electrical power supply for the control section of the drive device
- 264 **3.1.20**
265 **model**
266 mathematical or physical representation of a system or a process, based with sufficient
267 precision upon known laws, identification or specified suppositions
268 [Source: IEC 351-21-36]
- 269 **3.1.21**
270 **operating mode**
271 characterisation of the way and the extent to which the human operator intervenes in the
272 control equipment
273 [Source: IEC 351-31-01]
- 274 **3.1.22**
275 **output data**
276 data originating in a device, resource or functional element and transferred from them to
277 external systems
278 [Source: IEC/TR 62390:2005, 3.1.21]

279 **3.1.23**
280 **parameter**
281 data element that represents device information that can be read from or written to a device,
282 for example through the network or a local HMI

283 Note 1 to entry: Adapted from IEC/TS 61915.

284 Note 2 to entry: A parameter is typically characterised by a parameter name, data type and access direction.

285 [Source: IEC/TR 62390:2005, 3.1.22, modified]

286 **3.1.24**
287 **profile**
288 representation of a PDS interface in terms of its parameters, parameter assemblies and
289 behaviour according to a communication profile and a device profile

290 **3.1.25**
291 **reference variable**
292 input variable to a comparing element in a controlling system which sets the desired value of
293 the controlled variable and is deducted from the command variable

294 [Source: IEC 351-27-02]

295 **3.1.26**
296 **set-point**
297 value or variable used as output data of the application control program to control the PDS

298 **3.1.27**
299 **status**
300 set of information from the PDS to the application control program reflecting the state or mode
301 of the PDS or a functional element of the PDS

302 Note 1 to entry: The different status information may be coded with one bit each.

303 **3.1.28**
304 **type**
305 hardware or software element which specifies the common attributes shared by all instances
306 of the type

307 [Source: IEC/TR 62390:2005, 3.1.25]

308 **3.1.29**
309 **use case**
310 class specification of a sequence of actions, including variants, that a system (or other entity)
311 can perform, interacting with actors of the system

312 [Source: IEC/TR 62390:2005, 3.1.26]

313 **3.1.30**
314 **variable**
315 software entity that may take different values, one at a time

316 Note 1 to entry: The values of a variable as well as of a parameter are usually restricted to a certain data type.

317 [Source: IEC/TR 62390:2005, 3.1.27, modified]

318 **3.2 Abbreviated terms**

319	AC	Alternating Current
320	BL	Brush-Less
321	c	Constant
322	CiA	CAN in Automation
323	COB	Communication Object
324	csp	Cyclic Synchronous Profile mode

325	cst	Cyclic Synchronous Torque mode
326	csv	Cyclic Synchronous Velocity mode
327	DC	Direct Current
328	DIV	Divisor
329	FC	Frequency Converter
330	FE	Functional Element
331	FIFO	First In, First Out
332	FSA	Finite State Automaton
333	hm	Homing Mode
334	HMI	Human Machine Interface
335	I/O	Input/Output
336	ip	Interpolated Position mode
337	LSB	Less significant bit/byte
338	MSB	Most significant bit/byte
339	MUL	Multiplication
340	NMT	Network Management
341	PDS	Power Drive System
342	PM	Permanent Magnet
343	pp	Profile Position mode
344	pv	Profile Velocity mode
345	r	Reserved
346	r.m.s.	Root Mean Square
347	ro	Read-Only
348	rw	Read-Write
349	tq	Torque Mode
350	vl	Velocity Mode

351 **4 General**

352 **4.1 General considerations**

353 This part of the IEC 61800-7 series specifies the bus-independent CiA 402 device profile for
 354 power drive systems such as frequency converters, servo controllers, or stepper motor
 355 controllers. It includes the definition of real-time control objects as well as of configuration,
 356 adjustment, identification and network management objects. The PDS finite state automaton
 357 (FSA) is also defined, which may be controlled externally by a control device communicating
 358 via a communication system to the drive device.

359 The device profile defines several modes of operation. They include profile position mode,
 360 homing mode, interpolated position mode, profile velocity mode, profile torque mode, velocity
 361 mode, cyclic synchronous position mode, cyclic synchronous velocity mode, and cyclic
 362 synchronous torque mode.

363 4.2 Communication interface

364 The communication system connects the drive device to the control device and other field
365 devices. Via the communication system the control device uses communication services to
366 exchange with the drive device:

- 367 • Non real-time data (configuration, identification, adjustment, diagnostic, etc.)
- 368 • Process data like target values and actual values

369 These services are defined in the IEC 61800-7-301. The process data are exchanged by real-
370 time data messages. These messages may be configured by means of configuration services
371 provided by the communication system.

372 The communication system shall provide services to transmit and receive communication
373 objects (COB). The following COBs shall be supported:

- 374 • COB for real-time data transmission
- 375 • COB for emergency information transmission
- 376 • COB for network management purposes

377 Additionally, the communication system may provide the following COBs:

- 378 • COB for configuration data transmission
- 379 • COB for synchronisation purposes
- 380 • COB for system time distribution

381 The COBs are defined in detail in IEC 61800-7-301.

382 4.3 Object dictionary

383 All objects in this part of the IEC 61800-7 series are grouped in the object dictionary, and
384 defined by attributes as defined in EN 50325-4. All objects shall be accessible via the network
385 in an ordered pre-defined fashion by means of COB for configuration data transmission. Each
386 object within the dictionary shall be addressed uniquely by using a 16-bit index and an 8-bit
387 sub-index. The communication-related objects are defined in detail in EN 50325-4 and
388 IEC 61800-7-301.

389 The standardised device profile area at indices 6000_h through $9FFF_h$ shall contain all
390 application objects common to this device profile specification. The following object indices
391 shall be reserved for compatibility reasons: 6045_h , 6047_h , $604D_h$, $604E_h$, $604F_h$, 6052_h ,
392 6053_h , 6054_h , 6055_h , 6056_h , 6057_h , 6058_h , 6059_h , 6089_h , $608A_h$, $608B_h$, $608C_h$, $608D_h$,
393 $608E_h$, 6093_h , 6094_h , 6095_h , 6096_h , 6097_h , $60A0_h$, $60A1_h$, $60A2_h$, $60F6_h$, $60F7_h$, $60F9_h$,
394 $60FB_h$, 6410_h , 6504_h , and 6510_h . The following object indices range shall be reserved for
395 compatibility reasons with other standards: from 6200_h to $62FF_h$ and from 6600_h to $67EF_h$

396 The objects may be read respectively written via the network. Within this range of objects, up
397 to 8 axes may be realised. Additionally, it is possible to implement other device profiles (e. g.
398 generic I/O module or encoder) within the drive device. These other device profiles may be
399 implemented instead of one or several axes.

400 For multi axes devices, the object range 6000_h to $67FF_h$ shall be shifted as follows:

- 401 – 6000_h to $67FF_h$: axis 0
- 402 – 6800_h to $6FFF_h$: axis 1
- 403 – 7000_h to $77FF_h$: axis 2
- 404 – 7800_h to $7FFF_h$: axis 3
- 405 – 8000_h to $87FF_h$: axis 4
- 406 – 8800_h to $8FFF_h$: axis 5
- 407 – 9000_h to $97FF_h$: axis 6
- 408 – 9800_h to $9FFF_h$: axis 7

409 The category and entry category attributes of an object indicate if the object shall be
410 implemented (mandatory) or may be implemented (optional).

411 The object code and data type attributes are defined in detail in EN 50325-4 or in other
412 network technology specifications. The used data type attributes are given in Clause 5. In the
413 entry description, the access attribute indicating if an application object is read only (*ro*),
414 read/write (*rw*) or write only (*wo*) or constant (*c*) is defined. Read only indicates that this shall
415 not be written via the bus; read/write allows to read and to write this object; and write only
416 means that this application object shall be not read via the bus.

417 The PDO mapping attribute shall indicate if this object shall be or may be or shall not be
418 mapped into COB for real-time data transmission. The detailed definition of these attributes is
419 given in IEC 61800-7-301.

420 The default value attribute defines the value of an object with access attribute of the value '*rw*'
421 and '*c*' after power-on or application reset.

422 5 Data types

423 5.1 Standard data types

424 The data types used in this profile are listed in Table 1.

425 **Table 1 – List of used data types**

Data type	Reference
Unsigned8	EN 50325-4
Unsigned16	EN 50325-4
Unsigned32	EN 50325-4
Integer8	EN 50325-4
Integer16	EN 50325-4
Integer32	EN 50325-4
Visible string	EN 50325-4
Time of day	EN 50325-4
Interpolated time period	See Table 2
Interpolated data configuration	See Table 3
v/ velocity acceleration/deceleration	See Table 4

426

427 5.2 Record definitions

428 Table 2, Table 3, and Table 4 define the records used in this part of the IEC 61800-7 series.

429

Table 2 – Interpolated time period

Index	Sub-index	Description	Data type
0080 _h	00 _h	Highest index supported	Unsigned8
	01 _h	Interpolation time units	Unsigned8
	02 _h	Interpolation time index	Integer8

430

431

Table 3 – Interpolated data configuration

Index	Sub-index	Description	Data type
0081 _h	00 _h	Highest index supported	Unsigned8
	01 _h	Maximum buffer size	Unsigned32
	02 _h	Actual buffer size	Unsigned32
	03 _h	Buffer organisation	Unsigned8
	04 _h	Buffer position	Unsigned16
	05 _h	Size of data record	Unsigned8
	06 _h	Buffer clear	Unsigned8

432

433

Table 4 – vl velocity acceleration/deceleration

Index	Sub-index	Description	Data type
0082 _h	00 _h	Highest index supported	Unsigned8
	01 _h	Delta speed	Unsigned32
	02 _h	Delta time	Integer16

434

435 6 General object definitions**436 6.1 General**

437 In the following Subclauses, the communication parameter objects, the additional
438 identification and the information objects are defined.

439 6.2 Communication parameter objects

440 There are three communication parameter objects that shall be implemented:

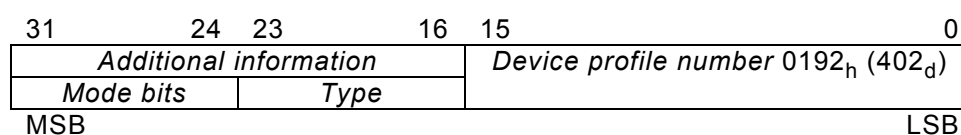
- 441 – Device type object 1000_h
- 442 – Error register object 1001_h
- 443 – Identity object 1018_h

444 They are defined in EN 50325-4 and the following definitions shall also apply.

445 The device type object shall define the device type, the device's functionality, and the
446 mapping variant.

447 For multi device modules, the additional information parameter shall contain 0FFF_h and the
448 device profile number referenced by object 1000_h is the device profile of the first device in the
449 object dictionary. All other devices of a multiple device module shall identify their profiles at
450 object 67FF_h + x × 800_h with x = internal number of the device (0 to 7). For details, see EN
451 50325-4.

452 Figure 2 specifies the structure and the values of the *device type* object, Table 5 specifies the
453 object description, and Table 6 specifies the entry description.



454

Figure 2 – Value definition

455 *Mode bits* and *type* in the *additional information* are defined in IEC 61800-7-301.

456

Table 5 – Object description

Attribute	Value
Index	1000 _h
Name	Device type
Object Code	See EN 50325-4
Data Type	See EN 50325-4
Category	Mandatory

457

458

Table 6 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	See value definition
Default Value	Manufacturer-specific

459

460 The device-profile specific bit in the *error register* object (1001_h) shall be used to indicate that
 461 the *error code* in the Emergency message is defined in this part of the IEC 61800-7 series.

462 NOTE The corresponding *error code* is readable in object 1003_h (see EN 50325-4) or object 603F_h.

463 6.3 Additional identification and information objects

464 6.3.1 Object 6402_h: Motor type

465 This object shall indicate the type of motor attached to and driven by the drive device. Table 7
 466 specifies the value definition, Table 8 specifies the object description, and Table 9 specifies
 467 the entry description.

468

Table 7 – Value definition

Value	CANopen name	Other names
0000 _h	Non-standard motor	-
0001 _h	Phase modulated DC motor	-
0002 _h	Frequency controlled DC motor	-
0003 _h	PM synchronous motor	-
0004 _h	FC synchronous motor	AC synchronous sinewave wound field
0005 _h	Switched reluctance motor	AC synchronous reluctance switched
0006 _h	Wound rotor induction motor	AC asynchronous induction polyphase wound rotor
0007 _h	Squirrel cage induction motor	AC asynchronous induction squirrel cage
0008 _h	Stepper motor	AC synchronous step
0009 _h	Micro-step stepper motor	-
000A _h	Sinusoidal PM BL motor	AC synchronous sinusoidal PM
000B _h	Trapezoidal PM BL motor	AC synchronous brushless PM trapezoidal
000C _h	AC synchronous reluctance sync	-
000D _h	DC commutator PM	-
000E _h	DC commutator wound field series	-
000F _h	DC commutator wound field shunt	-
0010 _h	DC commutator wound field compound	-

Value	CANopen name	Other names
0011 _h to 7FFE _h	reserved	-
7FFF _h	No motor type assigned	-
8000 _h to FFFF _h	Manufacturer-specific	-

Table 8 – Object description

Attribute	Value
Index	6402 _h
Name	Motor type
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 9 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 7
Default Value	Manufacturer-specific

6.3.2 Object 6403_h: Motor catalogue number

This object shall indicate the motor catalogue number (nameplate number) provided by the motor manufacturer. If the number is not assigned yet, this object shall indicate this by /0 (empty string). Table 10 specifies the object description, and Table 11 specifies the entry description.

Table 10 – Object description

Attribute	Value
Index	6403 _h
Name	Motor catalogue number
Object Code	Variable
Data Type	Visible String
Category	Optional

Table 11 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Visible String
Default Value	Manufacturer-specific

6.3.3 Object 6404_h: Motor manufacturer

This object shall indicate the name of the motor manufacturer. If the name is not assigned yet, this object shall indicate this by /0 (empty string). Table 12 specifies the object description, and Table 13 specifies the entry description.

Table 12 – Object description

Attribute	Value
Index	6404 _h
Name	Motor manufacturer
Object Code	Variable
Data Type	Visible String
Category	Optional

Table 13 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Visible String
Default Value	Manufacturer-specific

6.3.4 Object 6405_h: http motor catalogue address

This object shall indicate the assigned web-address of the motor catalogue. If the address is not assigned yet, this object shall indicate this by /0 (empty string). Table 14 specifies the object description, and Table 15 specifies the entry description.

Table 14 – Object description

Attribute	Value
Index	6405 _h
Name	http motor catalogue address
Object Code	Variable
Data Type	Visible String
Category	Optional

Table 15 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Visible String
Default Value	Manufacturer-specific

6.3.5 Object 6406_h: Motor calibration date

This object shall indicate the assigned date of the last motor inspection. If the date is not assigned yet, this object shall indicate this by a value of 0. Table 16 specifies the object description, and Table 17 specifies the entry description.

Table 16 – Object description

Attribute	Value
Index	6406 _h
Name	Motor calibration date
Object Code	Variable
Data Type	Time of Day
Category	Optional

Table 17 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	0 _d or Time of Day
Default Value	Manufacturer-specific

6.3.6 Object 6407_h: Motor service period

This object shall indicate the assigned motor service period. If the period is not assigned yet, this object shall indicate this by 0000 0000_h. The value shall be given in multiples of hours. Table 18 specifies the object description, and Table 19 specifies the entry description.

Table 18 – Object description

Attribute	Value
Index	6407 _h
Name	Motor service period
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 19 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

515 6.3.7 Object 6503_h: Drive catalogue number

516 This object shall indicate the assigned manufacturer's drive catalogue number (nameplate
517 number). Table 20 specifies the object description, and Table 21 specifies the entry
518 description.

519 Table 20 – Object description

Attribute	Value
Index	6503 _h
Name	Drive catalogue number
Object Code	Variable
Data Type	Visible String
Category	Optional

520

521 Table 21 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	No
Default Value	Manufacturer specific

522

523 6.3.8 Object 6505_h: http drive catalogue address

524 This object shall indicate the assigned web address of the drive manufacturer. If the address
525 is not assigned yet, this object shall indicate this by /0 (empty string). Table 22 specifies the
526 object description, and Table 23 specifies the entry description.

527 Table 22 – Object description

Attribute	Value
Index	6505 _h
Name	http drive catalogue address
Object Code	Variable
Data Type	Visible String
Category	Optional

528

529 Table 23 – Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	No
Default Value	Manufacturer-specific

530

531 **7 Error codes and error behaviour**532 **7.1 Error codes**

533 Emergency messages are triggered by internal errors and severe warnings detected within
 534 the drive device. They are defined in detail in the IEC 61800-7-301. They shall contain the 16-
 535 bit error code. Error codes from xx00_h to xx7F_h are defined in EN 50325-4 or in Table 24.
 536 Error codes between xx80_h and xxFF_h are used manufacturer-specific.

537

Table 24 – Error codes

Error code	Meaning
2110 _h	Short circuit/earth leakage (input)
2120 _h	Earth leakage (input)
2121 _h	Earth leakage phase L1
2122 _h	Earth leakage phase L2
2123 _h	Earth leakage phase L3
2130 _h	Short circuit (input)
2131 _h	Short circuit phases L1-L2
2132 _h	Short circuit phases L2-L3
2133 _h	Short circuit phases L3-L1
2211 _h	Internal current no.1
2212 _h	Internal current no.2
2213 _h	Over-current in ramp function
2214 _h	Over-current in the sequence
2220 _h	Continuous over current (device internal)
2221 _h	Continuous over current no.1
2222 _h	Continuous over current no.2
2230 _h	Short circuit/earth leakage (device internal)
2240 _h	Earth leakage (device internal)
2250 _h	Short circuit (device internal)
2310 _h	Continuous over current (device output side)
2311 _h	Continuous over current no.1
2312 _h	Continuous over current no.2
2320 _h	Short circuit/earth leakage (motor-side)
2330 _h	Earth leakage (motor-side)
2331 _h	Earth leakage phase U
2332 _h	Earth leakage phase V
2333 _h	Earth leakage phase W
2340 _h	Short circuit (motor-side)
2341 _h	Short circuit phases U-V
2342 _h	Earth leakage phase V-W
2343 _h	Earth leakage phase W-U
2350 _h	Load level fault (I ² t, thermal state)
2351 _h	Load level warning (I ² t, thermal state)
3110 _h	Mains over-voltage



Error code	Meaning
3111 _h	Mains over-voltage phase L1
3112 _h	Mains over-voltage phase L2
3113 _h	Mains over-voltage phase L3
3120 _h	Mains under-voltage
3121 _h	Mains under-voltage phase L1
3122 _h	Mains under-voltage phase L2
3123 _h	Mains under-voltage phase L3
3130 _h	Phase failure
3131 _h	Phase failure L1
3132 _h	Phase failure L2
3133 _h	Phase failure L3
3134 _h	Phase sequence
3140 _h	Mains frequency
3141 _h	Mains frequency too great
3142 _h	Mains frequency too small
3210 _h	DC link over-voltage
3211 _h	Over-voltage no. 1
3212 _h	Over voltage no. 2
3220 _h	DC link under-voltage
3221 _h	Under-voltage no. 1
3222 _h	Under-voltage no. 2
3230 _h	Load error
3310 _h	Output over-voltage
3311 _h	Output over-voltage phase U
3312 _h	Output over-voltage phase V
3313 _h	Output over-voltage phase W
3320 _h	Armature circuit
3321 _h	Armature circuit interrupted
3330 _h	Field circuit
3331 _h	Field circuit interrupted
4110 _h	Excess ambient temperature
4120 _h	Too low ambient temperature
4130 _h	Temperature supply air
4140 _h	Temperature air outlet
4210 _h	Excess temperature device
4220 _h	Too low temperature device
4300 _h	Temperature drive
4310 _h	Excess temperature drive
4320 _h	Too low temperature drive
4400 _h	Temperature supply
4410 _h	Excess temperature supply

Error code	Meaning
4420 _h	Too low temperature supply
5100 _h	Supply device hardware
5110 _h	Supply low voltage
5111 _h	U1 = supply ±15V
5112 _h	U2 = supply +24 V
5113 _h	U3 = supply +5 V
5114 _h	U4 = manufacturer-specific
5115 _h	U5 = manufacturer-specific
5116 _h	U6 = manufacturer-specific
5117 _h	U7 = manufacturer-specific
5118 _h	U8 = manufacturer-specific
5119 _h	U9 = manufacturer-specific
5120 _h	Supply intermediate circuit
5200 _h	Control
5210 _h	Measurement circuit
5220 _h	Computing circuit
5300 _h	Operating unit
5400 _h	Power section
5410 _h	Output stages
5420 _h	Chopper
5430 _h	Input stages
5440 _h	Contacts
5441 _h	Contact 1 = manufacturer-specific
5442 _h	Contact 2 = manufacturer-specific
5443 _h	Contact 3 = manufacturer-specific
5444 _h	Contact 4 = manufacturer-specific
5445 _h	Contact 5 = manufacturer-specific
5450 _h	Fuses
5451 _h	S1 = I1
5452 _h	S2 = I2
5453 _h	S3 = I3
5454 _h	S4 = manufacturer-specific
5455 _h	S5 = manufacturer-specific
5456 _h	S6 = manufacturer-specific
5457 _h	S7 = manufacturer-specific
5458 _h	S8 = manufacturer-specific
5459 _h	S9 = manufacturer-specific
5500 _h	Hardware memory
5510 _h	RAM
5520 _h	ROM/EPROM
5530 _h	EEPROM

Error code	Meaning
6010 _h	Software reset (watchdog)
6301 _h to 630F _h	Data record no. 1 to no. 15
6310 _h	Loss of parameters
6320 _h	Parameter error
7100 _h	Power additional modules
7110 _h	Brake chopper
7111 _h	Failure brake chopper
7112 _h	Over current brake chopper
7113 _h	Protective circuit brake chopper
7120 _h	Motor
7121 _h	Motor blocked
7122 _h	Motor error or commutation malfunc.
7123 _h	Motor tilted
7200 _h	Measurement circuit
7300 _h	Sensor
7301 _h	Tacho fault
7302 _h	Tacho wrong polarity
7303 _h	Resolver 1 fault
7304 _h	Resolver 2 fault
7305 _h	Incremental sensor 1 fault
7306 _h	Incremental sensor 2 fault
7307 _h	Incremental sensor 3 fault
7310 _h	Speed
7320 _h	Position
7400 _h	Computation circuit
7500 _h	Communication
7510 _h	Serial interface no. 1
7520 _h	Serial interface no. 2
7600 _h	Data storage (external)
8300 _h	Torque control
8311 _h	Excess torque
8312 _h	Difficult start up
8313 _h	Standstill torque
8321 _h	Insufficient torque
8331 _h	Torque fault
8400 _h	Velocity speed controller
8500 _h	Position controller
8600 _h	Positioning controller
8611 _h	Following error
8612 _h	Reference limit
8613 _h	Homing Error

Error code	Meaning
8700 _h	Sync controller
8800 _h	Winding controller
8900 _h	Process data monitoring
8A00 _h	Control monitoring
F001 _h	Deceleration
F002 _h	Sub-synchronous run
F003 _h	Stroke operation
F004 _h	Control additional functions
FF00 _h to FFFF _h	Manufacturer-specific

538

539 **7.2 Error behavior**

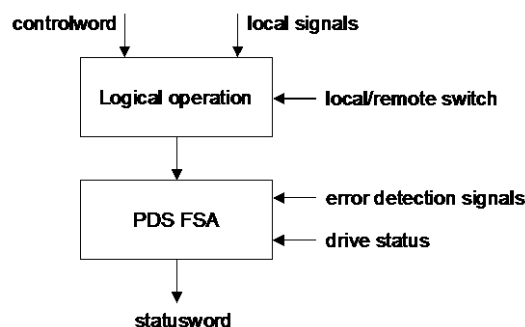
540 The communication system may support an object specifying to which network management
 541 state the drive device shall transit, when a communication error or a severe device-internal
 542 error is detected. When the PDS FSA transits into *Error* state, this shall be regarded as a
 543 severe device-internal failure.

544 **8 Controlling the power drive system**545 **8.1 General**

546 The PDS FSA is an abstraction to define the behavior of a black box as a control device
 547 experiences the PDS. It defines the application behavior of the PDS. Due to the requirement
 548 that a PDS provides local control even when the communication network is not working
 549 properly, the communication FSA as defined in the communication system mapping
 550 specifications and the PDS FSA are only loosely coupled.

551 Figure 3 specifies how the PDS may be operated locally or via the network remotely. The PDS
 552 is operated by local signals (not in the scope of this part of IEC 61800) and by the controlword
 553 sent by the control device via the network. The state of the PDS is reported by the statusword
 554 produced by the drive device. The FSA is also controlled by error detection signals.

555 The PDS FSA defines the PDS status and the possible control sequence of the PDS. A single
 556 state represents a special internal or external behavior. The state of the PDS also determines
 557 which commands are accepted. For example, it is only possible to start a point-to-point move
 558 when the drive is in the *operation enabled* state.



559

560 **Figure 3 – Remote and local control**561 **8.2 Finite state automaton**

562 Figure 4 specifies the PDS FSA with respect to control of the power electronics as a result of
 563 user commands and internal drive faults.

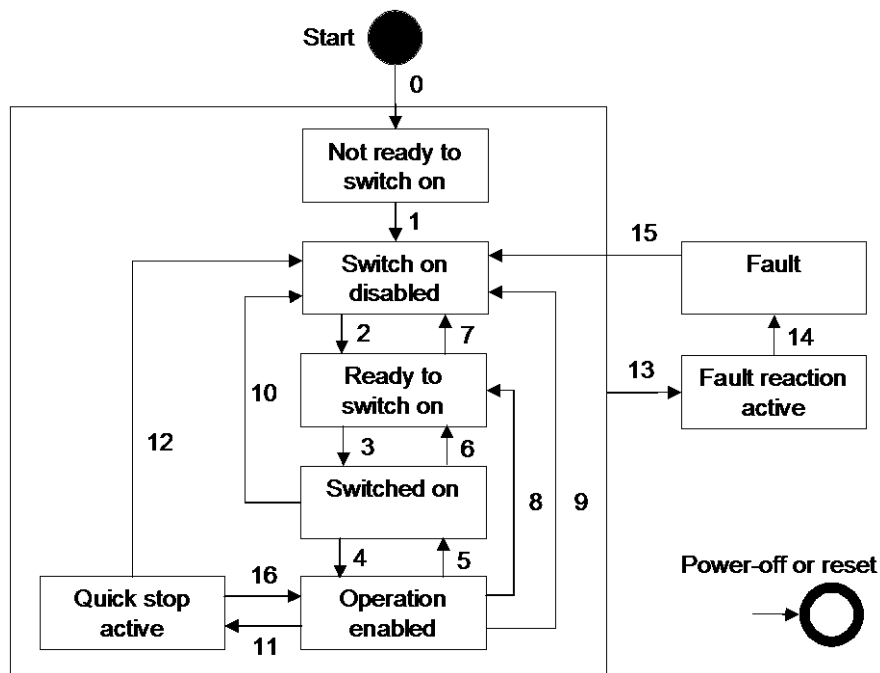


Figure 4 – Power drive system finite state automaton

The FSA states shall support the functions as shown in Table 25. The *start* state shall be a pseudo state indicating the start when the FSA is activated during the start-up sequence of the device drive's application software.

Table 25 – FSA states and supported functions

Function	FSA states							
	Not ready to switch on	Switch on disabled	Ready to switch on	Switched on	Operation enabled	Quick stop active	Fault reaction active	Fault
Brake applied, if present	Yes	Yes	Yes	Yes	Yes/No	Yes/No	Yes/No	Yes
Low-level power applied	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
High-level power applied	Yes/No	Yes/No	Yes/No	Yes	Yes	Yes	Yes	Yes/No
Drive function enabled	No	No	No	No	Yes	Yes	Yes	No
Configuration allowed	Yes	Yes	Yes	Yes	Yes/No	Yes/No	Yes/No	Yes

If in the *quick stop active* state the quick stop option code is set to 5, 6, 7 or 8, the drive device shall not leave this state, but it may transit to the *operation enabled* state with the *Enable operation* command.

The drive device shall support the transitions and actions as given in Table 26. The events shall initiate the transition. The transition shall be terminated after the action has been performed.

577

Table 26 – Transition events and actions

Transition	Event(s)	Action(s)
0	Automatic transition after power-on or reset application	Drive device self-test and/or self initialisation shall be performed.
1	Automatic transition	Communication shall be activated.
2	Shutdown command from control device or local signal	None
3	Switch on command received from control device or local signal	The high-level power shall be switched on, if possible.
4	Enable operation command received from control device or local signal	The drive function shall be enabled and all internal set-points cleared.
5	Disable operation command received from control device or local signal	The drive function shall be disabled.
6	Shutdown command received from control device or local signal	The high-level power shall be switched off, if possible.
7	Quick stop or disable voltage command from control device or local signal	None
8	Shutdown command from control device or local signal	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
9	Disable voltage command from control device or local signal	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
10	Disable voltage or quick stop command from control device or local signal	The high-level power shall be switched off, if possible.
11	Quick stop command from control device or local signal	The quick stop function shall be started.
12	Automatic transition when the quick stop function is completed and quick stop option code is 1, 2, 3 or 4, or disable voltage command received from control device (depends on the quick stop option code)	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
13	Fault signal (see also IEC 61800-7-301)	The configured fault reaction function shall be executed.
14	Automatic transition	The drive function shall be disabled; the high-level power shall be switched off, if possible.
15	Fault reset command from control device or local signal	A reset of the fault condition is carried out, if no fault exists currently on the drive device; after leaving the Fault state, the Fault reset bit in the controlword shall be cleared by the control device.
16	Enable operation command from control device, if the quick stop option code is 5, 6, 7, or 8	The drive function shall be enabled.

NOTE It is not recommended to support transition 16.

578

579 If a state transition is requested, the related actions shall be processed completely before
 580 transitioning to the new state. Example: In *operation enabled* state, when the *disable*
 581 *operation* command is received, the drive device shall stay in the *operation enabled* state until
 582 the disable operation function (see object 605C_h) is completed.

583 Drive devices able to control the contactor for the mains may switch the high-level power. If
 584 the high-level power is switched-off, the motor shall be free to rotate if not braked.

585 Drive function is disabled implies no energy shall be supplied to the motor. Target or set-point
 586 values (e.g. torque, velocity, position) shall be not processed.

587 Drive function is enabled implies that energy may be supplied to the motor. Target or set-point
 588 values shall be processed.

If a fault is detected in the drive device, there shall be a transition to the *fault reaction active* state. In this state, the PDS shall execute a special fault reaction. After the execution of this fault reaction, the drive device shall switch automatically to the *fault* state. This state shall only be left by the fault reset command, but only if the fault is not active any more.

In case of fatal error, the drive device is not longer able to control the motor, so that an immediate switch-off of the drive device is necessary.

The behaviour of drive disabling, quick stop, halt, and fault reaction functions is configurable by means of configuration objects defined in 8.4.

NOTE If a brake is present, the high-level power is switched off after a delay time in order to apply the brake.

8.3 Modes of operation

The PDS behaviour depends on the activated mode of operation. The PDS may implement several modes of operation. Since it is not possible to operate the modes in parallel, the user is able to activate the required function by selecting a mode of operation.

The control device writes to the *modes of operation* object in order to select the operation mode. The drive device provides the *modes of operation display* object to indicate the actual activated operation mode. Controlword, statusword, and set-points are used mode-specific. This implies the responsibility of the control device to avoid inconsistencies and erroneous behaviour. The switching between the modes of operation implies no automatic reconfiguration of COBs for real-time data transmission.

Therefore, the PDS may limit mode switching in one or some PDS FSA state(s). Mode switching may also be limited to the 'local control' function; this means it is not possible to select the operation mode via the network.

The following modes of operation are described in this part of the IEC 61800-7 series:

- Profile position mode
- Homing mode
- Interpolated position mode
- Profile velocity mode (e.g. servo drives)
- Torque profile mode
- Velocity mode (e.g. frequency converter)
- Cyclic sync position mode
- Cyclic sync velocity mode
- Cyclic sync torque mode

With the exception of the 'Homing mode', the listed modes of operation deal with set-points. In addition to this, manufacturer-specific modes of operation may also be implemented. These are not limited to set-points.

Figure 5 shows the general relations between target, reference, effort, and actual values.

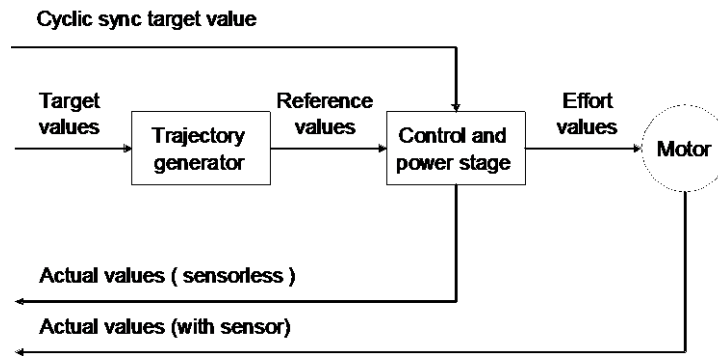


Figure 5 – Relation between different value parameters

8.4 Detailed object specifications

8.4.1 Object 6040_h: Controlword

This object shall indicate the received command controlling the PDS FSA. It shall be structured as defined in Figure 6. The bits 7, 3, 2, 1, and 0 shall be supported. The bits 0 to 9 shall be supported according to the mode of operation. If the related functionality is not available, an appropriate emergency message shall be generated. The manufacturer-specific (*ms*) bits may be supported. The commands shall be coded as given in Table 27. All implemented bits of the controlword are valid independent of the PDS FSA state. Starting of any movement is operation mode specific and is described in the related clause.

15	11	10	9	8	7	6	4	3	2	1	0
<i>ms</i>	<i>r</i>	<i>oms</i>	<i>h</i>	<i>fr</i>	<i>oms</i>	<i>eo</i>	<i>qs</i>	<i>ev</i>	<i>so</i>		
MSB											LSB

LEGEND: *ms* = manufacturer-specific; *r* = reserved; *oms* = operation mode specific; *h* = halt; *fr* = fault reset; *eo* = enable operation; *qs* = quick stop; *ev* = enable voltage; *so* = switch on

Figure 6 – Value definition

Table 27 – Command coding

Command	Bits of the controlword					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Switch on + enable operation	0	1	1	1	1	3 + 4 (NOTE)
Disable voltage	0	X	X	0	X	7,9,10,12
Quick stop	0	X	0	1	X	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset		X	X	X	X	15
NOTE Automatic transition to enable operation state after executing SWITCHED ON state functionality.						

Bits 9, 6, 5, and 4 of the controlword are operation mode specific. The halt function (bit 8) behaviour is operation mode specific. If the bit is 1, the commanded motion shall be interrupted, the PDS shall behave as defined in the halt option code. After releasing the halt function, the commanded motion shall be continued if possible.

The bit 10 is reserved for further use; it shall be set to 0. The bits 11, 12, 13, 14, and 15 are manufacturer-specific.

Table 28 specifies the object description, and Table 29 specifies the entry description.