

DIN EN 61800-7-204

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Ersatzvermerk
siehe unten

**Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl –
Teil 7-204: Generisches Interface und Nutzung von Profilen für
Leistungsantriebssysteme (PDS) –
Spezifikation von Profil-Typ 4 (IEC 61800-7-204:2007);
Englische Fassung EN 61800-7-204:2008**

Adjustable speed electrical power drive systems –
Part 7-204: Generic interface and use of profiles for power drive systems –
Profile type 4 specification (IEC 61800-7-204:2007);
English version EN 61800-7-204:2008

Entraînements électriques de puissance à vitesse variable –
Partie 7-204: Interface et utilisation génériques de profils pour les entraînements
électriques de puissance –
Spécifications des profils de type 4 (CEI 61800-7-204:2007);
Version anglaise EN 61800-7-204:2008

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 61800-7-1:2008-11 und DIN EN 61800-7-304:2008-11 Ersatz für DIN EN 61491:1999-11
Siehe jedoch Beginn der Gültigkeit

Gesamtumfang 313 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

Beginn der Gültigkeit

Die von CENELEC am 2008-02-01 angenommene EN 61800-7-204 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 61800-7-2:2006-06.

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.

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

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

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.

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 7-204: Generic interface and use of profiles for power drive systems –
Profile type 4 specification
(IEC 61800-7-204:2007)**

Entraînements électriques de puissance
à vitesse variable –
Partie 7-204: Interface et utilisation
génériques de profils pour les
entraînements électriques de puissance –
Spécifications des profils de type 4
(CEI 61800-7-204:2007)

Elektrische Leistungsantriebssysteme
mit einstellbarer Drehzahl –
Teil 7-204: Generisches Interface
und Nutzung von Profilen
für Leistungsantriebssysteme (PDS) –
Spezifikation von Profil-Typ 4
(IEC 61800-7-204:2007)

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/184/FDIS, future edition 1 of IEC 61800-7-204, 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 61800-7-204 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 61800-7-204:2007 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 61158	NOTE	Harmonized in EN 61158 series (not modified).
IEC 61499-1	NOTE	Harmonized as EN 61499-1:2005 (not modified).
IEC 61800	NOTE	Harmonized in EN 61800 series (not modified).
IEC 61800-7	NOTE	Harmonized in EN 61800-7 series (not modified).
IEC 61800-7-1	NOTE	Harmonized as EN 61800-7-1:2008 (not modified).
IEC 61800-7-201	NOTE	Harmonized as EN 61800-7-201:2008 (not modified).
IEC 61800-7-202	NOTE	Harmonized as EN 61800-7-202:2008 (not modified).
IEC 61800-7-203	NOTE	Harmonized as EN 61800-7-203:2008 (not modified).
IEC 61800-7-301	NOTE	Harmonized as EN 61800-7-301:2008 (not modified).
IEC 61800-7-302	NOTE	Harmonized as EN 61800-7-302:2008 (not modified).
IEC 61800-7-303	NOTE	Harmonized as EN 61800-7-303:2008 (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 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 (builds modules, machines, plants etc.)

- 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 specified with incompatibilities. It is up to the systems integrator to write interfaces to the application software to handle that which 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.

IEC 61800-7-1 is divided into a generic part and several annexes as shown in Figure 1. The drive profile 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.

This part of IEC 61800-7 specifies the profile type 4 (SERCOS).

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

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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 - ⁴ SERCOSTM and SERCOS InterfaceTM are trade names of SERCOS International 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 SERCOS and SERCOS interface. Use of the trade name SERCOS and SERCOS interface requires permission of the trade name holder.
 - ⁵ CANopen is an acronym for Controller Area Network *open* and is used to refer to EN 50325-4.
 - 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.
 - ⁷ Ethernet PowerlinkTM is a trade name of B&R, control of trade name use is given to the non profit organisation EPSG. 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 Ethernet PowerlinkTM. Use of the trade name Ethernet PowerlinkTM requires permission of the trade name holder.
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 - ¹¹ PROFIBUS is a trade name of PROFIBUS 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.

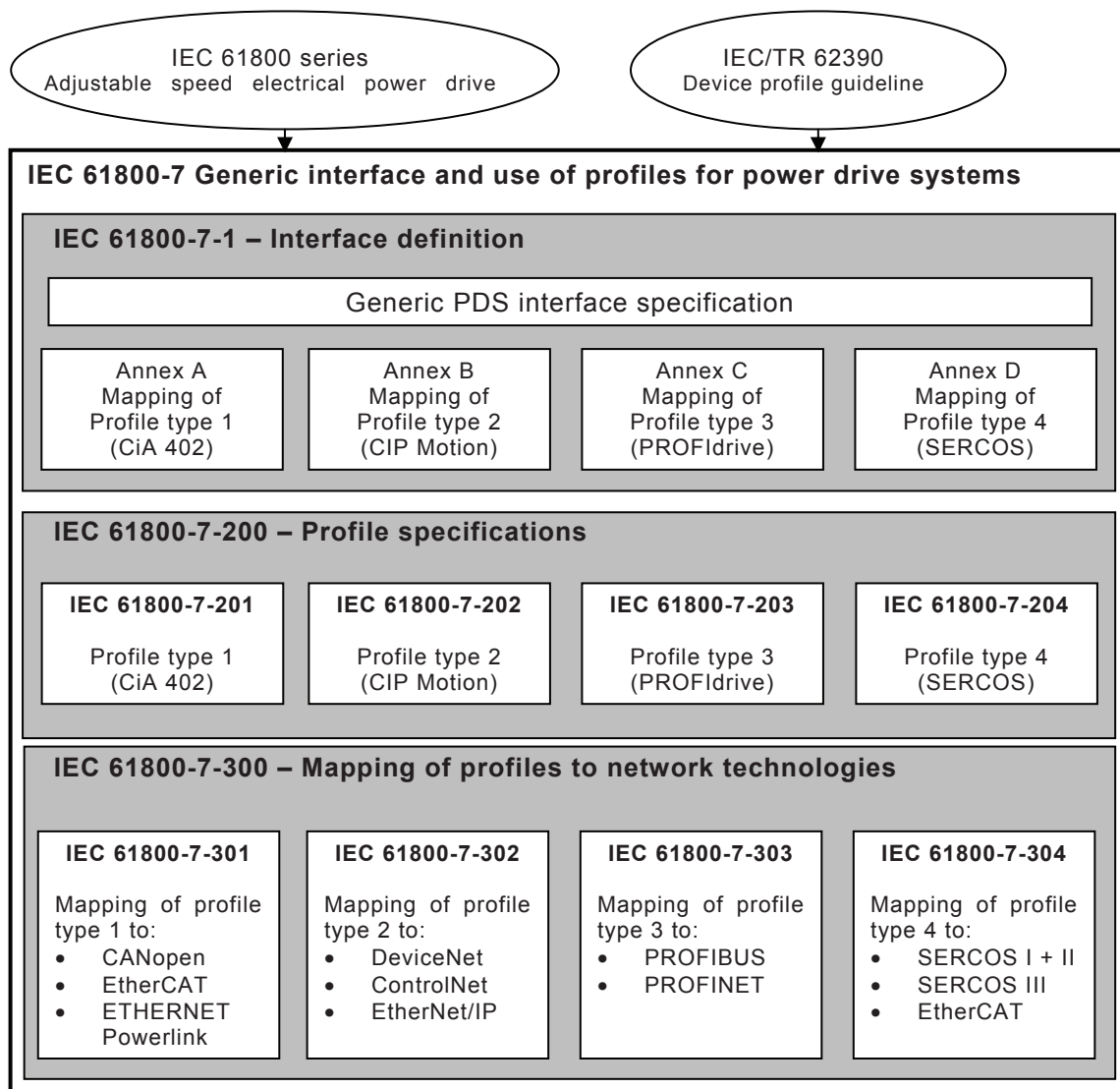


Figure 1 – Structure of IEC 61800-7

Compliance to this profile does not require use of the trade name PROFIBUS. Use of the trade name PROFIBUS requires permission of PROFIBUS International.

- ¹² PROFINET is a trade name of PROFIBUS 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 International.

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-204: Generic interface and use of profiles for power drive systems – Profile type 4 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 4 for Power Drive Systems (PDS). Profile type 4 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 61158-4-16, *Industrial communication networks – Fieldbus specifications – Part 4-16 (Ed.1.0): Data-link layer protocol specification – Type 16 elements*

IEC 61158-5-16, *Industrial communication networks – Fieldbus specifications – Part 5-16 (Ed.1.0): Application layer service definition – Type 16 elements*

IEC 61158-6-16, *Industrial communication networks – Fieldbus specifications – Part 6-16 (Ed.1.0): Application layer protocol specification – Type 16 elements*

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

IEC 61800-7-304, *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*

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

acknowledge telegram (AT)

telegram, in which each slave inserts its data

3.1.2

actual value

value of a variable at a given instant

[IEV 351-21-02]

NOTE 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.

3.1.3

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]

3.1.4

attribute

property or characteristic of an entity

[IEC/TR 62390:2005, 3.1.3]

3.1.5

class

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

[ISO/IEC 19501, modified]

3.1.6

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.

3.1.7

communication cycle

accumulation of all telegrams between two master synchronisation telegrams

3.1.8

control

purposeful action on or in a process to meet specified objectives

[IEV 351-21-29]

3.1.9

control device

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

3.1.10

control unit

control device

3.1.11

control word

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

3.1.12

cycle time

Time span between two consecutive cyclically recurring events

3.1.13

cyclic data

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

3.1.14

cyclic operation

devices in the communication network are addressed and queried one after the other at fixed, constant time intervals

3.1.15

data exchange

demand dependent; non cyclic transmission (service channel)
transmission of information after a request was sent by the master

3.1.16

data type

set of values together with a set of permitted operations

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

3.1.17

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 61499-1:2005, 3.30, modified]

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

[ISO 15745-1:2003, 3.11]

3.1.18

device profile

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

NOTE This is a definition from IEC/TS 61915 which is extended by the addition of the device functional structure.

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

3.1.19

feed forward

command value used to compensate the lag in the control loop

3.1.20

feedback variable

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

[IEV 351-27-03]

3.1.21

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]

3.1.22

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

3.1.23

input data

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

[IEC/TR 62390:2005, 3.1.14]

3.1.24

interface

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

[IEV 351-21-35, modified]

3.1.25

machine zero point

machine related point (in each axis) to which all position data are referred

3.1.26

master

node, which assigns the other nodes the right to transmit

3.1.27

Master Data Telegram

MDT

telegram, in which the master inserts its data

3.1.28

Master Synchronisation Telegram

MST

telegram, or part of a telegram, in which the master inserts a time synchronisation signal

**3.1.29
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]

**3.1.30
operating mode**

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

[IEV 351-30-01]

**3.1.31
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]

**3.1.32
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 characterised by a parameter name, data type and access direction.

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

**3.1.33
PDS enable**

command to close the feedback loop(s)

**3.1.34
PDS on**

command that the power stage can be activated

**3.1.35
profile**

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

**3.1.36
reference point**

feedback system related point (in each axis) to which the feedback and command values are referred to after a homing procedure

**3.1.37
scaling data**

data which determines the weight of the transferred operation data

3.1.38

slave

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

3.1.39

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.

3.1.40

status word

two adjacent bytes inside the drive telegram containing status information

3.1.41

telegram

message dataset

3.1.42

type

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

[IEC/TR 62390:2005, 3.1.25]

3.1.43

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.

3.2 Abbreviated terms

AT	Acknowledge Telegram
C1D	Class 1 Diagnostic
C2D	Class 2 Diagnostic
C3D	Class 3 Diagnostic
CP	Communication Phase (CP0 to CP6 – communication phases 0 to 6)
ID	Identifier
IDN	Identification Number
IPOSYNC	Synchronisation for PDS interpolator
HMI	Human Machine Interface
K_v (K_v -factor)	Gain of the position loop regulator
LSB	Least Significant Bit
Max	Maximum

MDT	Master Data Telegram
Min	Minimum
MSB	Most Significant Bit
MST	Master Sync Telegram
n	Velocity
$n_{\min}$	Shut-off velocity in the drive after C1D error
n_x	Velocity threshold
P	Power
PDS	Power Drive System
P_x	Power threshold
SERCOS	SErial Real time COmmunication System
T	Torque
T_{limit}	Limit value for the torque
T_x	Threshold torque
t_{Ncyc}	Control unit cycle time
t_{Scyc}	Communication cycle time

4 General

In the SERCOS interface, the data exchange between the master and the slaves and vice versa consists of the transmission of operation data and procedure commands. All operation data and procedure commands shall be assigned to an IDN.

5 Data types

Table 1 shows references of data types used in this profile and the related definitions.

Table 1 – Data types

Data types used in SERCOS	SERCOS name	Reference to definition
BitString16	binary number, 2 bytes long	IEC 61158-6-16
BitString32	binary number, 4 bytes long	IEC 61158-6-16
BitString64	binary number, 8 bytes long	IEC 61158-6-16
Integer16	integer, 2 bytes long	IEC 61158-6-16
Integer32	integer, 4 bytes long	IEC 61158-6-16
Integer64	integer, 8 bytes long	IEC 61158-6-16
Unsigned16	unsigned integer, 2 bytes long	IEC 61158-6-16
Unsigned32	unsigned integer, 4 bytes long	IEC 61158-6-16
Unsigned64	unsigned integer, 8 bytes long	IEC 61158-6-16
Float32	floating-point number, 4 bytes long	IEC 61158-6-16

Float64	floating-point number, 8 bytes long	IEC 61158-6-16
VisibleString	text, variable length (e.g., 1 byte long)	IEC 61158-6-16

6 Short description of SERCOS data exchange

6.1 General

Each IDN shall have an associated data block which consists of several elements, as shown in Table 2.

Table 2 – Elements of an IDN

Element number	Element content	Requirement
1	IDN	mandatory
2	Name	optional
3	Attribute	mandatory
4	Unit	optional
5	Minimum input value	optional ^a
6	Maximum input value	optional ^a
7	Operation data	mandatory
^a Element 5 and 6 are mandatory for cycle time parameters (S-0-0001, S-0-0002).		

The SERCOS interface distinguishes between cyclic and non-cyclic data exchanges (service channel). During the cyclic exchange, only element 7 (operation data) of a data block shall be transmitted. The transmission of all elements of the data block can only take place via the service channel. Non-cyclic data exchange shall take place in steps in special data fields of the telegrams.

The type and length of the data exchange depends on the condition of the SERCOS interface and on the mode of operation of the drives which are connected to the slaves. The most important operation modes are:

- position control;
- velocity control;
- torque control.

Important information, such as status signals from the drives or control signals to the drives, is always transmitted cyclically. All other operation data may be transmitted cyclically (e.g., command values, feedback values) or non-cyclically (e.g., limit values) depending on the application.

6.2 Synchronisation

In order to assure movements coordination without deviations on a machine with several drives from different manufacturers with one control (contouring control), technical requirements shall be fulfilled in order to achieve synchronism when:

- processing the command values;
- sampling the feedback values;
- synchronising different cycle times and fine interpolators in the drives.

Details on how to achieve this synchronisation are described in IEC 61800-7-304.