IEC 61800-7-302

Edition 1.0 2007-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Entraînements électriques de puissance à vitesse variable –
Partie 7-302: Interface générique et utilisation de profils pour les entraînements électriques de puissance – Mise en correspondance du profil de type 2 avec les technologies de réseaux

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-302: Generic interface and use of profiles for power drive systems – Mapping of profile type 2 to network technologies

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Publication / Application serial number	Holder	Title
US 11/241,539	[RA]	Time Stamped Motion Control Network Protocol That Enables Balanced Single Cycle Timing and Utilization of Dynamic Data Structures

The IEC takes no position concerning the evidence, validity and scope of this patent right.

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[RA]	Rockwell Automation, Inc. 1201 S. Second Street Milwaukee, WI 53204 USA Attention: Intellectual Property Dept.

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The International Standard IEC 61800-7-302 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 bilingual version (2013-04) corresponds to the monolingual English version, published in 2007-11.

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

FDIS	Report on voting
22G/185/FDIS	22G/193/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.

The French version of this standard has not been voted upon.

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.

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INTRODUCTION

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

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

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

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

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

There are several reasons to define a generic interface:

For a drive device manufacturer

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

For a control device manufacturer

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

For a system integrator

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

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

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

IEC 61800-7-1 is divided into a generic part and several annexes as shown in Figure 1. The drive profile types for CiA 402[1], CIP Motion™[2], PROFIdrive[3] and SERCOS interface™[4] are mapped to the generic interface in the corresponding annex. The annexes have been submitted by open international network or fieldbus organizations which are responsible for the content of the related annex and use of the related trademarks.

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

This part of IEC 61800-7 specifies how the profile type 2 (CIP Motion™) is mapped to the network technologies DeviceNet™[5], ControlNet™[6] and EtherNet/IP™[7].

IEC 61800-7-301, IEC 61800-7-303 and IEC 61800-7-304 specify how the profile types 1, 3 and 4 are mapped to different network technologies (such as CANopen[8], EtherCAT™[9], Ethernet Powerlink™[10], PROFIBUS[11], PROFINET[12] and SERCOS interface).

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8 CANopen is an acronym for *C*ontroller *A*rea *N*etwork *open* and is used to refer to EN 50325-4.

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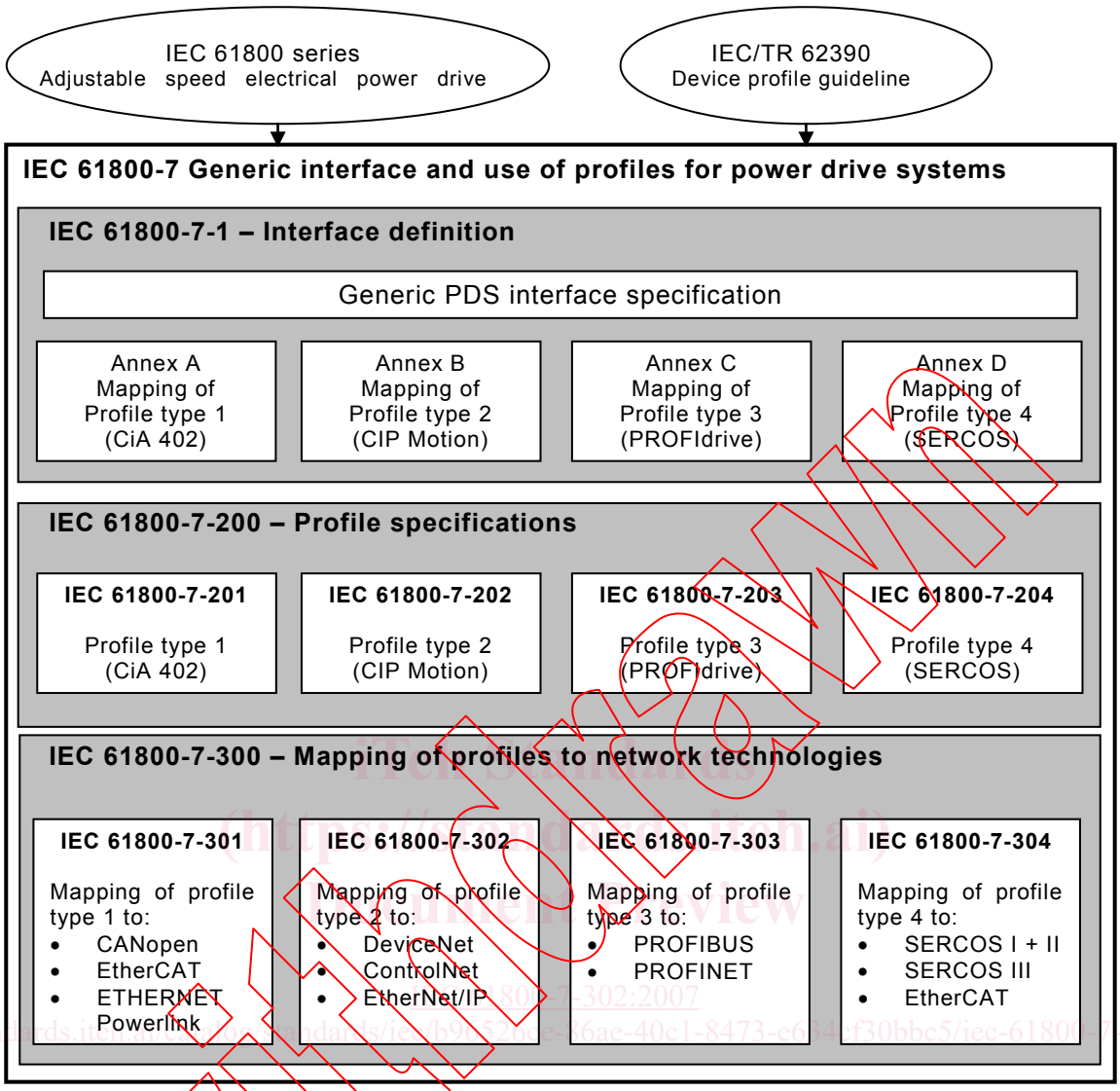

Figure 1 – Structure of IEC 61800-7

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-302: Generic interface and use of profiles for power drive systems – Mapping of profile type 2 to network technologies

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 the mapping of the profile type 2 (CIP Motion™) specified in IEC 61800-7-202 onto different network technologies.

– DeviceNet™ (CP 2/3), see Clause 5,
– ControlNet™ (CP 2/1), see Clause 6,
– EtherNet/IP™ (CP 2/2), see Clause 7.

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 61158-4-2, *Industrial communication networks – Fieldbus specifications – Part 4-2 (Ed.1.0): Data-link layer protocol specification – Type 2 elements*

IEC 61158-5-2, *Industrial communication networks – Fieldbus specifications – Part 5-2 (Ed.1.0): Application layer service definition – Type 2 elements*

IEC 61158-6-2, *Industrial communication networks – Fieldbus specifications – Part 6-2 (Ed.1.0): Application layer protocol specification – Type 2 elements*

IEC 61588:2004, *Precision clock synchronization protocol for networked measurement and control systems*

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

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

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

[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.

3.1.2
application
software functional element specific to the solution of a problem in industrial-process measurement and control

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

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

3.1.3
attribute
property or characteristic of an entity

[IEC/TR 62390:2005, 3.1.3]

3.1.4
axis
logical element of a motion control system that exhibits some form of movement

NOTE 1 Axes can be rotary or linear, physical or virtual, controlled or simply observed.

NOTE 2 A physical *axis* may include one or more of the following components: a motion sensor, a motion control structure, a power amplifier, and a motion actuator.

3.1.5
CIP Motion™ [13]
extensions to the CIP services and protocol to support motion control over CIP networks

3.1.6
CIP (Motion) drive
drive that complies with the CIP (Motion) specification

3.1.7
CIP Motion drive profile
collection of objects used to implement a CIP Motion drive device that includes the Motion Axis Object, as well as standard support objects like the Identity Object and the Time Sync Object

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

3.1.8
CIP Motion I/O connection
periodic bi-directional, class 1, CIP connection between a controller and a drive that is defined as part of the CIP Motion specification

3.1.9
CIP Sync™[13]
extensions to the CIP services and protocol to encapsulate IEC 61588:2004 time synchronisation functionality over a CIP Network (see Time Sync Object in IEC 61158-5-2 and IEC 61158-6-2)

3.1.10
class
description of a set of objects that share the same attributes, operations, methods, relationships, and semantics

[ISO/IEC 19501, modified]

3.1.11
closed loop
methods of control where there is a feedback signal of some kind that is used to drive the actual dynamics of the motor to match the commanded dynamics by servo action.

NOTE In most cases, there is a literal feedback device to provide this signal, but in some cases, the signal is derived from the motor excitation (i.e. sensorless operation).

3.1.12
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.

3.1.13
control
purposeful action on or in a process to meet specified objectives

[IEV 351-21-29]

3.1.14
control device
physical unit that contains – in a module/subassembly or device – an application program to control the PDS

3.1.15
cyclic data block
high priority real-time data block that is transferred by a CIP Motion connection on a periodic basis

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
drive
device designed to control the dynamics of a motor

3.1.20
event data block
medium priority real-time data block that is transferred by a CIP Motion connection only after a specified event occurs

NOTE Registration and marker input transitions are typical drive events.

3.1.21
feedback variable
variable which represents a controlled variable and which is returned to a comparing element

[IEV 351-27-03]

3.1.22
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]

3.1.23
get/read
operation that involves the retrieving of an attribute value from the perspective of the controller side of the interface

3.1.24
I/O data
includes the input data composed by commands and set-points and output data composed of status and actual values