

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Entraînements électriques de puissance à vitesse variable –
Partie 7-202: Interface générique et utilisation de profils pour les entraînements
électriques de puissance – Spécification de profil de type 2**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 60 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Entraînements électriques de puissance à vitesse variable –
Partie 7-202: Interface générique et utilisation de profils pour les entraînements
électriques de puissance – Spécification de profil de type 2**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.200; 35.100.05

ISBN 978-2-8322-2943-9

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	10
INTRODUCTION.....	12
0.1 General	12
0.2 Patent declaration	15
1 Scope.....	17
2 Normative references	17
3 Terms, definitions and abbreviated terms	17
3.1 Terms and definitions.....	17
3.2 Abbreviated terms.....	25
4 Overview	25
4.1 General.....	25
4.2 Control modes	26
4.2.1 General	26
4.2.2 Control methods	26
4.2.3 Control nomenclature	27
4.2.4 Position control.....	27
4.2.5 Velocity control.....	28
4.2.6 Acceleration control.....	30
4.2.7 Torque control	30
4.2.8 No Control	31
5 Data types.....	32
5.1 Data type overview	32
5.2 Conventions.....	32
6 CIP Motion drive profile	32
6.1 Object model	32
6.1.1 Object overview.....	32
6.1.2 Object description.....	33
6.2 How objects affect behavior	34
6.3 Defining object interfaces.....	34
6.4 I/O connection messages.....	35
6.4.1 General	35
6.4.2 CIP Motion I/O Connection	35
6.4.3 Controller-to-Device Connection	39
6.4.4 Device-to-Controller Connection	59
6.4.5 Fixed Motion I/O connection format	68
6.4.6 CIP Motion I/O Connection timing model.....	69
6.5 Device startup procedure	85
6.5.1 General	85
6.5.2 Motion I/O Connection creation.....	85
6.5.3 Motion Device Axis Object configuration	88
6.5.4 Time Synchronization	90
6.6 Device visualisation	92
6.7 Ethernet/IP Quality of Service (QoS).....	93
7 Motion Device Axis Object.....	93
7.1 General considerations	93

7.1.1	General	93
7.1.2	Revision history	93
7.1.3	Object overview	93
7.1.4	Motion Device Axis Object abstraction	94
7.1.5	Motion Control Axis Object	95
7.1.6	Device control classification.....	95
7.1.7	Required vs. Optional in implementation.....	96
7.2	Class attributes.....	107
7.2.1	General	107
7.2.2	Semantics.....	111
7.3	Instance attributes	114
7.3.1	General	114
7.3.2	Motion Control configuration attributes	116
7.3.3	Motion Scaling attributes	117
7.3.4	Connection Data attributes	123
7.3.5	Motor attributes	129
7.3.6	Feedback attributes	140
7.3.7	Event Capture attributes	149
7.3.8	Command reference generation attributes	155
7.3.9	Control mode attributes	158
7.3.10	Stopping & Braking attributes	176
7.3.11	DC Bus Control attributes	186
7.3.12	Power and thermal management attributes	190
7.3.13	Axis Status attributes.....	193
7.3.14	Exception, fault, and alarm attributes.....	199
7.3.15	Fault and alarm Log attributes	205
7.3.16	Exception limit attributes.....	210
7.3.17	Axis exception action configuration attribute	213
7.3.18	Initialization fault attributes	215
7.3.19	Start inhibit attributes	216
7.3.20	APR fault attributes	217
7.3.21	Axis statistical attributes	219
7.3.22	Axis info attributes	219
7.3.23	General purpose I/O attributes.....	220
7.3.24	Local Mode attributes	222
7.3.25	Axis Safety attributes.....	222
7.4	Common services	223
7.4.1	Supported services	223
7.4.2	Service specific data.....	224
7.5	Object specific services	226
7.5.1	Supported services	226
7.5.2	Service specific data.....	226
7.6	Behavior	241
7.6.1	State model	241
7.6.2	State behavior	252
7.6.3	Fault and alarm behavior	259
7.6.4	Start Inhibit behavior	261
7.6.5	Visualization behavior.....	261
7.6.6	Command generation behavior	266

7.6.7	Feedback interface behavior.....	271
7.6.8	Event Capture Behavior.....	273
7.6.9	Control Mode behavior.....	274
	Bibliography.....	288
Figure 1	– Structure of IEC 61800-7.....	15
Figure 2	– Open loop position control.....	27
Figure 3	– Closed loop position control	28
Figure 4	– Open loop velocity control.....	29
Figure 5	– Closed loop velocity control	29
Figure 6	– Acceleration control	30
Figure 7	– Torque control.....	31
Figure 8	– No Control (Feedback Only).....	31
Figure 9	– Object Model for a CIP Motion device	33
Figure 10	– CIP Motion I/O Connection model	35
Figure 11	– CIP Motion I/O Connection channels	36
Figure 12	– Controller-to-Device Connection format (Connection Point 2).....	37
Figure 13	– Device-to-Controller Connection format (Connection Point 2).....	38
Figure 14	– CIP Motion Controller-to-Device Connection format.....	39
Figure 15	– Connection Header	39
Figure 16	– Connection Format.....	39
Figure 17	– Connection Header	40
Figure 18	– Instance Data Block	43
Figure 19	– Instance Data Header	43
Figure 20	– Cyclic Data Block.....	44
Figure 21	– Control Mode	44
Figure 22	– Feedback Mode.....	44
Figure 23	– Cyclic Write Data Block.....	50
Figure 24	– Cyclic Write Data Block example.....	50
Figure 25	– Event Data Block.....	51
Figure 26	– Service Data Block.....	58
Figure 27	– CIP Motion Device-to-Controller Connection format.....	59
Figure 28	– Connection Header	59
Figure 29	– Connection Header	60
Figure 30	– Node Fault/Alarm	61
Figure 31	– Adjustment of actual position data based on Device Time Stamp	62
Figure 32	– Instance Data Block	63
Figure 33	– Instance Data Header	63
Figure 34	– Cyclic Data Block.....	63
Figure 35	– Cyclic Read Data Block.....	65
Figure 36	– Cyclic Read Data Block example.....	65
Figure 37	– Event Data Block.....	66
Figure 38	– Service Data Block.....	68

Figure 39 – Fixed Controller-to-Device Connection format (fixed size = 16 bytes)	69
Figure 40 – Fixed Device-to-Controller Connection format (fixed size = 16 bytes)	69
Figure 41 – CIP Motion 1-Cycle timing model.....	70
Figure 42 – CIP Motion 2-Cycle timing model.....	72
Figure 43 – CIP Motion 3-Cycle timing model.....	73
Figure 44 – Controller-to-Device Connection timing with fine interpolation	74
Figure 45 – Controller-to-Device Connection timing with extrapolation	76
Figure 46 – Use of Time Stamp to adjust actual position to the controller’s timebase	77
Figure 47 – Coordination of two drives with different Update Periods.....	79
Figure 48 – Coordination of multiple drive axes in case of delayed Controller-to-Device Connection packets.....	80
Figure 49 – Propagation of a step change in time	81
Figure 50 – Configuration Block Format Revision 1 (Connection Point 81)	86
Figure 51 – Configuration Block Format Revision 2 (Connection Point 82)	87
Figure 52 – Typical initial C-to-D connection data block	88
Figure 53 – Typical initial D-to-C connection data block	88
Figure 54 – Typical contents of first C-to-D class attribute configuration packet	88
Figure 55 – Typical response to first C-to-D class configuration packet.....	89
Figure 56 – Typical contents of first C-to-D axis instance configuration packet.....	89
Figure 57 – Typical response to first C-to-D axis configuration packet	90
Figure 58 – Typical contents of C-to-D Time Sync service request packet.....	90
Figure 59 – Group Sync of CIP Motion devices	91
Figure 60 – Object components for CIP Motion control architecture	94
Figure 61 – Command Control Word field.....	127
Figure 62 – IEEE Std 112 per phase motor model.....	130
Figure 63 – Event Checking Control Word field	152
Figure 64 – Event Checking Status word field	153
Figure 65 – Brake Control Sequence (Category 0 Stop)	182
Figure 66 – Brake Control Sequence (Category 1 Stop)	183
Figure 67 – Brake Control Sequence (Category 2 Stop)	184
Figure 68 – Drive Enable sequence with Proving feature	185
Figure 69 – Drive Disable sequence with Proving feature.....	186
Figure 70 – Get_Axis_Attributes_List Request rormat	227
Figure 71 – Get_Axis_Attributes_List Response format.....	228
Figure 72 – Get_Axis_Attributes_List Response – Single 4-byte attribute	228
Figure 73 – Get_Axis_Attributes_List Response – Single 2-byte attribute	228
Figure 74 – Get_Axis_Attributes_List Response – Byte attribute array	229
Figure 75 – Get_Axis_Attributes_List Response – Two Dimensional attribute array	229
Figure 76 – Get_Axis_Attributes_List Response – Error example	229
Figure 77 – Set_Axis_Attributes_List Request format.....	230
Figure 78 – Set_Axis_Attributes_List Request – Single 4-byte attribute	230
Figure 79 – Set_Axis_Attributes_List Request – Single 2-byte attribute	231
Figure 80 – Set_Axis_Attributes_List Request – 2-byte attribute array	231

Figure 81 – Set_Axis_Attributes_List Request – Two dimensional attribute array	231
Figure 82 – Set_Axis_Attributes_List Response format	231
Figure 83 – Set_Cyclic_Write_List Request format	232
Figure 84 – Set_Cyclic_Write_List Response format	232
Figure 85 – Set_Cyclic_Read_List Request format	233
Figure 86 – Set_Cyclic_Read_List Response format	233
Figure 87 – Motion Device Axis Object State Model	241
Figure 88 – Motion Device Axis Object State Model for Feedback Only	243
Figure 89 – Motion Device Axis Object State Model for Converter	244
Figure 90 – Command Generator	267
Figure 91 – Feedback Channels 1 and 2	272
Figure 92 – Event Capture Functionality	273
Figure 93 – No Control (Feedback Only)	275
Figure 94 – Closed Loop Position Control	276
Figure 95 – Closed Loop Velocity Control	278
Figure 96 – Open Loop Frequency Control	280
Figure 97 – Acceleration Control	282
Figure 98 – Torque Control	282
Figure 99 – Closed Loop Current Vector Control	286
Table 1 – Data types	32
Table 2 – Objects present in a CIP Motion device	33
Table 3 – Motion Device Axis Object content by Device Type	34
Table 4 – Object effect on behavior	34
Table 5 – Object interfaces	35
Table 6 – Time Data Set	41
Table 7 – Axis Control	45
Table 8 – Control Status	45
Table 9 – Command Data Set	46
Table 10 – Command Data Element to Motion Device Axis Object attribute mapping	46
Table 11 – Actual Data Set	47
Table 12 – Actual Data Element to Motion Device Axis Object attribute Mapping	47
Table 13 – Status Data Set	48
Table 14 – Command Control	48
Table 15 – Command Target Update vs. Update Period Ratio	49
Table 16 – Basic Event Cycle	51
Table 17 – Extended Event Cycle	53
Table 18 – Basic Event Cycle with Auto-rearm	55
Table 19 – Registration Data Set	57
Table 20 – Home Data Set	58
Table 21 – Watch Data Set	58
Table 22 – Axis Response	64
Table 23 – Event Type	67

Table 24 – Propagation of a step change in time (example 1)	81
Table 25 – Propagation of a step change in time (example 2)	83
Table 26 – CIP Motion visualisation components	92
Table 27 – Motion Device Axis Object revision history	93
Table 28 – Example for instance attribute implementation vs. Device Function Code	96
Table 29 – Instance attribute implementation vs. Device Function Code	98
Table 30 – Class attributes for the Motion Device Axis Object.....	108
Table 31 – Node Control bit definitions	111
Table 32 – Node Status bit definitions.....	112
Table 33 – Node Fault Code definitions	113
Table 34 – Node Alarm Code definitions	114
Table 35 – Dynamic Units vs. Feedback Mode	116
Table 36 – Motion Control configuration attributes	116
Table 37 –Control Mode enumeration definitions.....	117
Table 38 – Control Method enumeration definitions.....	117
Table 39 – Motion Scaling attributes	118
Table 40 – Motion Unit selection rules	120
Table 41 – Signal attributes affected by Motion Polarity	121
Table 42 – Directional Limit attributes affected by Motion Polarity.....	123
Table 43 – Connection Data attributes	124
Table 44 – Actual Data Set value determination.....	126
Table 45 – Command Data Set value determination.....	127
Table 46 – Command Target Update enumeration definition	127
Table 47 – Command Position Data Type enumeration definition	128
Table 48 – Status Data Set bit definitions	128
Table 49 – Registration Event Data format.....	129
Table 50 – Home Event Data format	129
Table 51 – Watch Event Data format.....	129
Table 52 – General Motor Info attributes.....	130
Table 53 – General Motor Configuration attributes	131
Table 54 – General PM Motor Configuration attributes	134
Table 55 – General Rotary Motor Configuration attributes.....	135
Table 56 – General Linear Motor Configuration attributes	136
Table 57 – Rotary PM Motor Configuration attributes	137
Table 58 – Linear PM Motor Configuration attributes.....	137
Table 59 – Induction Motor Configuration attributes	138
Table 60 – Load Transmission and Actuator Configuration attributes	139
Table 61 – Feedback Types abbreviations	140
Table 62 – Logical Feedback Channel Control functions	140
Table 63 – Logical Feedback Channel rules.....	141
Table 64 – General Feedback Info attributes.....	142
Table 65 – General Feedback Signal attributes.....	142
Table 66 – Feedback Configuration attributes	143

Table 67 – Feedback Mode enumeration definitions.....	149
Table 68 – Event attributes	150
Table 69 – Event Checking Control bit definitions	152
Table 70 – Event Checking Status bit definitions.....	154
Table 71 – Command Generator Signal attributes	155
Table 72 – Command Generator Configuration attributes	157
Table 73 – Position Loop Signal attributes	159
Table 74 – Position Loop Configuration attributes	160
Table 75 – Velocity Loop Signal attributes	162
Table 76 – Velocity Loop Configuration attributes	163
Table 77 – Acceleration Signal attributes	165
Table 78 – Acceleration Configuration attributes	165
Table 79 – Torque/Force Control Signal attributes	166
Table 80 – Torque/Force Control Configuration attributes	167
Table 81 – Current Control Signal attributes	169
Table 82 – Current Control Configuration attributes	171
Table 83 – Frequency Control Signal attributes.....	175
Table 84 – Frequency Control Configuration attributes.....	175
Table 85 – Drive Output attributes	176
Table 86 – Stopping/Braking attributes	177
Table 87 – Stopping Action enumeration definitions.....	180
Table 88 – Proving sub-feature attribute dependencies.....	184
Table 89 – DC Bus Control attributes	187
Table 90 – Power and Thermal Management Status attributes	190
Table 91 – Power and Thermal Management Configuration attributes	192
Table 92 – Axis Status attributes	194
Table 93 – Axis Status bit definitions	195
Table 94 – Axis Status bit vs. Axis State	198
Table 95 – Stopping Action vs. Stop Category	199
Table 96 – Axis I/O Status bit definitions.....	199
Table 97 – Exception, Fault and Alarm attributes	200
Table 98 – Standard Exception Table	202
Table 99 – Fault and Alarm Log attributes.....	207
Table 100 – Exception Factory Limit Info attributes	210
Table 101 – Exception User Limit Configuration attributes	211
Table 102 – Axis Exception Action Configuration attribute	213
Table 103 – Axis Exception Action definitions	214
Table 104 – Initialization Fault attributes.....	216
Table 105 – Standard Initialization Fault Table	216
Table 106 – Start Inhibit attributes	217
Table 107 – Standard Start Inhibit Table	217
Table 108 – APR Fault attributes	218
Table 109 – Standard APR Fault Table	219

Table 110 – Axis Statistical attributes	219
Table 111 – Axis Info attributes.....	220
Table 112 – Drive General Purpose I/O attributes	221
Table 113 – Local Mode Configuration attributes	222
Table 114 – Axis Safety Status attributes.....	223
Table 115 – Motion Device Axis Object – Common Services.....	224
Table 116 – Group_Sync Request Data Structure	224
Table 117 – Group_Sync Response Data Structure	225
Table 118 – Motion Device Axis Object – Object Specific Services	226
Table 119 – Run_Motor_Test Request structure	234
Table 120 – Get_Motor_Test_Data measured by Test Type	235
Table 121 – Get_Motor_Test_Data Request structure (optional)	235
Table 122 – Get_Motor_Test_Data Response standard structure (Motor Type = Induction)	236
Table 123 – Get_Motor_Test_Data Response standard structure (Motor Type = SPM)	236
Table 124 – Get_Motor_Test_Data Response standard structure (Motor Type = IPM).....	237
Table 125 – Run_Inertia_Test Request structure	237
Table 126 – Get_Inertia_Test_Data Response structure	238
Table 127 – Run_Hookup_Test Request structure	239
Table 128 – Get_Hookup_Test_Data measured by Test Type	240
Table 129 – Get_Hookup_Test_Data Response structure	240
Table 130 – Axis State Machine transitions.....	242
Table 131 – Axis State Machine conditions	243
Table 132 – Axis State Machine transitions (Feedback Only)	244
Table 133 – Axis State Machine transitions (Converter)	245
Table 134 – Axis Control Request code	246
Table 135 – Axis Response Acknowledge codes.....	246
Table 136 – Completion criteria for requested operation	247
Table 137 – Possible error conditions for requested operation	247
Table 138 – Successful Axis Control Request Cycle	248
Table 139 – Unsuccessful Axis Control Request Cycle	248
Table 140 – Pending Axis Control Request Cycle	249
Table 141 – Cancel Request Cycle	250
Table 142 – Redefine Position Reference Cycle.....	252
Table 143 – Running State – Configurable attributes	255
Table 144 – Axis state mapping to Identity Object with LED behavior	262
Table 145 – CIP Motion Device seven-segment display behavior	263
Table 146 – CIP Motion multi-character alphanumeric display behavior	264
Table 147 – Multi-axis multi-character alphanumeric display behavior	266

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-202: Generic interface and use of profiles for power drive systems – Profile type 2 specification

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

International Standard IEC 61800-7-202 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.

This edition includes the following significant technical changes with respect to the previous edition:

- a) update of patent information;
- b) new revision of the Drive Profile and Drive Axis specifications, with multiple clarifications and enhancements.

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

FDIS	Report on voting
22G/308/FDIS	22G/323/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 stability date indicated on the IEC website 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.

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.

INTRODUCTION

0.1 General

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

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

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 adapt 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 profiles types for CiA® 402¹, CIP Motion™², PROFIdrive³ and SERCOS®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.

This part of IEC 61800-7 specifies the profile type 2 (CIP Motion™).

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

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 mark holder or any of its products. Compliance to this profile does not require use of the registered trade mark CiA® 402. Use of the registered trade mark CiA® 402 requires permission of CAN in Automation e.V (CiA).

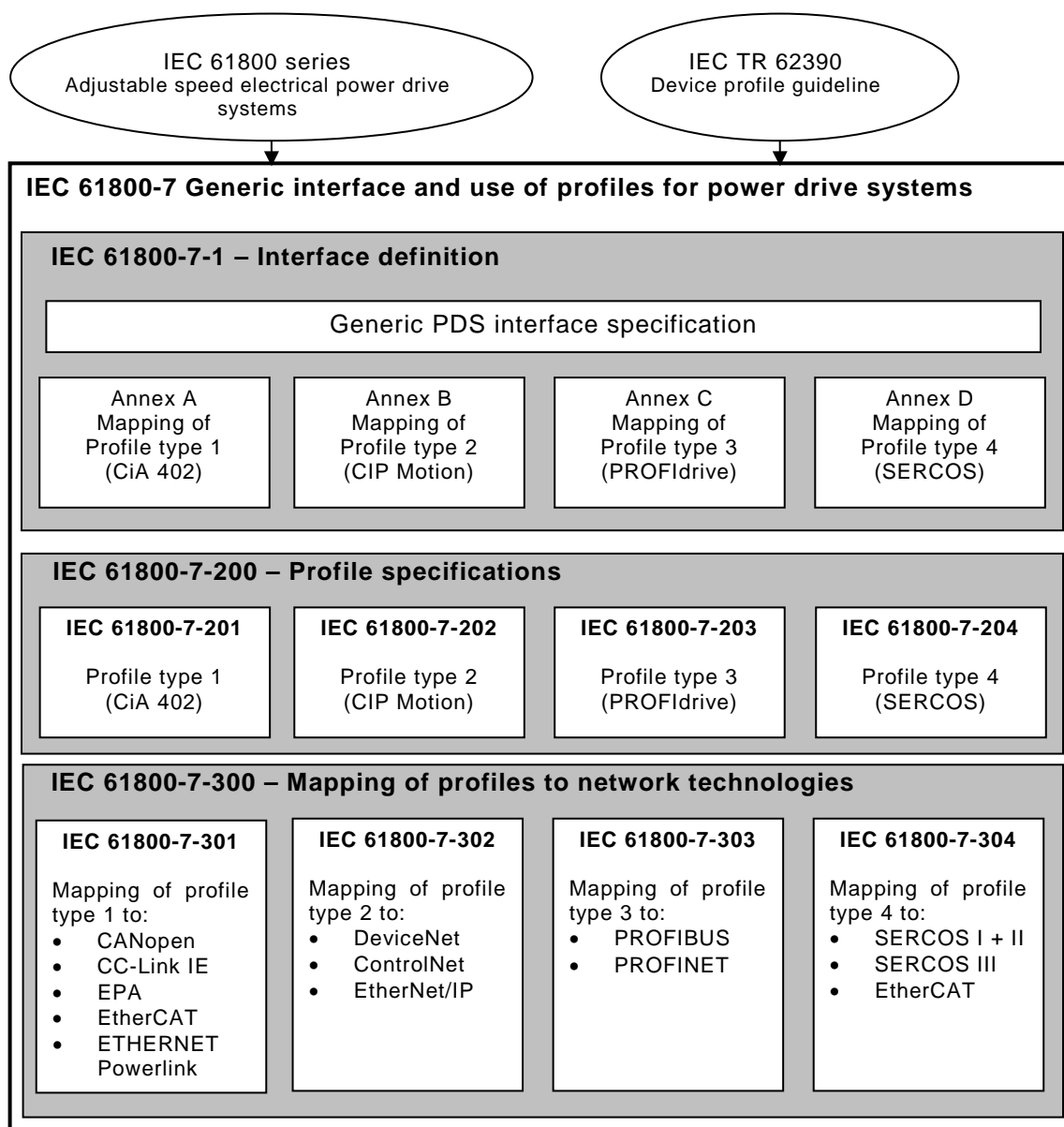
² CIP Motion™ is a trade mark of ODVA, Inc. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade mark holder or any of its products. Compliance to this profile does not require use of the trade mark CIP Motion™. Use of the trade mark CIP Motion™ requires permission of ODVA, Inc.

³ PROFIdrive 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 PROFIdrive. Use of the trade name PROFIdrive requires permission of PROFIBUS & PROFINET International.

⁴ SERCOS® is a registered trade mark 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 mark holder or any of its products. Compliance to this profile does not require use of the registered trade mark SERCOS®. Use of the registered trade mark SERCOS® requires permission of the trade mark holder.

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, CC-Link IE⁶ Field Network⁶, EPA⁷, EtherCAT⁸, Ethernet Powerlink⁹, DeviceNet¹⁰, ControlNet¹¹, EtherNet/IP¹², PROFIBUS¹³, PROFINET¹⁴ and SERCOS[®]).

-
- ⁵ CANopen[®] 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 mark holder or any of its products. Compliance to this profile does not require use of the registered trade mark CANopen[®]. Use of the registered trade mark CANopen[®] requires permission of CAN in Automation e.V. (CiA). CANopen[®] is an acronym for *Controller Area Network open* and is used to refer to EN 50325-4.
- ⁶ CC-Link IE[®] Field Network is a registered trade mark of Mitsubishi Electric Corporation. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade mark holder or any of its products. Compliance to this profile does not require use of the registered trade mark CC-Link IE[®] Field Network. Use of the registered trade mark CC-Link IE[®] Field Network requires permission of Mitsubishi Electric Corporation.
- ⁷ EPA[™] is a trade mark of SUPCON Group Co. Ltd. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade mark holder or any of its products. Compliance to this profile does not require use of the trade mark EPA[™]. Use of the trade mark EPA[™] requires permission of the trade mark holder.
- ⁸ EtherCAT[®] is a registered trade mark 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 trade mark holder or any of its products. Compliance to this profile does not require use of the registered trade mark EtherCAT[®]. Use of the registered trade mark EtherCAT[®] requires permission of the trade mark holder.
- ⁹ Ethernet Powerlink[™] is a trade mark of Bernecker & Rainer Industrieelektronik Ges.m.b.H., control of trade mark use is given to the non profit organization EPSG. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade mark holder or any of its products. Compliance to this profile does not require use of the trade mark Ethernet Powerlink[™]. Use of the trade mark Ethernet Powerlink[™] requires permission of the trade mark holder.
- ¹⁰ DeviceNet[™] is a trade mark of ODVA, Inc. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade mark holder or any of its products. Compliance to this profile does not require use of the trade mark DeviceNet[™]. Use of the trade mark DeviceNet[™] requires permission of ODVA, Inc.
- ¹¹ ControlNet[™] is a trade mark of ODVA, Inc. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade mark holder or any of its products. Compliance to this profile does not require use of the trade mark ControlNet[™]. Use of the trade mark ControlNet[™] requires permission of ODVA, Inc.
- ¹² EtherNet/IP[™] is a trade mark of ODVA, Inc. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade mark holder or any of its products. Compliance to this profile does not require use of the trade mark EtherNet/IP[™]. Use of the trade mark EtherNet/IP[™] requires permission of ODVA, Inc.
- ¹³ PROFIBUS 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 PROFIBUS. Use of the trade name PROFIBUS requires permission of PROFIBUS & PROFINET International.
- 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 PROFIBUS. Use of the trade name PROFIBUS requires permission of PROFIBUS & PROFINET International.



IEC

Figure 1 – Structure of IEC 61800-7

0.2 Patent declaration

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning the following. This patent is held by its inventors under license to ODVA, Inc:

Publication / Application serial number	Holder	Title
US 7,983,769 EP 1659465	[ODVA]	Time stamped motion control network protocol that enables balanced single cycle timing and utilization of dynamic data structures

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

ODVA and the holder of this patent right have assured the IEC that ODVA is willing to negotiate licences either free of charge or under reasonable and non-discriminatory terms and

conditions with applicants throughout the world. In this respect, the statement of ODVA and the holder of this patent right is registered with IEC. Information may be obtained from:

[ODVA]	ODVA, Inc. 2370 East Stadium Boulevard #1000 Ann Arbor, Michigan 48104 USA Attention: Office of the Executive Director email: odva@odva.org
--------	--

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

ISO (www.iso.org/patents) and IEC (<http://patents.iec.ch>) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-202: Generic interface and use of profiles for power drive systems – Profile type 2 specification

1 Scope

This part of IEC 61800 specifies profile type 2 (CIP Motion™) for Power Drive Systems (PDS). Profile type 2 can be mapped onto different communication network technologies.

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.

2 Normative references

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

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 61158-4-2:2014, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

IEC 61158-5-2:2014, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-6-2:2014, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

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

IEC 61800-7-1:2015, *Adjustable speed electrical power drive systems – Part 7-1: Generic interface and use of profiles for power drive systems – Interface definition*

IEEE Std 112-2004, *IEEE Standard Test Procedure for Polyphase Induction Motors and Generators*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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