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Also of interest to the following committees Intéresse également les comités suivants TC 65C	Supersedes document Remplace le document 22G/167/CDV	

Functions concerned
Fonctions concernées

☒ Safety Sécurité	☐ EMC CEM	☐ Environment Environnement	☐ Quality assurance Assurance de la qualité

INTERNATIONAL ELECTROTECHNICAL COMMISSION — COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

Title

IEC 61800-7-200: Adjustable speed electrical power drives systems – Part 7-200: Generic interface and use of profiles for power drive systems – Profile specifications

Titre

Introductory note

Warning to IEC National Committees when voting:
It has been decided to circulate for approval all the documents in the IEC 61800-7 series grouped by specific part.
It is imperative that the vote be taken on the whole set of subparts in order to ensure coherence.
The present part 7-200 consists of 4 subparts. After the vote has taken place, the specific part will be split into normal subpart publications with the normal numbering of pages, and will be available separately.

Hint: In case of comments please give the page number in order to make the reference unique.

ATTENTION
VOTE PARALLÈLE
CEI – CENELEC

L'attention des Comités nationaux de la CEI, membres du CENELEC, est attirée sur le fait que ce projet final de Norme internationale est soumis au vote parallèle. Un bulletin de vote séparé pour le vote CENELEC leur sera envoyé par le Secrétariat Central du CENELEC.

ATTENTION
IEC – CENELEC
PARALLEL VOTING

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this final Draft International Standard (DIS) is submitted for parallel voting. A separate form for CENELEC voting will be sent to them by the CENELEC Central Secretariat.

INCLUDED SUBPARTS

NOTE 1 The page numbers of each subpart are prefixed with the Type number of the subpart to facitlitate identification, and so that the numbering of each subpart can be independent of those that precede it.

NOTE 2 The Contents of each subpart begins on page 3, so that the page numbering will be unchanged when the final international Standard is iissued with its IEC-Central-Office-provided cover sheet.

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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 TC22: Power electronic systems and equipment.

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

FDIS	Report on voting
XX/XX/FDIS	XX/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[1] 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.

A bilingual version of this publication may be issued at a later date.

[1] The National Committees are requested to note that for this publication the maintenance result date is 2012.

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 402[2], CIP Motion™[3], PROFIdrive[4] and SERCOS Interface™[5] 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 1 (CiA 402).

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

IEC 61800-7-301, IEC 61800-7-302, IEC 61800-7-303 and IEC 61800-7-304 specify how the profile types 1, 2, 3 and 4 are mapped to different network technologies (such as CANopen[6], EtherCAT™[7], Ethernet Powerlink™[8], DeviceNet™[9], ControlNet™[10], EtherNet/IP™[11], PROFIBUS[12], PROFINET[13] and SERCOS Interface).

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2 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.

3 CIP Motion™ 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 Motion™. Use of the trade name CIP Motion™ requires permission of Open DeviceNet Vendor Association, Inc.

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5 SERCOS™ and SERCOS Interface™ 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.

6 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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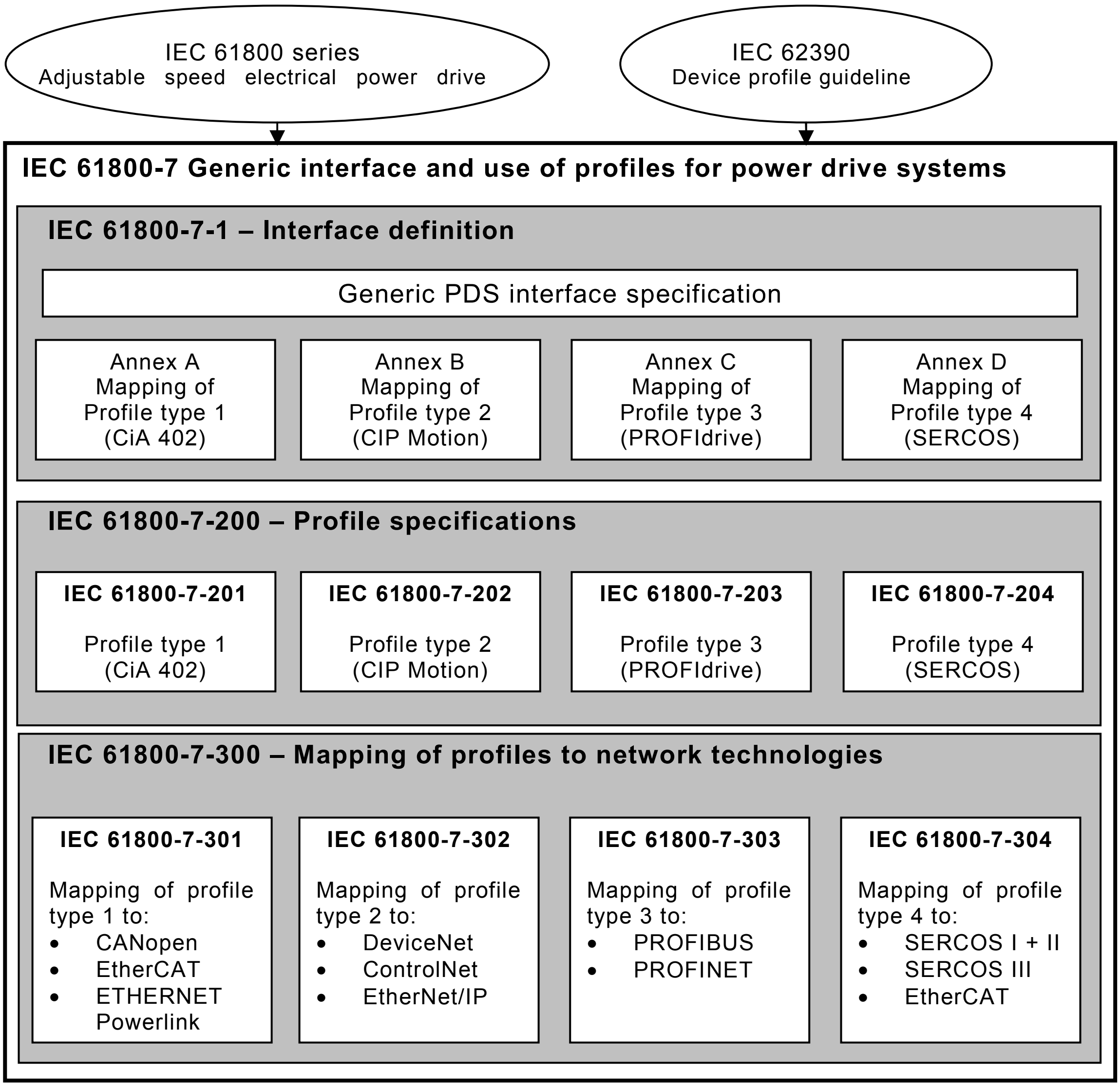

Figure 1 – Structure of IEC 61800-7

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-201: 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*[14]

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*[14]

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

[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.

[14] To be published

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

[IEV 351-21-37)

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
application mode
type of application that can be requested from a PDS

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

3.1.5
attribute
property or characteristic of an entity

[IEC/TR 62390:2005, 3.1.3]

3.1.6
class
description of a set of objects that share the same attributes, operations, methods, relationships, and semantics

[ISO/IEC 19501, modified]

3.1.7
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.

3.1.8
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
data type
set of values together with a set of permitted operations

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

3.1.11
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]

3.1.12
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]

3.1.13
feedback variable
variable which represents a controlled variable and which is returned to a comparing element

[IEV 351-27-03]

3.1.14
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]

3.1.15
high-level power
main electric power supply of the drive device

3.1.16
input data
data transferred from an external source into a device, resource or functional element

[IEC/TR 62390:2005, 3.1.14]

3.1.17
interface
shared boundary between two entities defined by functional characteristics, signal characteristics, or other characteristics as appropriate

[IEV 351-21-35, modified]

3.1.18
logical power drive system
model which includes PDS and communication network accessible through the generic PDS interface

3.1.19
low-level power
electrical power supply for the control section of the drive device

3.1.20
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]

3.1.21
operating mode
characterisation of the way and the extent to which the human operator intervenes in the control equipment

[IEV 351-31-01]

3.1.22
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]

3.1.23
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]

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

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

[IEV 351-27-02]

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

3.1.27
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.

3.1.28
type
hardware or software element which specifies the common attributes shared by all instances of the type

[IEC/TR 62390:2005, 3.1.25]

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

[IEC/TR 62390:2005, 3.1.26]

3.1.30
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

AC	Alternating Current
BL	Brush-Less
c	Constant
CiA	CAN in Automation
COB	Communication Object
csp	Cyclic Synchronous Profile mode
cst	Cyclic Synchronous Torque mode
csv	Cyclic Synchronous Velocity mode
DC	Direct Current
DIV	Divisor
FC	Frequency Converter
FE	Functional Element
FIFO	First In, First Out
FSA	Finite State Automaton
hm	Homing Mode
HMI	Human Machine Interface
I/O	Input/Output
ip	Interpolated Position mode
MUL	Multiplication
NMT	Network Management
PDS	Power Drive System

PM	Permanent Magnet
pp	Profile Position mode
pv	Profile Velocity mode
r	Reserved
r.m.s.	Root Mean Square
ro	Read-Only
rw	Read-Write
tq	Torque Mode
vl	Velocity Mode

4 General

4.1 General considerations

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

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

4.2 Communication interface

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

- Non real-time data (configuration, identification, adjustement, diagnostic, etc.)
- Process data like target values and actual values

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

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

- COB for real-time data transmission
- COB for emergency information transmission
- COB for network management purposes

Additionally, the communication system may provide the following COBs:

- COB for configuration data transmission
- COB for synchronisation purposes
- COB for system time distribution

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

4.3 Object dictionary

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

The standardised device profile area at indices 6000_h through $9FFF_h$ shall contain all application objects common to this device profile specification. The following object indices shall be reserved for compatibility reasons: 6045_h, 6047_h, $604D_h$, $604E_h$, $604F_h$, 6052_h, 6053_h, 6054_h, 6055_h, 6056_h, 6057_h, 6058_h, 6059_h, 6089_h, $608A_h$, $608B_h$, $608C_h$, $608D_h$, $608E_h$, 6093_h, 6094_h, 6095_h, 6096_h, 6097_h, $60A0_h$, $60A1_h$, $60A2_h$, $60F6_h$, $60F7_h$, $60F9_h$, $60FB_h$, 6410_h, 6504_h, and 6510_h.

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

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

- 6000_h to $67FF_h$: axis 0
- 6800_h to $6FFF_h$: axis 1
- 7000_h to $77FF_h$: axis 2
- 7800_h to $7FFF_h$: axis 3
- 8000_h to $87FF_h$: axis 4
- 8800_h to $8FFF_h$: axis 5
- 9000_h to $97FF_h$: axis 6
- 9800_h to $9FFF_h$: axis 7

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

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

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

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

5 Data types

5.1 Standard data types

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

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
vl velocity acceleration/deceleration	See Table 4

5.2 Record definitions

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

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

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

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

6 General object definitions

6.1 General

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

6.2 Communication parameter objects

There are three communication parameter objects that shall be implemented:

- Device type object 1000_h
- Error register object 1001_h
- Identity object 1018_h

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

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

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

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

31 … 24	23 … 16	15 … 0
Additional information		*Device profile number* 0192_h (402_d)
Mode bits	*Type*	
MSB		LSB

Figure 2 – Value definition

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

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

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

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

NOTE The corresponding *error code* may be read in object 1003_h (see EN 50325-4) or object $603F_h$.

6.3 Additional identification and information objects

6.3.1 Object 6402_h: Motor type

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

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	-
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

6.3.7 Object 6503_h: Drive catalogue number

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

Table 20 – Object description

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

Table 21 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	No
Default Value	/0 (empty string)

6.3.8 Object 6505_h: http drive catalogue address

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

Table 22 – Object description

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

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

7 Error codes and error behaviour

7.1 Error codes

Emergency messages are triggered by internal errors and severe warnings detected within the drive device. They are defined in detail in the IEC 61800-7-301. They shall contain the 16-

bit error code. Error codes from $xx00_h$ to $xx7F_h$ are defined in EN 50325-4 or in Table 24. Error codes between $xx80_h$ and $xxFF_h$ are used manufacturer-specific.

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
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^2t, thermal state)
2351_h	Load level warning (I^2t, thermal state)
3110_h	Mains over-voltage
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

Error code	Meaning
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
4420_h	Too low temperature supply
5100_h	Supply
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

Error code	Meaning
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 = l1
5452_h	S2 = l2
5453_h	S3 = l3
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
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
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.

Error code	Meaning
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
8700_h	Sync controller
8800_h	Winding controller
8900_h	Process data monitoring
$8A00_h$	Control
$F001_h$	Deceleration
$F002_h$	Sub-synchronous run
$F003_h$	Stroke operation
$F004_h$	Control
$FF00_h$ to $FFFF_h$	Manufacturer-specific

7.2 Error behavior

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

8 Controlling the power drive system

8.1 General

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

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

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

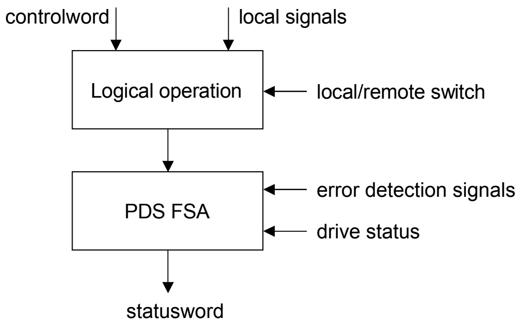

Figure 3 – Remote and local control

8.2 Finite state automaton

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

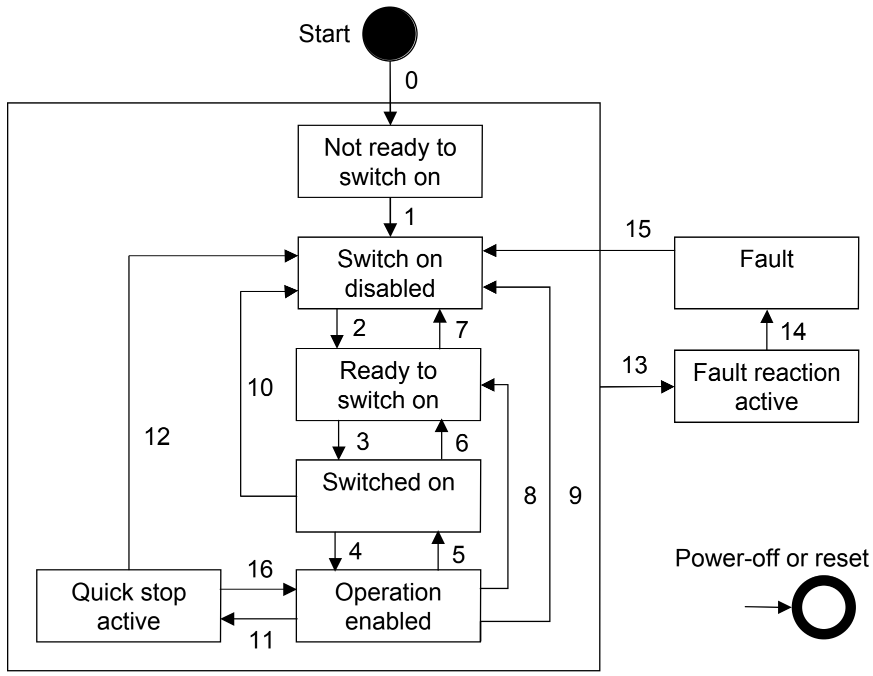

Figure 4 – Power drive system finite state automaton

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.

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.		

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

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

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

Drive function is enabled implies that energy may be supplied to the motor. Target or set-point 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.

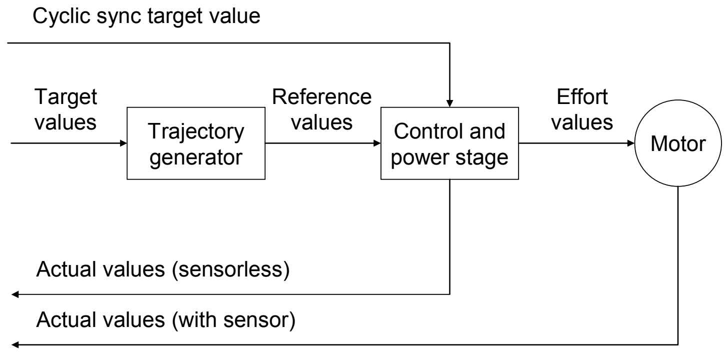

Figure 5 – Relation between different value parameters

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 other bits may be supported. The commands shall be coded as given in Table 27.

15 … 11	10	9	8	7	6 … 4	3	2	1	0
ms	*r*	*oms*	*h*	*fr*	*oms*	*eo*	*qs*	*ev*	*so*
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.

Table 28 – Object description

Attribute	Value
Index	6040_h
Name	Controlword
Object Code	Variable
Data Type	Unsigned16
Category	Mandatory

Table 29 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 27
Default Value	Device and operation mode specific

8.4.2 Object 6041_h: Statusword

This object shall provide the status of the PDS FSA. The object shall be structured as defined in Figure 7. The bits 10, 9, and 6 to 0 shall be supported. The other bits may be supported. The bit combinations defined in Table 30 shall code the PDS FSA states.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ms		*oms*		*ila*	*tr*	*rm*	*ms*	*w*	*sod*	*qs*	*ve*	*f*	*oe*	*so*	*rtso*
MSB															LSB

LEGEND: ms = manufacturer-specific; oms = operation mode specific; ila = internal limit active; tr = target reached; rm = remote; w = warning; sod = switch on disabled; qs = quick stop; ve = voltage enabled; f = fault; oe = operation enabled; so = switched on; rtso = ready to switch on

Figure 7 – Value definition

Table 30 – State coding

Statusword	PDS FSA state
xxxx xxxx x0xx 0000_b	Not ready to switch on
xxxx xxxx x1xx 0000_b	Switch on disabled
xxxx xxxx x01x 0001_b	Ready to switch on
xxxx xxxx x01x 0011_b	Switched on
xxxx xxxx x01x 0111_b	Operation enabled
xxxx xxxx x00x 0111_b	Quick stop active
xxxx xxxx x0xx 1111_b	Fault reaction active
xxxx xxxx x0xx 1000_b	Fault

If bit 4 (voltage enabled) of the statusword is 1, this shall indicate that high voltage is applied to the PDS.

If bit 5 (quick stop) of the statusword is 0, this shall indicate that the PDS is reacting on a quick stop request.

If bit 7 (warning) of the statusword is 1, this shall indicate the presence of a warning condition. Warning is not an error or fault (examples: temperature limit exceeded, job refused). The status of the PDS FSA shall not be changed. The cause of the warning may be given in the *fault code parameter* object ($603F_h$).

If bit 9 (remote) of the statusword is 1, this shall indicate that the controlword is processed. If it is 0 (local), this shall indicate that the controlword is not processed. Nevertheless, the PDS may provide actual values, and the PDS may accept COB for configuration data transmission for other parameter objects.

If bit 10 (target reached) of the statusword is 1, this shall indicate that the PDS has reached the set-point. The set-point is operation mode specific and is defined in detail in the corresponding clauses of this part of the IEC 61800-7 series. Bit 10 shall also be set to 1, if the operation mode has been changed. The change of a target value by software shall alter this bit. If quick stop option code is 5, 6, 7 or 8, bit 10 shall be set to 1, when the quick stop operation is finished and the PDS is halted. If halt occurred and the PDS has halted then bit 10 shall be set to 1, too.

If bit 11 (internal limit active) of the statusword is 1, this shall indicate that an internal limit is active (example: position range limit). The internal limits are manufacturer-specific.

Bit 13 and bit 12 of the statusword are operation mode specific.

Bit 14 and bit 15 are manufacturer-specific.

Table 31 specifies the object description, and Table 32 specifies the entry description.

Table 31 – Object description

Attribute	Value
Index	6041_h
Name	Statusword
Object Code	Variable
Data Type	Unsigned16
Category	Mandatory

Table 32 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 30
Default Value	No

8.4.3 Object $603F_h$: Error code

This object shall provide the error code of the last error which occurred in the drive device. Table 24 specifies the value definition, Table 33 specifies the object description, and Table 34 specifies the entry description.

NOTE In CANopen networks, this object provides the same information as the lower 16-bit of sub-index 01_h of the pre-defined error field (1003_h).

Table 33 – Object description

Attribute	Value
Index	$603F_h$
Name	Error code
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 34 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 24
Default Value	No

8.4.4 Object 6007_h: Abort connection option code

This object shall indicate what action shall be performed when one of the following events occurres: bus-off, heartbeat, life guarding, NMT stopped state entered, reset application, and reset communication. Table 35 specifies the value definition, Table 36 specifies the object description, and Table 37 specifies the entry description.

Table 35 – Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific
0	No action
+1	Fault signal
+2	Disable voltage command
+3	Quick stop command
+4 to +32 767	reserved

Table 36 – Object description

Attribute	Value
Index	6007_h
Name	Abort connection option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 37 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 35
Default Value	+1

8.4.5 Object $605A_h$: Quick stop option code

This object shall indicate what action is performed when the quick stop function is executed. The slow down ramp is the deceleration value of the used mode of operations. Table 38 specifies the value definition, Table 39 specifies the object description, and Table 40 specifies the entry description.

Table 38 – Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific
0	Disable drive function
+1	Slow down on slow down ramp and transit into Switch On Disabled
+2	Slow down on quick stop ramp and transit into Switch On Disabled
+3	Slow down on current limit and transit into Switch On Disabled
+4	Slow down on voltage limit and transit into Switch On Disabled
+5	Slow down on slow down ramp and stay in Quick Stop Active
+6	Slow down on quick stop ramp and stay in Quick Stop Active
+7	Slow down on current limit and stay in Quick Stop Active
+8	Slow down on voltage limit and stay in Quick Stop Active
+9 to +32 767	reserved

Table 39 – Object description

Attribute	Value
Index	$605A_h$
Name	Quick stop option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 40 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 38
Default Value	+2

8.4.6 Object 605B$_h$: Shutdown option code

This object shall indicate what action is performed if there is a transition from Operation Enabled state to Ready To Switch On state. The slow down ramp is the deceleration value of the used mode of operations. Table 41 specifies the value definition, Table 42 specifies the object description, and Table 43 specifies the entry description.

Table 41 – Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific
0	Disable drive function (switch-off the drive power stage)
+1	Slow down with slow down ramp; disable of the drive function
+2 to +32 767	reserved

Table 42 – Object description

Attribute	Value
Index	$605B_h$
Name	Shutdown option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 43 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 41
Default Value	0

8.4.7 Object 605C$_h$: Disable operation option code

This object shall indicate what action is performed if there is a transition from Operation Enabled state to Switched on state. The slow down ramp is the deceleration value of the used mode of operations. Table 44 specifies the value definition, Table 45 specifies the object description, and Table 46 specifies the entry description.

Table 44 – Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific
0	Disable drive function (switch-off the drive power stage)
+1	Slow down with slow down ramp; disable of the drive function
+2 to +32 767	reserved

Table 45 – Object description

Attribute	Value
Index	$605C_h$
Name	Disable operation option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 46 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 44
Default Value	+1

8.4.8 Object $605D_h$: Halt option code

This object shall indicate what action is performed when the halt function is executed. The slow down ramp is the deceleration value of the used mode of operations. Table 47 specifies the value definition, Table 48 specifies the object description, and Table 49 specifies the entry description.

Table 47 – Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific
0	Reserved
+1	Slow down on slow down ramp and stay in Operation Enabled
+2	Slow down on quick stop ramp and stay in Operation Enabled
+3	Slow down on current limit and stay in Operation Enabled
+4	Slow down on voltage limit and stay in Operation Enabled
+5 to +32 767	Reserved

Table 48 – Object description

Attribute	Value
Index	$605D_h$
Name	Halt option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 49 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 47
Default Value	+1

8.4.9 Object $605E_h$: Fault reaction option code

This object shall indicate what action is performed when fault is detected in the PDS. The slow down ramp is the deceleration value of the used mode of operations. Table 50 specifies the value definition, Table 51 specifies the object description, and Table 52 specifies the entry description.

Table 50 – Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific
0	Disable drive function, motor is free to rotate
+1	Slow down on slow down ramp
+2	Slow down on quick stop ramp
+3	Slow down on current limit
+4	Slow down on voltage limit
+5 to +32 767	reserved

Table 51 – Object description

Attribute	Value
Index	$605E_h$
Name	Fault reaction option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 52 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 50
Default Value	+2

8.4.10 Object 6060_h: Modes of operation

This object shall indicate the requested operation mode. Table 53 specifies the value definition, Table 54 specifies the object description, and Table 55 specifies the entry description.

NOTE This object shows only the value of the requested operation mode, the actual operation mode of the PDS is reflected in the object modes of operation display.

Table 53 – Value definition

Value	Definition
-128 to -1	Manufacturer-specific operation modes
0	No mode change/no mode assigned
+1	Profile position mode
+2	Velocity mode
+3	Profile velocity mode
+4	Torque profile mode
+5	reserved
+6	Homing mode
+7	Interpolated position mode
+8	Cyclic sync position mode
+9	Cyclic sync velocity mode
+10	Cyclic sync torque mode
+11 to +127	reserved

Table 54 – Object description

Attribute	Value
Index	6060_h
Name	Modes of operation
Object Code	Variable
Data Type	Integer8
Category	Optional

Table 55 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 53
Default Value	0

8.4.11 Object 6061_h: Modes of operation display

This object shall provide the actual operation mode. Table 53 specifies the value definition, Table 56 specifies the object description, and Table 57 specifies the entry description.

Table 56 – Object description

Attribute	Value
Index	6061_h
Name	Modes of operation display
Object Code	Variable
Data Type	Integer8
Category	Optional

Table 57 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 53
Default Value	No

8.4.12 Object 6502_h: Supported drive modes

This object shall provide information on the supported drive modes. Figure 8 specifies the value definition, Table 58 specifies the object description, and Table 59 specifies the entry description.

31 16	15 10	9	8	7	6	5	4	3	2	1	0
Manufacturer-specific	*r(eserved)*	*cst*	*csv*	*csp*	*ip*	*hm*	*r*	*tq*	*pv*	*vl*	*pp*
MSB											LSB

Figure 8 – Value definition

cst, csv, csp, ip, hm, tq, pv, vl, and pp bits:

1 = mode is supported 0 = mode is not supported

manufacturer-specific bits:

1 = function is supported 0 = function is not supported

r(eserved) bits: 0

Table 58 – Object description

Attribute	Value
Index	6502_h
Name	Supported drive modes
Object Code	Variable
Data Type	Unsigned32
Category	Mandatory

Table 59 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See Figure 8
Default Value	No

9 Factor group

9.1 General

In some drive device applications several sensor resolution values and ratio values are needed. They may make use for the objects defined in this clause.

The relation between the user-defined units and the internal units is calculated by the following equation:

$$position\ actual\ value = \frac{position\ internal\ value \times feed\ constant}{position\ encoder\ resolution \times gear\ ratio}$$

9.2 Detailed object definitions

9.2.1 Object $608F_h$: Position encoder resolution

This object shall indicate the configured encoder increments and number of motor revolutions. The position encoder resolution shall be calculated by the following formula:

$$position\,encoder\,resolution = \frac{encoder\,increments}{motor\,revolutions}$$

All values shall be dimensionless. Table 60 specifies the object description, and Table 61 specifies the entry description.

Table 60 – Object description

Attribute	Value
Index	$608F_h$
Name	Position encoder resolution
Object Code	Array
Data Type	Unsigned32
Category	Optional

Table 61 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	01_h
Description	Encoder increments
Entry Category	Mandatory
Access	Rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	02_h
Description	Motor revolutions
Entry Category	Mandatory
Access	Rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)

9.2.2 Object 6090_h: Velocity encoder resolution

This object shall indicate the configured encoder increments per second and motor revolutions per second. The velocity encoder resolution shall be calculated by the following formula:

$$velocityencoderresolution = \frac{encoder\frac{increments}{second}}{motor\frac{revolutions}{second}}$$

All values shall be dimensionless. Table 62 specifies the object description, and Table 63 specifies the entry description.

Table 62 – Object description

Attribute	Value
Index	6090_h
Name	Velocity encoder resolution
Object Code	Array
Data Type	Unsigned32
Category	Optional

Table 63 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	01_h
Description	Encoder increments per second
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	02_h
Description	Motor revolutions per second
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)

9.2.3 Object 6091_h: Gear ratio

This object shall indicate the configured number of motor shaft revolutions and number of driving shaft revolutions. The gear ratio shall be calculated by the following formula:

$$gear\ ratio = \frac{motor\ shaft\ revolutions}{driving\ shaft\ revolutions}$$

All values shall be dimensionless. Table 64 specifies the object description, and Table 65 specifies the entry description.

Table 64 – Object description

Attribute	Value
Index	6091_h
Name	Gear ratio
Object Code	Array
Data Type	Unsigned32
Category	Optional

Table 65 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	01_h
Description	Motor revolutions
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	02_h
Description	Shaft revolutions
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)

9.2.4 Object 6092_h: Feed constant

This object shall indicate the configured feed constant, this is the measurement distance per one revolution of the output shaft of the gearbox. The feed constant shall be calculated by the following formula:

$$feed\ constant = \frac{feed}{driving\ shaft\ revolutions}$$

The feed shall be given in user-defined position units, and the driving shaft revolution shall be dimensionless. Table 66 specifies the object description, and Table 67 specifies the entry description.

Table 66 – Object description

Attribute	Value
Index	6092_h
Name	Feed constant
Object Code	Array
Data Type	Unsigned32
Category	Optional

Table 67 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	01_h
Description	Feed
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	02_h
Description	Shaft revolutions
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)

9.2.5 Object $607E_h$: Polarity

This object shall indicate if the position demand value shall be multiplied by 1 of by –1. The polarity flag shall have no influence on the homing mode. The position polarity bit shall be used only for profile position (*pp*) mode and cyclic sync position mode (*csp*). The velocity polarity bit shall be used only for profile velocity (*pv*) mode and cyclic sync velocity mode (*csv*). Figure 9 specifies the value definition, Table 68 specifies the object description, and Table 69 specifies the entry description.

7	6	5 … 0
Position polarity	*Velocity polarity*	*reserved (0)*
MSB		LSB

Figure 9 – Value definition

The polarity bits shall be coded as follows: 0_b = multiply by 1 and 1_b = multiply by -1

Table 68 – Object description

Attribute	Value
Index	$607E_h$
Name	Polarity
Object Code	Variable
Data Type	Unsigned8
Category	Optional

Table 69 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Figure 9
Default Value	00_h

10 Profile position mode

10.1 General information

The overall structure for this mode is shown in Figure 10. A target position is applied to the trajectory generator. It is generating a position demand value for the position control loop described in the position control function (see 12.3.1). These two function blocks are optionally controlled by individual parameter sets.

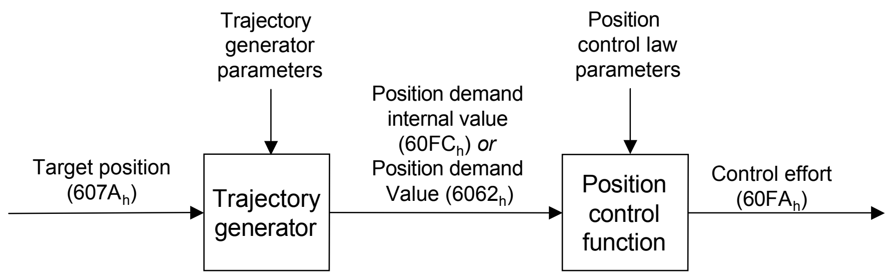

Figure 10 – Trajectory generator and position control function

At the input to the trajectory generator, parameters may have optional limits applied before being normalised to internal units. The simplest form of a trajectory generator is just to pass through a target position and to transform it to a position demand internal value with internal units (increments) only. Figure 11 defines the detailed structure of the trajectory generator.

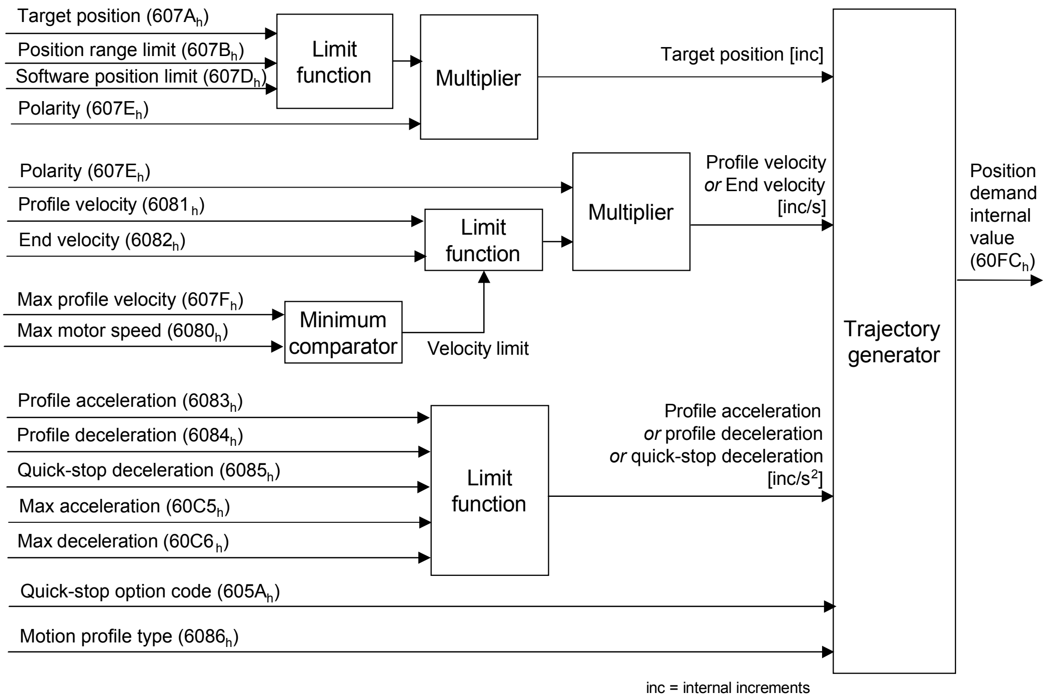

Figure 11 – Trajectory generator for profile position mode

10.2 Functional description

10.2.1 General

The setting of set-points is controlled by the timing of the *new set-point* bit and the *change set immediately* bit in the controlword as well as the *set-point acknowledge* bit in the statusword.

If the *change set immediately* bit of the controlword is set to 1, a single set-point is expected by the drive device. If the *change set immediately* bit of the controlword is set to 0, a set of set-points is expected by the drive device.

After a set-point is applied to the drive device, the control device signals that the set-point is valid by a rising edge of the *new set-point* bit in the controlword. The drive device sets the set-point acknowledge bit in the statusword to 1, and afterwards, the drive device signals with the *set-point acknowledge* bit set to 0 its ability to accept new set-points. An example is shown in Figure 12.

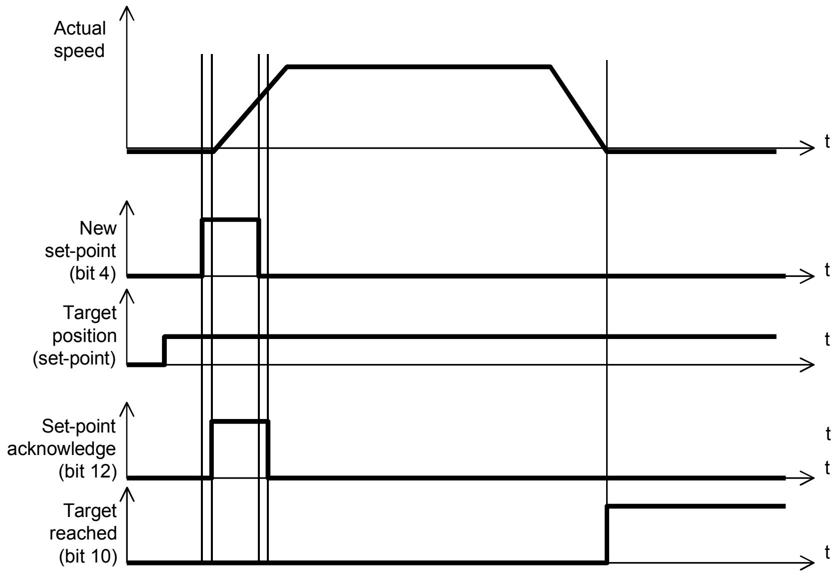

Figure 12 – Set-point example

If one set-point is still in progress and a new one is validated, two methods of handling are supported: *single set-point* (*change set immediately* bit of controlword is 1) and *set of set-points* (*change set immediately* bit of controlword is 0).

10.2.2 Single set-point

When a set-point is in progress and a new set-point is validated by the new set-point (bit 4) in the controlword, the new set-point shall be processed immediately. The handshaking procedure shown in Figure 13 is used for the single set-point method.

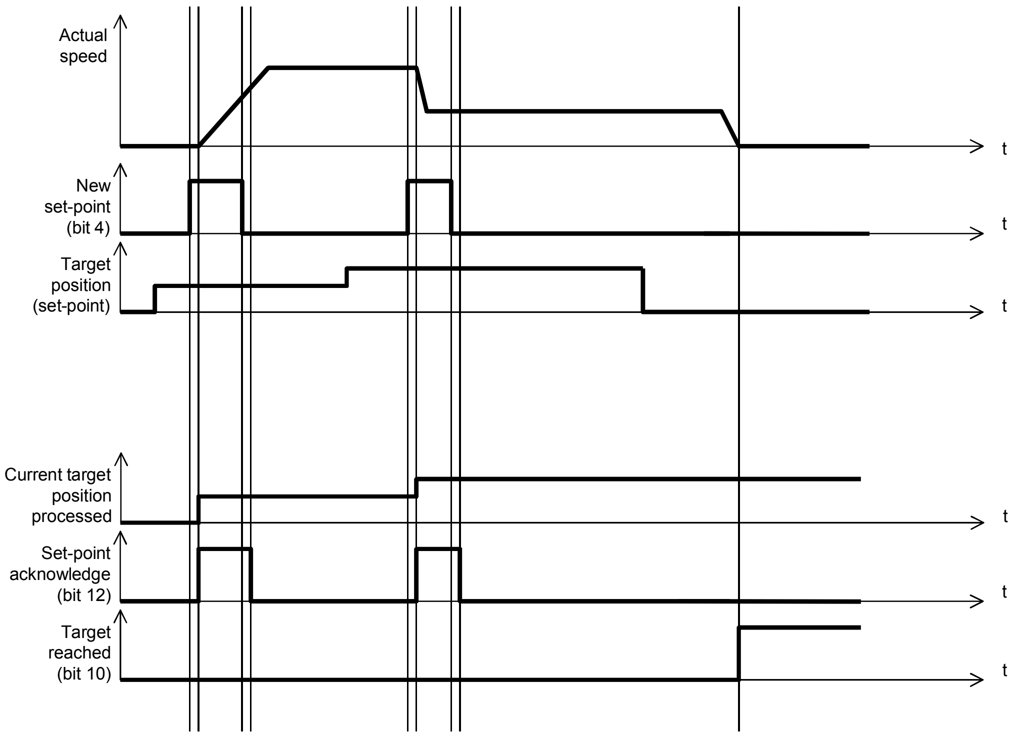

Figure 13 – Handshaking procedure for the single set-point method

10.2.3 Set of set-points

When a set-point is in progress and a new set-point is validated by the new set-point (bit 4) in the controlword, the new set-point shall be processed only after the previous has been reached. The handshaking procedure shown in Figure 14 is used for the set of set-points method. The additional grey line segment in the graph 'actual speed' shows the actual speed if the *change of set point* bit (bit 9) is set to 1.

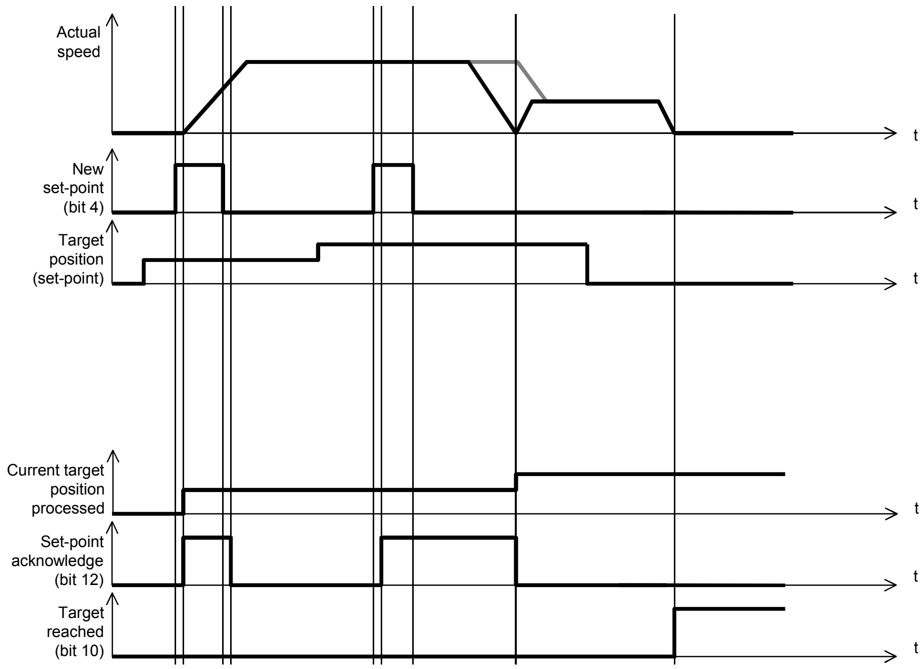

Figure 14 – Handshaking procedure for the set of set-points method

If a drive device supports set of set-points, a minimum of two set-points are available, a set-point that is currently been processed an d a buffered set-point. The set-points are handled as shown in Figure 15.

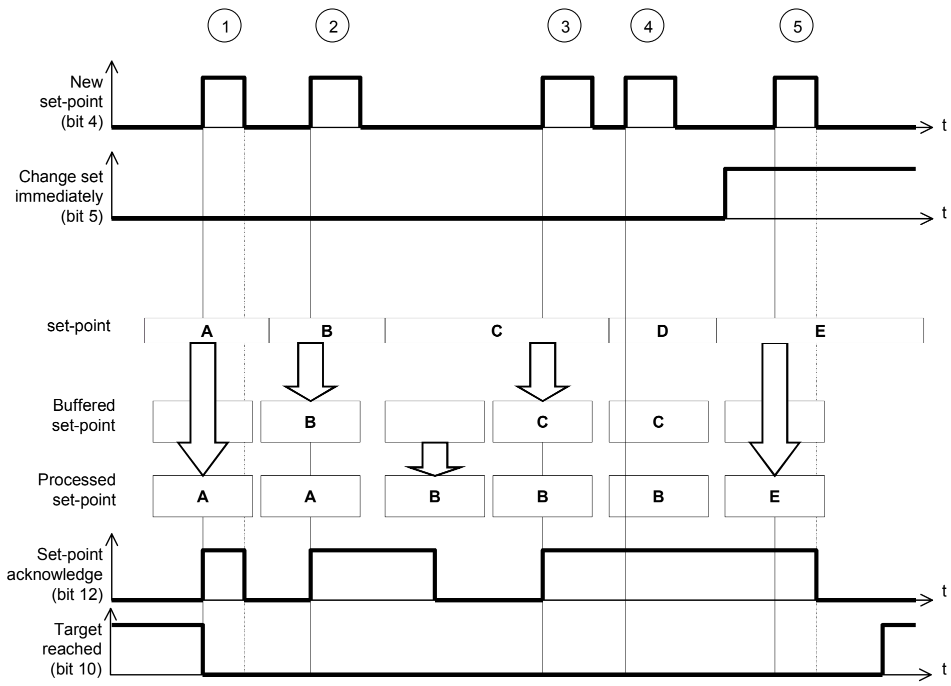

Figure 15 – Set-point handling for two set-points

New set-points are buffered in the set-point list as long as free set-points are available in the drive device. If no set-point is in progress, the new set-point shall become active immediately (1). If a set-point is in progress, the new set-point shall be stored in the first set-point buffer that is free (2 + 3).

If all set-point buffers are busy (*set-point acknowledge´* bit is 1), the reaction depends on the *change set immediately* bit. If the *change set immediately* bit is set to 1, the new set-point shall be processed immediately as single set-point. All previously loaded set-points shall be discarded (5).

The *target reached* bit shall remain 0 until all set-points are processed.

10.3 General definitions

The internal software limits shall not be exceeded by external settings configured by the user.

10.4 Use of controlword and statusword

The profile position mode uses some bits of the controlword and the statusword for mode-specific purposes. Figure 16 shows the structure of the controlword. If no positioning is in progress, the rising edge of bit 4 shall start the positioning of the axis. In case a positioning is in progress, the definitions given in Table 70 shall be used. Table 71 defines the values for bit 6 and 8 of the controlword.

NOTE It is assumed that the target position is edge-triggered 0->1 otherwise the drive could set immediately new values, which leads to unexpected behaviour.

15 … 10	9	8	7	6	5	4	3 … 0
(see 8.4.1)	*Change on set-point*	*Halt*	(see 8.4.1)	*abs/rel*	*Change set immediately*	*New set-point*	(see 8.4.1)
MSB							LSB

Figure 16 – Controlword for profile position (pp) mode

Table 70 – Definition of bit 4, bit 5, and bit 9

Bit 9	Bit 5	Bit 4	Definition
0	0	0 -> 1	Positioning shall be completed (target reached) before the next one gets started (see Figure 12 and Figure 14)
X	1	0 -> 1	Next positioning shall be started immediately (see Figure 12 and Figure 13)
1	0	0 -> 1	Positioning with the current profile velocity up to the current setpoint shall be proceeded and then next positioning (see Figure 12 and Figure 14) shall be applied

Table 71 – Definition of bit 6 and bit 8

Bit	Value	Definition
6	0	*Target position* shall be an absolute value
	1	*Target position* shall be a relative value (depending on object $60F2_h$)
8	0	Positioning shall be executed or continued
	1	Axis shall be stopped accordingly to halt option code ($605D_h$)

Figure 17 shows the structure of the statusword. Table 72 defines the values for bit 10, bit 12, and bit 13.

15 14	13	12	11	10	9 0
(see 8.4.2)	Following error	Set-point acknowledge	(see 8.4.2)	Target reached	(see 8.4.2)
MSB					LSB

Figure 17 – Statusword for profile position (pp) mode

Table 72 – Definition of bit 10, bit 12, and bit 13

Bit	Value	Definition
10	0	Halt (Bit 8 in controlword) = 0: *Target position* not reached Halt (Bit 8 in controlword) = 1: Axis decelerates
	1	Halt (Bit 8 in controlword) = 0: *Target position* reached Halt (Bit 8 in controlword) = 1: Velocity of axis is 0
12	0	Previous setpoint already processed, waiting for new setpoint
	1	Previous setpoint still in process, setpoint overwriting shall be accepted
13	0	No following error
	1	Following error

10.5 Detailed object definitions

10.5.1 Object 607A$_h$: Target position

This object shall indicate the commanded position that the drive should move to in position profile mode using the current settings of motion control parameters such as velocity, acceleration, deceleration, motion profile type etc. The value of this object shall be interpreted as absolute or relative depending on the ‘abs/rel' flag in the controlword. It shall be given in user-defined position units and shall be converted to position increments. Table 73 specifies the object description, and Table 74 specifies the entry description.

Table 73 – Object description

Attribute	Value
Index	607A$_h$
Name	Target position
Object Code	Variable
Data Type	Integer32
Category	Optional; mandatory if *pp, pc* or *csp* is supported

Table 74 – Entry description

Attribute	Value
Sub-Index	00$_h$
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

10.5.2 Object 607B$_h$: Position range limit

This object shall indicate the configured maximal and minimal position range limits. It shall limit the numerical range of the input value. On reaching or exceeding these limits, the input value shall wrap automatically to the other end of the range. Wrap-around of the input value may be prevented by setting software position limits as defined in software position limit object (607D$_h$). The values shall be given in user-defined position units. Table 75 specifies the object description, and Table 76 specifies the entry description.

Table 75 – Object description

Attribute	Value
Index	607B$_h$
Name	Position range limit
Object Code	Array
Data Type	Integer32
Category	Optional

Table 76 – Entry description

Attribute	Value
Sub-Index	00$_h$
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02$_h$
Default Value	Manufacturer-specific
Sub-Index	01$_h$
Description	Min position range limit
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific
Sub-Index	02$_h$
Description	Max position range limit
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

10.5.3 Object 607D$_h$: Software position limit

This object shall indicate the configured maximal and minimal software position limits. These parameters shall define the absolute position limits for the position demand value and the position actual value. Every new target position shall be checked against these limits. The limit positions shall be always relative to the machine home position. Before being compared with the target position, they shall be corrected internally by the home offset as follows:

corrected min position limit = min position limit – home offset

corrected max position limit = max position limit – home offset

This calculation needs only be performed when home offset or software position limit is changed.

The limit positions shall be given in user-defined position units (same as target position). Table 77 specifies the object description, and Table 78 specifies the entry description.

Table 77 – Object description

Attribute	Value
Index	$607D_h$
Name	Software position limit
Object Code	Array
Data Type	Integer32
Category	Optional

Table 78 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	Manufacturer-specific
Sub-Index	01_h
Description	Min position limit
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific
Sub-Index	02_h
Description	Max position limit
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

10.5.4 Object $607F_h$: Max profile velocity

This object shall indicate the configured maximal allowed velocity in either direction during a profiled motion. The value shall be given in the very same physical unit as the *profile velocity* object (6081_h). Table 79 specifies the object description, and Table 80 specifies the entry description.

Table 79 – Object description

Attribute	Value
Index	$607F_h$
Name	Max profile velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 80 – Entry description

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

10.5.5 Object 6080_h: Max motor speed

This object shall indicate the configured maximal allowed speed for the motor in either direction. It is used to protect the motor and is taken from the motor data sheet. The value shall be given in rotations per minute (rpm). Table 81 specifies the object description, and Table 82 specifies the entry description.

Table 81 – Object description

Attribute	Value
Index	6080_h
Name	Max motor speed
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 82 – Entry description

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

10.5.6 Object 6081_h: Profile velocity

This object shall indicate the configured velocity normally attained at the end of the acceleration ramp during a profiled motion and shall be valid for both directions of motion. allowed velocity in either direction during a profiled motion. The value shall be given in user-defined speed units. It shall be converted to position increments per second using the *velocity encoder factor* object. Table 83 specifies the object description, and Table 84 specifies the entry description.

Table 83 – Object description

Attribute	Value
Index	6081_h
Name	Profile velocity
Object Code	Variable
Data Type	Unsigned32
Category	Conditional: mandatory if *pp* is supported

Table 84 – Entry description

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

10.5.7 Object 6082_h: End velocity

This object shall indicate the configured velocity, which the drive shall have on reaching the target position. Normally, the drive stops at the target position, i.e. the end velocity = 0. The value shall be given in the same physical unit as the *profile velocity* object (6081_h). Table 85 specifies the object description, and Table 86 specifies the entry description.

Table 85 – Object description

Attribute	Value
Index	6082_h
Name	End velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 86 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	$0000\ 0000_h$

10.5.8 Object 6083_h: Profile acceleration

This object shall indicate the configured acceleration. The value shall be given in user-defined acceleration units; it shall be converted to position increments per square second (s^2) using the normalising factors (see Clause 9). Table 87 specifies the object description, and Table 88 specifies the entry description.

Table 87 – Object description

Attribute	Value
Index	6083_h
Name	Profile acceleration
Object Code	Variable
Data Type	Unsigned32
Category	Conditional: mandatory if *pp* or *pv* is supported

Table 88 – Entry description

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

10.5.9 Object 6084_h: Profile deceleration

This object shall indicate the configured deceleration. If this parameter is not supported, then the *profile acceleration* object (6083_h) value shall be used for deceleration, too. The value shall be given in the same physical units as *profile acceleration* object (6083_h). Table 89 specifies the object description, and Table 90 specifies the entry description.

Table 89 – Object description

Attribute	Value
Index	6084_h
Name	Profile deceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 90 – Entry description

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

10.5.10 Object 6085_h: Quick stop deceleration

This object shall indicate the configured deceleration used to stop the motor when the quick stop function is activated and the *quick stop code* object ($605A_h$) is set to 2 or 6. The quick stop deceleration is also used if the *fault reaction code* object ($605E_h$) is 2 and the *halt option code* object ($605D_h$) is 2. The value shall be given in the same physical unit as *profile acceleration* object (6083_h). Table 91 specifies the object description, and Table 92 specifies the entry description.

Table 91 – Object description

Attribute	Value
Index	6085_h
Name	Quick stop deceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 92 – Entry description

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

10.5.11 Object 6086_h: Motion profile type

This object shall indicate the configured type of motion profile used to perform a profiled motion. Table 93 specifies the value definition, Table 94 specifies the object description, and Table 95 specifies the entry description.

Table 93 – Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific
0	Linear ramp (trapeziodal profile)
+1	Sin^2 ramp
+2	Jerk-free ramp
+3	Jerk-limited ramp
+4 to +32 767	Reserved

Table 94 – Object description

Attribute	Value
Index	6086_h
Name	Motion profile type
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 95 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0

10.5.12 Object $60A3_h$: Profile jerk use

This object shall indicate the configured number of sub-indices used in the *profile jerk* object ($60A4_h$) for the jerk profile movement. If this object is not implemented, the *profile jerk* object shall be used as it is implemented. The value shall be dimensionless, the value of FF_h shall indicate that the profile jerk use is not configured. Table 96 specifies the object description, and Table 97 specifies the entry description.

Table 96 – Object description

Attribute	Value
Index	$60A3_h$
Name	Profile jerk use
Object Code	Variable
Data Type	Unsigned8
Category	Optional

Table 97 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	01_h to 06_h and FF_h
Default Value	Manufacturer-specific

10.5.13 Object $60A4_h$: Profile jerk

This object shall indicate the configured set of jerk parameters that shall be used during the profile movement. Figure 18 shows the defined jerks (A, B, C, D, E, and F). The values shall be given in user-defined jerk units. Table 98 specifies the value assignment to jerks depending of the value of *profile jerk use* object ($60A3_h$). If object $60A3_h$ is not implemented, the sub-index 00_h shall be used to assign the values given in the other sub-indices to the jerks. Table 99 specifies the object description, and Table 100 specifies the entry description.

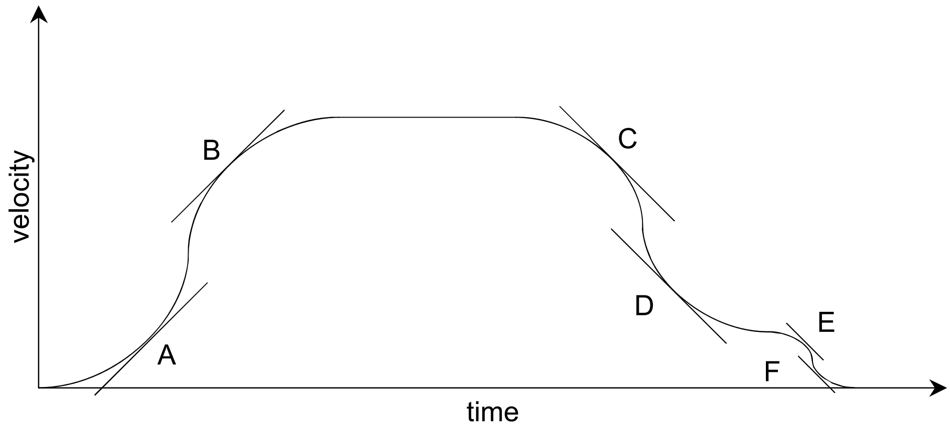

Figure 18 – Velocity/time diagram with jerk positions

Table 98 – Value assignments

Value in $60A3_h$ or sub-index 00_h of $60A4_h$ if $60A3_h$ is not implemented	Value assignment to jerks					
	A	B	C	D	E	F
01_h	01_h	01_h	01_h	01_h	-	-
02_h	01_h	01_h	02_h	02_h	-	-
04_h	01_h	03_h	02_h	04_h	-	-
06_h	01_h	03_h	02_h	04_h	05_h	06_h

Table 99 – Object description

Attribute	Value
Index	$60A4_h$
Name	Profile jerk
Object Code	Array
Data Type	Unsigned32
Category	Optional

Table 100 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	01_h, 02_h, 04_h, or 06_h,
Default Value	Manufacturer-specific
Sub-Index	01_h
Description	Profile jerk 1
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
Sub-Index	02_h
Description	Profile jerk 2
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
to	
Sub-Index	06_h
Description	Profile jerk 6
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

10.5.14 Object $60C5_h$: Max acceleration

This object shall indicate the configured maximal acceleration. It is used to limit the acceleration to an acceptable value in order to prevent the motor and the moved mechanics from being destroyed. The value shall be given in user-defined acceleration physical units. Table 101 specifies the object description, and Table 102 specifies the entry description.

Table 101 – Object description

Attribute	Value
Index	$60C5_h$
Name	Max acceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 102 – Entry description

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

10.5.15 Object $60C6_h$: Max deceleration

This object shall indicate the configured maximal deceleration. It is used to limit the acceleration to an acceptable value in order to prevent the motor and the moved mechanics from being destroyed. The value shall be given in the same physical unit as the *max acceleration* object ($60C5_h$). Table 103 specifies the object description, and Table 104 specifies the entry description.

Table 103 – Object description

Attribute	Value
Index	$60C6_h$
Name	Max deceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 104 – Entry description

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

11 Homing mode

11.1 General information

This clause describes the method by which a drive seeks the home position (also called, the datum, reference point or zero point). There are various methods of achieving this using limit switches at the ends of travel or a home switch (zero point switch) in mid-travel, most of the methods also use the index (zero) pulse train from an incremental encoder.

11.2 Functional description

Figure 19 shows the defined input objects as well as the output objects. The user may specify the speeds, acceleration and the method of homing. There is a further object home offset, which allows the user to displace zero in the user's coordinate system from the home position.

There is no output data except for those bits in the statusword, which return the status or result of the homing process and the demand to the position control loops.

There are two homing speeds; in a typical cycle, the faster speed is used to find the home switch and the slower speed is used to find the index pulse. The manufacturer is allowed some discretion in the use of these speeds as the response to the signals may be dependent upon the hardware used.

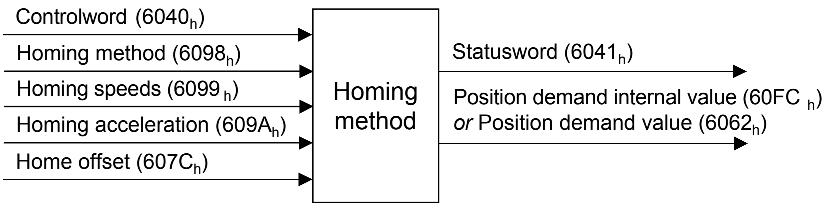

Figure 19 – Homing mode function

By choosing a homing method, the following behaviour is determined: The homing signal (positive limit switch, negative limit switch, home switch), the direction of actuation and where appropriate, the position of the index pulse.

The home position and the zero position are offset by the home offset; see the definition of home offset for how this offset is used.

An encircled number in the figures Figure 20 to Figure 27 indicates the code for selection of this homing position. The direction of movement is also indicated.

There are four sources of homing signal available: These are the negative and positive limit switches, the home switch and the index pulse from an encoder. In case, that a limit switch has reached the drive shall move in the other direction to leave the position.

In the diagrams of homing sequences shown below, the encoder count increases as the axis's position moves to the right, in other words, the left is the minimum position and the right is the maximum position.

For the operation of positioning drives, an exact knowledge of the absolute position is normally required. Since, for cost reasons, drives often do not have an absolute encoder, a homing operation is necessary. There are several, application-specific methods. The homing method is used for selection.

The exact sequence of the homing operation is clearly described by the method. In some circumstances, a drive device has several methods to choose from, using the homing method.

11.3 General definitions

11.3.1 Method 1: Homing on negative limit switch and index pulse

Using this method as shown in Figure 20, the initial direction of movement shall be leftward if the negative limit switch is inactive (here: low). The home position shall be at the first index pulse to the right of the position where the negative limit switch becomes inactive.

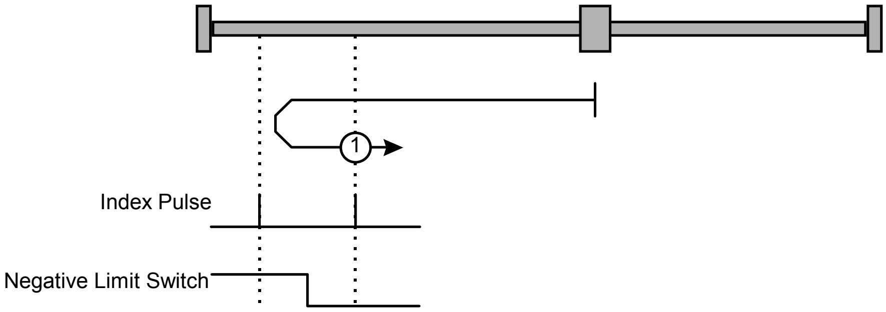

Figure 20 – Homing on negative limit switch and index pulse

11.3.2 Method 2: Homing on positive limit switch and index pulse

Using this method as shown in Figure 21, the initial direction of movement shall be rightward if the positive limit switch is inactive (here: low). The position of home shall be at the first index pulse to the left of the position where the positive limit switch becomes inactive.

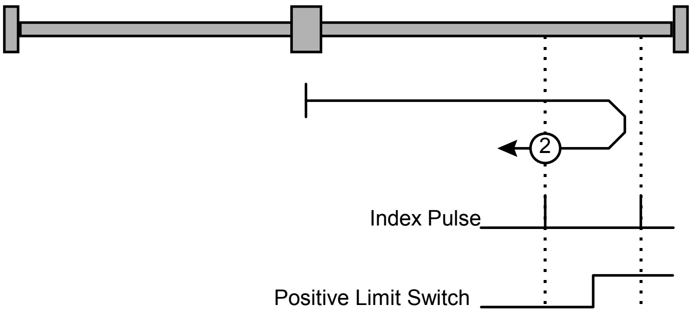

Figure 21 – Homing on positive limit switch and index pulse

11.3.3 Method 3 and 4: Homing on positive home switch and index pulse

Using these methods as shown in Figure 22, the initial direction of movement shall be dependent on the state of the home switch. The home position shall be at the index pulse to either to the left or the right of the point where the home switch changes state. If the initial position is situated so that the direction of movement shall reverse during homing, the point at which the reversal takes place is anywhere after a change of state of the home switch.

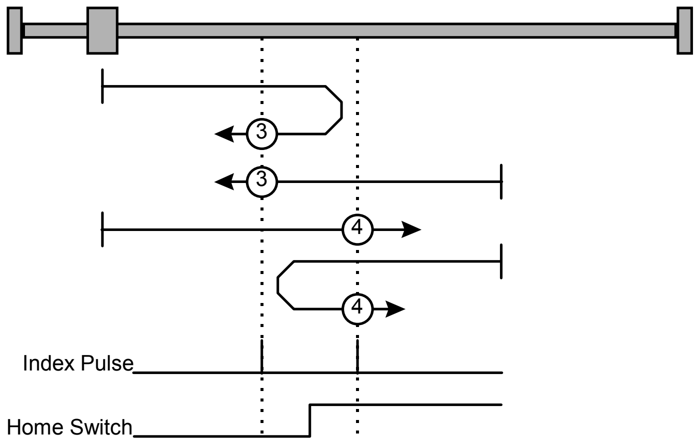

Figure 22 – Homing on positive home switch and index pulse

11.3.4 Method 5 and 6: Homing on negative home switch and index pulse

Using these methods as shown in Figure 23, the initial direction of movement shall be dependent on the state of the home switch. The home position shall be at the index pulse to either to the left or the right of the point where the home switch changes state. If the initial position is situated so that the direction of movement shall reverse during homing, the point at which the reversal takes place is anywhere after a change of state of the home switch.

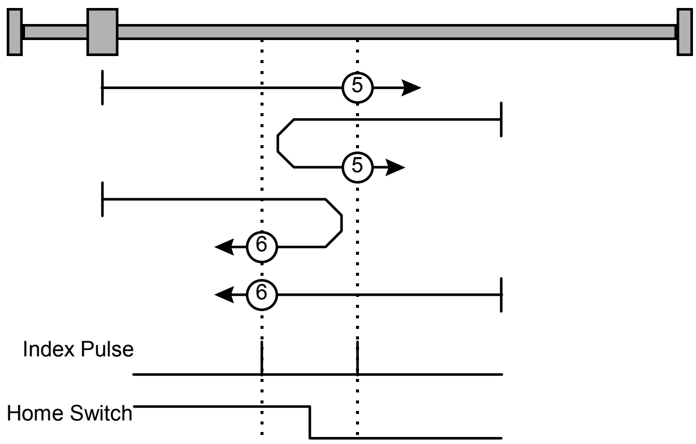

Figure 23 – Homing on negative home switch and index pulse

11.3.5 Method 7 to 14: Homing on home switch and index pulse

These methods use a home switch, which is active over only a portion of the travel, in effect the switch has a 'momentary' action as the axis's position sweeps past the switch. Using the methods 7 to 10, the initial direction of movement shall be to the right, and using methods 11 to 14, the initial direction of movement shall be to the left except if the home switch is active at the start of the motion. In this case, the initial direction of motion shall be dependent on the edge being sought. The home position shall be at the index pulse on either side of the rising or falling edges of the home switch, as shown in Figure 24 and Figure 25. If the initial direction of movement leads away from the home switch, the drive shall reverse on encountering the relevant limit switch.

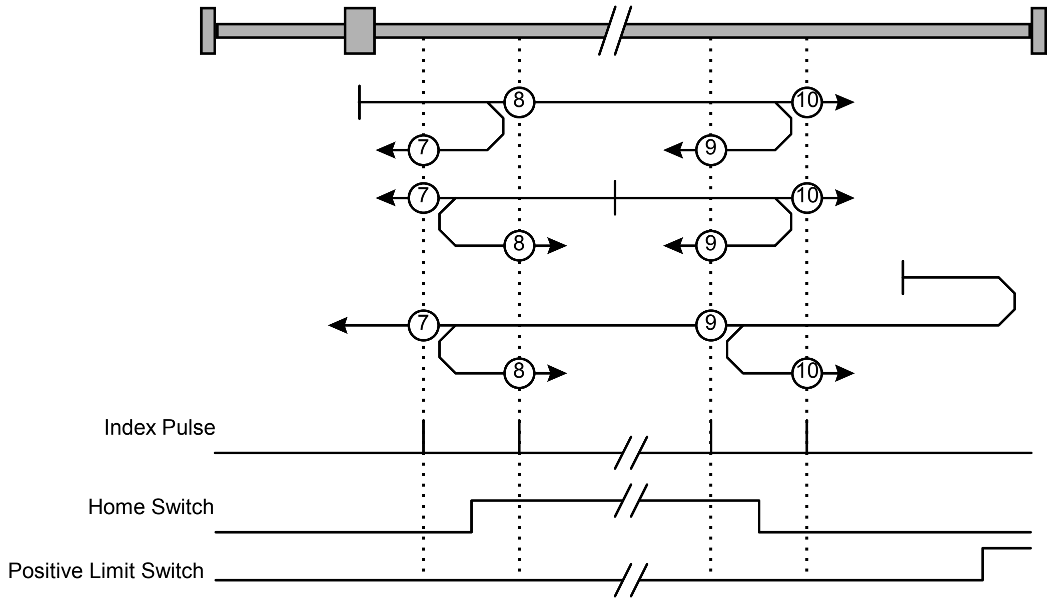

Figure 24 – Homing on home switch and index pulse – positive initial motion

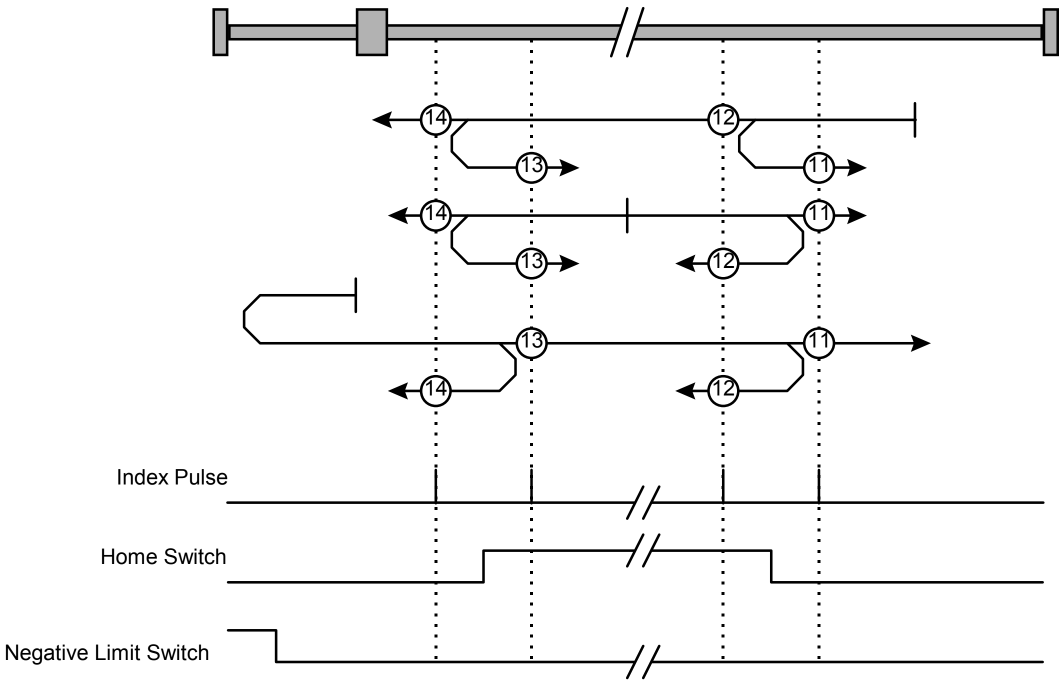

Figure 25 – Homing on home switch and index pulse – negative initial motion

11.3.6 Method 15 and 16: Reserved

These methods are reserved.

11.3.7 Method 17 to 30: Homing without index pulse

These methods are similar to methods 1 to 14 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions. For example methods 19 and 20 are similar to methods 3 and 4 as shown in Figure 26.

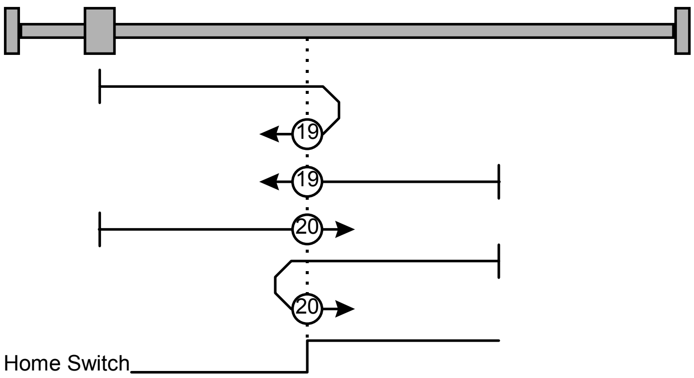

Figure 26 – Homing on positive home switch

11.3.8 Method 31 and 32: Reserved

These methods are reserved.

11.3.9 Method 33 and 34: Homing on index pulse

Using these methods, the direction of homing is negative or positive respectively. The home position shall be at the index pulse found in the selected direction as shown in Figure 27.

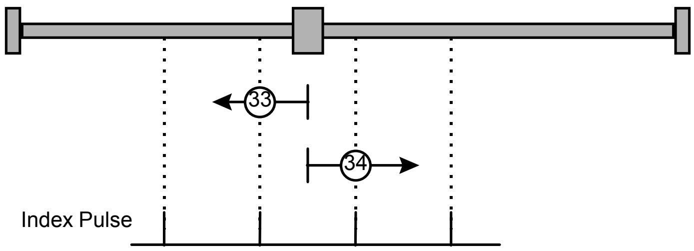

Figure 27 – Homing on index pulse

11.3.10 Method 35: Homing on index pulse

In this method, the current position shall be taken to be the home position. This method does not require the drive device to be in *operational enabled* state.

11.3.11 Method 36: Homing with touch-probe

In this method, the position is not sampled by the control device, but by the drive device itself. When the switch is triggered, the corresponding actual position together with the switch signal shall be reported.

11.4 Use of controlword and statusword

The homing mode uses some bits of the controlword and the statusword for mode-specific purposes. Figure 28 shows the structure of the controlword. Table 105 defines the values for bit 4 and 8 of the controlword.

15 … 9	8	7	6 … 5	4	3 … 0
(see 8.4.1)	*Halt*	(see 8.4.1)	reserved (0)	*Homing operation start*	(see 8.4.1)
MSB					LSB

Figure 28 – Controlword for homing mode

Table 105 – Definition of bit 4 and bit 8

Bit	Value	Definition
4	0	Do not start homing procedure
	1	Start or continue homing procedure
8	0	Enable bit 4
	1	Stop axis according to halt option code (605D$_h$)

Figure 29 shows the structure of the statusword. Table 106 defines the values for bit 10, bit 12, and bit 13.

15 – 14	13	12	11	10	9 – 0
(see 8.4.2)	Homing error	Homing attained	(see 8.4.2)	Target reached	(see 8.4.2)
MSB					LSB

Figure 29 – Statusword for homing mode

Table 106 – Definition of bit 10, bit 12, and bit 13

Bit 13	Bit 12	Bit 10	Definition
0	0	0	Homing procedure is in progress
0	0	1	Homing procedure is interrupted or not started
0	1	0	Homing is attained, but target is not reached
0	1	1	Homing procedure is completed successfully
1	0	0	Homing error occurred, velocity is not 0
1	0	1	Homing error occurred, velocity is 0
1	1	X	reserved

11.5 Detailed object definitions

11.5.1 Object 607C$_h$: Home offset

This object shall indicate the configured difference between the zero position for the application and the machine home position (found during homing). During homing, the machine home position is found and once the homing is completed, the zero position is offset from the home position by adding the home offset to the home position. All subsequent absolute moves shall be taken relative to this new zero position. This is illustrated in Figure 30. If this object is not implemented, then the home offset shall be regarded as zero. The value of this object shall be given in user-defined position units. Negative values shall indicate the opposite direction.

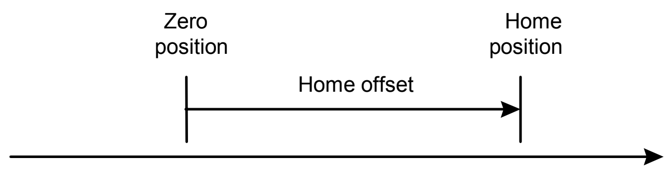

Figure 30 – Home offset definition

Table 107 specifies the object description, and Table 108 specifies the entry description.

Table 107 – Object description

Attribute	Value
Index	$607C_h$
Name	Home offset
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 108 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	0_d

11.5.2 Object 6098_h: Homing method

This object shall indicate the configured homing method that shall be used. Table 109 specifies the value definition, Table 110 specifies the object description, and Table 111 specifies the entry description.

Table 109 – Value definition

Value	Definition
-128_d to -1_d	Manufacturer-specific
0_d	No homing method assigned
$+1_d$	Method 1 shall be used
to	
$+35_d$	Method 35 shall be used
$+36_d$	Method 36 shall be used
$+37_d$ to $+127_d$	reserved

Table 110 – Object description

Attribute	Value
Index	6098_h
Name	Homing method
Object Code	Variable
Data Type	Integer8
Category	Conditional: mandatory if *hm* is supported

Table 111 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 109
Default Value	Manufacturer-specific

11.5.3 Object 6099_h: Homing speeds

This object shall indicate the configured speeds used during homing procedure. The values shall be given in user-defined velocity units. Table 112 specifies the object description, and Table 113 specifies the entry description.

Table 112 – Object description

Attribute	Value
Index	6099_h
Name	Homing speeds
Object Code	Array
Data Type	Unsigned32
Category	Conditional: mandatory if *hm* is supported

Table 113 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	02_h
Sub-Index	01_h
Description	Speed during search for switch
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
Sub-Index	02_h
Description	Speed during search for zero
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

11.5.4 Object $609A_h$: Homing acceleration

This object shall indicate the configured acceleration and deceleration to be used during homing operation. The value shall be given in user-defined acceleration units. Table 114 specifies the object description, and Table 115 specifies the entry description.

Table 114 – Object description

Attribute	Value
Index	$609A_h$
Name	Homing acceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 115 – Entry description

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

11.5.5 Object $60B8_h$: Touch probe function

This object shall indicate the configured function of the touch probe. Table 116 specifies the value definition, Table 117 specifies the object description, and Table 118 specifies the entry description.

Table 116 – Value definition

Bit	Value	Definition
0	0	Switch off touch probe 1
	1	Enable touch probe 1
1	0	Trigger first event
	1	continous
2	0	Trigger with touch probe 1 input
	1	Trigger with zero impulse signal or position encoder
3	0	Reserved
4	0	Switch off sampling at positive edge of touch probe 1
	1	Enable sampling at positive edge of touch probe 1
5	0	Switch off sampling at negative edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1
6, 7	-	User-defined (e.g. for testing)
8	0	Switch off touch probe 2
	1	Enable touch probe 2
9	0	Trigger first event
	1	Continous
10	0	Trigger with touch probe 2 input
	1	Trigger with zero impulse signal or position encoder
11	0	Reserved
12	0	Switch off sampling at positive edge of touch probe 2
	1	Enable sampling at positive edge of touch probe 2

Bit	Value	Definition
13	0	Switch off sampling at negative edge of touch probe 2
	1	Enable sampling at negative edge of touch probe 2
14, 15	-	User-defined (e.g. for testing)

Table 117 – Object description

Attribute	Value
Index	$60B8_h$
Name	Touch probe function
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 118 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 116
Default Value	Manufacturer-specific

11.5.6 Object $60B9_h$: Touch probe status

This object shall provide the status of the touch probe. Table 119 specifies the value, Table 120 specifies the object description, and Table 121 specifies the entry description.

Table 119 – Value definition

Bit	Value	Definition
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no positive edge value stored
	1	Touch probe 1 negative edge position stored
2	0	Touch probe 1 no negative edge value stored
	1	Touch probe 1 positive edge position stored
3 to 5	0	Reserved
6, 7	-	User-defined (e.g. for testing)
8	0	Touch probe 2 is Switched off
	1	Touch probe 2 is Enabled
9	0	Touch probe 2 no positive edge value stored
	1	Touch probe 2 negative edge position stored
10	0	Touch probe 2 no negative edge value stored
	1	Touch probe 2 positive edge position stored
11 to 13	0	Reserved
14, 15	-	User-defined (e.g. for testing)

Table 120 – Object description

Attribute	Value
Index	$60B9_h$
Name	Touch probe status
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 121 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 119
Default Value	No

11.5.7 Object $60BA_h$: Touch probe pos1 pos value

This object shall provide the position value of the touch probe 1 at positive edge. The value shall be given in user-defined position units. Table 122 specifies the object description, and Table 123 specifies the entry description.

Table 122 – Object description

Attribute	Value
Index	$60BA_h$
Name	Touch probe pos1 pos value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 123 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

11.5.8 Object $60BB_h$: Touch probe pos1 neg value

This object shall provide the position value of the touch probe 1 at negative edge. The value shall be given in user-defined position units. Table 124 specifies the object description, and Table 125 specifies the entry description.

Table 124 – Object description

Attribute	Value
Index	$60BB_h$
Name	Touch probe pos1 neg value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 125 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

11.5.9 Object $60BC_h$: Touch probe pos2 pos value

This object shall provide the position value of the touch probe 2 at positive edge. The value shall be given in user-defined position units. Table 126 specifies the object description, and Table 127 specifies the entry description.

Table 126 – Object description

Attribute	Value
Index	$60BC_h$
Name	Touch probe pos2 pos value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 127 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

11.5.10 Object $60BD_h$: Touch probe pos2 neg value

This object shall provide the position value of the touch probe 2 at negative edge. The value shall be given in user-defined position units. Table 128 specifies the object description, and Table 129 specifies the entry description.

Table 128 – Object description

Attribute	Value
Index	$60BD_h$
Name	Touch probe pos2 neg value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 129 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

12 Position control function

12.1 General information

For closed-loop position, the *position demand value* (as one of the outputs of the trajectory generator) and the output of the position detection unit (*position actual value*) like a resolver or encoder, are used input parameters. The behaviour of the closed-loop control is influenced by control parameters, which are externally applicable. To keep the loop stable, a relative limitation of the output using the previous *control effort* is optional. In order not to exceed the physical limits of a drive, an absolute limit function may be implemented for the control effort.

12.2 Functional description

Figure 31 shows the inputs and outputs of the position control function. The *control effort* may be a *velocity demand value*, a *position demand* value or any other output value, depending on the *modes of operation* implemented in the drive device. Especially in cascaded control structures, where a position control is followed by a torque control, for example the *control effort* of the position control loop is used as an input for a further calculation.

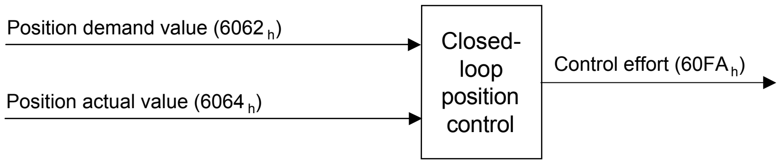

Figure 31 – Position control function

All values are transformed – if necessary – from user-defined units to normalised units such as increments.

A *position actual value* outside the allowed range of the *following error window* around a *position demand value* for longer than the following error time out shall result in setting bit 13 (*following error*) in the statusword to 1. This is shown in detail in Figure 32. Depending on the supported modes of operation (*pp*, *hm*, or *ip*) and on the capabilities of different categories of drives, only some of the mentioned input parameters may be necessary.

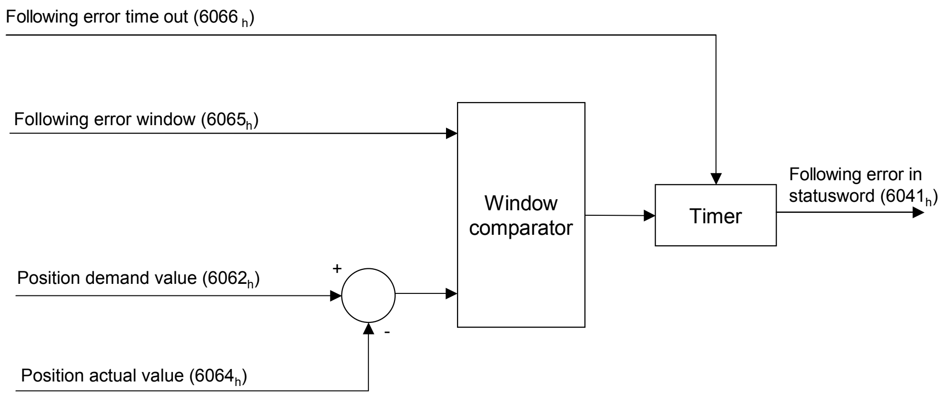

Figure 32 – Following error (functional overview)

The *position reached* function as shown in Figure 33 offers the possibility to define a position range around a position demand value to be regarded as valid. If a drive's position is within this area for a specified time – the position window time – the related control bit 10 target reached in the statusword shall be set to 1.

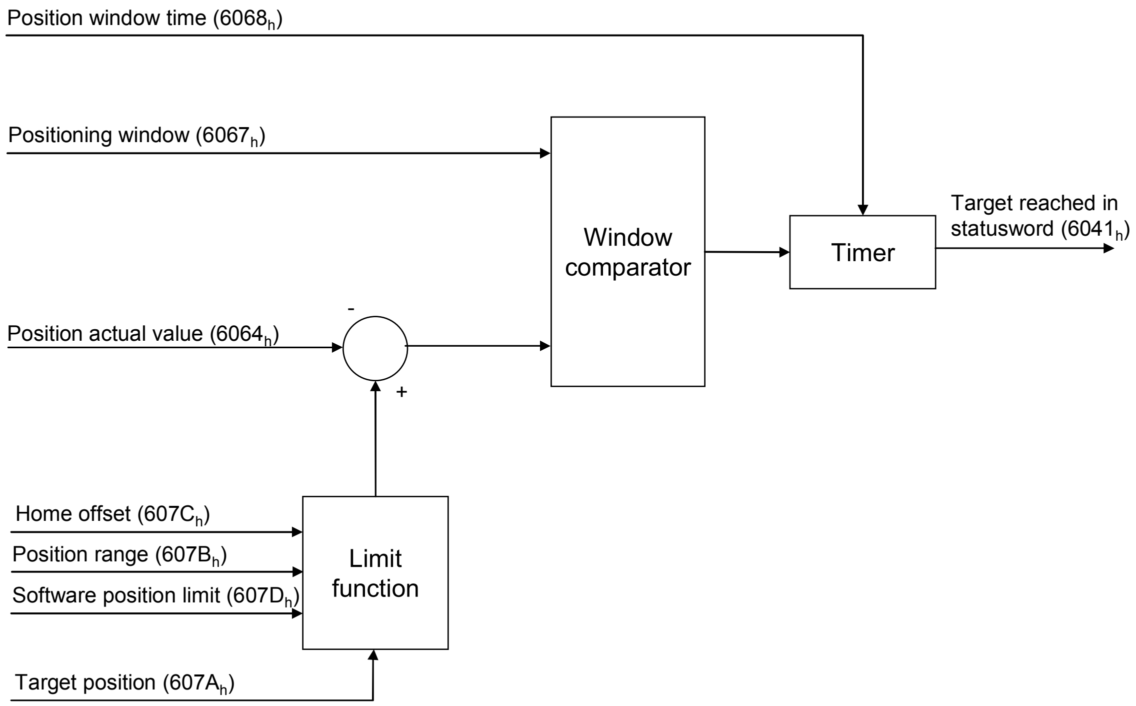

Figure 33 – Position reached (functional overview)

The control functions following error and position reached have direct access to the statusword and shall give immediate notification to the user if their results change.

Figure 34 shows the definitions of the sub-function position reached. A window is defined for the accepted position range symmetrically around the target position. If a drive is situated in the accepted position range over the time position window time, the bit target reached (bit 10) in the statusword shall be set to 1.

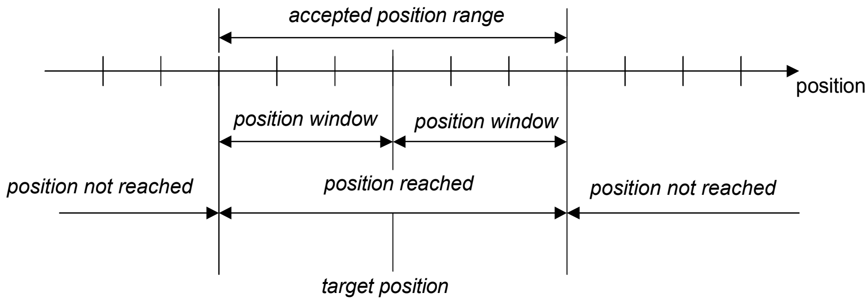

Figure 34 – Position reached (definitions)

Figure 35 shows the definitions of the sub-function following error in the profile position mode. A window is defined for the accepted following error tolerance symmetrically around the reference position. If a drive is situated out of the accepted position range for more than following error time out time, the bit following error (bit 13) in the statusword shall be set to 1.

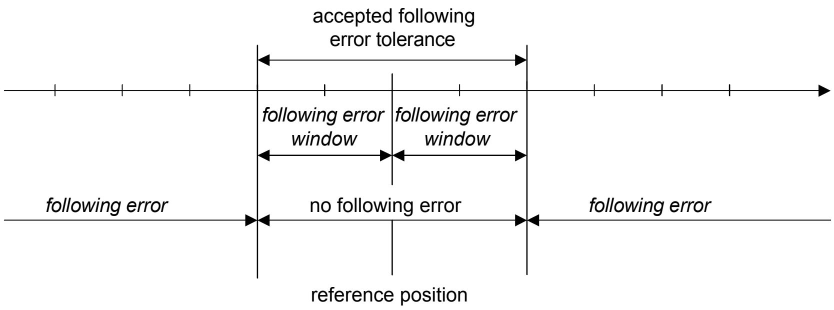

Figure 35 – Following error (definitions)

12.3 Detailed object definitions

12.3.1 Object 6062$_h$: Position demand value

This object shall provide the demanded position value. The value shall be given in user-defined position units. Table 130 specifies the object description, and Table 131 specifies the entry description.

Table 130 – Object description

Attribute	Value
Index	6062$_h$
Name	Position demand value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 131 – Entry description

Attribute	Value
Sub-Index	00$_h$
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

12.3.2 Object 6063$_h$: Position actual internal value

This object shall provide the actual value of the position measurement device, which shall be one of the two input values of the closed-loop position control. If necessary, the data unit may be transformed from user-defined units to increments. The value shall be given in internal units. Table 132 specifies the object description, and Table 133 specifies the entry description.

Table 132 – Object description

Attribute	Value
Index	6063_h
Name	Position actual internal value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 133 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

12.3.3 Object 6064_h: Position actual value

This object shall provide the actual value of the position measurement device. The value shall be given in user-defined position units. Table 134 specifies the object description, and Table 135 specifies the entry description.

Table 134 – Object description

Attribute	Value
Index	6064_h
Name	Position actual value
Object Code	Variable
Data Type	Integer32
Category	Mandatory if *csp* is supported

Table 135 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

12.3.4 Object 6065_h: Following error window

This object shall indicate the configured range of tolerated position values symmetrically to the position demand value. If the position actual value is out of the following error window, a following error occurs. A following error may occur when a drive is blocked, unreachable profile velocity occurs, or at wrong closed-loop coefficients. The value shall be given in user-defined position units. If the value of the following error window is FFFF $FFFF_h$, the following control shall be switched off. Table 136 specifies the object description, and Table 137 specifies the entry description.

Table 136 – Object description

Attribute	Value
Index	6065_h
Name	Following errror window
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 137 – Entry description

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

12.3.5 Object 6066_h: Following error time out

This object shall indicate the configured time for a following error condition, after that the bit 13 of the statusword shall be set to 1. The reaction of the drive when a following error occurs is manufacturer-specific. The value shall be given in ms. Table 138 specifies the object description, and Table 139 specifies the entry description.

Table 138 – Object description

Attribute	Value
Index	6066_h
Name	Following errror time out
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 139 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

12.3.6 Object 6067_h: Position window

This object shall indicate the configured symmetrical range of accepted positions relative to the target position. If the actual value of the position encoder is within the position window, this target position shall be regarded as having been reached. As the user mostly prefers to specify the position window in his application in user-defined units, the value is transformed into increments. The target position shall be handled in the same manner as in the *trajectory generator* concerning limiting functions and transformation into internal machine units before it may be used with this function. The value shall be given in user-defined position units. If the value of the position window is FFFF $FFFF_h$, the position window control shall be switched off. Table 140 specifies the object description, and Table 141 specifies the entry description.

Table 140 – Object description

Attribute	Value
Index	6067_h
Name	Position window
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 141 – Entry description

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

12.3.7 Object 6068_h: Position window time

This object shall indicate the configured time, during which the actual position within the position window is measured. The value shall be given in ms. Table 142 specifies the object description, and Table 143 specifies the entry description.

Table 142 – Object description

Attribute	Value
Index	6068_h
Name	Position window time
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 143 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

12.3.8 Object $60F4_h$: Following error actual value

This object shall provide the actual value of the following error. The value shall be given in user-defined position units. Table 144 specifies the object description, and Table 145 specifies the entry description.

Table 144 – Object description

Attribute	Value
Index	$60F4_h$
Name	Following errror actual value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 145 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

12.3.9 Object $60FA_h$: Control effort

This object shall provide the control effort as the output of the position control loop. It is particular to the *position control function* that the notation of the control effort is mode-dependent and therefore not specified. The value shall be given in user-defefined velocity units. Table 146 specifies the object description, and Table 147 specifies the entry description.

Table 146 – Object description

Attribute	Value
Index	$60FA_h$
Name	Control effort
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 147 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

12.3.10 Object $60FC_h$: Position demand internal value

This object shall provide the output of the trajectory generator in profile position mode. This value shall be given in increments of the position encoder. Table 148 specifies the object description, and Table 149 specifies the entry description.

Table 148 – Object description

Attribute	Value
Index	$60FC_h$
Name	Position demand internal value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 149 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

12.3.11 Object $60F2_h$: Positioning option code

This object shall indicate the configured positioning behaviour as described by the *profile positioning mode* or the *interpolated positioning mode*. Figure 36 shows the defined object structure.

15	14 12	11 8	7 6	5 4	3 2	1 0
ms	*reserved*	*ip option*	*reserved*	*rro*	*cio*	*relative option*
MSB						LSB

LEGEND ms = manufacturer-specific rro = request-response option cio = change immediately option

Figure 36 – Object structure

The *relative option* bits shall control the behaviour of positioning tasks in detail when the *abs_rel* bit (bit 6) of the controlword is set to 1 in *pp* mode. Table 150 shows the bit value definitions.

Table 150 – Value definition for bit 0 and bit 1

Bit 1	Bit 0	Definition
0	0	Positioning moves shall be performed relative to the preceding (internal absolute) target position (rsp. relative to 0 if there is no preceding target position) as described in 10.2
0	1	Positioning moves shall be performed relative to the actual position demand value (object $60FC_h$) – output of the trajectory generator
1	0	Positioning moves shall be performed relative to the position actual value (object 6064_h)
1	1	Reserved

The *change immediately option* bits shall control the behaviour of positioning tasks in detail when the *change_set_immediately* bit (bit 5) of the controlword is set to 1 in *pp* mode. Table 151 shows the bit value definitions.

Table 151 – Value definition for bit 2 and bit 3

Bit 3	Bit 2	Definition
0	0	The drive device shall readapt the actual motion to the new target position (considering potentially changed profile velocity and accelerations etc.) immediately as described in 10.2
0	1	The actually performed positioning task shall be continued (without attempting to stop on target position) and blended to the newly commanded task (considering potentially changed profile velocity and accelerations etc.) when target position is touched
1	0	Reserved
1	1	Reserved

The *request-response option* bits shall allow the drive device to release the *new_setpoint* bit (bit 4) of the controlword internally in order to avoid the need of setting this bit to 0 by the control device in *pp* mode. After internally releasing the *new_setpoint* bit, the drive device shall indicate the action to the control device by setting the *setpoint_acknowledgement* bit (bit 12) in the statusword to 0. Table 152 shows the bit value definitions.

Table 152 – Value definition for bit 4 and bit 5

Bit 5	Bit 4	Definition
0	0	The handshake as described in 10.2 shall be performed
0	1	The drive device shall release autonomously the *new setpoint* bit as soon as target is reached
1	0	The drive shall release autonomously the *new setpoint* bit as soon as able to accept new set-point data
1	1	Reserved

The *ip option* bits are reserved for defining the interpolated position mode. When the *manufacturer-specific* bit is set to 0, the function shall be not enabled; if it is set to 1, the manufacturer-specific function shall be enabled. The other reserved bits shall be set to 0.

Table 153 specifies the object description, and Table 154 specifies the entry description.

Table 153 – Object description

Attribute	Value
Index	$60F2_h$
Name	Positioning option code
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 154 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 150, Table 151, Table 152
Default Value	0000_h

13 Interpolated position mode

13.1 General information

The interpolated position mode is used to control multiple coordinated axes or a single axis with the need for time-interpolation of set-point data. The interpolated position mode normally uses time synchronisation mechanisms for a time coordination of the related drive units.

The interpolation data record contains the interpolation data; the data type of the sub-indices of this structure are manufacturer-specific.

For synchronous operation, the interpolation cycle time is defined by the object interpolation time period. Time synchronisation may be done by network dependent mechanisms. Each syncronisation cycle actuates the next data record if a valid data record is available.

For asynchronous operation, the interpolation time (for each time slice), may be included in the interpolation data record. If this is so, then the units for the interpolation time are still specified by the interpolation time index as for synchronous operation. The next data record shall be actuated as soon as the interpolation time expires and a valid data record is available.

The interpolated position mode allows the control deviced to transmit a stream of interpolation data with either an implicit or explicit time reference to a drive unit. If the drive supports an input buffer, the interpolation data may be sent in bursts rather than continuously in real time. The maximum size of the input buffer may be read by the control device using the interpolation data configuration. The actual buffer size may be both written and read by the control device using the interpolation data configuration. The buffer size is the number of interpolation data records which may be sent to a drive to fill the input buffer and it is not the size in bytes. Drive devices without input buffer capabilities shall accept at least one interpolation data item.

The interpolation data buffer may be implemented as a FIFO or a ring. The definition of a valid data record for each type of buffer shall be as follows:

- For the FIFO implementation, a valid data record is one that has not been actuated yet.

- For the Ring implementation, all data records within the actual buffer size are treated as valid data records, so interpolation data will continue to be actuated while ip enable is true.

The interpolation algorithm is defined in the interpolation sub mode select. Linear interpolation is the default interpolation method. This requires only one interpolation data item to be buffered for the calculation of the next demand value. For each interpolation cycle, the drive shall calculate a position demand value by interpolating positions over a period of time.

Optionally the common limit functions for speed, acceleration and deceleration may be applied to the interpolation data.

The placement of the scaling and limiting of the interpolation data record in Figure 37 is for indication only. These functions may be performed during the input of the interpolation data record.

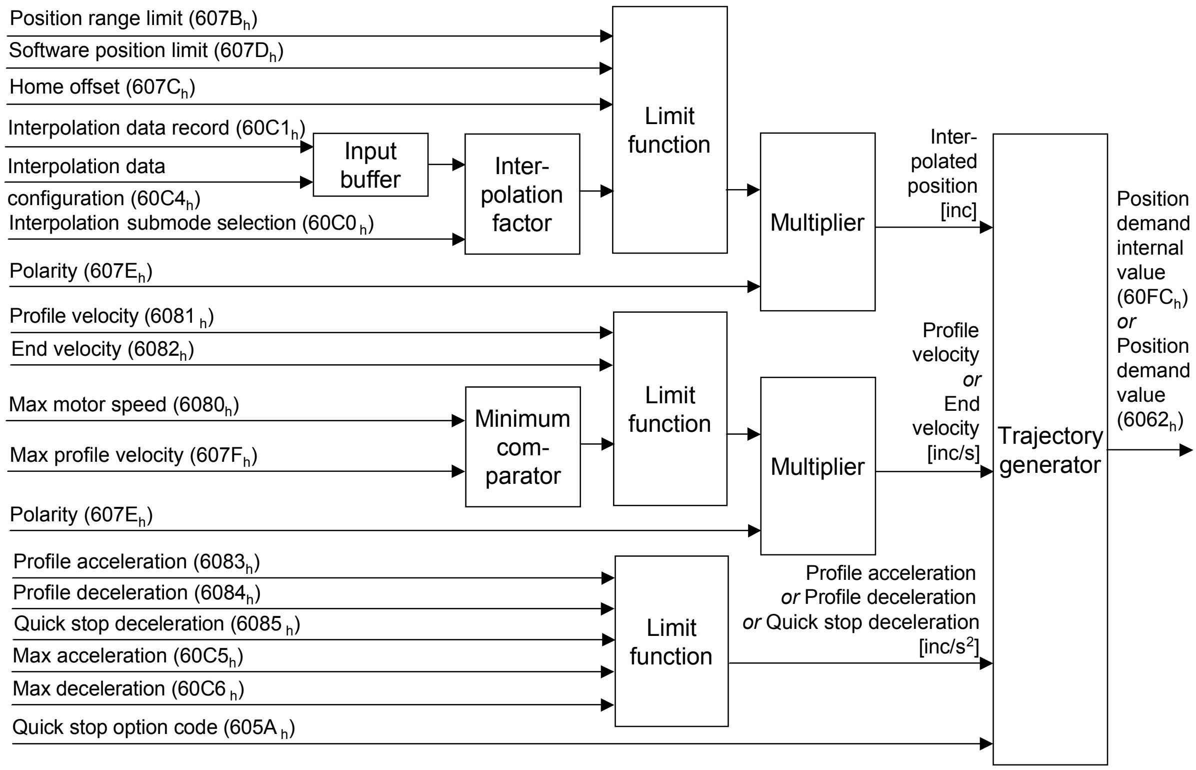

Figure 37 – Interpolation controller

13.2 Functional description

13.2.1 General

The manufacturer specifies the way the drive device handles the next valid interpolation data record. This may be in a way corresponding to the standard position mode, or might be a more complex algorithm. The standard method is to apply the new data immediately, after the next synchronisation signal in synchronous mode or after the previous interpolation time has expired in asynchronous mode.

An input buffer for interpolation data records eases the data exchange between control device and drive device. The real-time requirements to the network as well as to the drive device decrease in this case, because an input buffer decouples the data processing in the drive device from the data transmission on the network.

13.2.2 Linear interpolated position mode with several axes

In order to follow a two- or more-dimensional curve through the space with a defined speed, the control device calculates the different positions P_i for each set of coordinates which shall be reached at specified times t_i.

For each set-point P_i the control device shall calculate x_i, y_i.. and t_i. Each axis gets a set of interpolation data records, which each axis shall process internally independent from the other axes according to the chosen interpolation mode. This is shown in Figure 38.

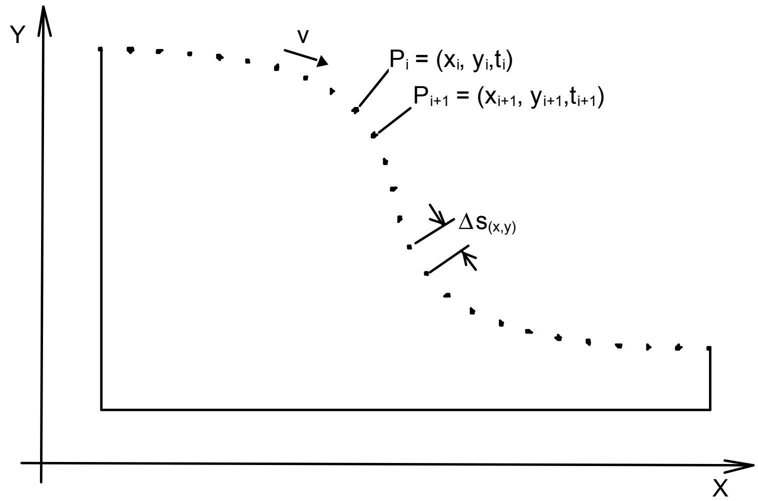

Figure 38 – Interpolated position mode for two axes

In a centralised drive system with a remote motion device doing the interpolation calculation, a central clocking scheme for synchronisation of the different axes. This results in a movement depending on the calculation cycle time of the interpolation controller. The velocity becomes more or less a fixed value for each axis. This is detailed in Table 155.

Table 155 – Position calculation in interpolated position mode for several axes

Calculated positions	*ip* data records for		
	x-axis	y-axis	z-axis
P_i	x_i, t_i	y_i, t_i	z_i, t_i
$P_i + 1$	$x_i + 1$, $t_i + 1$	$y_i + 1$, $t_i + 1$	$z_i + 1$, $t_i + 1$
$P_i + 2$	$x_i + 2$, $t_i + 2$	$y_i + 2$, $t_i + 2$	$z_i + 2$, $t_i + 2$
…	…	…	…
$P_i + n$	$x_i + n$, $t_i + n$	$y_i + n$, $t_i + n$	$z_i + n$, $t_i + n$

In decentralised motion systems, the control device starts all relevant axes by changing the mode-internal state to interpolation active after preparing and sending one or more interpolation data records to all axes and synchronises them. Each axis calculates internally and independently the necessary speed and acceleration needed to move from one position to the next. This may be done by calculating a linear or any other move between two given position set-points. Along this track, every axis controls the movement between the set-points independently from the other axes. The axes may continue their movement, as long as there is enough data to continue the calculations. Therefore it is easy to use the input buffer to give data records ahead.

With this information, each axis may act as shown in Figure 39.

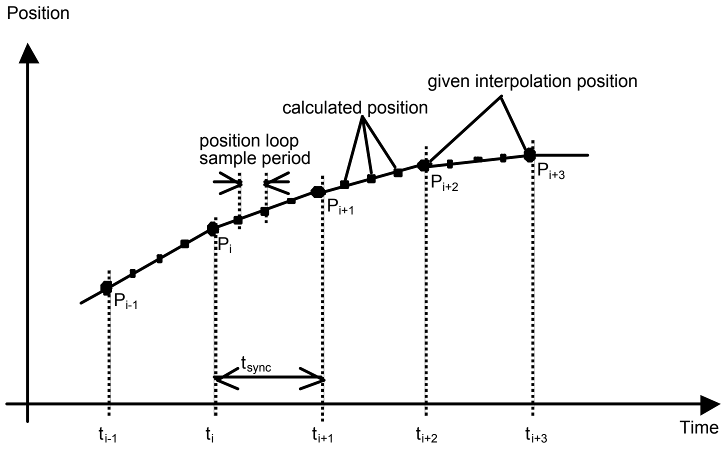

Figure 39 – Linear interpolation for one axis

NOTE In CANopen synchronous mode, the interpolation time is normally the same as the nominal period for the sync signal.

13.2.3 Buffer strategies for the interpolated position mode

If a drive device provides an input buffer for interpolation data records, its size may be organised by the control device using the interpolation data configuration. The control device splits the available buffer capacity into pages which have the size of one interpolation data record each. This is done by size of data record. If one page, which cannot keep one complete data record remains, it may not be used. After the reorganisation of the input buffer, all previous stored data will be lost. All devices supporting the interpolated position mode shall implement an input buffer, which at least may keep one interpolation data record. The input buffer organisation is specified in Figure 40.

The content of the buffer items may only be accessed via the interpolation data record.

Commonly, first-in-first-out (FIFO) structures or ring buffers are used as input buffers.

FIFO: If the buffer is organised as FIFO, every new received interpolation data record is placed at the end of the queue, and the device takes the next data record from the top of the queue. When the last item of a data record is stored, the buffer pointer is incremented in order to point to the next buffer position. For this buffer principle, the object buffer position does not have any influence.

Ring buffer: If the buffer is structured as a ring, the control device may place an interpolation data record into any valid position in the ring by changing the pointer defined in buffer position. Without changing the buffer position, all data records will be written at the same location. The drive reads the next entry out of the buffer by an internal ring pointer. It is set to the first data record with a clear buffer, and after the reorganisation of the input buffer.

↑ data record size ↓	parameter 1 parameter 2 ::::: parameter n	*ip data record* 1	↑
↑ data record size ↓	parameter 1 parameter 2 ::::: parameter n	*ip data record* 2	buffer size
:::::			
↑ data record size ↓	parameter 1 parameter 2 ::::: parameter n	*ip data record* i	
not accessible			↓

Figure 40 – Input buffer organisation

Figure 41 shows the difference between a FIFO buffer and a Ring buffer. The ring buffer may be used to achieve a periodic motion and all data records in the actual data buffer are considered to be valid. If no new data is written to the FIFO, then the motion shall halt and interpolation should become inactive at the last valid data point.

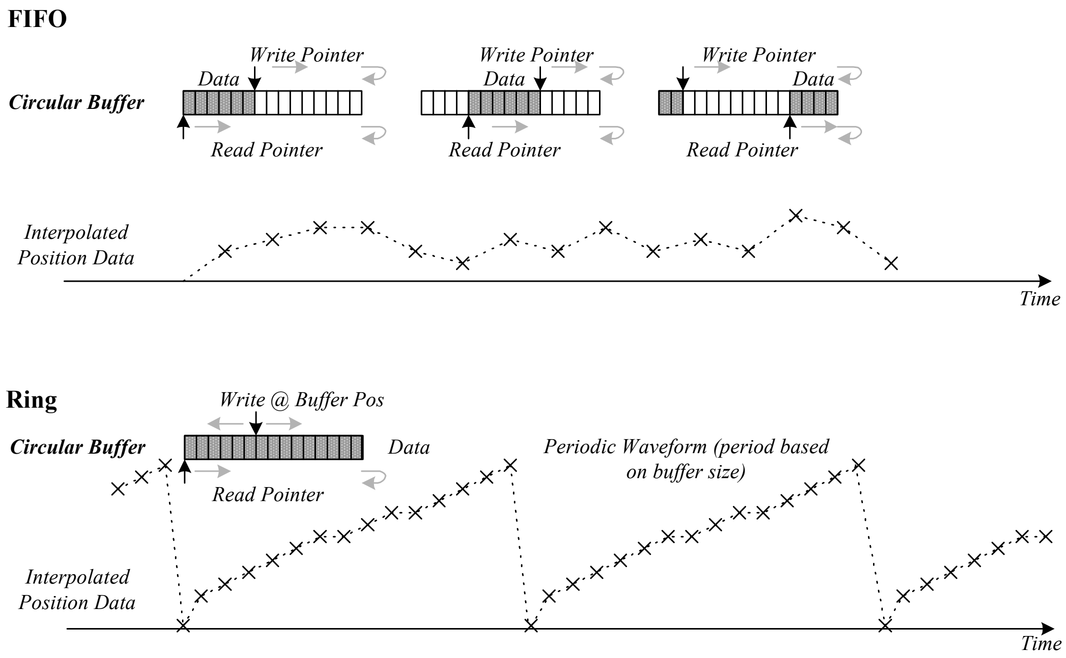

Figure 41 – Input buffer examples

13.2.4 Interpolated position mode FSA

Figure 42 specifies the interpolated position mode FSA. It is a sub FSA of the *Operation enable* state as shown in Figure 4.

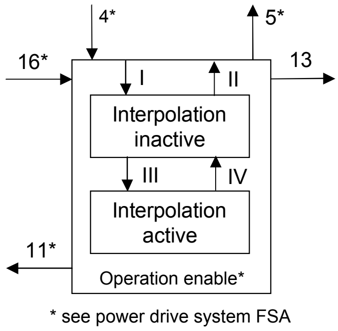

Figure 42 – Interpolated position mode FSA

The FSA states shall support the functions as shown in Table 156.

Table 156 – FSA states and supported functions

FSA state	Function
Interpolation inactive	The drive device will accept input data and will buffer it for interpolation calculations, but it does not move the axis.
Interpolation active	The drive unit will accept input data and it moves the axis.

The drive device supporting the *ip* mode shall support the transitions and actions as given in Table 157. The events shall initiate the transitions. The transition shall be terminated, after the action has been performed.

Table 157 – Transition events and actions

Transition	Event(s)	Action(s)
I	*ip* mode selected (see object 6060_h)	none
II	*ip* mode not selected (see object 6060_h)	none
III	Enable interpolation (bit 4 of the controlword is 1)	none
IV	Disable interpolation (bit 4 of the controlword is 0)	none

13.3 General definitions

The output values provided by the *interpolated position* mode depend on the number and type of interpolation functions implemented. For the predefined linear time interpolation, the output is a position demand internal value.

13.4 Use of controlword and statusword

The interpolated position mode uses some bits of the controlword and the statusword for mode-specific purposes. Figure 43 shows the structure of the controlword. Table 158 defines the values for bit 4 and bit 8 of the controlword.

15 … 9	8	7	6 … 5	4	3 … 0
(see 8.4.1)	*Halt*	(see 8.4.1)	*reserved (0)*	*Enable interpolation*	(see 8.4.1)
MSB					LSB

Figure 43 – Controlword for interpolated position mode

Table 158 – Definition of bit 4 and bit 8

Bit	Value	Definition
4	0	Disable *interpolation*
	1	Enable *interpolation*
8	0	Execute instruction of bit 4
	1	Axis shall be stopped accordingly to halt option code ($605D_h$), and bit 12 in the statusword shall be set to 0

Figure 44 shows the structure of the statusword. Table 159 defines the values for bit 10 and bit 12 of the statusword. The *target position reached* bit shall remain 0 until all set-points are processed.

15 … 14	13	12	11	10	9 … 0
(see 8.4.2)	reserved	*ip* mode active	(see 8.4.2)	Target reached	(see 8.4.2)
MSB					LSB

Figure 44 – Statusword for interpolated position mode

Table 159 – Definition of bit 10 and bit 12

Bit	Value	Definition
10	0	Target position not (yet) reached (if Halt bit in last controlword was 0) or axle decelerates (if Halt bit in last controlword was 1)
	1	Target position reached (if Halt bit in last controlword was 0) or axle has veloxity 0 (if halt bit in last controlword was 1)
12	0	*Interpolation* inactive
	1	*Interpolation* active

13.5 Detailed object definitions

13.5.1 Object $60C0_h$: Interpolation sub mode select

This object shall indicate the actually chosen interpolation mode. If linear interpolation is the only algorithm avalaible, then it is not necessary to implement this object. If a manufacturer-specific interpolation mode is selected, the corresponding interpolation data record shall be implemented in the manufacturer-specific profile area of the object dictionary. If the linear interpolation mode is selected, the interpolation data given in object $60C1_h$ shall be used. Table 160 specifies the value definition, Table 161 specifies the object description, and Table 162 specifies the entry description.

Table 160 – Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific
0	Linear interpolation
+1 to +32 767	Reserved

Table 161 – Object description

Attribute	Value
Index	$60C0_h$
Name	Interpolation sub mode select
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 162 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 160
Default Value	0

13.5.2 Object $60C1_h$: Interpolation data record

This object shall indicate data words, which are necessary to perform the interpolation algorithm. The number *N* of data words in the record is defined by interpolation data configuration. The interpretation of the data words in interpolation data record may vary with the different possible interpolation modes as set by the interpolation sub mode select.

For the linear interpolation mode, each interpolation data record simply is regarded as a new position set-point. To describe a cubic spline interpolation, four or more data words are needed for the spline coefficients, and further interpolation parameters.

After the last item of an interpolation data record is written to the drive device's input buffer, the pointer of the buffer shall be automatically incremented to the next buffer position.

Table 163 specifies the object description, and Table 164 specifies the entry description.

Table 163 – Object description

Attribute	Value
Index	$60C1_h$
Name	Interpolated data record
Object Code	Array
Data Type	Integer32
Category	Optional

Table 164 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	01_h to FE_h
Default Value	No
Sub-Index	01_h
Description	1st set-point
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific
Sub-Index	02_h
Description	2nd set-point
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific
to	
Sub-Index	FE_h
Description	254th set-point
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

13.5.3 Object $60C2_h$: Interpolation time period

This object shall indicate the configured interpolation cycle time. The interpolation time period (sub-index 01_h) value shall be given in $10^{(\text{interpolation time index})}$ s(econd). The interpolation time index (sub-index 02_h) shall be dimensionless.

Table 165 specifies the object description, and Table 166 specifies the entry description.

Table 165 – Object description

Attribute	Value
Index	$60C2_h$
Name	Interpolation time period
Object Code	Record
Data Type	Interpolation time period record (0080_h)
Category	Conditional: mandatory if *ip, csp, csv* or *cst* mode is supported

Table 166 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	02_h
Sub-Index	01_h
Description	Interpolation time period value
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned8
Default Value	01_h
Sub-Index	02_h
Description	Interpolation time index
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	-128 to +63
Default Value	-3

13.5.4 Object $60C4_h$: Interpolation data configuration

This object shall provide the maximum buffer size, shall indicate the configured buffer organisation of interpolation data, and shall provide objects to define the size of the data record and to clear the buffers. This object is used to enable the drive device to receive the needed data in advance. It also is used to store the positions and further data sent by the control device.

The value of sub-index 01_h shall be given in number of interpolation data records.

The value of sub-index 02_h shall be given in number of interpolation data records.

If sub-index 03_h is 00_h this shall indicate a FIFO buffer oganisation, if it is 01_h this shall indicate a ring buffer organisation. All other values are reserved.

The value of sub-index 04_h shall be dimensionless indicating the next free buffer entry point.

The value of sub-index 05_h shall be given in byte.

If 00_h is written to sub-index 06_h this shall clear the buffer inputs, shall disable the access, and shall clear all *ip* data records. If 01_h is written to sub-index 06_h, this enables access to the input buffers. All other values are reserved.

Table 167 specifies the object description, and Table 168 specifies the entry description.

Table 167 – Object description

Attribute	Value
Index	$60C4_h$
Name	Interpolation data configuration
Object Code	Record
Data Type	Interpolation data configuration record (0081_h)
Category	Optional

Table 168 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	07_h
Default Value	07_h
Sub-Index	01_h
Description	Maximum buffer size
Entry Category	Mandatory
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	No
Sub-Index	02_h
Description	Actual buffer size
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	$0000\ 0000_h$

Attribute	Value
Sub-Index	03_h
Description	Buffer organisation
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	00_h or 01_h
Default Value	00_h
Sub-Index	04_h
Description	Buffer position
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	0000_h
Sub-Index	05_h
Description	Size of data record
Entry Category	Mandatory
Access	wo
PDO Mapping	See IEC 61800-7-301
Value Range	01_h to FE_h
Default Value	01_h
Sub-Index	06_h
Description	Buffer clear
Entry Category	Mandatory
Access	wo
PDO Mapping	See IEC 61800-7-301
Value Range	00_h or 01_h
Default Value	00_h

14 Profile velocity mode

14.1 General information

The profile velocity mode covers the following sub-functions:

- Demand value input via trajectory generator
- Velocity capture using position sensor or velocity sensor
- Velocity control function with appropriate input and output signals
- Monitoring of the profile velocity using a window-function
- Monitoring of velocity actual value using a threshold

The operation of the reference value generator and its input parameters includes and are described in Clause 10:

- Profile velocity
- Profile acceleration
- Profile deceleration
- Emergency stop
- Motion profile type

Various sensors may be used for velocity capture. In particular, the aim is that costs are reduced and the drive power system is simplified by evaluating position and velocity using a common sensor, such as is optional using a resolver or an encoder.

The velocity control function is not specified more precisely at this point, as it is highly manufacturer-specific, but the format and maximum number of control coefficients are established.

Monitoring functions for the velocity actual value provide status information for super-ordinated systems.

14.2 Functional description

Figure 45 shows the defined structure of the profile velocity mode. The actual velocity may be obtained through differentiation from the position encoder and is represented in position encoder increments.

The *target reached* bit (bit 10) shall be set to 1 in the statusword when the difference between the target velocity and the velocity actual value is within the velocity window longer than the velocity window time.

As soon as the velocity actual value exceeds the velocity threshold longer than the *velocity threshold time,* then bit 12 shall be set to 0 in the statusword. Below this threshold, the bit shall be set to 1 and shall indicate that the axis is stationary.

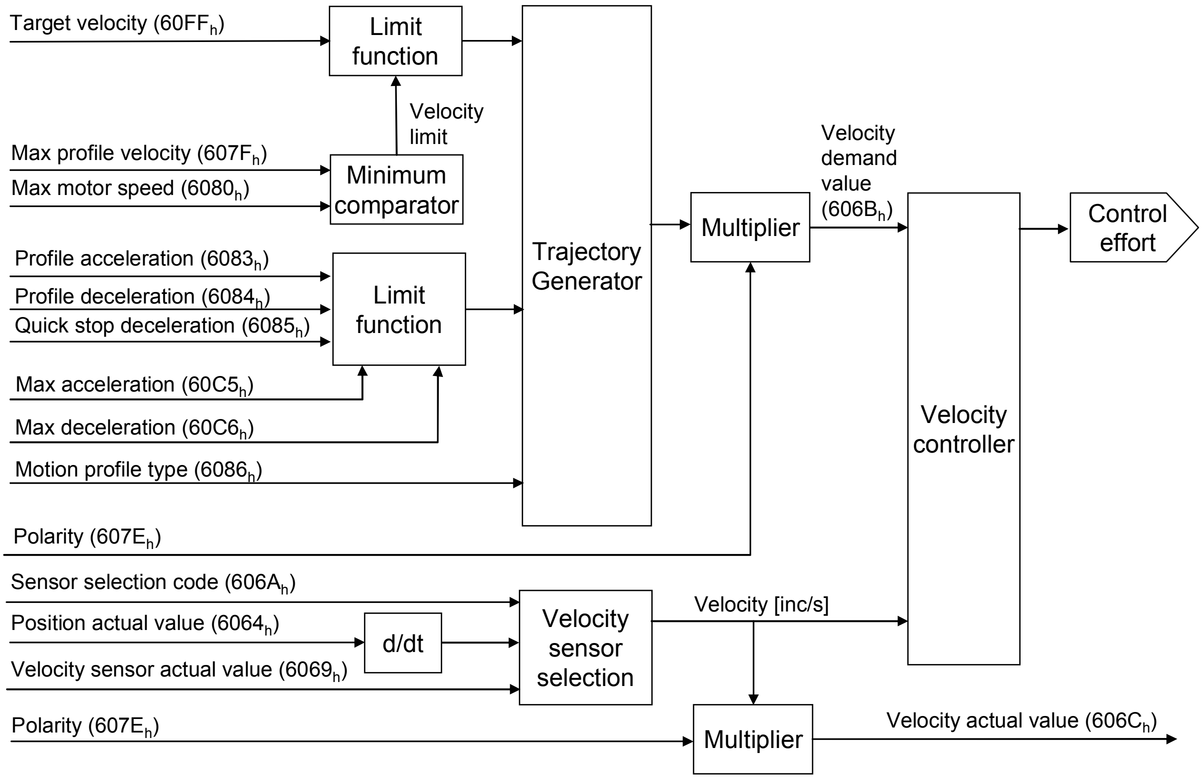

Figure 45 – Profile velocity mode

14.3 General definitions

The factors necessary for scaling have a linear relationship and therefore they are described in the factor group. The polarity is described in the factor group as well.

14.4 Use of controlword and statusword

The profile velocity mode uses some bits of the controlword and the statusword for mode-specific purposes. Figure 46 shows the structure of the controlword. Table 169 defines the values for bit 8 of the controlword.

15 … 9	8	7	6 … 4	3 … 0
(see 8.4.1)	*Halt*	(see 8.4.1)	*reserved*	(see 8.4.1)
MSB				LSB

Figure 46 – Controlword for profile velocity mode

Table 169 – Definition of bit 8

Bit	Value	Definition
8	0	The motion shall be executed or continued
	1	Axis shall be stopped according to the halt option code (605D$_h$)

Figure 47 shows the structure of the statusword. Table 170 defines the values for bit 10, 12, and 13 of the statusword.

15 14	13	12	11	10	9 0
(see 8.4.2)	Max slippage error	Speed	(see 8.4.2)	Target reached	(see 8.4.2)
MSB					LSB

Figure 47 – Statusword for profile velocity mode

Table 170 – Definition of bit 10, bit 12, and bit 13

Bit	Value	Definition
10	0	Halt (Bit 8 in controlword) = 0: Target not reached Halt (Bit 8 in controlword) = 1: Axis decelerates
	1	Halt (Bit 8 in controlword) = 0: Target reached Halt (Bit 8 in controlword) = 1: Velocity of axis is 0
12	0	Speed is not equal 0
	1	Speed is equal 0
13	0	Maximum slippage not reached
	1	Maximum slippage reached

14.5 Detailed object definitions

14.5.1 Object 6069$_h$: Velocity sensor actual value

This object shall provide the value read from a velocity sensor. The value shall be given in increments per second. Table 171 specifies the object description, and Table 172 specifies the entry description.

Table 171 – Object description

Attribute	Value
Index	6069$_h$
Name	Velocity sensor actual value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 172 – Entry description

Attribute	Value
Sub-Index	00$_h$
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

14.5.2 Object 606A$_h$: Sensor selection code

This object shall provide the source of the velocity sensor actual value. It determines whether a differentiated position signal or the signal from a separate velocity sensor is evaluated. Table 173 specifies the value definition, Table 174 specifies the object description, and Table 175 specifies the entry description.

Table 173 – Value definition

Value	Definition
0000_h	Actual velocity value from position encoder
0001_h	Actual velocity value from velocity encoder
0002_h to $7FFF_h$	Reserved
8000_h to $FFFF_h$	Manufacturer-specific

Table 174 – Object description

Attribute	Value
Index	$606A_h$
Name	Sensor selection code
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 175 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 173
Default Value	Manufacturer-specific

14.5.3 Object $606B_h$: Velocity demand value

This object shall provide the output value of the trajectory generator. The value shall be given in the user-defined velocity units. Table 176 specifies the object description, and Table 177 specifies the entry description.

Table 176 – Object description

Attribute	Value
Index	$606B_h$
Name	Velocity demand value
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 177 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

14.5.4 Object $606C_h$: Velocity actual value

This object shall provide the actual velocity value derived either from the velocity sensor or the position sensor. The value shall be given in user-defined velocity units. Table 178 specifies the object description, and Table 179 specifies the entry description.

Table 178 – Object description

Attribute	Value
Index	$606C_h$
Name	Velocity actual value
Object Code	Variable
Data Type	Integer32
Category	Conditional: mandatory if *pv* or *csv* is supported

Table 179 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

14.5.5 Object $606D_h$: Velocity window

This object shall indicate the configured velocity window. The value shall be given in user-defined velocity units. Table 180 specifies the object description, and Table 181 specifies the entry description.

Table 180 – Object description

Attribute	Value
Index	$606D_h$
Name	Velocity window
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 181 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

14.5.6 Object $606E_h$: Velocity window time

This object shall indicate the configured velocity window time. The value shall be given in milliseconds. Table 182 specifies the object description, and Table 183 specifies the entry description.

Table 182 – Object description

Attribute	Value
Index	$606E_h$
Name	Velocity window time
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 183 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	0000_h

14.5.7 Object $606F_h$: Velocity threshold

This object shall indicate the configured velocity threshold. The value shall be given in user-defined velocity units. Table 184 specifies the object description, and Table 185 specifies the entry description.

Table 184 – Object description

Attribute	Value
Index	$606F_h$
Name	Velocity threshold
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 185 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

14.5.8 Object 6070_h: Velocity threshold time

This object shall indicate the configured velocity threshold time. The value shall be given in milliseconds. Table 186 specifies the object description, and Table 187 specifies the entry description.

Table 186 – Object description

Attribute	Value
Index	6070_h
Name	Velocity threshold time
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 187 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

14.5.9 Object $60FF_h$: Target velocity

This object shall indicate the configured target velocity and shall be used as input for the trajectory generator. The value shall be given in user-defined velocity units. Table 188 specifies the object description, and Table 189 specifies the entry description.

Table 188 – Object description

Attribute	Value
Index	$60FF_h$
Name	Target velocity
Object Code	Variable
Data Type	Integer32
Category	Conditional: mandatory if *pv* or *csv* is supported

Table 189 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

14.5.10 Object $60F8_h$: Max slippage

This object shall indicate the configured maximal slippage of an asynchronous motor. When the max slippage has been reached, the corresponding bit 13 max slippage error in the statusword shall be set to 1. The reaction of the drive device, when the max slippage error occurs, is manufacturer-specific. This value shall be given in user-defined units. Table 190 specifies the object description, and Table 191 specifies the entry description.

Table 190 – Object description

Attribute	Value
Index	$60F8_h$
Name	Max slippage
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 191 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

15 Profile torque mode

15.1 General information

The profile torque mode allows control device (i.e. closed-loop speed controller, open-loop transmission force controller) to transmit the target torque value, which is processed via the trajectory generator. The torque slope and torque profile type parameters are required.

15.2 Functional description

If the control device switches the controlword bit 8 (halt) from 0 to 1 or from 1 to 0, than the trajectory generator ramps its control effort output down to zero, respectively up to the target torque. In both cases, the trajectory generator takes the torque slope and torque profile type into consideration.

All definitions refer to rotating motors. Using linear motors instead requires that all "torque" objects refer to a "force" instead. For the sake of simplicity, the objects are not duplicated and their names are not modified. As an example, the linear motor target force is transmitted using the target torque object. Refer to the object descriptions for additional information.

The manufacturer-specific torque control and power-stage functions are not described as they fall beyond the scope of this drive profile specification. They are only mentioned for showing how some parameters affect them. As an example, the closed-loop torque control coefficients (if any) are to be defined and described by the manufacturer.

The torque control parameters, power stage parameters and motor parameters are defined as objects in order that they may be handled (i.e. downloaded) in a standard way. Their detailed data definition is manufacturer-specific.

The torque demand, torque actual value, current actual value and DC link voltage are available to the user as parameters, if they are monitored.

Figure 48 shows the defined structure of the profile torque mode.

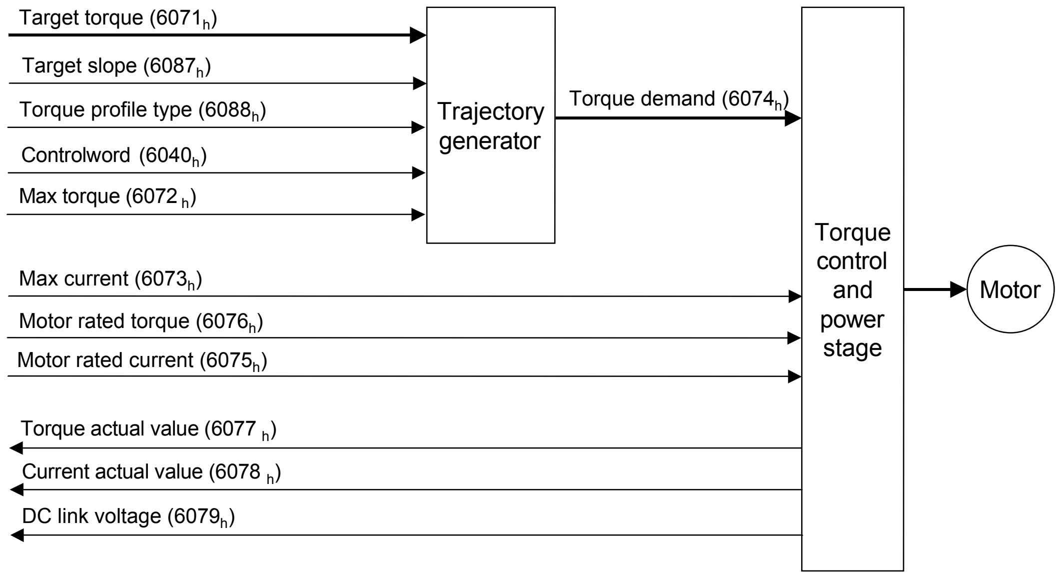

Figure 48 – Structure of the profile torque mode

15.3 General definitions

There are no general definitions given for the profile torque mode.

15.4 Use of controlword and statusword

The profile torque mode uses some bits of the controlword and the statusword for mode-specific purposes. Figure 49 shows the structure of the controlword. Table 192 defines the values for bit 8 of the controlword.

15 … 9	8	7	6 … 4	3 … 0
(see 8.4.1)	*Halt*	(see 8.4.1)	*reserved*	(see 8.4.1)
MSB				LSB

Figure 49 – Controlword for profile torque mode

Table 192 – Definition of bit 8

Bit	Value	Definition
8	0	The motion shall be executed or continued
	1	Axis shall be stopped according to the halt option code ($605D_h$)

Figure 50 shows the structure of the statusword. Table 193 defines the values for bit 10 of the statusword.

15 14	13 12	11	10	9 0
(see 8.4.2)	reserved	(see 8.4.2)	Target reached	(see 8.4.2)
MSB				LSB

Figure 50 – Statusword for profile torque mode

Table 193 – Definition of bit 10

Bit	Value	Definition
10	0	Halt (Bit 8 in controlword) = 0: *Target torque* not reached Halt (Bit 8 in controlword) = 1: Axis decelerates
	1	Halt (Bit 8 in controlword) = 0: *Target torque* reached Halt (Bit 8 in controlword) = 1: Velocity of axis is 0

NOTE *Target torque* reached is defined by a manufacturer-specific time or window object.

15.5 Detailed object definitions

15.5.1 Object 6071_h: Target torque

This object shall indicate the configured input value for the torque controller in profile torque mode. The value shall be given per thousand of rated torque. Table 194 specifies the object description, and Table 195 specifies the entry description.

Table 194 – Object description

Attribute	Value
Index	6071_h
Name	Target torque
Object Code	Variable
Data Type	Integer16
Category	Conditional: mandatory if *tq* or *cst* is supported

Table 195 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0000_h

15.5.2 Object 6072$_h$: Max torque

This object shall indicate the configured maximum permissible torque in the motor. The value shall be given per thousand of rated torque. Table 196 specifies the object description, and Table 197 specifies the entry description.

Table 196 – Object description

Attribute	Value
Index	6072$_h$
Name	Max torque
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 197 – Entry description

Attribute	Value
Sub-Index	00$_h$
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

15.5.3 Object 6073$_h$: Max current

This object shall indicate the configured maximum permissible torque creating current in the motor. The value shall be given per thousand of rated current. Table 198 specifies the object description, and Table 199 specifies the entry description.

Table 198 – Object description

Attribute	Value
Index	6073$_h$
Name	Max current
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Table 199 – Entry description

Attribute	Value
Sub-Index	00$_h$
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

15.5.4 Object 6074_h: Torque demand

This object shall provide the output value of the trajectory generator. The value shall be given in 1/1 000 of rated torque. Table 200 specifies the object description, and Table 201 specifies the entry description.

Table 200 – Object description

Attribute	Value
Index	6074_h
Name	Torque demand
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 201 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	No

15.5.5 Object 6075_h: Motor rated current

This object shall indicate the configured motor rated current. It is taken from the motor's name-plate. Depending on the motor and drive technology, this current is DC, peak or r.m.s. (root-mean-square) current. All relative current data refers to this value. The value shall be given in mA. Table 202 specifies the object description, and Table 203 specifies the entry description.

Table 202 – Object description

Attribute	Value
Index	6075_h
Name	Motor rated current
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 203 – Entry description

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

15.5.6 Object 6076_h: Motor rated torque

This object shall indicate the configured motor rated torque. It is taken from the motor's name-plate. All relative torque data shall refer to this value. For linear motors, the object name is not changed, but the motor rated force value shall be entered as multiples of mN (milli Newton). The value shall be given in mNm (milli Newton metre). Table 204 specifies the object description, and Table 205 specifies the entry description.

Table 204 – Object description

Attribute	Value
Index	6076_h
Name	Motor rated torque
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 205 – Entry description

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

15.5.7 Object 6077_h: Torque actual value

This object shall provide the actual value of the torque. It shall correspond to the instantaneous torque in the motor. The value shall be given per thousand of rated torque. Table 206 specifies the object description, and Table 207 specifies the entry description.

Table 206 – Object description

Attribute	Value
Index	6077_h
Name	Torque actual value
Object Code	Variable
Data Type	Integer16
Category	Conditional: mandatory if *cst* is supported

Table 207 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	No

15.5.8 Object 6078_h: Current actual value

This object shall provide the actual value of the current. It shall correspond to the current in the motor. The value shall be given per thousand of rated current. Table 208 specifies the object description, and Table 209 specifies the entry description.

Table 208 – Object description

Attribute	Value
Index	6078_h
Name	Current actual value
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 209 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	No

15.5.9 Object 6079_h: DC link circuit voltage

This object shall provide the instantaneous DC link current voltage at the drive device. The value shall be given in mV. Table 210 specifies the object description, and Table 211 specifies the entry description.

Table 210 – Object description

Attribute	Value
Index	6079_h
Name	DC link circuit voltage
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 211 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	No

15.5.10 Object 6087_h: Torque slope

This object shall indicate the configured rate of change of torque. The value shall be given in units of per thousand of rated torque per second. Table 212 specifies the object description, and Table 213 specifies the entry description.

Table 212 – Object description

Attribute	Value
Index	6087_h
Name	Torque slope
Object Code	Variable
Data Type	Unsigned32
Category	Conditional: mandatory if *tq* is supported

Table 213 – Entry description

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

15.5.11 Object 6088_h: Torque profile type

This object shall indicate the configured type of profile used to perform a torque change. Table 214 specifies the value definition, Table 215 specifies the object description, and Table 216 specifies the entry description.

Table 214 – Value definition

Value	Definition
0000_h	Linear ramp (trapezoidal profile)
0001_h	$\sin^2$ ramp
0002_h to $7FFF_h$	Reserved
8000_h to $FFFF_h$	Manfacturer-specific

Table 215 – Object description

Attribute	Value
Index	6088_h
Name	Torque profile type
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 216 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0000_h

16 Velocity mode

16.1 General information

This mode is used by frequency inverters, but not limited to this kind of drive device. Most applications use a velocity set-point and a controlword for switching the drive device on and off.

Figure 51 shows the overall structure of the velocity mode. The possible torque control function is not in the scope of this part of the IEC 61800-7 series, it may use the target torque and torque actual value objects defined in 15.5.1 or respectively in 15.5.7.

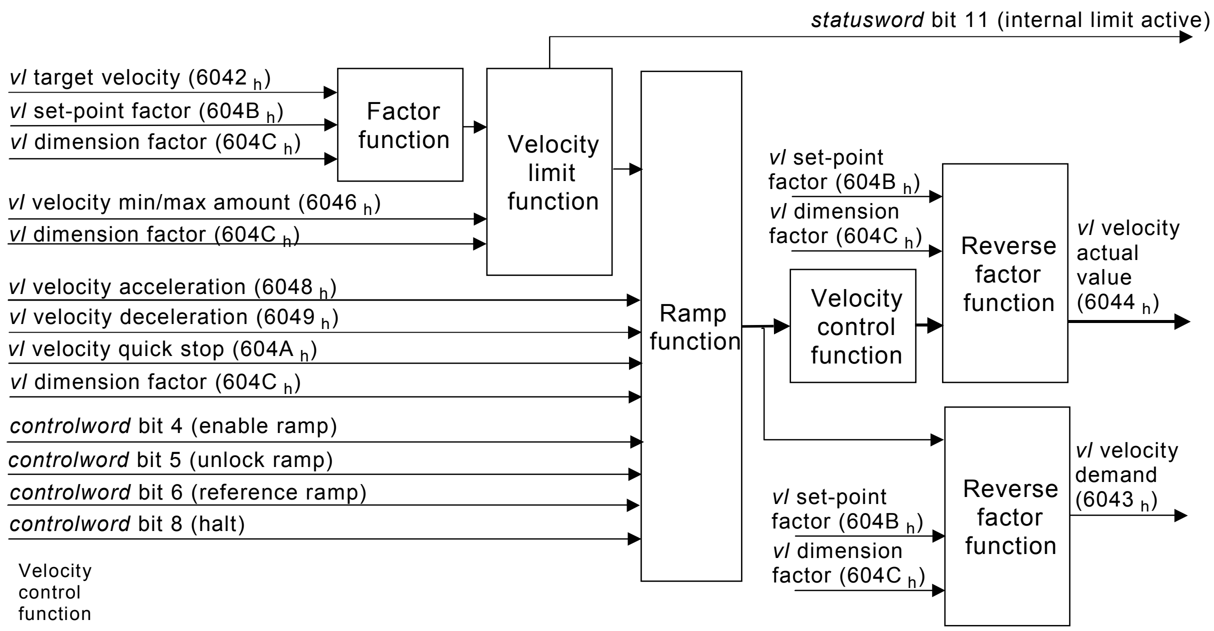

Figure 51 – Velocity mode with all objects

All drive devices using this profile and supporting the velocity mode shall implement the mandatory objects and there functionality as shown in Figure 52.

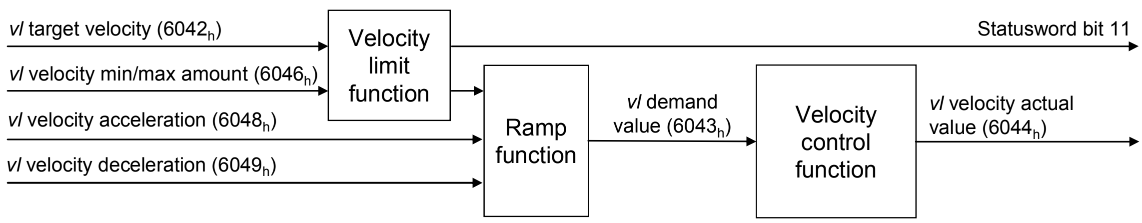

Figure 52 – Velocity mode with mandatory objects only

16.2 Functional description

16.2.1 Velocity limit function

The limits in the velocity limit function may be given in user-specific units by including the *vl* dimension factor in the velocity limit or in rotations per minute (rpm). The limit-value message is generated if the input value of the speed limit results in a value outside the speed limit's operating range. The limit-value message is mapped as one bit in the statusword.

16.2.2 Ramp function

Figure 53 shows the velocity profile that is used to limit the increase and decrease of velocity. The velocity output is equal to the input as long as the changes are below as defined in *vl* velocity acceleration, *vl* velocity deceleration, and *vl* velocity quickstop.

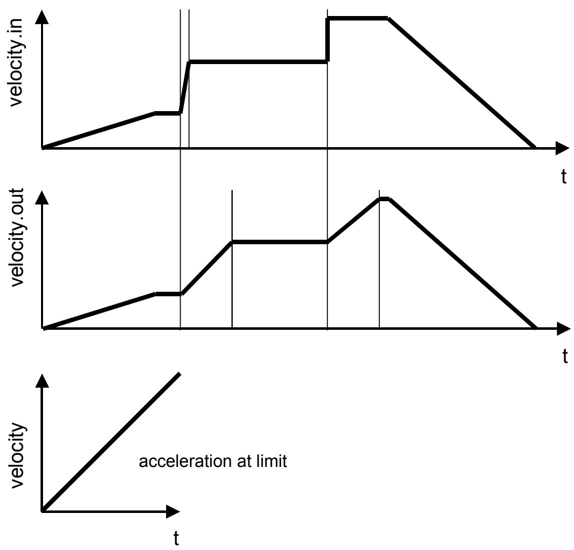

Figure 53 – Velocity profile

16.2.3 Velocity control function

On the basis of the *vl* velocity demand, the velocity control function provides the *vl* control-effort.

16.2.4 Factor function

The factor function multiplies the input variables by the assigned factors. The factor shall have a value of 1, if it is not implemented.

Figure 54 shows the structure of the factor function; the factor function for two factors is built of two functions in series connection.

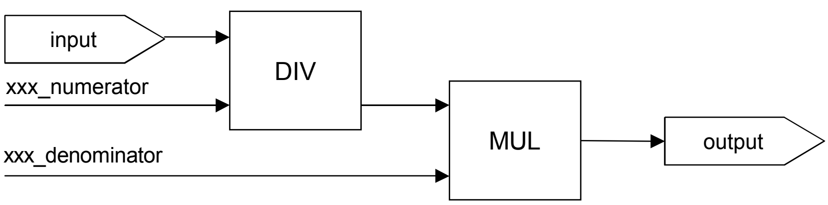

Figure 54 – Factor function

Figure 55 shows the structure of the reverse factor function. The reverse factor function divides the input variables by the assigned factors.

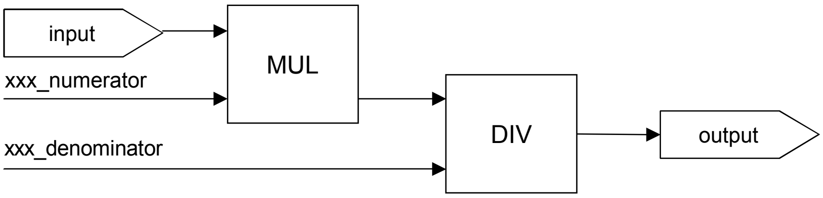

Figure 55 – Reverse factor function

16.3 General definitions

All objects defined in 16.5 are used only for the velocity mode.

16.4 Use of controlword and statusword

The velocity mode uses some bits of the controlword and the statusword for mode-specific purposes. Figure 56 shows the structure of the controlword. Table 217 and Figure 57 define the values for bit 4, bit 5, bit 6, and bit 8 of the controlword. These bits are optional.

15 … 9	8	7	6	5	4	3 … 0
(see 8.4.1)	*Halt*	(see 8.4.1)	*reference ramp*	*unlock ramp*	*enable ramp*	(see 8.4.1)
MSB						LSB

Figure 56 – Controlword for profile velocity mode

Table 217 – Definition of bit 4, bit 5, bit 6, and bit 8

Bit	Value	Definition
4	0	Velocity demand value shall be controlled in any other (manufacturer-specific) way, for example by a test function generator or manufacturer-specific halt function
	1	Velocity demand value shall accord with ramp output value
5	0	Ramp output value shall be locked to current output value
	1	Ramp output value shall follow ramp input value
6	0	Ramp input value shall be set to zero
	1	Ramp input value shall accord with ramp reference
8	0	No command
	1	Motor shall be stopped

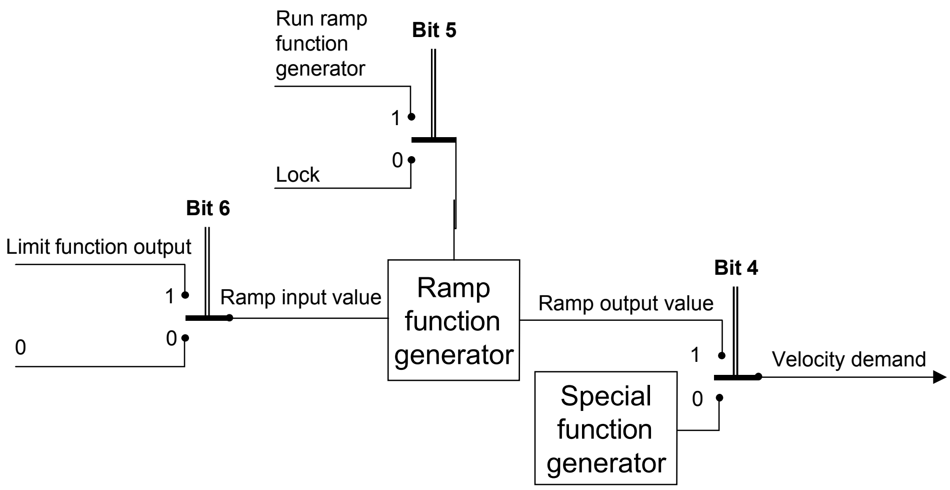

Figure 57 – Usage of controlword bits in velocity mode

Figure 58 shows the structure of the statusword.

15 14	13 12	11	10	9 0
(see 8.4.2)	reserved (0)	(see 8.4.2)	reserved (0)	(see 8.4.2)
MSB				LSB

Figure 58 – Statusword for profile velocity mode

16.5 Detailed object definitions

16.5.1 Object 6042_h: *vl* target velocity

This object shall indicate the required velocity of the system. It shall be multiplied by the *vl* dimension factor and the *vl* set-point factor, if these are implemented. The value shall be given in user-defined velocity units or in revolutions per minute (rpm), if the *vl* dimension factor and the *vl* set-point factor are not implemented or have the value 1. Positive values shall indicate forward direction and negative values shall indicate reverse direction. Table 218 specifies the object description, and Table 219 specifies the entry description.

Table 218 – Object description

Attribute	Value
Index	6042_h
Name	*vl* target velocity
Object Code	Variable
Data Type	Integer16
Category	Conditional: mandatory if *vl* is supported

Table 219 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0000_h

16.5.2 Object 6043$_h$: *vl* velocity demand

This object shall provide the instantaneous velocity generated by the ramp function. It is an internal object of the drive device. The value shall be given in the very same unit as the *vl* target velocity. Positive values shall indicate forward direction and negative values shall indicate reverse direction. Table 220 specifies the object description, and Table 221 specifies the entry description.

Table 220 – Object description

Attribute	Value
Index	6043$_h$
Name	*vl* velocity demand
Object Code	Variable
Data Type	Integer16
Category	Conditional: mandatory if *vl* is supported

Table 221 – Entry description

Attribute	Value
Sub-Index	00$_h$
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	No

16.5.3 Object 6044$_h$: *vl* velocity actual value

This object shall provide the velocity at the motor spindle or load. Depending on the implementation (simple drive device, without sensor, with sensor, etc.), the drive shall provide the appropriate image of the actual velocity (velocity demand, velocity control effort, calculated velocity, measured velocity).

The value shall be given in the very same unit as the *vl* target velocity. Positive values shall indicate forward direction and negative values shall indicate reverse direction. Table 222 specifies the object description, and Table 223 specifies the entry description.

Table 222 – Object description

Attribute	Value
Index	6044$_h$
Name	*vl* velocity actual value
Object Code	Variable
Data Type	Integer16
Category	Conditional: mandatory, if *vl* is supported

Table 223 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	No

16.5.4 Object 6046_h: *vl* velocity min max amount

This object shall indicate the configured minimum and maximum amount of velocity. The *vl* velocity max amount sub-object shall be mapped internally to the *vl* velocity max pos and *vl* velocity max neg values. The *vl* velocity min amount sub-object shall be mapped internally to the *vl* velocity min pos and *vl* velocity min neg values.

This transfer characteristic is shown in Figure 59.

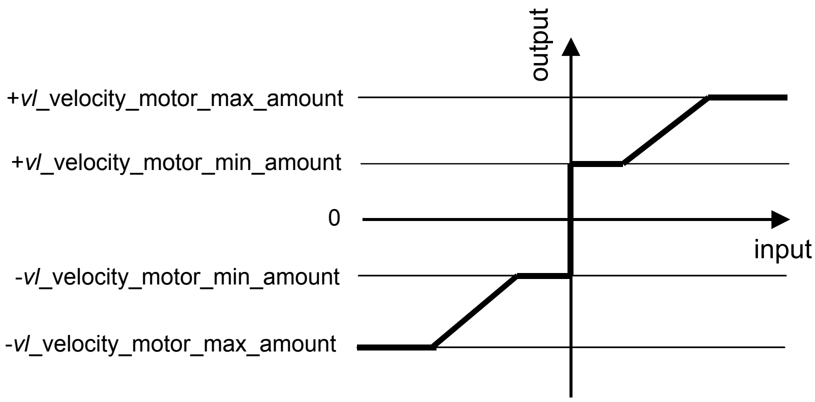

Figure 59 – Transfer characteristic of *vl* velocity min max amount

The values shall be given in rotations per minute (rpm) or in user-defined velocity unit if the vl dimension factor object is implemented and is not set to 1. Table 224 specifies the object description, and

Table 225 specifies the entry description.

Table 224 – Object description

Attribute	Value
Index	6046_h
Name	*vl* velocity min max amount
Object Code	Array
Data Type	Unsigned32
Category	Conditional: mandatory if *vl* mode is supported

Table 225 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	02_h
Sub-Index	01_h
Description	*vl* velocity min amount
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
Sub-Index	02_h
Description	*vl* velocity max amount
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

16.5.5 Object 6049_h: *vl* velocity deceleration

This object shall indicate the configured delta speed and delta time of the slope of the deceleration ramp as shown in Figure 60.

$$vl\ velocity\ deceleration\ = \frac{delta\ speed}{delta\ time}$$

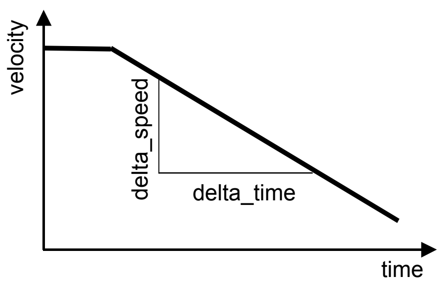

Figure 60 – Transfer characteristic of the velocity deceleration

The value of delta speed shall be given in rotations per minute (rpm) or in a user-defined velocity unit if the *vl* dimension factor object is implemented and is not set to 1; the value of delta time shall be given in s. Table 226 specifies the object description, and Table 227 specifies the entry description. If this object is not implemented, the value in object 6048_h shall be used for *vl velocity deceleration*.

Table 226 – Object description

Attribute	Value
Index	6049_h
Name	*vl* velocity deceleration
Object Code	Record
Data Type	*vl* velocity acceleration decelaration
Category	Conditional: optional

Table 227 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	02_h
Sub-Index	01_h
Description	Delta speed
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
Sub-Index	02_h
Description	Delta time
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

16.5.6 Object 6048_h: *vl* velocity acceleration

This object shall indicate the configured delta speed and delta time of the slope of the acceleration ramp as shown in Figure 61.

Example: If you ramp to 1 500 rpm in 3,7 s, the delta speed equals to 15 000 rpm and delta time equals to 37 s.

$$vl\ velocity\ acceleration = \frac{delta\ speed}{delta\ time}$$

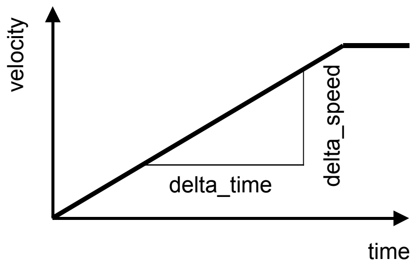

Figure 61 – Transfer characteristic of the velocity acceleration

The value of delta speed shall be given in rotations per minute (rpm) or in a user-defined velocity unit if the *vl* dimension factor object is implemented and is not set to 1; the value of delta time shall be given in s. Table 228 specifies the object description, and Table 229 specifies the entry description.

Table 228 – Object description

Attribute	Value
Index	6048_h
Name	*vl* velocity acceleration
Object Code	Record
Data Type	*vl* velocity acceleration decelaration
Category	Conditional: mandatory if *vl* is supported

Table 229 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	02_h
Sub-Index	01_h
Description	Delta speed
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
Sub-Index	02_h
Description	Delta time
Entry Category	Mandatory

Attribute	Value
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

16.5.7 Object 604A$_h$: *vl* velocity quick stop

This object shall indicate the configured delta speed and delta time of the slope of the deceleration ramp for quick stop as shown in Figure 62.

$$velocity\ quick\ stop\ = \frac{delta\ speed}{delta\ time}$$

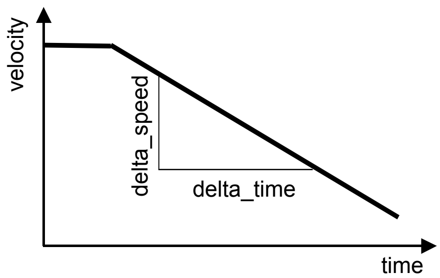

Figure 62 – Transfer characteristic of the quick stop deceleration

The value of delta speed shall be given in rotations per minute (rpm) or in a user-defined velocity unit if the *vl* dimension factor object is implemented and is not set to 1; the value of delta time shall be given in s. Table 230 specifies the object description, and Table 231 specifies the entry description.

Table 230 – Object description

Attribute	Value
Index	604A$_h$
Name	*vl* velocity quick stop
Object Code	Record
Data Type	*vl* velocity acceleration decelaration
Category	Conditional: optional

Table 231 – Entry description

Attribute	Value
Sub-Index	00$_h$
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02$_h$
Default Value	02$_h$

Attribute	Value
Sub-Index	01_h
Description	Delta speed
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
Sub-Index	02_h
Description	Delta time
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

16.5.8 Object $604B_h$: *vl* set-point factor

This object shall indicate the configured numerator and denominator of the *vl* set-point factor. The *vl* set-point factor serves to modify the resolution or directing range of the specified set-point. It is aso included in calculation of the *vl* velocity demand, and *vl* velocity actual value. It does not influence the velocity limit function and the ramp function. The value shall have no physical unit and shall be given in the range from -32 768 to +32 767, but the value of 0 shall not be used. Table 232 specifies the object description, and Table 233 specifies the entry description.

Table 232 – Object description

Attribute	Value
Index	$604B_h$
Name	*vl* set-point factor
Object Code	Array
Data Type	Integer16
Category	Optional

Table 233 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	02_h

Attribute	Value
Sub-Index	01_h
Description	*vl* set-point factor numerator
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See value definition
Default Value	+1
Sub-Index	02_h
Description	*vl* set-point factor denominator
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See value definition
Default Value	+1

16.5.9 Object $604C_h$: *vl* dimension factor

This object shall indicate the configured numerator and denominator of the *vl* dimension factor. The *vl* dimension factor serves to include gearing in calculation or serves to scale the frequencies or specific units of the user. It influences the *vl* target velocity, *vl* velocity demand, *vl* velocity actual value as well as the velocity limit function and the ramp function.

Calculating the *vl* dimension factor: Every user-specific velocity consists of a specific unit referred to a specific unit of time (e.g. 1/s, bottles/min, m/s, etc.). The purpose of the *vl* dimension factor is to convert this specific unit to the revolutions/minute unit.

Velocity [user-defined unit] × Dimension factor [rpm/user-defined unit] = Velocity [rpm]

The values shall be in the range of -2 147 483 648 to +2 147 483 647, but the value of 0 shall be not used.

Table 234 specifies the object description, and Table 235 specifies the entry description.

Example: If the target unit is 0,1 Hz the numerator is 120 and the denominator is the pole number.

Table 234 – Object description

Attribute	Value
Index	$604C_h$
Name	*vl* dimension factor
Object Code	Array
Data Type	Integer32
Category	Optional

Table 235 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h
Default Value	02_h
Sub-Index	01_h
Description	*vl* dimension factor numerator
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See value definition
Default Value	+1
Sub-Index	02_h
Description	*vl* dimension factor denominator
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See value definition
Default Value	+1

17 Cyclic synchronous position mode

17.1 General information

The overall structure for this mode is shown in Figure 63. With this mode, the trajectory generator is located in the control device, not in the drive device. In cyclic synchronous manner, it provides a target position to the drive device, which performs position control, velocity control and torque control. Optionally, additive velocity and torque values can be provided by the control system in order to allow for velocity and/or torque feedforward. Measured by sensors, the drive device may provide actual values for position, velocity and torque to the control device.

The behavior of the control function is influenced by control parameters like limit functions, which are externally applicable. The drive internal control function is not specified more precisely in this part of the IEC 618700-7 series as it is highly manufacturer specific, but the format and content of the control parameters are provided.

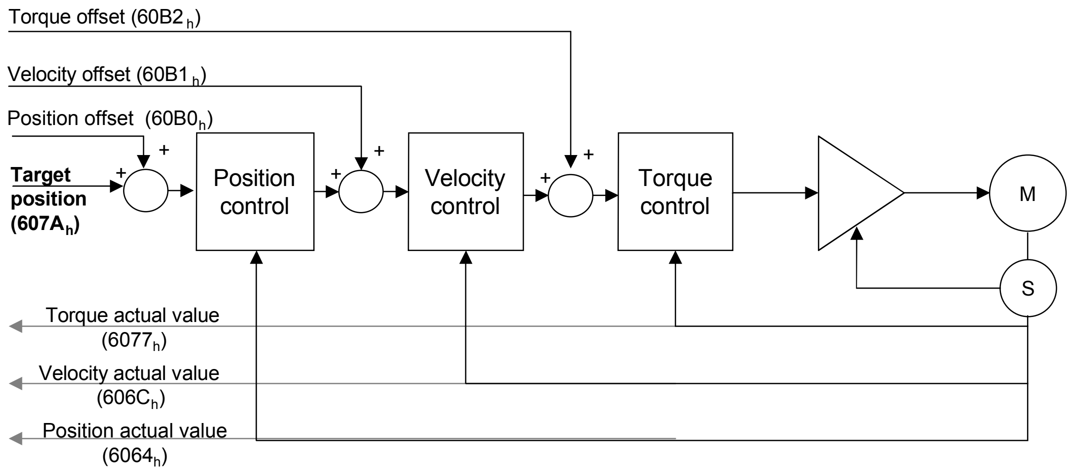

Figure 63 – Cyclic synchronous position mode overview

17.2 Functional description

Figure 64 shows the inputs and outputs of the drive control function. The input values (from the control function point of view) are the target position and optionally a position offset (to be added to the target position to allow two instances to set up the position) as well as an optional velocity offset and an optional torque offset used for feedforward control. Especially in cascaded control structures, where a position control is followed by a velocity or torque control, the output of the position control loop is used as an input for a further calculation in the drive device. Limit functions may be used to restrict the range of values to avoid unintended positions.

The drive device monitors the following error. Other features specified in this mode are limitation of motor speed and a quick stop function for emergency reasons. The torque may be limited as well.

The interpolation time period defines the time period between two updates of the target position and/or additive position and shall be used for intercycle interpolation.

The target position shall be interpreted as absolute value.

The position actual value is used as mandatory output to the control device. Further outputs may be the velocity actual value, torque actual value and the velocity sensor actual value. The following error actual value may be used as an additional parameter.

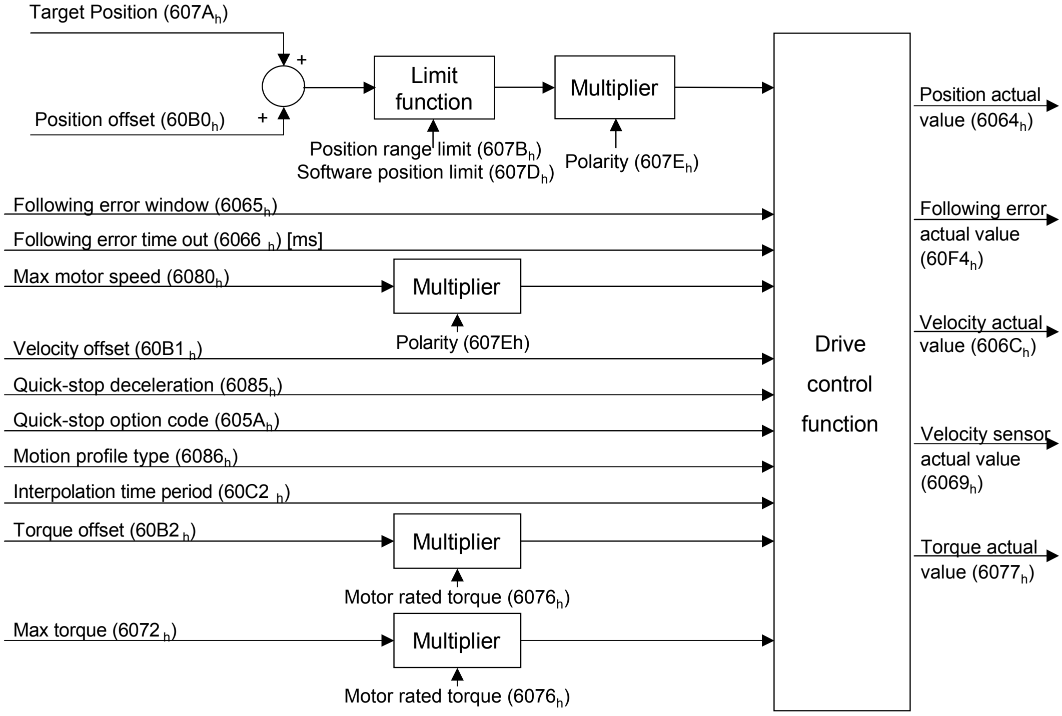

Figure 64 – Cyclic synchronous position control function

All values are transformed – if necessary – from user-defined units to normalised units such as increments with the functions described in Clause 9.

A *target position value* or *position offset* outside the allowed range of the *following error window* around a *position demand value* for longer than the *following error time out* shall result in setting bit 13 (*following error*) in the statusword to 1.

17.3 Use of controlword and statusword

The cyclic synchrounous position mode uses no mode specific bits of the controlword and three bits of the statusword for mode-specific purposes. Figure 65 shows the structure of the statusword. Table 236 defines the values for bit 10, 12, and 13 of the statusword.

15 … 14	13	12	11	10	9 … 0
(see 8.4.2)	Following error	Target position ignored	(see 8.4.2)	reserved	(see 8.4.2)
MSB					LSB

Figure 65 – Statusword for profile cyclic synchronous position mode

Table 236 – Definition of bit 10, bit 12, and bit 13

Bit	Value	Definition
10	0	Reserved
	1	Reserved
12	0	Target position ignored
	1	Target position shall be used as input to position control loop
13	0	No following error
	1	Following error

17.4 Detailed object definitions

17.4.1 Object 60B0$_h$: Position offset

This object shall provide the offset of the target position. The offset shall be given in user-defined position units.

NOTE The value itself is absolute and thus independent of how often it is transmitted over the communication system, for example, transmitted twice does not mean double value. Since the additive position value represents an offset to the target position, it can be also used to control the drive with relative values with regard to the target position.

Table 237 specifies the object description, and Table 238 specifies the entry description.

Table 237 – Object description

Attribute	Value
Index	60B0$_h$
Name	Position offset
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 238 – Entry description

Attribute	Value
Sub-Index	00$_h$
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	0

17.4.2 Object 60B1$_h$: Velocity offset

This object shall provide the offset for the velocity value. The offset shall be given in user-defined velocity units. In cyclic synchronous position mode, this object contains the input value for velocity feed forward. In cyclic synchronous velocity mode (see Clause 18), it contains the commanded offset of the drive device.

NOTE The value itself is absolute and thus independent of how often it is transmitted over the communication system, for example transmitted twice does not mean double value. Since the additive velocity value represents an offset to the target velocity, it can be also used to control the drive with relative values with regard to the target velocity.

Table 239 specifies the object description, and Table 240 specifies the entry description.

Table 239 – Object description

Attribute	Value
Index	60B1$_h$
Name	Velocity offset
Object Code	Variable
Data Type	Integer32
Category	Optional

Table 240 – Entry description

Attribute	Value
Sub-Index	00_h
Access	Rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	0

17.4.3 Object $60B2_h$: Torque offset

This object shall provide the offset for the torque value. The offset shall be given in per thousand rated torque. In cyclic synchronous position mode and cyclic synchronous velocity mode (see Clause 18), this object contains the input value for torque feed forward. In cyclic synchronous torque mode (see Clause 18) it contains the commanded additive torque of the drive, which is added to the target torque value.

NOTE The value itself is absolute and thus independent of how often it is transmitted over the communication system, for example transmitted twice does not mean double value.

Table 241 specifies the object description, and Table 242 specifies the entry description.

Table 241 – Object description

Attribute	Value
Index	$60B2_h$
Name	Torque offset
Object Code	Variable
Data Type	Integer16
Category	Optional

Table 242 – Entry description

Attribute	Value
Sub-Index	00_h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0

18 Cyclic synchronous velocity mode

18.1 General information

The overall structure for this mode is shown in Figure 66. With this mode, the trajectory generator is located in the control device, not in the drive device. In cyclic synchronous manner, it provides a target velocity to the drive device, which performs velocity control and torque control. If desired, the position control loop may be closed over the communication system. Optionally, additive velocity and torque values may be provided by the control system in order to allow a second source for velocity and/or a torque feed forward. Measured by sensors, the drive device may provide actual values for position, velocity and torque to the control device.

The cyclic synchronous velocity mode covers the following sub-functions:

- Demand value input
- Velocity capture using position sensor or velocity sensor
- Velocity control function with appropriate input and output signals
- Limitation of torque demand

Various sensors may be used for velocity capture. In particular, the aim is that costs are reduced and the drive power system is simplified by evaluating position and velocity using a common sensor, such as is optional using a resolver or an encoder.

The behavior of the control function is influenced by control parameters such as limit functions, which are externally applicable. The drive internal control function is not specified more precisely in this part of the IEC 61800-7 series, as it is highly manufacturer specific, but the format and content of the control parameters are provided.

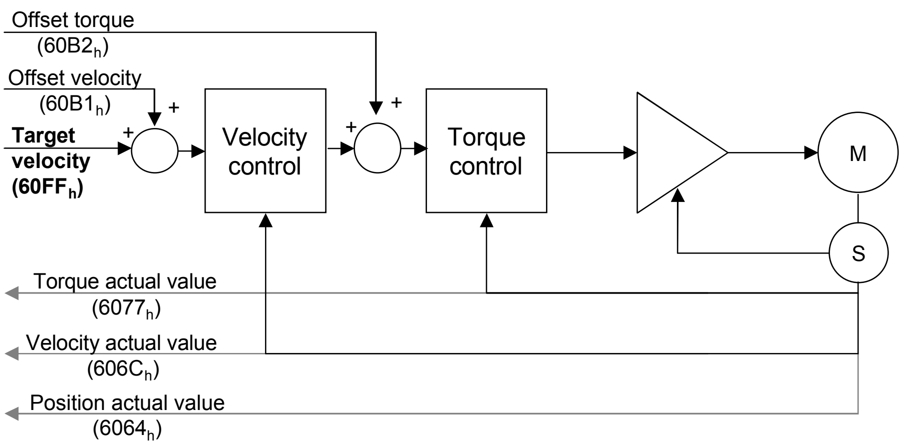

Figure 66 – Cyclic synchronous velocity mode overview

18.2 General definitions

The factors necessary for scaling have a linear relationship and therefore they are described in the factor group. The polarity is described in the factor group as well.

18.3 Functional description

Figure 67 shows the inputs and outputs of the drive control function. The input (from the control device point of view) are the target velocity and optionally, a velocity offset (to be added to the target velocity to allow two instances to set up the velocity) as well as a torque offset. Especially in cascaded control structures, where a velocity control is followed by a torque control, the output of the velocity control loop is used as an input for a further calculation in the drive device.

The drive device may support limitation of motor speed and a quick stop function for emergency reasons. The torque may be limited as well.

The interpolation time period defines the time period between two updates of the target velocity and/or additive velocity and shall be used for intercycle interpolation.

The velocity actual value is used as mandatory output to the control device. Further outputs may be the torque actual value and the velocity sensor actual value.

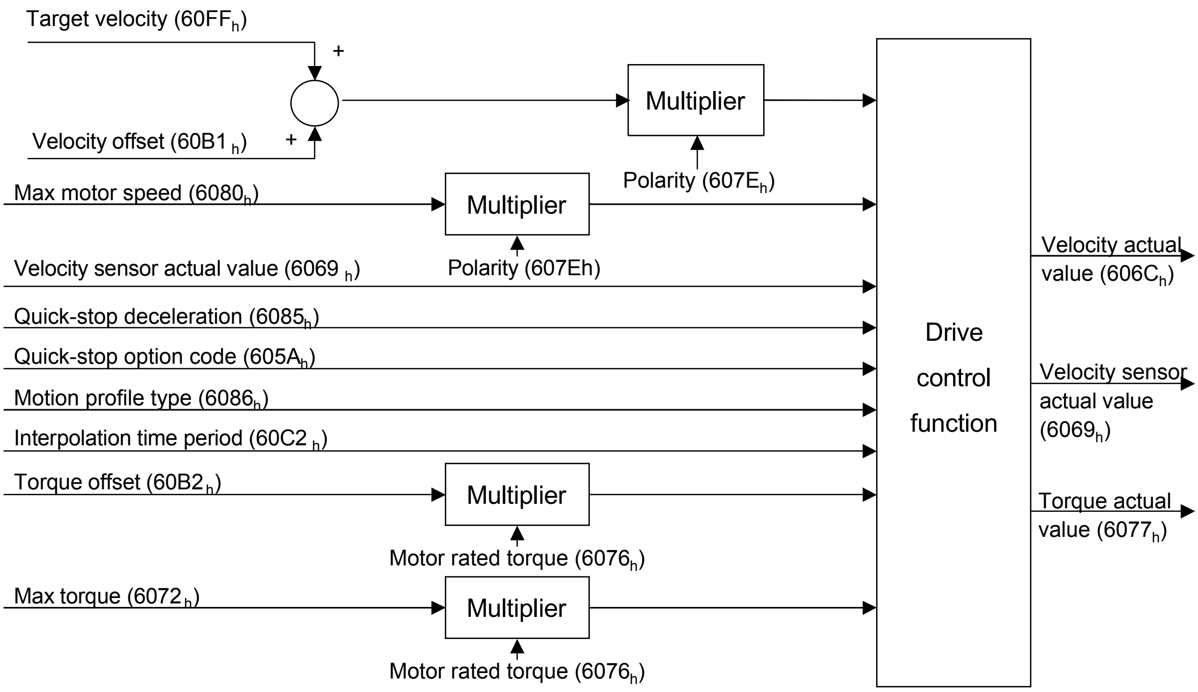

Figure 67 – Cyclic synchronous velocity control function

All values are transformed – if necessary – from user-defined units to normalised units such as increments with the functions described in Clause 9.

18.4 Use of controlword and statusword

The cyclic synchronous velocity mode uses no mode specific bits of the controlword and some bits of the statusword for mode-specific purposes. Figure 68 shows the structure of the statusword. Table 243 defines the values for bit 10, 12, and 13 of the statusword.

15 – 14	13	12	11	10	9 – 0
(see 8.4.2)	reserved	Target velocity ignored	(see 8.4.2)	reserved	(see 8.4.2)
MSB					LSB

Figure 68 – Statusword for profile cyclic synchronous velocity mode

Table 243 – Definition of bit 10, bit 12, and bit 13

Bit	Value	Definition
10	0	Reserved
	1	Reserved
12	0	Target velocity ignored
	1	Target velocity shall be used as input to velocity control loop
13	0	Reserved
	1	Reserved

19 Cyclic synchronous torque mode

19.1 General information

The overall structure for this mode is shown in Figure 69. With this mode, the trajectory generator is located in the control device, not in the drive device. In cyclic synchronous manner, it provides a target torque to the drive device, which performs torque control. Optionally, an additive torque value can be provided by the control system in order to allow two instances to set up the torque. Measured by sensors, the drive device may provide actual values for position, velocity and torque to the control device.

The cyclic synchronous torque mode covers the following sub-functions:

- demand value input;
- torque capture;
- torque control function with appropriate input and output signals;
- limitation of torque demand.

The drive internal control function is not specified more precisely in this part of the IEC 61800-7 series as it is highly manufacturer specific, but the format and content of the control parameters are provided.

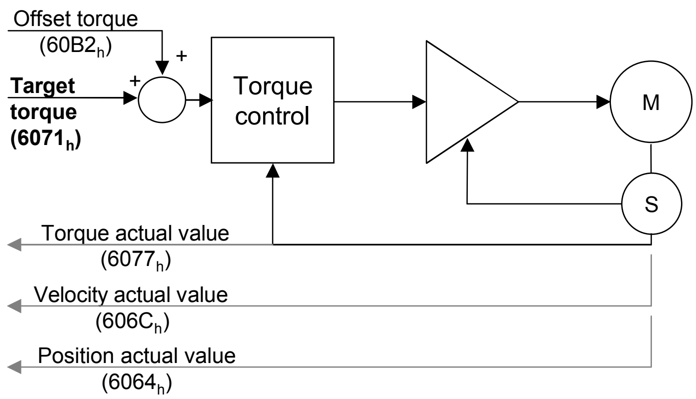

Figure 69 – Cyclic synchronous torque mode overview

19.2 General definitions

The factors necessary for scaling have a linear relationship and therefore they are described in the factor group. The polarity is described in the factor group as well.

19.3 Functional description

Figure 70 shows the inputs and outputs of the torque control function. The input (from the control function point of view) are the target torque and optionally a torque offset (to be added to the target torque to allow two instances to set up the torque).

The drive device can have features for limitation of motor speed. The torque can be limited as well.

The interpolation time period defines the time period between two updates of the target velocity and/or additive velocity and shall be used for intercycle interpolation.

The torque actual value is used as mandatory output to the control device.

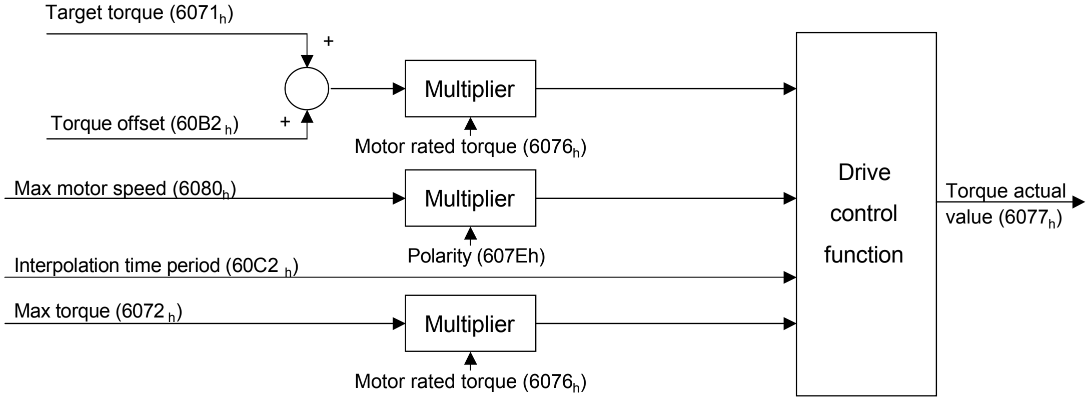

Figure 70 – Cyclic synchronous torque control function

19.4 Use of controlword and statusword

The cyclic synchronous torque mode uses no mode specific bits of the controlword and some bits of the statusword for mode-specific purposes. Figure 71 shows the structure of the statusword. Table 244 defines the values for bit 10, 12, and 13 of the statusword.

15 – 14	13	12	11	10	9 – 0
(see 8.4.2)	reserved	Target torque ignored	(see 8.4.2)	reserved	(see 8.4.2)
MSB					LSB

Figure 71 – Statusword for profile cyclic synchronous torque mode

Table 244 – Definition of bit 10, bit 12, and bit 13

Bit	Value	Definition
10	0	Reserved
	1	Reserved
12	0	Target torque ignored
	1	Target torque shall be used as input to torque control loop
13	0	Reserved
	1	Reserved

20 Optional application FE

20.1 General

The objects defined in this clause are used for the optional generic input/output FE.

20.2 Object $60FD_h$: Digital inputs

This object shall provide digital inputs. Figure 72 specifies the object structure.

31 16	15 4	3	2	1	0
Manufacturer-specific	reserved	interlock	home switch	positive limit switch	negative limit switch
MSB					LSB

Figure 72 – Object structure

Table 245 specifies the values.

Table 245 – Value definition

Value	Definition
0_b	Switched off
1_b	Switched on

Table 246 specifies the object description, Table 247 specifies the entry description.

Table 246 – Object description

Attribute	Value
Index	$60FD_h$
Name	Digital inputs
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Table 247 – Entry description

Attribute	Value
Sub-Index	00_h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	$0000\ 0000_h$

20.3 Object $60FE_h$: Digital outputs

This object shall command simple digital outputs. Figure 73 specifies the object structure.

31 16	15 1	0
Manufacturer-specific	reserved	set brake
MSB		LSB

Figure 73 – Object structure

Table 248 specifies the values.

Table 248 – Value definition

Value	Definition for sub-index 01_h	Definition for sub-index 02_h
0_b	Switch off/don’t set brake	Disable output
1_b	Switch on/set brake	Enable output

Table 249 specifies the object description, Table 250 specifies the entry description.

Table 249 – Object description

Attribute	Value
Index	$60FE_h$
Name	Digital output
Object Code	Array
Data Type	Unsigned32
Category	Optional

Table 250 – Entry description

Attribute	Value
Sub-Index	00_h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02_h or 02_h
Default Value	Manufacturer-specific
Sub-Index	01_h
Description	Physical outputs
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	$0000\ 0000_h$
Sub-Index	02_h
Description	Bit mask
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	$0000\ 0000_h$

Bibliography

IEC 60050-351, *International Electrotechnical Vocabulary – Part 351: Control technology*[15]

IEC 61499-1, *Function blocks – Part 1: Architecture*

IEC 61800 (all parts), *Adjustable speed electrical power drive systems*

IEC 61800-7-1:—, *Adjustable speed electrical power drive systems – Part 7-1: Generic interface and use of profiles for power drive systems – Interface definition*[16]

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*[16]

IEC 61800-7-203:—, *Adjustable speed electrical power drive systems – Part 7-203: Generic interface and use of profiles for power drive systems – Profile type 3 specification*[16]

IEC 61800-7-204:—, *Adjustable speed electrical power drive systems – Part 7-204: Generic interface and use of profiles for power drive systems – Profile type 4 specification*[16]

IEC 61800-7-302:—, *Adjustable speed electrical power drive systems – Part 7-302: Generic interface and use of profiles for power drive systems – Mapping of profile type 2 to network technologies*[16]

IEC 61800-7-303:—, *Adjustable speed electrical power drive systems – Part 7-303: Generic interface and use of profiles for power drive systems – Mapping of profile type 3 to network technologies*[16]

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*[16]

IEC/TS 61915, *Low-voltage switchgear and controlgear – Principles for the development of device profiles for networked industrial devices*

IEC/TR 62390:2005, *Common Automation Device – Profile Guideline*

ISO/IEC 2382-15:1999, *Information technology, Vocabulary – Part 15: Programming languages*

ISO/IEC 19501, *Information technology – Open Distributed Processing – Unified Modeling Language (UML) Version 1.4.2*

ISO 15745-1:2003, *Industrial automation systems and integration – Open systems application integration framework – Part 1: Generic reference description*

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[15] See also the IEC Multilingual Dictionary – Electricity, Electronics and Telecommunications.

[16] To be published.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-204: Generic interface and use of profiles for power drive systems – Profile type 4 specification

FOREWORD

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The International Standard IEC 61800-7-204 has been prepared by subcommittee SC 22G: Adjustable speed electric drive systems incorporating semiconductor power converters, of IEC technical committee TC22: Power electronic systems and equipment.

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

FDIS	Report on voting
XX/XX/FDIS	XX/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[1] 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.

A bilingual version of this publication may be issued at a later date.

[1] The National Committees are requested to note that for this publication the maintenance result date is 2012.

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 402[2], CIP Motion™[3], PROFIdrive[4] and SERCOS Interface™[5] 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 CANopen[6], EtherCAT™[7], Ethernet Powerlink™[8], DeviceNet™[9], ControlNet™[10], EtherNet/IP™[11], PROFIBUS[12], PROFINET[13] and SERCOS Interface).

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2 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.

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6 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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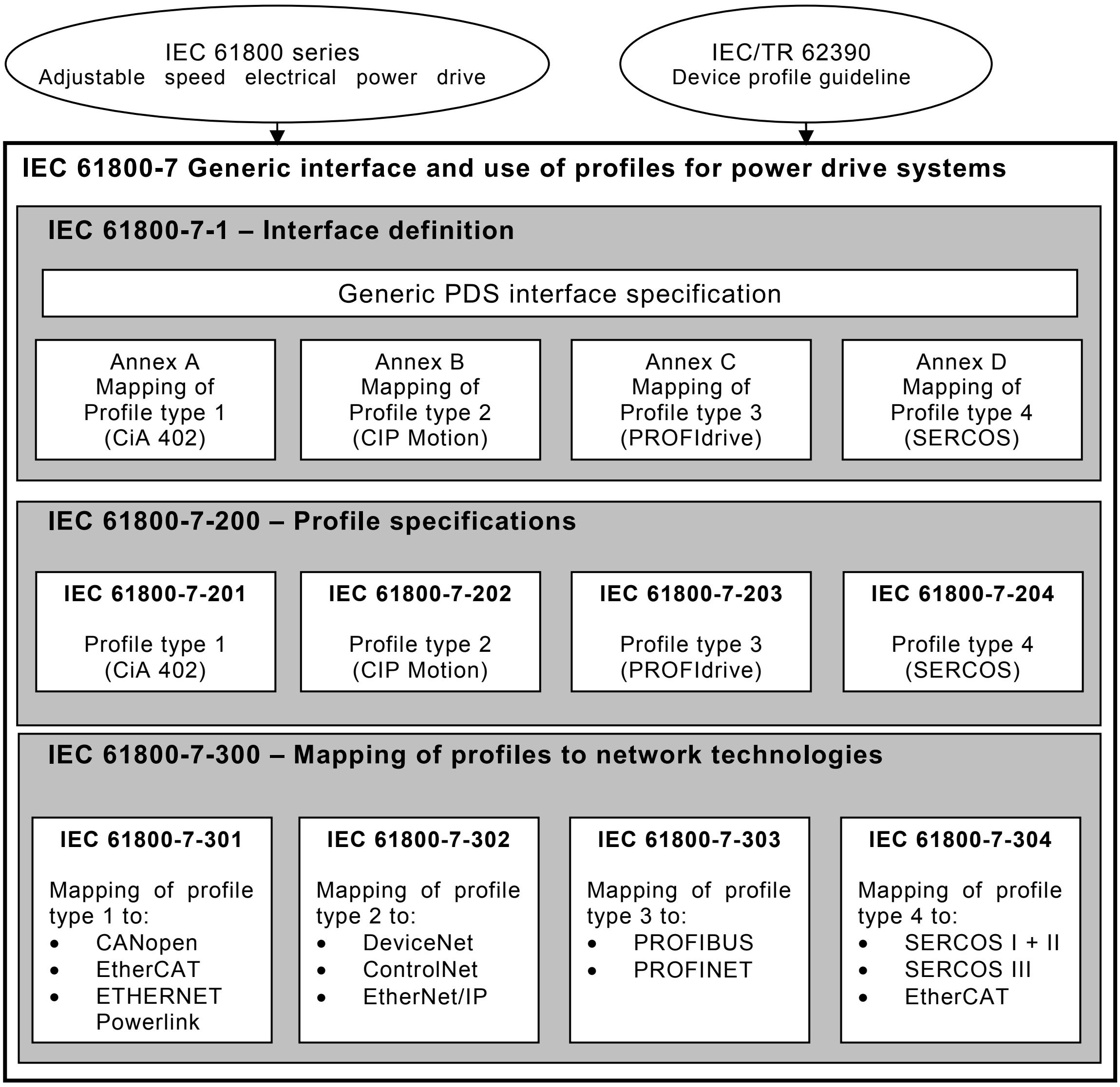


Figure 1 – Structure of IEC 61800-7

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 7-204: 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*[14]

IEC 61158-5-16: —, *Industrial communication networks – Fieldbus specifications – Part 5-16 (Ed.1.0): Application layer service definition – Type 16 elements* [14]

IEC 61158-6-16: —, *Industrial communication networks – Fieldbus specifications – Part 6-16 (Ed.1.0): Application layer protocol specification – Type 16 elements*[14]

IEC 61800-7 (all parts), *Adjustable speed electrical power drive systems – Generic interface and use of profiles for power drive systems* [14]

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*[14]

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

[14] To be published

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.

7 Application function groups

7.1 General

The following functional sequences describe procedure commands and real-time bits and their application. The IDNs refer to parameter set 0 of the standardised data.

7.2 Scaling of operation data

7.2.1 General

Operation data may have different scaling depending on the functional capabilities of the drives and applications. This part of IEC 61800-7 uses SI-units.

Scaling determines the weight of the operation data which is transferred between the control unit and the drives (and vice versa) using the SERCOS interface. The processing accuracy of the control unit and the drives is not affected by scaling. The type of scaling is defined by setting the scaling type definition bits of the scaling type parameters.

The SERCOS interface differentiates between non-scaled operation data and application-specific scaled data. With a non-scaled data format, the user shall apply scaling to the operation data. With application-specific scaling, the data may be referred in several ways, depending on rotational or linear load movements. It shall also be possible to choose from scaling preferred values and scaling of arbitrary values by means of freely adjustable scaling parameters.

7.2.2 Scaling of position data

7.2.2.1 IDN list

Table 3 shows the IDNs used to deal with scaling of position data.

Table 3 – Scaling of position data IDNs

IDN	Description
S-0-0076	Position data scaling type
S-0-0077	Linear position data scaling factor
S-0-0078	Linear position data scaling exponent
S-0-0079	Rotational position resolution
S-0-0103	Modulo value
S-0-0294	Divider modulo value

7.2.2.2 No scaling of position data

If no scaling is chosen, the position data acquired by the drive and the position data calculated by the control unit shall be transferred between the drives and the control unit (and vice versa) without scaling (see S-0-0076). The user shall apply scaling to the position data.

7.2.2.3 Scaling of linear position data

Linear scaling shall be defined by the scaling type (see S-0-0076). Linear scaling parameters (S-0-0077 and S-0-0078) shall apply to all linear position data.

The weight of the LSB of linear position data shall be derived from the multiplication of the scaling factor and the scaling exponent (base 10).

$$\text{LSB weight} = \text{unit} \times \text{factor} \times 10^{\text{exponent}}$$

If preferred linear scaling (see S-0-0076) is used, the scaling factor (S-0-0077) shall be based on 1 and the scaling exponent (S-0-0078) on -7. Table 4 summarises scaling of linear position data.

Table 4 – Scaling of linear position data

Scaling type (S-0-0076)	Unit	Scaling factor (S-0-0077)	Scaling exponent (S-0-0078)	Preferred scaling
linear	m	1	-7	0,1 µm
linear (additional)	in	1	-6	0,000 001 in

7.2.2.4 Scaling of rotational position data

Rotational scaling shall be defined by the scaling type (see S-0-0076). Rotational position resolution (S-0-0079) shall apply to all rotational position data.

The weight of the LSB of rotational position data shall be defined by the rotational position resolution.

$$\text{LSB weight} = \frac{\text{1 revolution}}{\text{Rotational position resolution}}$$

If preferred rotational scaling (see S-0-0076) is used, the rotational resolution shall be fixed at 3 600 000. Thus, LSB weight for all rotational position data is fixed at 0,000 1° (10^{-4} angular degrees). Table 5 summarises scaling of rotational position data.

Table 5 – Scaling of rotational position data

Scaling type (S-0-0076)	Unit	Rotational position resolution (S-0-0079)	Preferred scaling
rotational	angular degree	3 600 000	0,000 1°

Figure 2 shows the different possibilities for position data scaling.

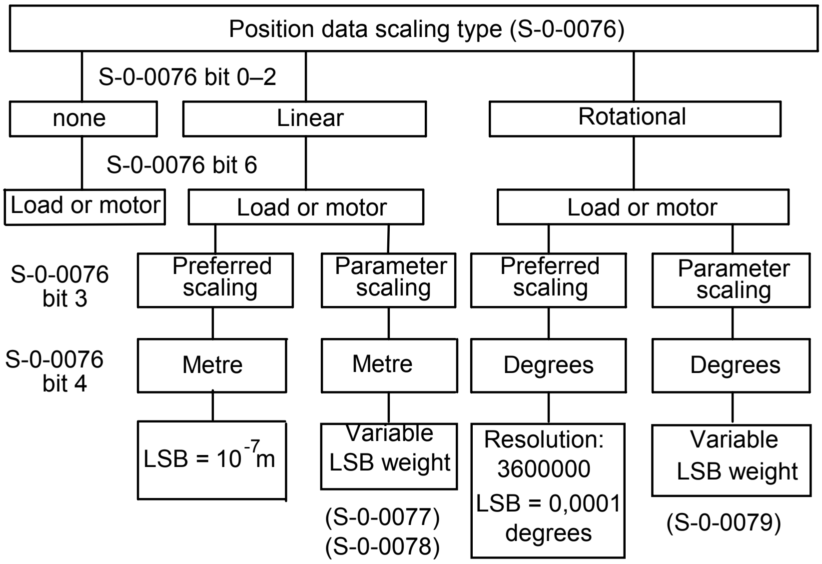


Figure 2 – Position data scaling type diagram

7.2.3 Scaling of velocity data

7.2.3.1 IDN list

Table 6 shows the IDNs used to deal with scaling of velocity data.

Table 6 – Scaling of velocity data IDNs

IDN	Description
S-0-0044	Velocity data scaling type
S-0-0045	Velocity data scaling factor
S-0-0046	Velocity data scaling exponent

7.2.3.2 No scaling of velocity data

If no scaling is chosen, the velocity data acquired by the drive and the velocity data computed by the control unit shall be transferred between the drives and the control unit (and vice versa) without scaling (see IDN S-0-0044). The user shall then apply scaling to the velocity data.

7.2.3.3 Scaling of linear velocity data

The linear scaling shall be defined by the scaling type (see S-0-0044). The scaling parameters (S-0-0045 and S-0-0046) shall apply to all linear velocity data.

The weight of the LSB of linear velocity data shall be derived from the multiplication of the scaling factor and the scaling exponent (base 10).

$$\text{LSB weight} = \frac{\text{unit}}{\text{time unit}} \times \text{factor} \times 10^{\text{exponent}}$$

If preferred linear scaling (see S-0-0044) is used, the scaling factor (S-0-0045) shall be based on 1 and the scaling exponent (S-0-0046) on -6. Table 7 summarises linear scaling of velocity data.

Table 7 – Linear scaling of velocity data

Scaling type (S-0-0044)	Unit	Scaling factor (S-0-0045)	Scaling exponent (S-0-0046)	Preferred Scaling
linear	m/min	1	-6	0,001 mm/min
linear (additional)	in/min	1	-5	0,000 01 in/min

7.2.3.4 Scaling of rotational velocity data

Rotational scaling shall be defined by the scaling type (see S-0-0044). The scaling parameters (S-0-0045 and S-0-0046) shall apply to all rotational velocity data.

The weight of the LSB of rotational velocity data shall be derived from the multiplication of the scaling factor and the scaling exponent (base 10).

$$\text{LSB weight} = \frac{\text{unit}}{\text{time unit}} \times \text{factor} \times 10^{\text{exponent}}$$

Two preferred scaling units are defined for rotational velocity data. For both, the scaling factor (S-0-0045) shall be 1 and the scaling exponent (S-0-0046) shall depend on the time unit used. Table 8 summarises scaling of rotational velocity data.

Table 8 – Scaling of rotational velocity data

Scaling type (S-0-0044)	Unit	Scaling factor (S-0-0045)	Scaling exponent (S-0-0046)	Preferred Scaling
rotational	min^{-1} (RPM)	1	-4	0,000 1 min^{-1}
rotational	s^{-1} (rev/s)	1	-6	0,000 001 s^{-1}

Figure 3 shows the different possibilities for velocity data scaling.

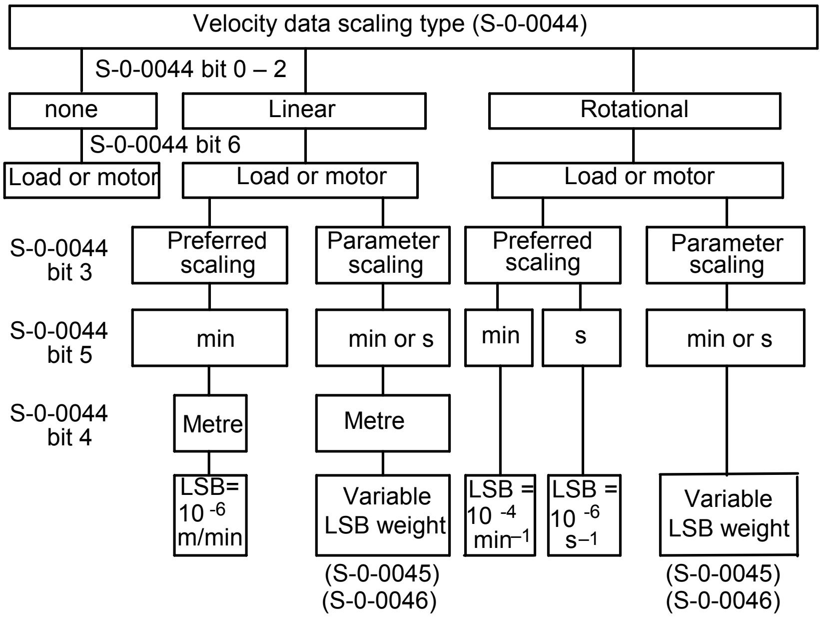


Figure 3 – Velocity data scaling type diagram

7.2.4 Scaling of torque/force data

7.2.4.1 IDN list

Table 9 shows the IDNs used to deal with scaling of torque/force data.

Table 9 – Scaling of torque/force IDNs

IDN	Description
S-0-0086	Torque/force data scaling type
S-0-0093	Torque/force data scaling factor
S-0-0094	Torque/force data scaling exponent

7.2.4.2 Percentage scaling of torque/force data

The percentage scaling shall be defined by the scaling type parameter (S-0-0086). No further scaling parameters shall be required.

With percentage torque scaling, the LSB weight of the torque data shall be based on 0,1 % of the continuous stall torque of the motor (see S-0-0111), respectively, of the rated torque of the motor (see S-0-0196).

7.2.4.3 Scaling of force data

The scaling of force data shall be defined by the scaling type (see S-0-0086). The scaling parameters (S-0-0093 and S-0-0094) shall apply to all force data.

The weight of the LSB of force data shall be derived from the multiplication of the scaling factor and the scaling exponent (base 10).

$$\text{LSB weight} = \text{unit} \times \text{factor} \times 10^{\text{exponent}}$$

If preferred scaling is used, the scaling factor (S-0-0093) shall be based on 1 and the scaling exponent (S-0-0094) on 0. Table 10 summarises scaling of force data.

Table 10 – Scaling of force data

Scaling type (S-0-0086)	Unit	Scaling factor (S-0-0093)	Scaling exponent (S-0-0094)	Preferred Scaling
linear	N	1	0	1 N
linear (additional)	lbf	1	-1	0,1 lbf
NOTE 1 N = 0,224 81 lbf.				

7.2.4.4 Scaling of torque data

The scaling of torque data shall be defined by the scaling type (see S-0-0086). The scaling parameters (S-0-0093 and S-0-0094) apply to all torque data.

The weight of the LSB of torque data is derived from the multiplication of the scaling-factor and the scaling exponent (base 10).

$$\text{LSB weight} = \text{unit} \times \text{factor} \times 10^{\text{exponent}}$$

If preferred scaling is used, the scaling factor (S-0-0093) shall be based on 1 and the scaling exponent (S-0-0094) on -2. Table 11 summarises scaling of torque data.

Table 11 – Scaling of torque data

Scaling type (S-0-0086)	Unit	Scaling factor (S-0-0093)	Scaling exponent (S-0-0094)	Preferred Scaling
rotational	Nm	1	-2	0,01 Nm
rotational (additional)	in lbf	1	-1	0,1 in lbf
NOTE 1 Nm = 8,851 in lbf.				

Figure 4 shows the different possibilities for torque/force data scaling.

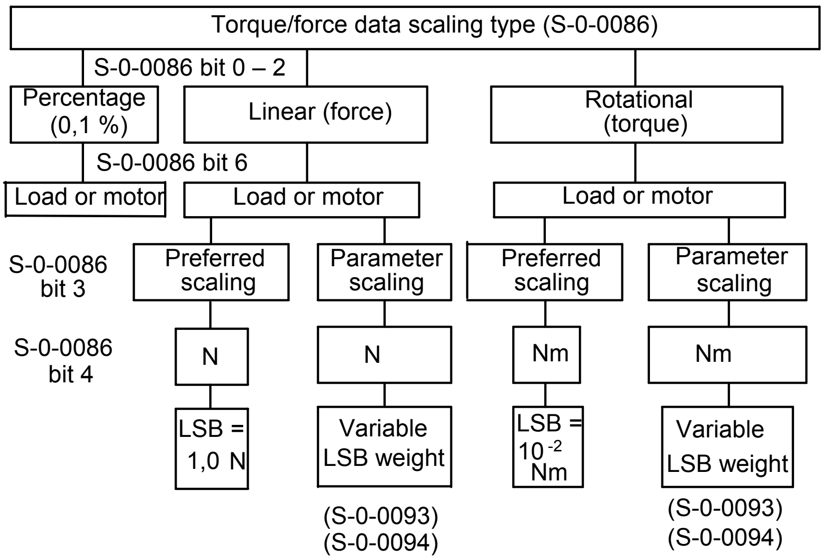


Figure 4 – Torque/force data scaling type diagram

7.2.5 Scaling of acceleration data and jerk data

7.2.5.1 IDN list

Table 12 shows the IDNs used to deal with scaling of acceleration and jerk data.

Table 12 – Scaling of acceleration and jerk data IDNs

IDN	Description
S-0-0160	Acceleration data scaling type
S-0-0161	Acceleration data scaling factor
S-0-0162	Acceleration data scaling exponent
S-0-0446	Ramp reference velocity

7.2.5.2 No scaling of acceleration data and jerk data

If no scaling is chosen, the acceleration/jerk data acquired by the drive and the acceleration/jerk data computed by the control unit shall be transferred between the drives and the control unit (and vice versa) without scaling (see S-0-0160). It shall then be up to the user to apply scaling to the acceleration/jerk data.

7.2.5.3 Scaling of linear acceleration/jerk data

The linear scaling shall be defined by the scaling type (see S-0-0160). The scaling parameters (S-0-0161 and S-0-0162) shall apply to all linear acceleration data and jerk data.

The weight of the LSB of linear acceleration data and jerk data shall be derived from the multiplication of the scaling factor and the scaling exponent (base 10).

$$\text{LSB weight} = \frac{\text{unit}}{\text{time unit}^{2\text{ (or 3 for jerk)}}} \times \text{factor} \times 10^{\text{exponent}}$$

Only one preferred unit is defined for linear acceleration data and jerk data (i.e., metric). The scaling factor (S-0-0161) is based on 1 and the scaling exponent (S-0-0162) is based on -6. Table 13 summarises scaling of acceleration/jerk data.

Table 13 – Scaling of linear acceleration/jerk data

Scaling type (S-0-0160)	Unit	Scaling factor (S-0-0161)	Scaling exponent (S-0-0162)	Preferred Scaling
Linear (acceleration)	m/s^2	1	-6	0,000 001 m/s^2
Linear (jerk)	m/s^3	1	-6	0,000 001 m/s^3

7.2.5.4 Scaling of rotational acceleration/jerk data

Rotational scaling shall be defined by the scaling type (see IDN S-0-0160). The scaling parameters (S-0-0161 and S-0-0162) shall apply to all rotational acceleration/jerk data.

The weight of the LSB of rotational acceleration data and jerk data shall be derived from the multiplication of the scaling factor and the scaling exponent (base 10).

$$\text{LSB weight} = \frac{\text{unit}}{\text{time unit}^{2\text{ (or 3 for jerk)}}} \times \text{factor} \times 10^{\text{exponent}}$$

Only one preferred unit is defined for rotational acceleration/jerk data. Table 14 summarises scaling of rotational acceleration/jerk data.

Table 14 – Scaling of rotational acceleration/jerk data

Scaling type (S-0-0160)	Unit	Scaling factor (S-0-0161)	Scaling exponent (S-0-0162)	Preferred Scaling
Rotational (acceleration)	rad/s^2	1	-3	0,001 rad/s^2
Rotational (jerk)	rad/s^3	1	-3	0,001 rad/s^3

7.2.5.5 Scaling of ramp time

The scaling of ramp time data shall be defined by the scaling type (S-0-0160). The scaling parameters (S-0-0161 and S-0-0162) shall apply to all ramp time data. The acceleration shall be calculated by the ramp time data related to the ramp reference velocity (S-0-0446).

The weight of the LSB of ramp time data shall be derived from the multiplication of the scaling factor and the scaling exponent (base 10).

$$\text{LSB weight} = \text{unit} \times \text{factor} \times 10^{\text{exponent}}$$

If preferred scaling (see S-0-0160) is used, the scaling factor (S-0-0161) shall be based on 1 and the scaling exponent (S-0-0162) on -3. Table 15 summarises scaling of ramp time.

Table 15 – Scaling of ramp time

Scaling type (S-0-0160)	Unit	Scaling factor (S-0-0161)	Scaling exponent (S-0-0162)	Preferred Scaling
ramp time	s	1	-3	0,001 s

Figure 5 shows the different possibilities for acceleration data scaling.

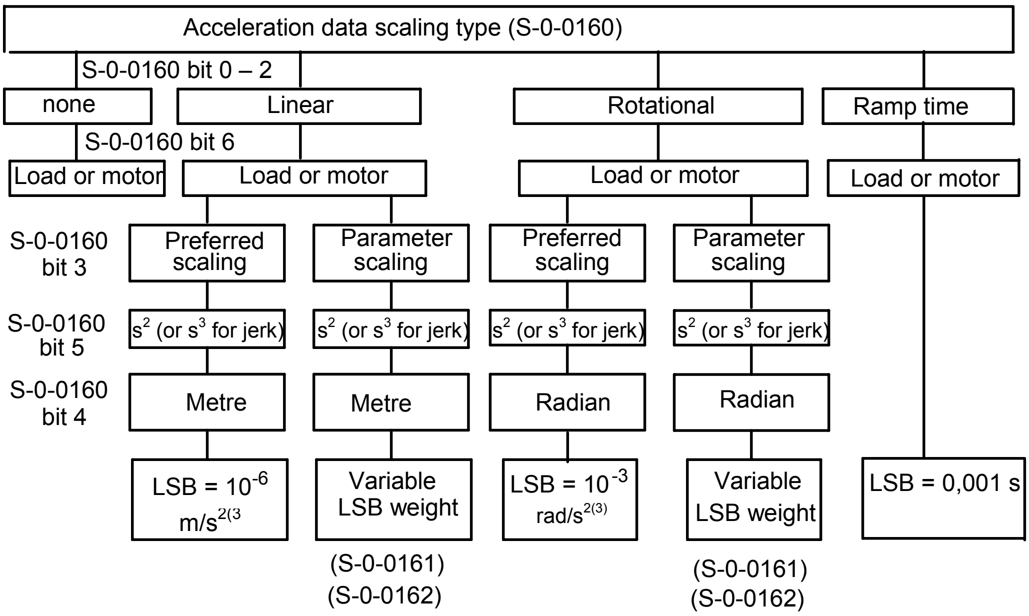


Figure 5 – Acceleration/jerk data scaling type diagram

7.2.6 Scaling of temperature data

Table 16 shows the IDN used to deal with temperature data scaling.

Table 16 – Scaling of temperature data IDN

IDN	Description
S-0-0208	Temperature data scaling type

7.3 Drive parameters

7.3.1 Velocity loop parameters

7.3.1.1 IDN list

Table 17 shows the IDNs used to deal with velocity loop of the drive.

Table 17 – Velocity loop IDNs

IDN	Description
S-0-0100	Velocity loop proportional gain
S-0-0101	Velocity loop integral action time
S-0-0102	Velocity loop differential time

7.3.1.2 Adaptation of the velocity loop

When using the adaptation parameters (S-0-0209, S-0-0210, S-0-0211, S-0-0212), the proportional gain (S-0-0100) and the integral action time (S-0-0101) in the velocity loop may be adapted within a programmable velocity range, according to specific application needs.

Table 18 shows the usable IDNs for adapting the velocity loop.

Table 18 – Adaptation of the velocity loop IDNs

IDN	Description
S-0-0209	Lower adaptation limit
S-0-0210	Upper adaptation limit
S-0-0211	Adaptation proportional gain
S-0-0212	Adaptation integral action time

Example (see Figure 6):

- Velocity loop proportional gain (S-0-0100): 50
- Lower adaptation limit (S-0-0209): 3 min^{-1}
- Upper adaptation limit (S-0-0210): 8 min^{-1}
- Adaptation proportional gain (S-0-0211): 150 %

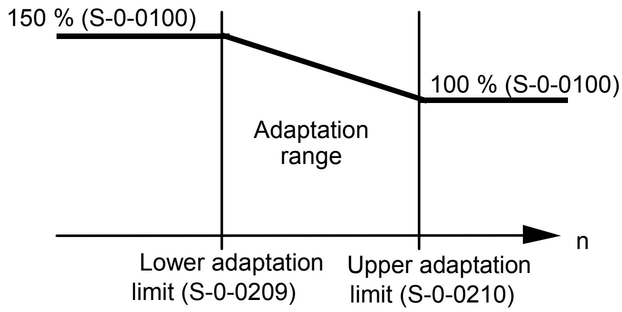


Figure 6 – Adaptation of the velocity loop proportional gain

Example (see Figure 7):

- Velocity loop integral action time (S-0-0101): 2 ms
- Lower adaptation limit (S-0-0209): 3 min^{-1}
- Upper adaptation limit (S-0-0210): 8 min^{-1}
- Adaptation integral action time (S-0-0212): 75 %

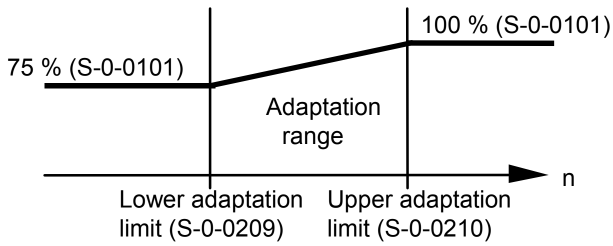


Figure 7 – Adaptation of the velocity loop integral action time

7.3.2 Position loop parameters

Table 19 shows the IDNs used to deal with position loop parameters.

Table 19 – Position loop parameters IDNs

IDN	Description
S-0-0104	Position loop K_V–factor
S-0-0105	Position loop integral action time
S-0-0159	Monitoring window
S-0-0056	Auxiliary interpolation position value

7.3.3 Current loop parameters

Current loop parameters shall be divided into two groups:

- group 1 for torque/force-producing current;
- group 2 for flux-producing current.

Table 20 shows the IDNs used to deal with current loop parameters.

Table 20 – Current loop parameters IDNs

IDN	Description
S-0-0106	Current loop proportional gain 1
S-0-0107	Current loop integral action time 1
S-0-0119	Current loop proportional gain 2
S-0-0120	Current loop integral action time 2

7.3.4 Drive limit values

Table 21 lists the IDNs used to adjust drive limit values.

Table 21 – Drive limit values IDNs

IDN	Description
S-0-0109	Motor peak current
S-0-0110	Amplifier peak current
S-0-0111	Motor continuous stall current
S-0-0196	Motor rated current
S-0-0112	Amplifier rated current
S-0-0113	Maximum motor speed
S-0-0114	Load limit of the motor
S-0-0108	Feedrate override
S-0-0200	Amplifier warning temperature
S-0-0201	Motor warning temperature
S-0-0202	Cooling error warning temperature
S-0-0203	Amplifier shut-down temperature
S-0-0204	Motor shut-down temperature
S-0-0205	Cooling error shut-down temperature

7.3.5 General drive parameters

Table 22 lists the IDNs used to adjust general drive parameters.

Table 22 – General drive parameters IDNs

IDN	Description
S-0-0206	Drive on delay time
S-0-0207	Drive off delay time

7.3.6 Spindle parameters

Table 23 lists the IDNs used to adjust spindle parameters.

Table 23 – Spindle parameters IDNs

IDN	Description
S-0-0190	Drive controlled gear engaging procedure command
S-0-0158	Power threshold (*px*)
S-0-0213	Engaging dither amplitude
S-0-0214	Average engaging speed
S-0-0215	Engaging dither period
S-0-0339	Status “$n_{\text{feedback}} \leq$ minimum spindle speed”
S-0-0340	Status “$n_{\text{feedback}} \geq$ maximum spindle speed”
S-0-0220	Minimum spindle speed
S-0-0221	Maximum spindle speed
S-0-0152	Position spindle procedure command
S-0-0154	Spindle positioning parameter
S-0-0222	Spindle positioning speed
S-0-0153	Spindle angle position
S-0-0180	Spindle relative offset

7.3.7 Spindle synchronous operation

Table 24 lists the IDNs used to adjust spindle synchronous operation.

Table 24 – Spindle synchronous operation IDNs

IDN	Description
S-0-0223	Drive controlled synchronous operation procedure command
S-0-0224	Lead spindle address
S-0-0225	Synchronous operation parameter
S-0-0226	Lead spindle revolutions
S-0-0227	Synchronous spindle revolutions
S-0-0230	Synchronous position offset
S-0-0228	Synchronisation position window
S-0-0308	Synchronisation operation status
S-0-0229	Synchronisation position error limit
S-0-0309	Synchronisation error status
S-0-0183	Synchronisation velocity window
S-0-0184	Synchronisation velocity error limit

Figure 8 shows an example of synchronous spindle operation.

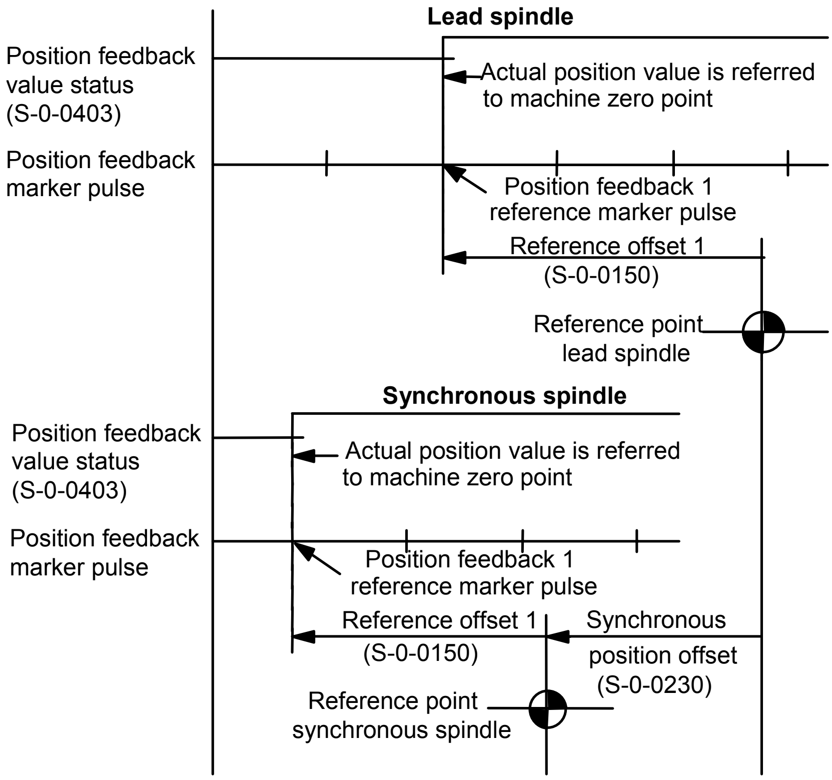


Figure 8 – Synchronous spindle operation diagram

NOTE The signs of the position data depend on the machine configuration. Reference points are referred to the machine zero point.

7.4 Mechanics

7.4.1 Feedback systems

Table 25 lists the IDNs used to adjust feedback systems.

Table 25 – Feedback systems IDNs

IDN	Description
S-0-0116	Resolution of rotational feedback 1
S-0-0117	Resolution of rotational feedback 2
S-0-0118	Resolution of linear feedback
S-0-0165	Distance coded reference marks A
S-0-0166	Distance coded reference marks B
S-0-0167	Frequency limit of feedback 1
S-0-0168	Frequency limit of feedback 2
S-0-0115	Position feedback type parameter

7.4.2 Feed constant

Table 26 lists the IDN used to adjust the feed constant.

Table 26 – Feed constant IDN

IDN	Description
S-0-0123	Feed constant

7.4.3 Gear train

The gear ratio of a gear train shall be calculated by the drive from the ratio of input revolutions to output revolutions.

$$\text{Gear ratio} = \frac{input\ \ revolutions}{output\ \ revolutions}$$

Table 27 lists the IDNs used to adjust the calculation of the gear ratio.

Table 27 – Gear train IDNs

IDN	Description
S-0-0121	Input revolutions of load gear
S-0-0122	Output revolutions of load gear

7.4.4 Polarities

These parameters shall be used to switch polarities of reported command values and feedback values for specific applications. Polarities shall be switched outside (i.e. on the input and output) of a closed loop system. Table 28 lists the IDNs used to adjust polarities.

Table 28 – Polarities IDNs

IDN	Description
S-0-0055	Position polarity parameter
S-0-0043	Velocity polarity parameter
S-0-0085	Torque polarity parameter

Following references shall be considerer when programming polarities:

- **Position loop:** The motor shaft turns clockwise when there is a positive position command difference and no inversion is programmed.
- **Velocity loop:** The motor shaft turns clockwise when there is a positive velocity command difference and no inversion is programmed.
- **Torque loop:** The motor shaft turns clockwise when there is a positive torque command difference and no inversion is programmed.

Figure 9 summarises the adjustment of polarities.

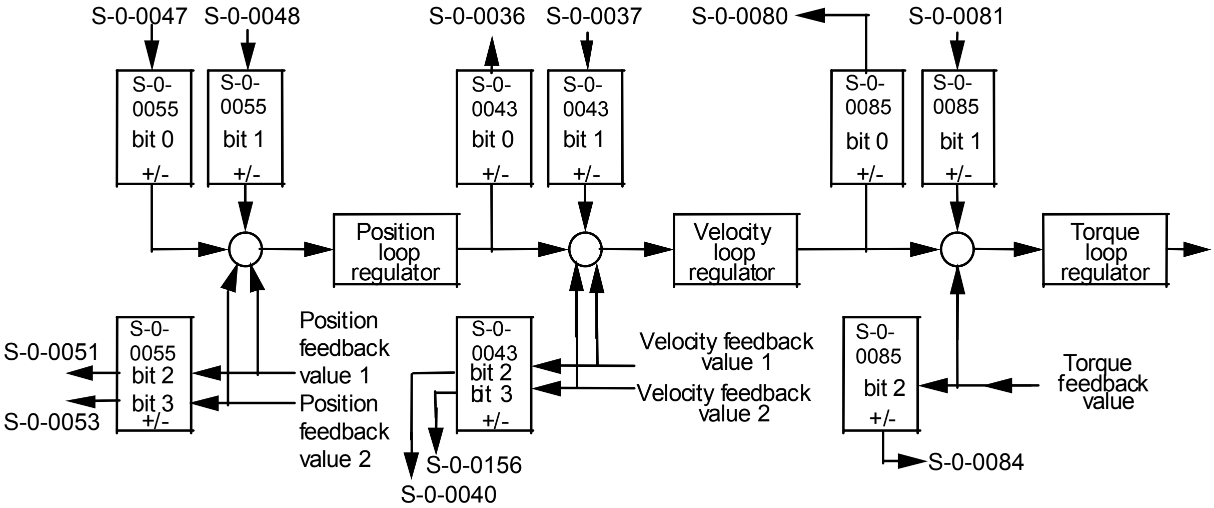


Figure 9 – Polarity parameter

7.4.5 Parameter sets and gear ratios

The number of parameters in a parameter set and the number of parameter sets for the drive shall be determined by the drive manufacturer. All data block numbers ranging from 0000 through 4095 may be defined in each parameter set as fixed IDNs (see Table 2 for the structure of IDNs.) according to constructor needs.

The standard and the product data range shall contain eight parameter sets each. Generally, the drive will work with the IDNs of parameter set 0. With the switch parameter set procedure command (S-0-0216), some (or all) of the parameters of parameter set 0 may be switched (e.g., the adaptation of the regulator on the changed inertia) depending on application.

IDN list (S-0-0219) shall contain all these switchable parameters that are listed in the IDN-lists S-X-0219 (X = 1 to 7). The switchable parameters shall be activated in the drive when a preselected parameter set (S-0-0217) is set by the switch parameter set procedure command (S-0-0216).

Since the parameter set number is contained in the structure of the IDN (see Table 2), the control unit has access to all IDNs via the service channel, independent of the actual parameter set. This enables the control unit to modify parameters in a parameter set which is off-line while another parameter set is running on-line. These modifications shall be accomplished through the service channel.

The switch parameter set procedure command (S-0-0216) shall also be valid for gear ratio switching. The demanded gear ratio shall be selected with S-0-0218 (only possible if the drive supports a gear changing function.)

Table 29 lists the IDNs used to adjust parameter sets and gear ratios.

Table 29 – Parameter sets and gear ratios IDNs

IDN	Description
S-0-0219	IDN-list of parameter set
S-0-0216	Switch parameter set procedure command
S-0-0217	Parameter set preselection
S-0-0218	Gear ratio preselection
S-0-0254	Actual parameter set
S-0-0255	Actual gear ratio

7.4.6 Switching of parameter sets and gear ratio

The following sequence (see Figure 10) shall be valid for the switching of parameter sets and gear ratio:

– write request for “parameter set preselection” (S-0-0217) and/or “gear ratio preselection” (S-0-0218);
– set and enable procedure command “switch parameter set” (S-0-0216);
– the procedure command is acknowledged positively when “parameter set preselection” (S-0-0217) or “gear ratio preselection” (S-0-0218) are equal to the “actual parameter set” (S-0-0254) or “actual gear ratio” (S-0-0255), respectively.
– cancel the procedure command.

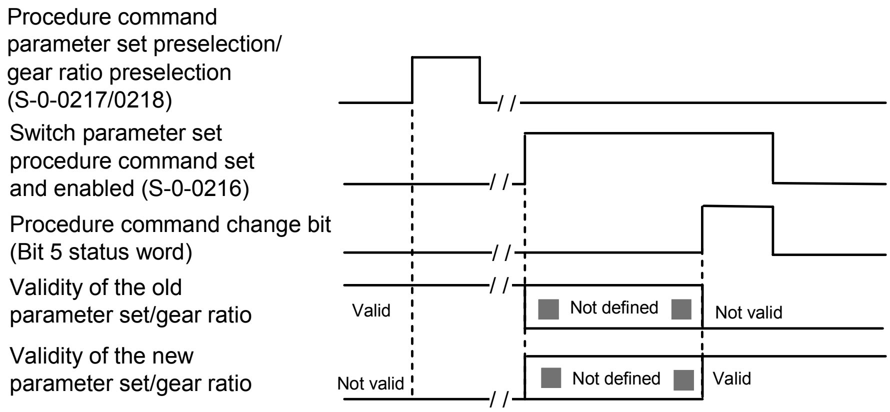


Figure 10 – Bit sequence for switching parameter sets and/or gear ratio

7.5 Drive operation modes

7.5.1 General

In a machine, several PDSs perform tasks which are coordinated by the control unit. Figure 11 shows only one of several PDSs. The coordinated command values are shown on the left side of Figure 11. In the current control structures, the closed control loops for torque, velocity, and position are cascaded. This example shows a cascaded structure where all relevant time constants decrease for underlying control circuits (at least by a factor of two to four).

The SERCOS interface is capable of handling all the operating modes shown in Figure 11, including:

a) only torque control in the PDSs;
b) velocity and torque control in the PDSs;
c) all closed control loops, including position control in the PDSs;
d) PDS controlled interpolation and positioning.

NOTE Velocity and torque control in the PDSs [b) above] corresponds to the concept of commonly used analogue interfaces.

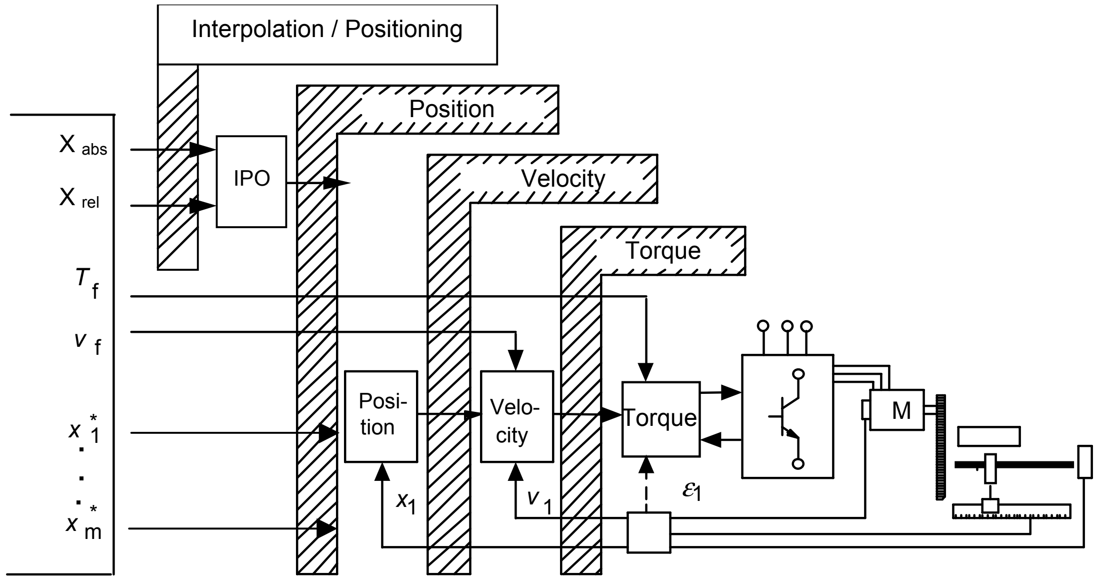


Figure 11 – Operation modes

In Figure 11 the abbreviations have following meanings:

- T_f: additive torque command value (feed forward);
- v_1: velocity feedback value of PDS 1;
- v_f: additive velocity command value (feed forward);
- x_1: position feedback value of PDS 1;
- x_1^*: position command value of PDS 1;
- x_m^*: position command value of PDS XX with data record m;
- x_{abs}: absolute position command value;
- x_{rel}: relative position command value;
- ε_1: rotor position of PDS 1.

A contouring control system with good dynamic properties and with minimum following distance can be created. The control unit can generate coordinated commands for position, velocity, and torque for all axes based on a dynamic path model. Since there is practically no limitation of resolution with digital data transmission, it is possible to put all closed control loops inside the PDSs. In this configuration, both position command values as well as feed forward signals for velocity and torque can be transmitted by the control unit.

If desired, different operating modes can be applied to different axes within one network. In addition, each axis can have a main operating mode and several secondary operating modes, which the control unit can toggle during operation.

PDSs which are equipped with a CP16/1 or CP16/2 interface do not need to be capable of all the operating modes mentioned above. The only requirement is to adequately document the particular mode of operation (or variation thereof) and the subset of variables and parameters supported by the appropriate components (see IEC 61800-7-304, 5.11 for compliance classes for the PDSs and control units).

7.5.2 Selection of the operation mode

The drive operation mode shall be set by the control word in the MDT. The control word allows the system to choose between one primary mode of operation and up to seven secondary modes of operation. The response to the active mode shall appear in the status word of the AT.

The drive shall generate the actual operating mode (drive status, bit 8, 9, 10) independently of the following conditions:

- Drive OFF
- Drive not enabled
- Drive controlled functions (see drive status, bit 3)
- Error of C1D

7.5.3 Switching of the operation mode

While switching the operation mode, the drive shall be given several communication cycles to acknowledge the switching in the status word. During the switching phase, the control unit needs to keep all cyclic command values current. After the drive acknowledges the switching in the status word, only the command values for the new operation mode need to be kept valid by the control unit.

Switching to an uninitialised operation mode shall result in an error message in the interface status (S-0-0014) generated by the drive.

The primary and secondary operation modes shall be individually defined in separate parameters. The drive modes of operation defined by these parameters shall become active when the operation mode is selected via bits 11, 9, and 8 in the control word of the MDT. If a drive supports secondary operation modes 4 through 7, it shall also support bit 11 in the control word and bit 10 in the drive status word. The activated operation mode shall be indicated by bits 10, 9 and 8 of the drive status in the AT.

Table 30 lists the IDNs used to switch operation modes.

Table 30 – Switching operation mode IDNs

IDN	Description
S-0-0032	Primary operation mode
S-0-0033	Secondary operation mode 1
S-0-0034	Secondary operation mode 2
S-0-0035	Secondary operation mode 3
S-0-0284	Secondary operation mode 4
S-0-0285	Secondary operation mode 5
S-0-0286	Secondary operation mode 6
S-0-0287	Secondary operation mode 7
S-0-0292	List of supported operation modes

The bit structure of the above-listed operation mode IDNs shall be as specified in Table 31

Table 31 – Structure of drive operation modes

Bit coding							Operation modes according to Bit coding
15	**14 to 10**	**9**	**8**	**7 to 4**	**3**	**2 to 0**	
1 = manufacturer operation mode 0 = SERCOS operation mode	Reserved	0 = without axis control word 1 = with axis control word (S-0-0520)	0 = without transition support 1 = with transition support	Expanded operation modes	0 = with following error 1 = without following error	Basic operation modes	
1	xxx xx	x	x	xxxx	x	xxx	Operation mode (bits 14 to 0) defined by manufacturer
0	000 00	0	0	0000	0	000	No mode of operation defined
0	000 00	0	0	0000	0	001	Torque control
0	000 00	0	0	0000	0	010	Velocity control
0	000 00	0	0/1	0000	0/1	011	Position control using position feedback value 1
0	000 00	0	0/1	0000	0/1	100	Position control using position feedback value 2
0	000 00	0	0/1	0000	0/1	101	Position control using position feedback values 1 and 2
0	000 00	1	0	0000	0	101	Position control using axis control word
0	000 00	0	0	0000	0	110	Pressure control
0	000 00	0	0	0000	0	111	Operating mode without control loops
0	000 00	0	0/1	0001	0/1	011	Interpolation using position feedback value 1
0	000 00	0	0/1	0001	0/1	100	Interpolation using position feedback value 2
0	000 00	0	0/1	0001	0/1	101	Interpolation using position feedback values 1 and 2
0	000 00	1	0	0001	0	101	Interpolation using axis control word
0	000 00	0	0/1	0010	0/1	011	Positioning using position feedback value 1
0	000 00	0	0/1	0010	0/1	100	Positioning using position feedback value 2
0	000 00	0	0/1	0010	0/1	101	Positioning using position feedback values 1 and 2
0	000 00	1	0	0010	0	101	Positioning using axis control word
0	000 00	0	0/1	0011	0/1	011	Block mode using position feedback value 1
0	000 00	0	0/1	0011	0/1	100	Block mode using position feedback value 2
0	000 00	0	0/1	0011	0/1	101	Block mode using position feedback value 1 and 2
0	000 00	1	0	0011	0	101	Block mode using axis control word
0	000 00	0	0	0100	0	010	Synchronous Operation with velocity control
0	000 00	0	0/1	0100	0/1	011	Synchronous Operation with position control using position feedback value 1
0	000 00	0	0/1	0100	0/1	100	Synchronous Operation with position control using position feedback value 2
0	000 00	0	0/1	0100	0/1	101	Synchronous Operation with position control using position feedback values 1 and 2
0	000 00	1	0	0100	0	101	Synchronous Operation with position control using axis control word

Bits 0, 1, and 2 shall select the basic operation modes. Bits 4, 5, 6 and 7 shall select expanded operation modes. Additional functions shall be activated via bits 3, 8 and 9. If bit 15 is set to "1", then the coding of bits 0 through 14, as well as the operation modes, shall be defined by the drive supplier.

Figure 12 presents the operation modes block diagram.

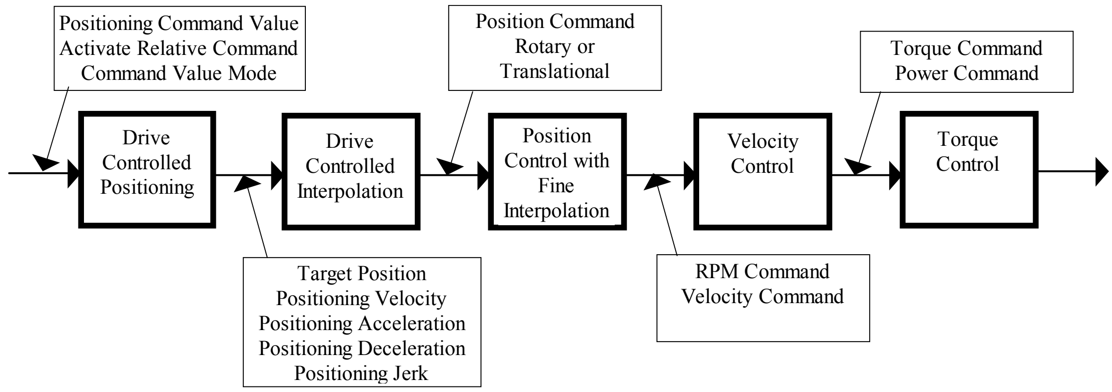


Figure 12 – Block diagram of operation modes

7.6 Homing

7.6.1 General

The homing procedure may either be controlled by the control unit or by the drive. There shall be procedure commands available for both possibilities.

7.6.2 Drive controlled homing procedure command

The following conditions shall be valid:

- The position feedback is connected to the drive and the actual position acquisition is done by the drive.
- The home switch is connected directly to the drive or to the control unit.

Before the control unit starts the drive controlled homing procedure by setting and enabling the procedure command S-0-0148, the control unit shall allocate the necessary control and status signals to real-time bits via the service channel.

Figure 13 illustrates the bit sequence for a drive controlled homing and shows the drive controlled homing diagram, whereas the signs of the position data depend on the machine configuration. During the period noted with a " * " in Figure 13, the control unit shall read the position command value (S-0-0047) from the drive.

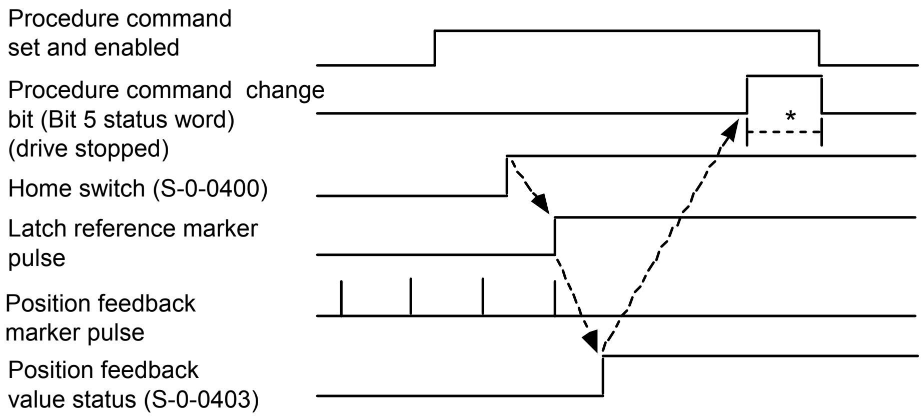


Figure 13 – Bit sequence for drive controlled homing

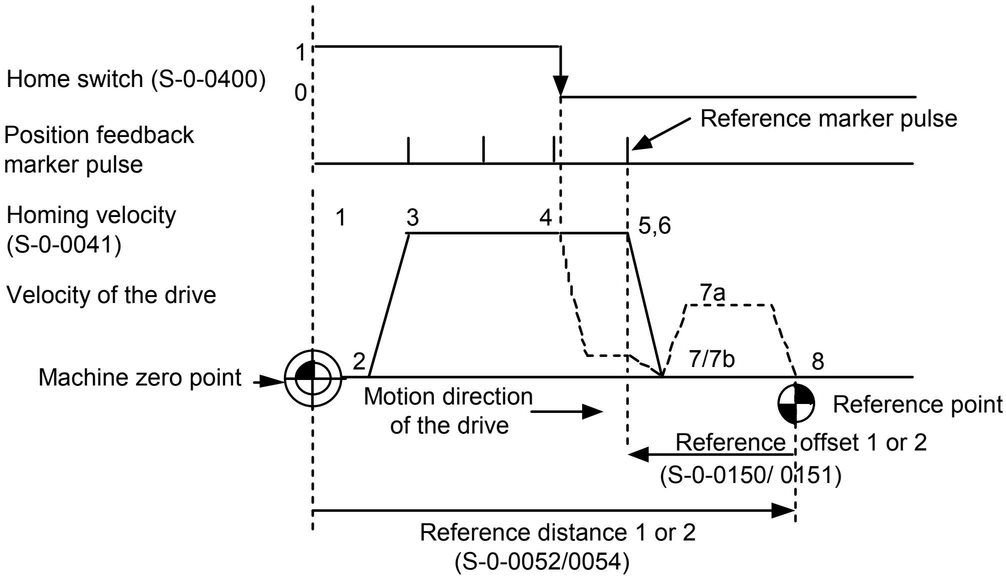


Figure 14 – Drive controlled homing diagram

In Figure 14, the following steps are illustrated, whereas the signs of the position data depend on the machine configuration:

1) The procedure command "drive controlled homing" (S-0-0148) is set and enabled.
2) Start-point of the drive not yet referenced to the machine zero point. The drive switches into internal position control and resets the bit "position feedback value status" (S-0-0403).
3) Taking the start direction into account, which is determined by the homing parameter (S-0-0147) and the Homing acceleration (S-0-0042), the drive accelerates to the homing velocity (S-0-0041).
4) Recognising the programmed signal change at the home switch (programmed by the homing parameter S-0-0147), the drive finds the next position feedback marker pulse of the feedback as the reference marker pulse. The drive may have an internal function for reducing the velocity after it has recognised the home switch signal change (dotted line in Figure 14). This function is not part of this part of IEC 61800-7.
5) The drive reduces the velocity to a standstill using the homing acceleration.
6) The recognition of the position feedback reference marker pulse in the drive leads to the setting of the position feedback value 1 or 2 (position feedback value 1 or 2 = reference distance 1 or 2 + reference offset 1 or 2 + distance to reference marker pulse). The signs of these position data shall be taken into account. As soon as the position feedback value 1 or 2 referenced to the machine zero point, is entered in the drive telegram, the drive sets the procedure command change bit (bit 5 in the status word, indicating that the drive controlled homing was executed properly).

The drive calculates a command value which equals the referenced position feedback value 1 or 2 and the control unit reads this position command value (S-0-0047) from the drive and sets its command value to this position.

7) Afterwards, the control unit cancels the procedure command and the drive follows the command values of the control unit. Depending on control unit functionality (manufacturer specific, not subject to this specification), two cases may be distinguished:
   a) the control unit automatically assigns a new position value to the drive in order to go through the reference offset 1 or 2 and to reach the reference point (dotted line in Figure 14);
   b) the control unit does not assign new position command values (i.e., the axis stops near the position feedback reference marker pulse) and later the control unit starts from that point.
8) Reference point of the axis. The control unit continues with the same procedure for all other drives.

7.6.3 Control unit controlled homing procedure command

7.6.3.1 General

For control unit controlled homing, three procedure commands shall be available:

– “control unit controlled homing” (S-0-0146);
– “calculate displacement” (S-0-0171);
– “displacement to the referenced system” (S-0-0172).

These commands may also be used partially, depending on application, for example if the control unit calculates the displacement and writes it to the drive.

7.6.3.2 Procedure command “control unit controlled homing”

For the correct operation of the procedure command (S-0-0146), the following assignments to real-time control and status bits shall be made:

– real-time control bit: homing enable (S-0-0407);
– real-time status bit: reference marker pulse registered (S-0-0408).

If the home switch is connected to the drive, the following additional allocation to the other real-time status bit is necessary:

– real-time status bit: home switch (S-0-0400).

These allocations to the other real-time status bit shall be made before the procedure command is started and shall be checkable by the drive.

For control unit controlled homing, three cases shall be distinguished:

Case 1 (Figure 15): the home switch is connected to the control unit; the drive only evaluates the “homing enable” signal.

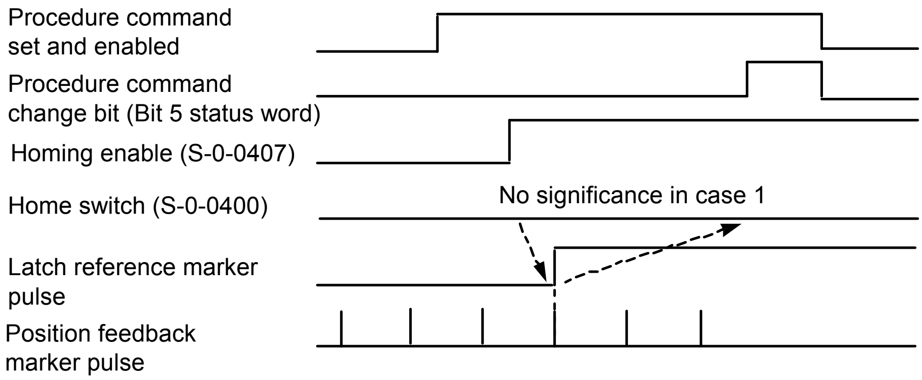


Figure 15 – Bit sequence for control unit controlled homing (case 1)

Case 2: the home switch is connected to the drive.

Case 2.1 (Figure 16): the drive signals the home switch (S-0-0400) to the control unit via the real-time status bit 2.

The control unit shall set the homing enable (S-0-0407) via the real-time control bit. The drive shall evaluate homing enable (S-0-0407) only.

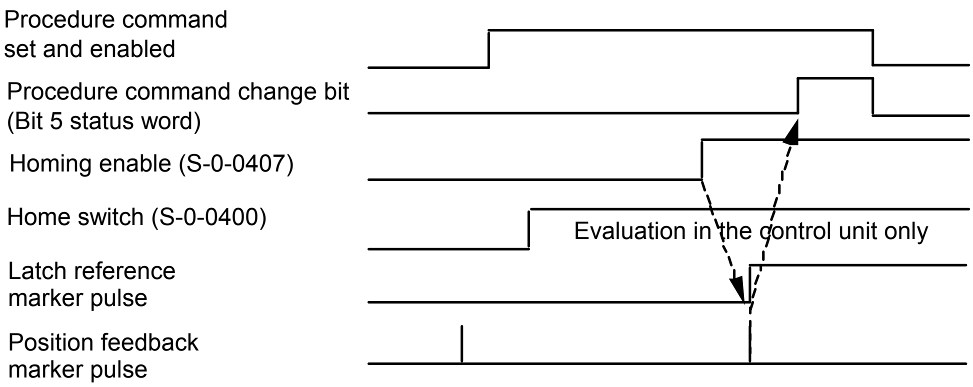


Figure 16 – Bit sequence for control unit controlled homing (case 2.1)

Case 2.2 (Figure 17): The drive signals the home switch (S-0-0400) to the control unit via the real-time status bit 2.

The control unit shall set the homing enable (S-0-0407) via the real-time control bit. The drive shall evaluate the homing enable (S-0-0407) and the home switch (S-0-0400).

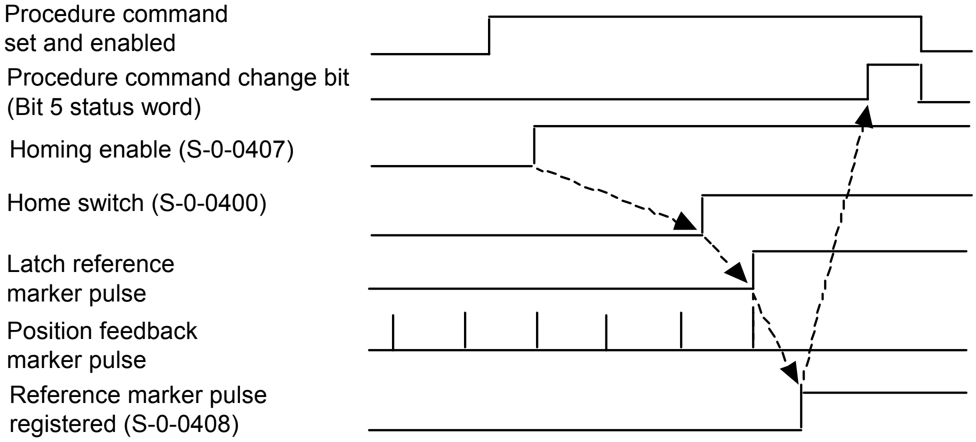


Figure 17 – Bit sequence for control unit controlled homing (case 2.2)

The programmed function shall be recognised by the drive by the homing parameter (S-0-0147).

7.6.3.3 Procedure command "calculate displacement"

To calculate the displacement between the old and the new feedback system (which is referenced to the machine zero point), two methods shall be applicable:

a) The drive calculates the displacement via the procedure command "calculate displacement" (S-0-0171).
   1) The control unit starts and enables the procedure command "calculate displacement".
   2) The drive calculates the distance from the machine zero point.
      i) For incremental feedback: distance from machine zero point = reference distance 1 or 2 (S-0-0052/0054) + reference offset 1 or 2 (S-0-0150/0151) (the signs depend on the machine configuration).
      ii) For distance-coded marker pulses: distance from machine zero point is calculated by means of marker position A (S-0-0173), marker position B (S-0-0174) and the absolute distance 1 or 2 (S-0-0177/0178).
   3) The drive calculates the distance between the machine zero point and the zero point of the unreferenced drive by the following formula (observing the signs): Displacement 1 or 2 = distance from machine zero point - marker position A (S-0-0173). The result is stored in the displacement parameter 1 or 2 (S-0-0175/0176) and is valid for incremental and distance-coded feedback systems.
   4) The drive acknowledges the procedure command positively as soon as the displacement is calculated and stored.
   5) The control unit reads the displacement parameter 1 or 2 from the drive to set the command value to the referenced system.
   6) The control unit cancels the procedure command "calculate displacement".
b) The control unit calculates the displacement.
   1) The control unit reads the data out of the drive which are necessary for the calculation (see a).
   2) The control unit calculates the displacement 1 or 2 = distance from machine zero point - marker position A (S-0-0173).
   3) The control unit writes the displacement parameter 1 or 2 (S-0-0175/0176) to the drive.

Figure 18 and Figure 19 illustrate the two ways to calculate displacement, whereas the signs of the position data depend on the machine configuration.

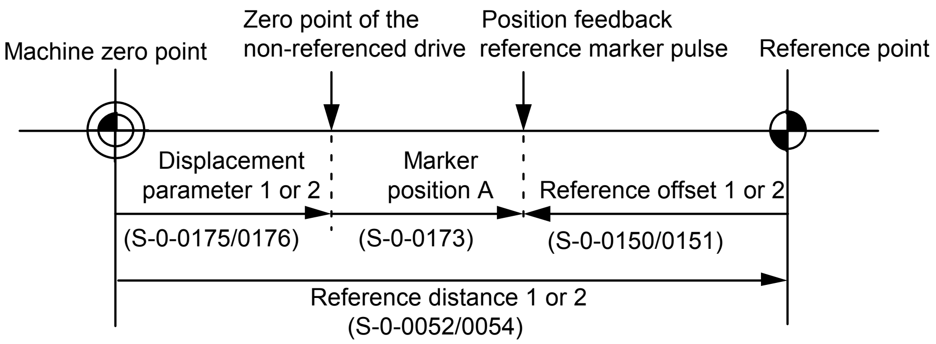


Figure 18 – Incremental feedback system

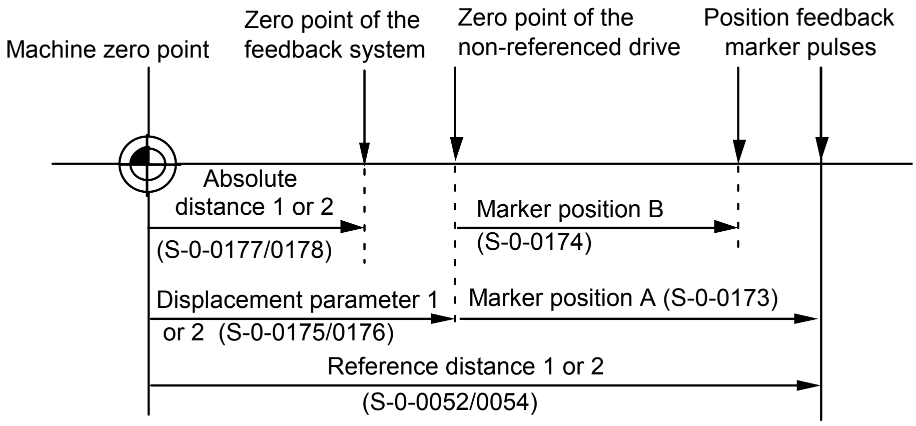


Figure 19 – Distance-coded feedback system

7.6.3.4 Procedure command "displacement to the referenced system"

For the correct operation of the procedure command "displacement to the referenced system" (S-0-0172), the following assignments of real-time bits are necessary:

- real-time control bit: position command value status (S-0-0404);
- real-time status bit: position feedback value status (S-0-0403).

Simultaneous to the setting of the real-time control bit (position command value status), the position command values shall be switched to the referenced system. Simultaneous to entering the referenced feedback values 1 or 2 in the AT, the position feedback value status (S-0-0403) shall be set via the real-time status bit known in the control unit (the position feedback values are referred to the reference point). When both bits are set, the drive shall acknowledge the procedure command positively. The sequence (see Figure 20) in which the bits shall be set is not fixed.

Position command value status shall be set by the control unit independently from the operation mode.

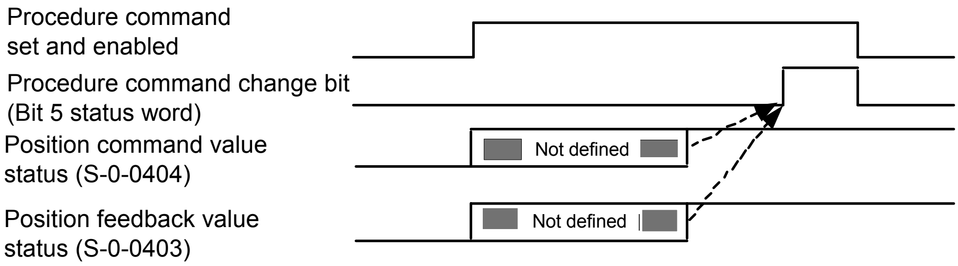


Figure 20 – Bit sequence to activate the displacement to the referenced system

7.7 Measurements

To activate the function "measuring via probe", the procedure command "probing cycle" (S-0-0170) shall be available. With this procedure command, single probing shall be possible as well as multiple probing (using real-time bits).

Setting and enabling the procedure command shall activate the function "measuring" in the drive (see Figure 21). The drive shall signal this by setting the procedure command acknowledgment (data status) to "procedure command set, enabled, and not yet executed". An acknowledgment "procedure command executed correctly" shall not be set. That means that the procedure command change bit shall be set only in the case of an error.

Using the "probe control parameter" (S-0-0169), specific edges of probe 1 and 2 may be selected as needed. The measuring shall be enabled using the signals "probe 1 or 2 enable" (S-0-0405/0406).

With the appearance of a selected edge at the probe, the drive shall store the position feedback value, which is assigned to the appropriate edge, in the parameters S-0-0130 to S-0-0133 (probe value 1 or 2, positive or negative edge), and set the corresponding bit in the probe status (S-0-0179). The status bits in the probe status shall be separately addressable by IDNs S-0-0409 to S-0-0412 (probe 1 or 2 latched) and therefore may be allocated to real-time status bits for this measuring.

With the appearance of an active edge, the operation of an equivalent edge shall be disabled. This disabling shall be cancelled by resetting the procedure command "probe 1 or 2 enable" (S-0-0405/0406). With the following setting of the procedure command "probe 1 or 2 enable" (Figure 21), the measuring shall be enabled again.

NOTE 1 Selection of probe 1 or 2 and the active edge via the probe control parameter IDN S-0-0169.

NOTE 2 The active probe status 1 or 2, positive or negative edge, shall appear in IDN S-0-0179. These bits shall be assigned to IDN S-0-0409 to S-0-0412.

NOTE 3 Within this period, the probe value 1 or 2, positive or negative edge (IDN S-0-0130 to S-0-0133) shall be normally read.

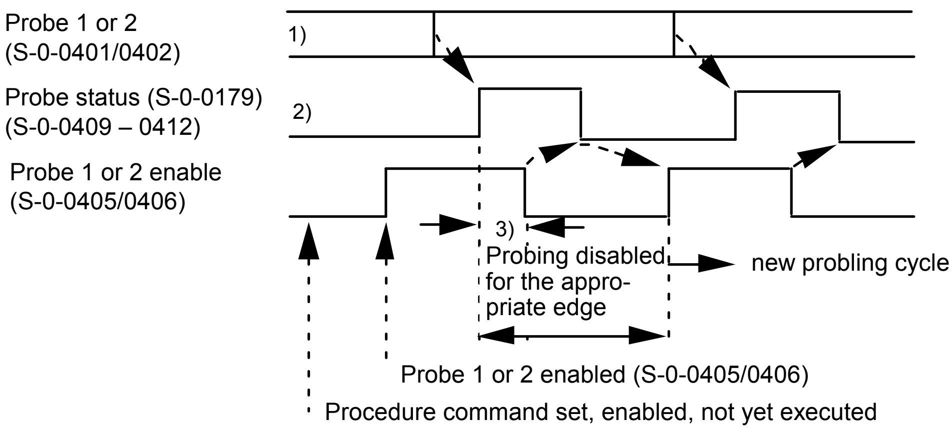


Figure 21 – Bit sequence for measuring

7.8 Position spindle procedure command

7.8.1 General

The position spindle procedure command (S-0-0152) shall be used to position a spindle at an absolute angle position or to rotate a spindle at a relative offset (i.e., a defined angle).

The function shall be activated in the drive by setting and enabling the procedure command. The drive shall signal the activation by setting the procedure command acknowledgment (data status) to "procedure command set, enabled, and not yet executed". An acknowledgment "procedure command executed" shall not be set. This means that the procedure command change bit shall only be set in case of an error.

The mode of positioning the spindle shall be stored in the "spindle positioning parameter" (S-0-0154). This parameter shall define whether the spindle is driven into the position clockwise, counter clockwise or in the shortest way. Additionally, it shall define whether the positioning shall be executed absolutely or relatively.

7.8.2 Spindle Positioning when the function is started

7.8.2.1 Velocity feedback value > spindle positioning speed

When the procedure command "position spindle" is activated and the velocity feedback value of the drive at that moment is greater than the spindle positioning speed (S-0-0222), the drive shall slow down to the spindle positioning speed and then start the positioning (see Figure 22).

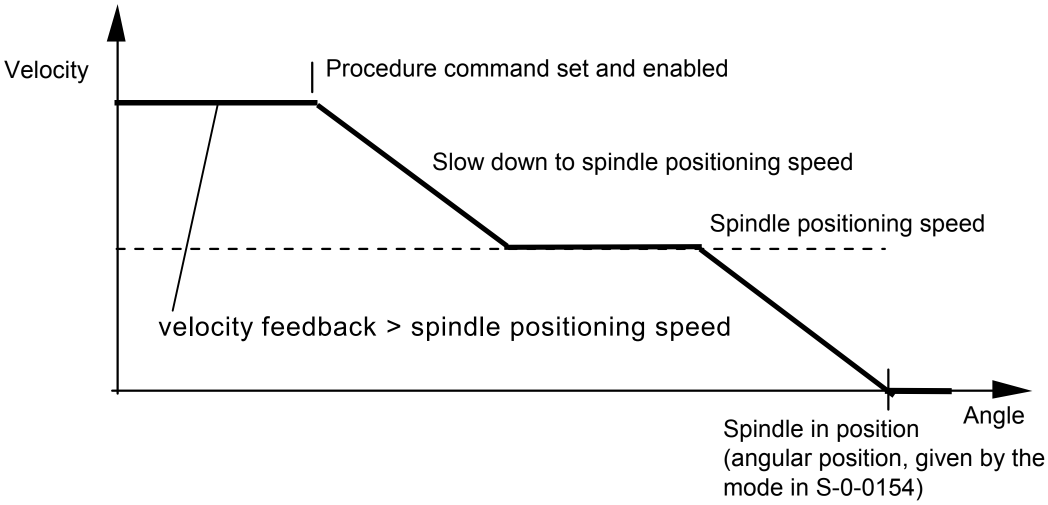


Figure 22 – Velocity diagram for spindle positioning (1)

7.8.2.2 Velocity feedback value ≤ spindle positioning speed

When the velocity feedback value is equal to or less than the spindle positioning speed (S-0-0222), the drive shall switch into internal position control and position the spindle to the absolute angle defined by IDN S-0-0153, taking the spindle positioning parameter (S-0-0154) into account (see Figure 23).

NOTE For 7.8.2.1 and 7.8.2.2: the covered distance is undefined because the start-point of the motion is not defined. Bit 2 of S-0-0154 can only be 0.

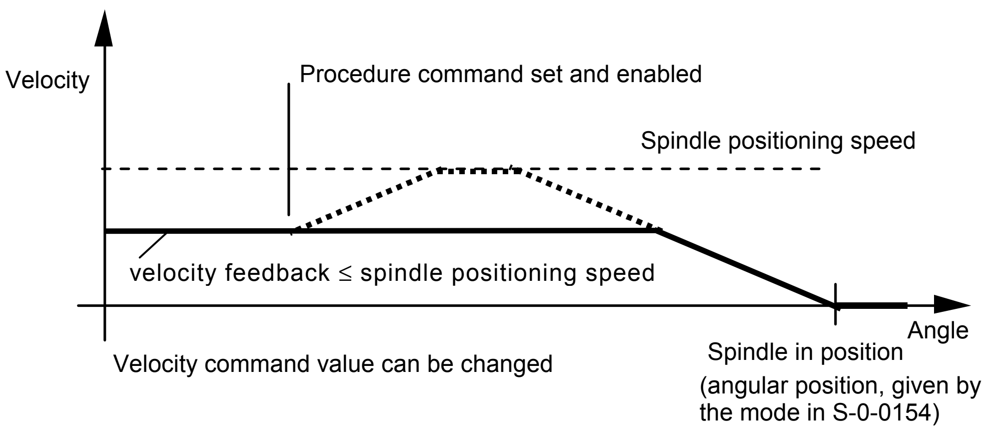


Figure 23 – Velocity diagram for spindle positioning (2)

7.8.2.3 Velocity feedback value = 0

When the procedure command "position spindle" is activated while the drive is stopped, the drive shall:

- position the spindle to the absolute Spindle angle position (S-0-0153), taking the spindle positioning parameter (S-0-0154), the acceleration parameters and the maximum spindle positioning speed (S-0-0222) into account.

- or drive a relative spindle relative offset (S-0-0180) (also defined by the spindle positioning parameter). See Figure 24.

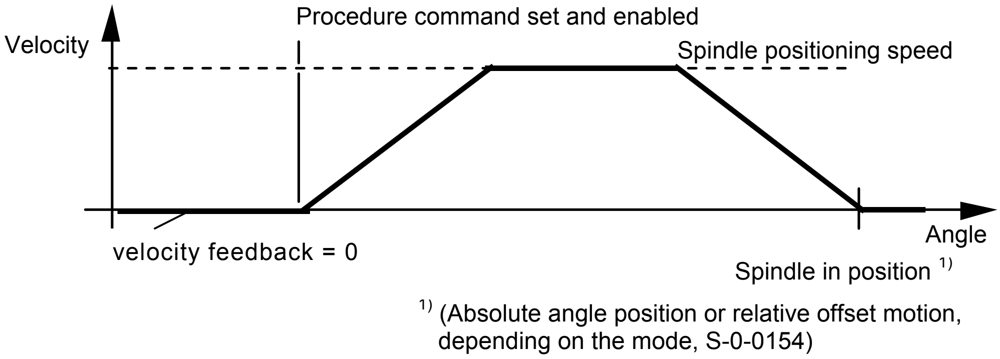


Figure 24 – Velocity diagram for spindle positioning (3)

7.8.3 New position values while the procedure command is active

While the procedure command "position spindle" (S-0-0152) is activated by the control unit, the drive shall stay in internal position control and execute every new (absolute) spindle angle position (S-0-0153), or respectively drive every new spindle relative offset (S-0-0180) as long as the positioning mode angle position/relative offset is not changed by writing the spindle positioning parameter (S-0-0154). The values of a spindle relative offset shall be accumulated each time a new relative offset value is written via IDN S-0-0180.

When a new spindle position is taken over and acknowledged by resetting the busy bit, the status "in position" (S-0-0336), respectively in the C3D (S-0-0013), shall be valid for the new position (see Figure 25).

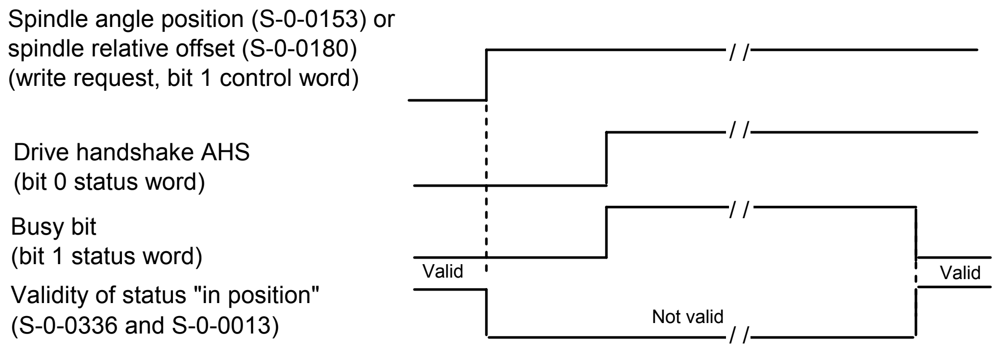


Figure 25 – Bit sequence while writing new position values (S-0-0153 or S-0-0180)

7.8.4 Switching the positioning mode angle position/relative offset while the procedure command is active

Switching of the positioning mode from angular with spindle angle positions (S-0-0153) to relative with values for spindle relative offset (S-0-0180) or vice versa while the procedure command "position spindle" (S-0-0152) is active shall be initiated by writing the spindle positioning parameter (S-0-0154) and shall not be valid before a new position value is written. The old "in position" status shall be valid until the write request for a new position command value is given (see Figure 26).

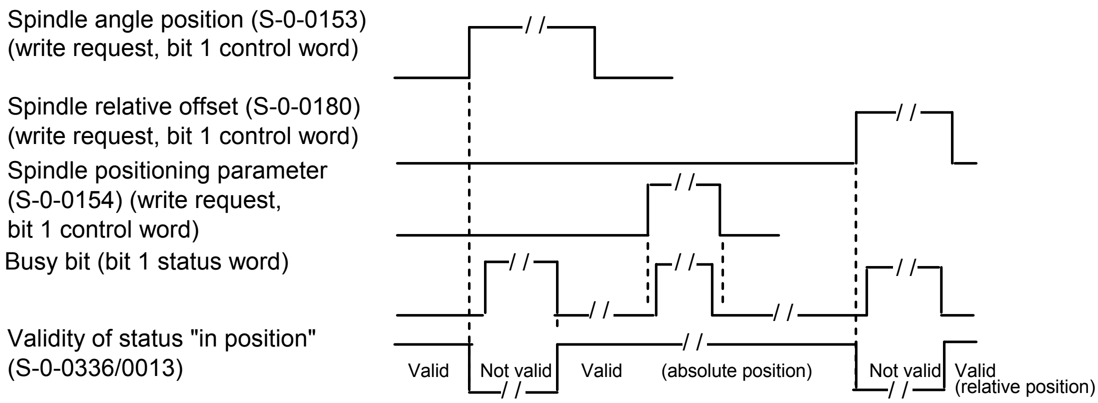


Figure 26 – Bit sequence for switching spindle positioning mode

7.9 Velocity window

Table 32 shows the IDNs necessary to work with the velocity window.

Table 32 – Velocity window IDNs

IDN	Description
S-0-0036	Velocity command value
S-0-0040	Velocity feedback value 1
S-0-0156	Velocity feedback value 2
S-0-0157	Velocity window
S-0-0272	Velocity window percentage
S-0-0330	Status "$n_{feedback} = n_{command}$"

The “velocity window” relates the current velocity to the velocity command value (S-0-0036). If the current velocity feedback value falls within the calculated velocity window, the drive shall set the status "$n_{feedback} = n_{command}$" (see Figure 27).

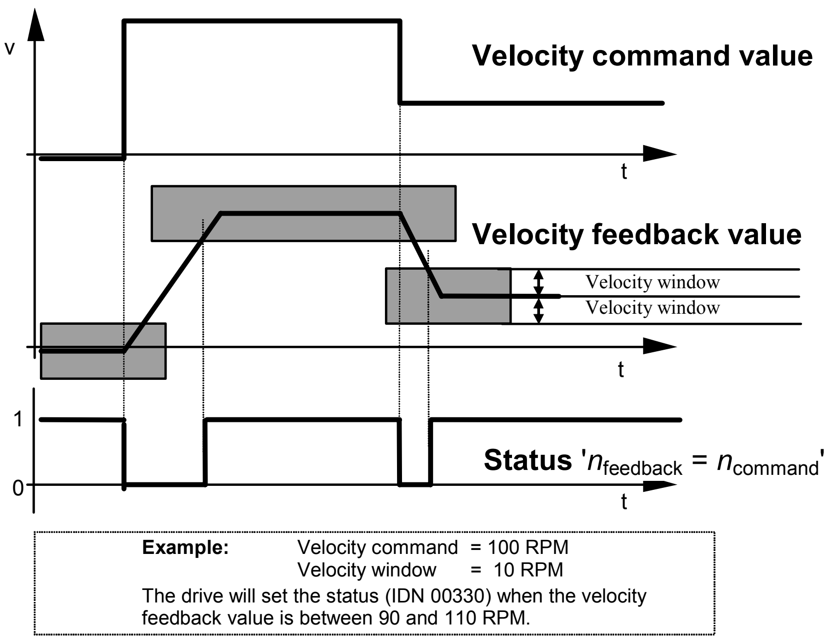


Figure 27 – Velocity window

The velocity window percentage shall refer to a percentage of the “Velocity command value” (S-0-0036). If the current velocity feedback value is found to be within a window of the velocity command defined by this percentage, the drive shall set the status "n_{feedback} = n_{command}" (see Figure 28).

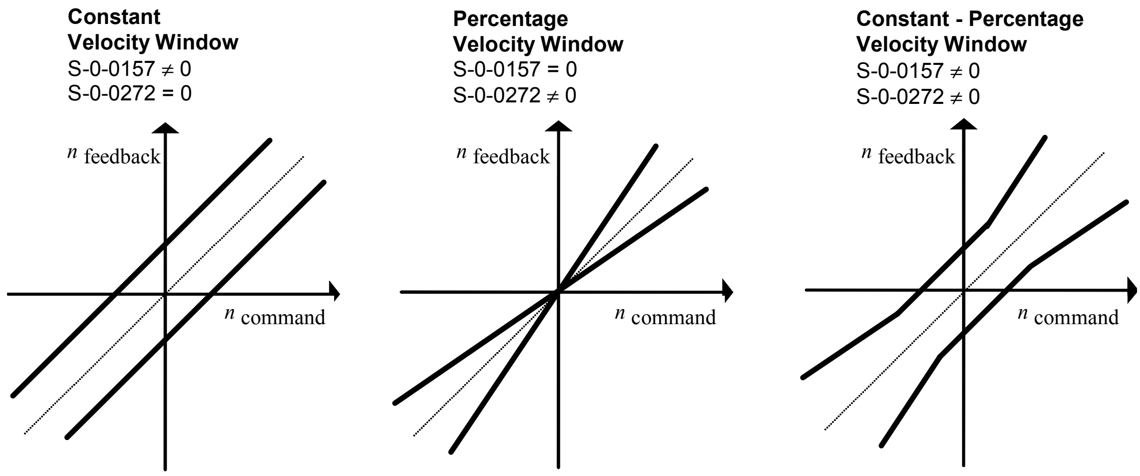


Figure 28 – n_{feedback} = n_{command} depiction

The IDN S-0-0330 shall allow the status “n_{feedback} = n_{command}” to be assigned to a real-time status bit (see S-0-0305). The status “n_{feedback} = n_{command}” shall be defined as a C3D bit (S-0-0013) and be set when the current velocity feedback value (S-0-0040 or S-0-0156) lies within the calculated command value for the velocity window (S-0-0157 and/or S-0-0272), which shall be based upon the velocity command value (S-0-0036).

Calculation of "n_{feedback} = n_{command}":

$| n_{\text{feedback}} - n_{\text{command}} | \leq | n_{\text{command}} | \times$ S-0-0272 + S-0-0157

7.10 Position switches

7.10.1 General

The position switches shall make it possible to generate a position switch flag at programmed positions referred on the position feedback value in the drive.

Two functions shall be specified:

- Position switch mode is used at limited position ranges without modulo function.
- Cam switch mode is used at limited position ranges and continuous moving axes.

The cam switch mode shall include the position switch mode and additional parameters. Table 33 shows the IDNs necessary to work with the velocity window.

Table 33 – Position switches IDN

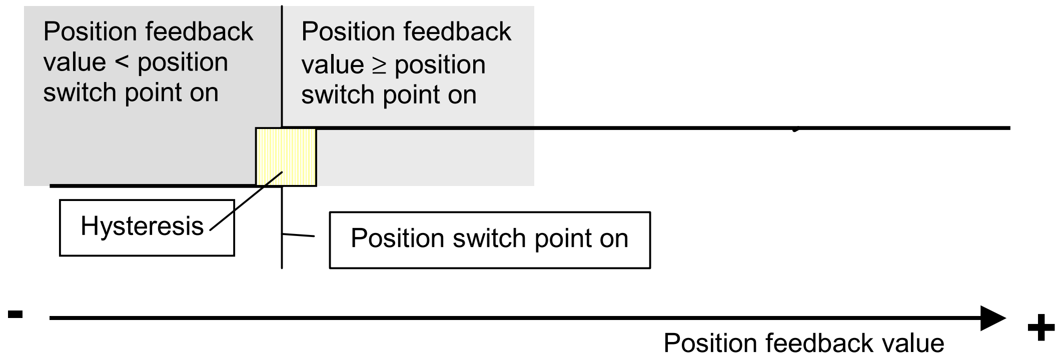
IDN	Description
	Position switch mode
S-0-0059	Position switch flag
S-0-0060 to S-0-0075	Position switch points on 1 to 16
S-0-0477	Position switch hysteresis
	Cam switch mode (additional parameters)
S-0-0460 to S-0-0475	Position switch points off 1 to 16
S-0-0476	Position switch control

7.10.2 Position switch mode

The position switch mode shall consist of a “position switch point on” (S-0-0060 to S-0-0075) and a position switch flag (S-0-0059). If the position feedback value is less than the position switch point on, the appropriate position switch flag shall be set to 0. If the position feedback value is equal to or greater than the position switch point on, the appropriate position switch flag shall be set to 1. The sequence is shown in Figure 29.

The hysteresis (S-0-0477) shall have effect on all position switch points on (S-0-0060 to S-0-0075) and shall be taken into account, at which the flags (S-0-0059) switch on and off.

In the position switch mode, the function of the related bit shall be deactivated, if the corresponding bit (bit 0 to 15) in the position switch control is set to 0.



Position switch mode with absolute format

Figure 29 – Position switch mode

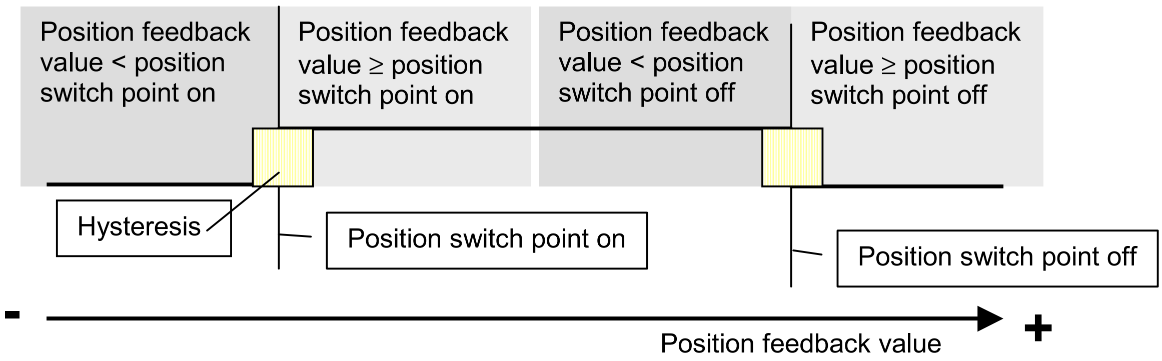
7.10.3 Cam switch mode

The cam switch mode shall consist of the position switch mode, the **position switch point off** and a position switch control (S-0-0476). If the position feedback value is less than the position switch point off, the appropriate position switch flag shall be set to 1. If the position feedback value is equal to or greater than the position switch point off, the appropriate position switch flag shall be set to 0. The sequence is shown in Figure 30.

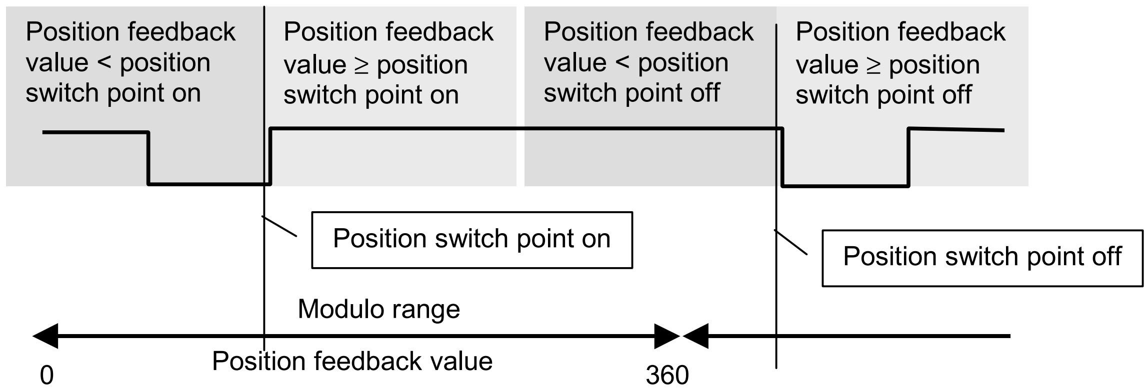
The hysteresis (S-0-0477) shall have effect on all position switch points off (S-0-0460 to S-0-0475) and shall be taken into account, at which the flags (S-0-0059) switch on and off.

In cam switch mode, the function of the related bit shall be deactivated if the corresponding bit (bit 0 to 15) in the position switch control is set to 0.

The adjusting in the S-0-0476, bits 16 to 31 shall define the position switch mode or cam switch mode. In cam switch mode, the position switch points on (S 0-0060 to S 0-0075) and position switch points off (S 0-0460 to S 0-0475) shall be necessary.



Cam switch mode with absolute format



Cam switch mode with modulo format (example 360°)

Figure 30 – Cam switch mode

7.11 PDS state machine control

7.11.1 Control and status word

The control unit shall command the PDS state machine by setting the appropriate bits in the control word of that PDS (see Table 34).

The PDS shall acknowledge these commands and inform the control unit on its state by setting the appropriate bits in its status word (see Table 35).

Table 34 – Control word

Bit No.	Value	Control word description
15 to 13		
	111	Drive should follow command values
15 (MSB)		Drive ON/OFF
	1→0	Drive OFF: when changing from 1 to 0: the "maximum drive off delay time“ (S-0-0273) is started, drive is decelerated as best as possible limited by the “emergency stop deceleration“ (S-0-0429), followed by disabling of the torque at n_{min}, after the “drive off delay time“ (S-0-0207). The power stage can remain in an activated state (only possible when bit 14 = 1). After the "maximum drive off delay time“ (S-0-0273) is elapsed, the locking of brake is initiated and the torque is disabled.
	0→1	Drive ON: when changing from 0 to 1, drive follows the command values of the control unit after the drive on delay time (S-0-0206).
14		Enable drive
	1→0	Not enabled: when changing from 1 to 0, torque is immediately disabled and the power stage pulses are blocked (independent of bits 15 and 13).
	0→1	Enable Drive: when changing from 0 to 1, the enable is delayed in the drive by the drive enable delay time (S-0-0295). The enable delay is required at use of a contactor in the motor cable.
13		Halt/restart drive (may be used to stop the drive regardless of the presently active control unit function)
	1→0	Halt drive: when changing from 1 to 0, if drive internal interpolator is inactive, drive is halted according to the “drive halt acceleration bipolar“ parameter (S-0-0372) and the control loop remains closed (only possible when bits 15 and 14 are set to 1); if drive internal interpolator is active, drive is halted according to the active parameters of the interpolator and the control loop remains closed (only possible when bits 15 and 14 are set to 1).
	0→1	Restart drive: when changing from 0 to 1, if drive internal interpolator is inactive, original function is continued. Only in velocity control the drive shall use the “drive halt acceleration bipolar“ (S-0-0372). In position control, the control unit shall set the position command value to the position feedback value before bit 13 is set; if drive internal interpolator is active, original function is continued maintaining the active parameters of the interpolator.
12		Reserved
10		IPOSYNC: Control unit synchronisation bit
	0/1	This bit is initially set to 0. It becomes valid in CP3 and shall remain valid during drive-controlled functions. This bit is toggled with the control unit cycle time (t_{Ncyc}) indicating the update of the command values (function: used to synchronise the interpolation in the control unit with the fine interpolator in the drive).
11, 9, 8		Operation mode
	000	Primary operation mode (defined by operation data S-0-0032).
	001	Secondary operation mode 1 (defined by operation data S-0-0033)
	010	Secondary operation mode 2 (defined by operation data S-0-0034)
	011	Secondary operation mode 3 (defined by operation data S-0-0035)
	100	Secondary operation mode 4 (defined by operation data S-0-0284)
	101	Secondary operation mode 5 (defined by operation data S-0-0285)
	110	Secondary operation mode 6 (defined by operation data S-0-0286)
	111	Secondary operation mode 7 (defined by operation data S-0-0287)
7 to 0		Reserved for communication

Table 35 – Status word

Bit No.	Value	Status word description
15, 14		“Ready to operate”
	00	Drive not ready, internal checks not yet concluded successfully
	01	Drive logic ready for main power on (power stage section)
	10	Drive ready and main power applied, drive is free of torque, power stage pulses are blocked
	11	Drive ready to operate, “enable drive” is set and active. Power stage is active
13		Drive shut-down error in C1D (see S-0-0011)
	0	No shut-down
	1	Drive is shut-down due to error
12		Change bit for C2D (see S-0-0012)
	0	No change
	1	Change
11		Change bit for C3D (S-0-0013)
	0	No change
	1	Change
10, 9, 8		Actual operation mode
	000	Primary operation mode (defined by S-0-0032)
	001	Secondary operation mode 1 (defined by S-0-0033)
	010	Secondary operation mode 2 (defined by S-0-0034)
	011	Secondary operation mode 3 (defined by S-0-0035)
	100	Secondary operation mode 4 (defined by S-0-0284)
	101	Secondary operation mode 5 (defined by S-0-0285)
	110	Secondary operation mode 6 (defined by S-0-0286)
	111	Secondary operation mode 7 (defined by S-0-0287)
7, 6		Real-time status bits 2 (S-0-0306) and 1 (S-0-0304); see IEC 61800-7-304, 5.7
5		Procedure command change bit (see IEC 61158)
	0	No change in procedure command acknowledgement
	1	Changing procedure command acknowledgment
4		Reserved
3		Status command value processing
	0	Drive ignores the command values (e.g. during Halt drive, drive controlled functions or programmed delay times)
	1	Drive follows the command values
2 to 0		Reserved for communication

7.11.2 Starting/stopping functions (State machine)

7.11.2.1 General

The following sequences (see Figure 31, Figure 32 and Figure 33) illustrate the use of the bits 13 to 15 in the control word and the bits 14 to 15 in the status word for the starting and stopping functions.

7.11.2.2 Start-up

a) Control voltage “on”:

   1) power supplied to control unit and drive(s); initialisation of control unit and drive(s);

2) establishing the communication.

b) As long as drive-internal computations are not finished, the drive sends the status “not ready for power up” bits 14 and 15 = 0, status word.

c) The drive sends the status “ready for main power on”; (bit 14 =1, bit 15 = 0, status word). No error in C1D, (S-0-0011).

d) The main power for the drive(s) is turned on.

e) Drive is ready and free of torque (bit 14 = 0, bit 15 = 1, status word). The master may set “enable drive” and “drive on”.

f) Master issues “enable drive” (bit 14 = 1, control word). The “drive enable delay time” (S-0-0295) is started.

g) Master issues “drive on” (bit 15 = 1, control word).

h) "Drive enable delay time" (S-0-0295) is elapsed and “drive on” is set (bit 15 = 1, control word) and torque is active. Drive signals “ready to operate” (bit 14 = 1, status word) and the “drive on delay time” (S-0-0206) is started.

i) The “drive on delay time” (S-0-0206) is elapsed. The drive sets "status command value processing" (bit 3 = 1, status word) and follows the command values of the control unit.

Figure 31 shows the bit sequence during start-up sequence.

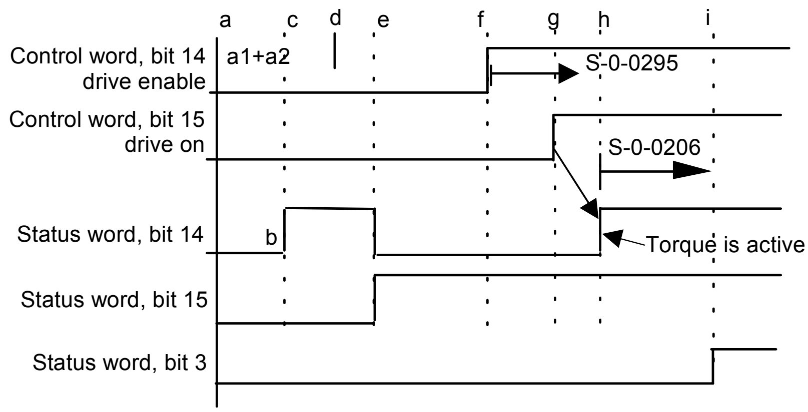


Figure 31 – Bit sequence during start-up

7.11.2.3 Shut-down

7.11.2.3.1 Case 1: Normal situation

a) The drive follows the command values of the control unit.

b) The master issues “drive off” (bit 15 = 0, control word). The drive is halted in the best possible manner.

c) n_{min} is reached inside the maximum drive off delay time (S-0-0273) and “drive off delay time“ (S-0-0207) is started: the drive is halted with torque until “drive off delay time“ (S-0-0207) is elapsed.

d) The drive disables torque and sends the status “free of torque” (bit 14 = 0, status word).

e) The master resets bit 14 to “not enabled” (bit 14 = 0, control word).

f) Main power is turned off.

g) The drive sends the status “ready for main power on” (bit 14 = 1, bit 15 = 0, status word).

7.11.2.3.2 Case 2: Error situation

a) The drive follows the command values of the control unit.

b) The master issues “drive off” (bit 15 = 0, control word). The drive is halted in the best possible manner.

c) n_{min} is not reached inside the maximum drive off delay time (S-0-0273). The break is locked if the maximum drive off delay time (S-0-0273) is elapsed. The drive disables the torque (bit 14 = 0, status word). Note: The drive is halted with break only.

d) Reaching n_{min} is no longer relevant.

e) The master resets bit 14 to “not enabled” (bit 14 = 0, control word).

f) Main power is turned off.

g) The drive sends the status “ready for main power on” (bit 14 = 1, bit 15 = 0, status word).

Figure 32 shows the two cases of shut-down sequences.

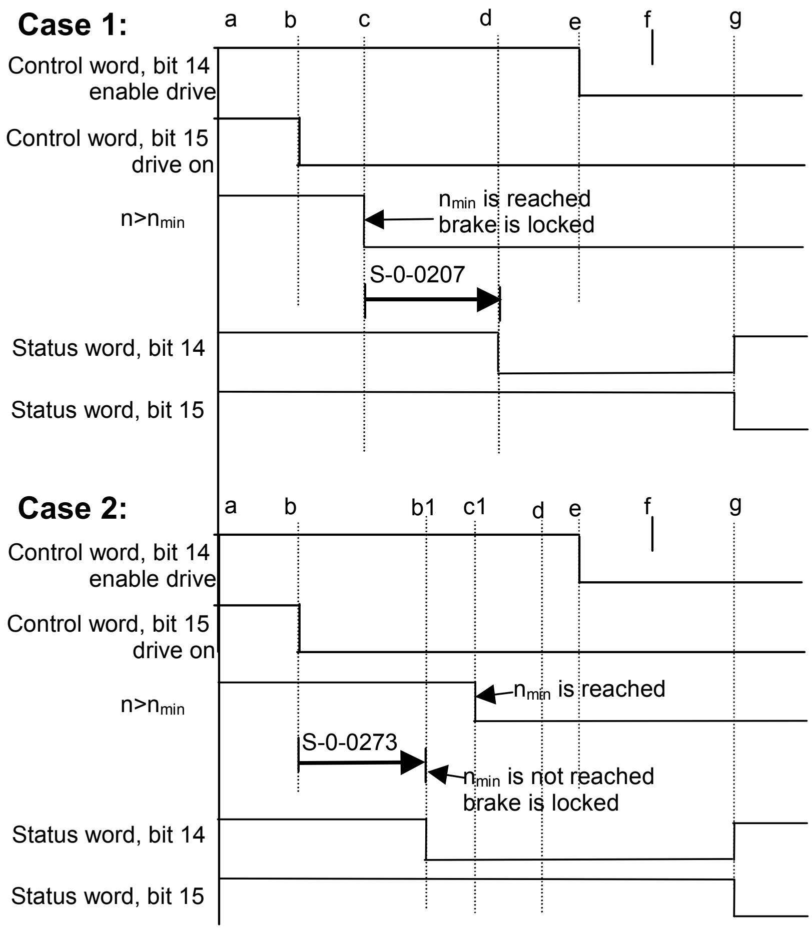


Figure 32 – Bit sequence during shut-down

7.11.2.3.3 Shut-down due to error

This shall be done by the drive when an error of C1D occurs.

a) The drive follows the command values of the control unit.

b) The drive has recognised an error and sends the status “drive shut-down, error in C1D” (bit 13 = 1, status word) and ignores the cyclic command values (bit 3 = 0, status word). The drive is halted in the best possible manner. The actual status of the drive after shut-down is sent back to the control unit with the state of bits 14 and 15, status word.

c) The drive has stopped and disables the torque.

d) Before turning on power again, the drive shut-down shall be cancelled via “reset class 1 diagnostic” (S-0-0099). After this, bit 15 of the control word shall be in the 0 state.

e) The master issues “drive on” (bit 15 = 1, control word).

Figure 33 shows the shut-down due to error bit sequence.

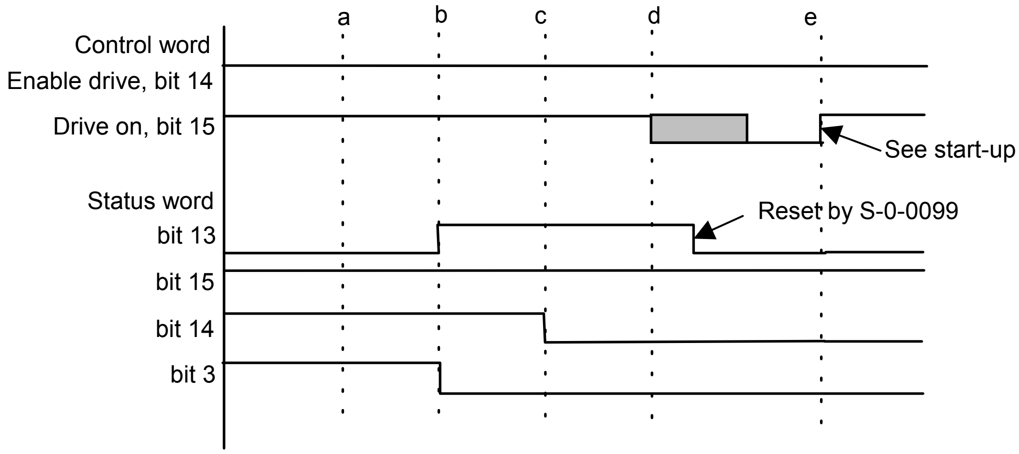


Figure 33 – Bit sequence for C1D error

7.12 Park axis procedure command

The following sequence (see Figure 34) shall be valid for the park axis procedure command (S-0-0139).

a) The park axis procedure command (S-0-0139) is set and enabled by the control unit via the service channel.

b) In the drive, the monitoring of the feedback system (e.g., position window) is shut-down.

c) Afterwards, the position feedback value status is reset in the drive and the procedure command change bit is set by the drive. This is the indication to the control unit that the procedure command is executed.

d) The drive is now able to perform other functions.

e) The procedure command is cancelled. This reactivates monitoring.

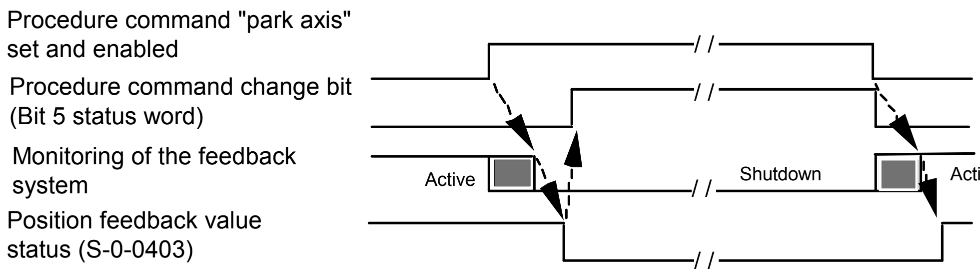


Figure 34 – Bit sequence for park axis

7.13 Positive stop drive procedure command

The following sequence (see Figure 35) shall be valid for the procedure command positive stop drive (S-0-0149).

a) The procedure command positive stop drive (S-0-0149) is set and enabled by the control unit via the service channel.

b) The drive turns off monitoring of the velocity (and position) control loop(s).

c) When $T \geq T_{limit}$ and $n_{feedback} = 0$, the procedure command is executed.

d) Before the procedure command is cancelled, the control unit shall set the command value to the feedback value.

e) As soon as the procedure command is cancelled, monitoring of the velocity (and position) becomes active again.

f) While this procedure command is active, the control unit monitors $n_{feedback} = 0$.

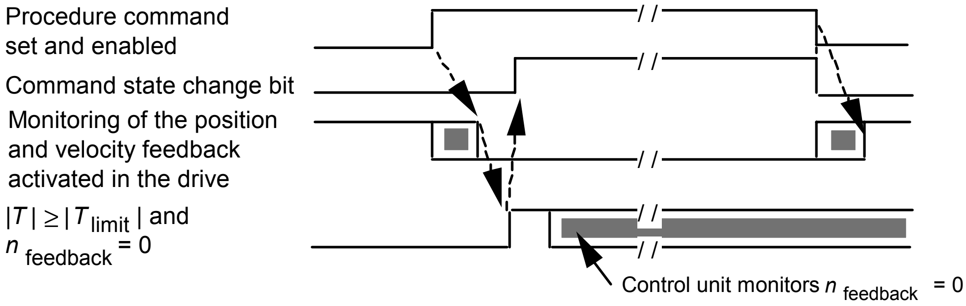


Figure 35 – Bit sequence for positive stop drive

7.14 Drive controlled synchronous operation procedure command

7.14.1 General

A typical application of a synchronous spindle drive is a turning machine where the work piece shall be transferred from the main spindle (lead spindle, address in S-0-0224) to the secondary spindle (= synchronous spindle) without requiring the main spindle to stop.

The synchronous operation parameter (S-0-0225) shall select which kind of synchronous operation is to be executed.

7.14.2 Synchronisation of the synchronous spindle to the lead spindle with a fixed angular offset

The following sequence (see Figure 36) shall be valid.

a) The synchronous spindle follows the command values of the control unit.

b) With the start of the drive controlled synchronous operation procedure command (S-0-0223), the command values for the synchronous spindle are derived from the velocity command value or the position command value of the lead spindle. This is done in the control unit. The MDT for the synchronised spindle contains the derived values.

c) The synchronous spindle accelerates to the synchronous speed. In order to reach the given angular offset (S-0-0230), the drive which shall be synchronised, may exceed the synchronous velocity for a short time period.

d) The synchronisation operation status (S-0-0308) is set when:

   1) The velocity feedback value is within the synchronisation velocity window (S-0-0183) during velocity synchronisation, or

   2) The position feedback value is within the synchronisation position window (S-0-0228) during position synchronisation.

e) The monitoring of the synchronisation error limit (S-0-0184 for velocity or S-0-0229 for position) is activated when synchronisation is achieved for the first time. When the feedback values (velocity or position) exceed the error limits, the synchronisation error status (S-0-0309) is set.

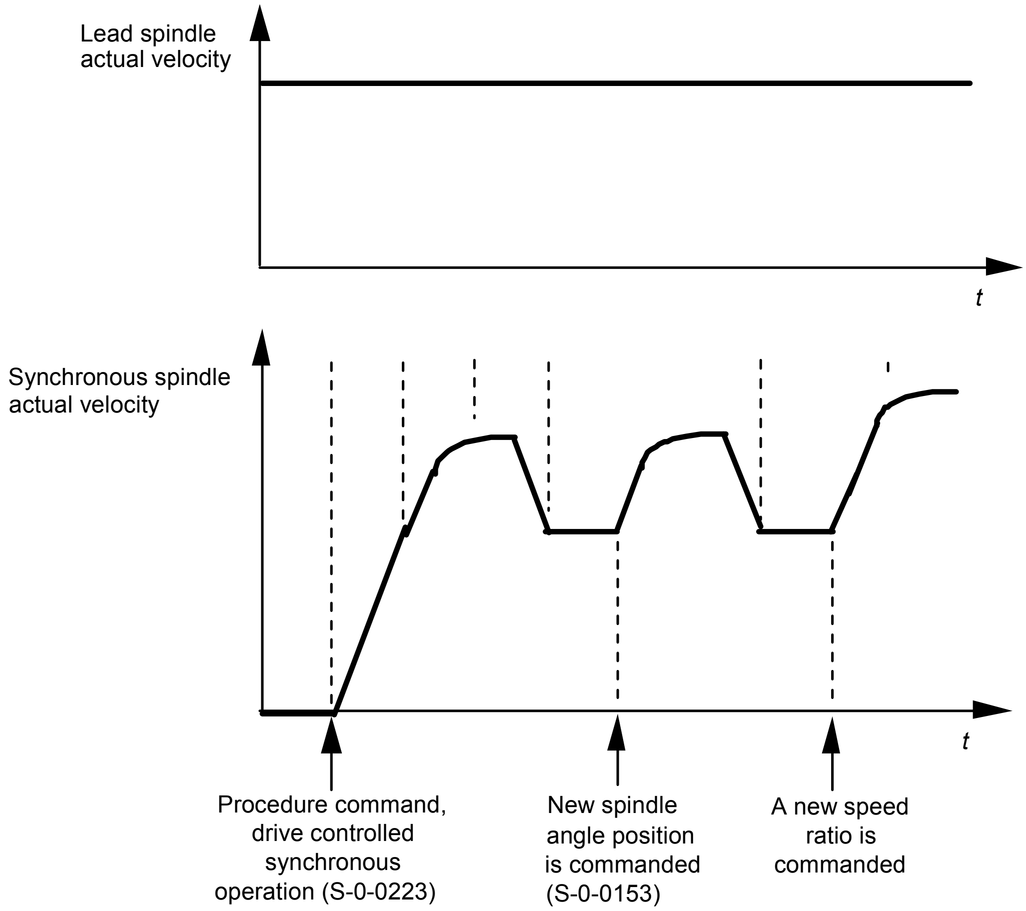


Figure 36 – Velocity diagram for lead and synchronous spindle

7.14.3 New synchronous position offset after synchronisation

While in the angle synchronisation mode (S-0-0225), and after the new spindle angle position (S-0-0153) is written, the synchronous spindle will exceed or reduce the synchronisation speed for a short time period to achieve the desired angular position. In Figure 36, point 6, the desired angular position is achieved.

7.14.4 New speed ratio after synchronisation

The control unit shall reset bit 2 of the synchronous operation parameter (S-0-0225) to 0 and permit a change of the ratio between lead spindle revolutions (S-0-0226) and synchronous spindle revolutions (S-0-0227). This shall have no effect upon the synchronous spindle at that time.

The control unit shall set new values for the lead spindle revolutions (S-0-0226) and the synchronous spindle revolutions (S-0-0227) in the synchronous spindle in order to calculate a new speed ratio between lead spindle and synchronous spindle.

Setting in the synchronous operation parameter (S-0-0225) bit 2 = 1 shall cause the synchronous spindle to take the new speed ratio into account, and to accelerate the synchronous spindle to the new synchronous speed. In Figure 36, point 7, the desired speed is achieved.

While in the position synchronisation mode, a new angular position shall be reachable by setting a new spindle angle position (S-0-0153).

Figure 37 summarises the synchronisation of two spindles.

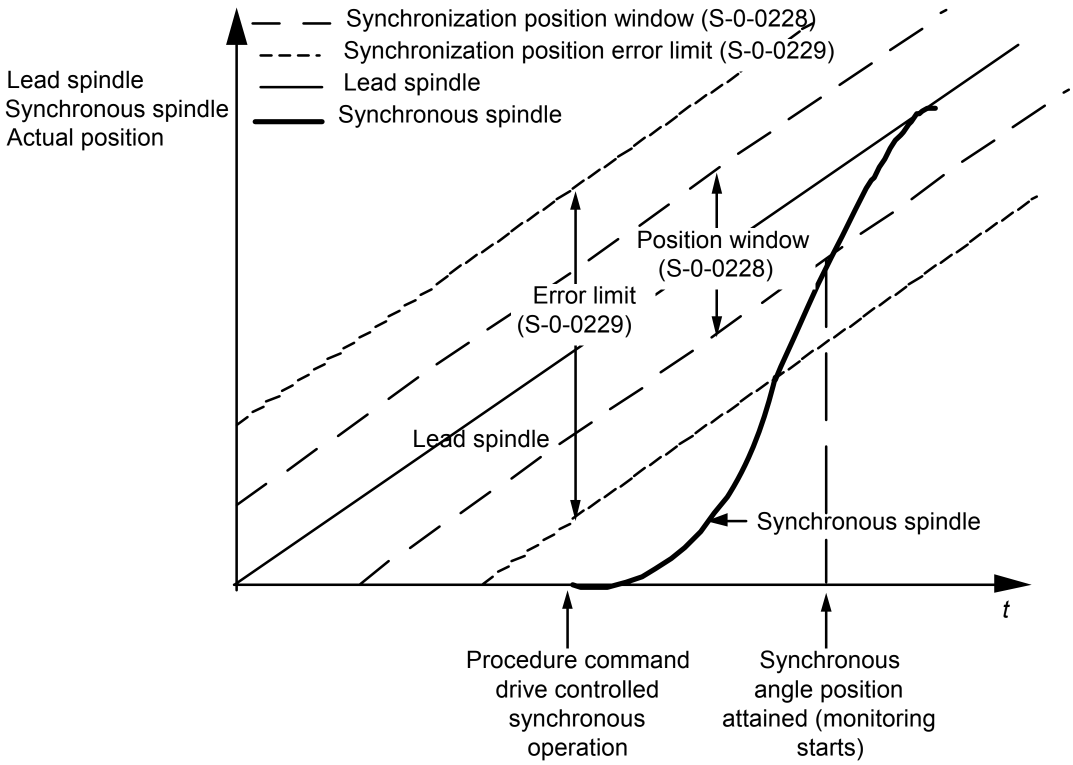


Figure 37 – Position feedback diagram for lead and synchronous spindle

7.15 Drive controlled gear engaging procedure command

The following sequence (see Figure 38) shall be valid for the drive controlled gear engaging procedure command (S-0-0190).

a) The control unit sets and enables this procedure command (S-0-0190) via the service channel.

b) The drive ignores the command values from the control unit and decelerates (or accelerates) to the average engaging speed (S-0-0214).

c) The average engaging speed is modulated by the engaging dither amplitude (S-0-0213), taking into account the engaging dither period (S-0-0215).

d) As soon as these conditions are met, the drive signals that the procedure command has been executed (ready for gear change).

e) The drive continues to dither at the average engaging speed (S-0-0214) until the control unit cancels the procedure command.

f) The drive turns off the gear engaging function and the command values of the control unit are accepted by the drive again.

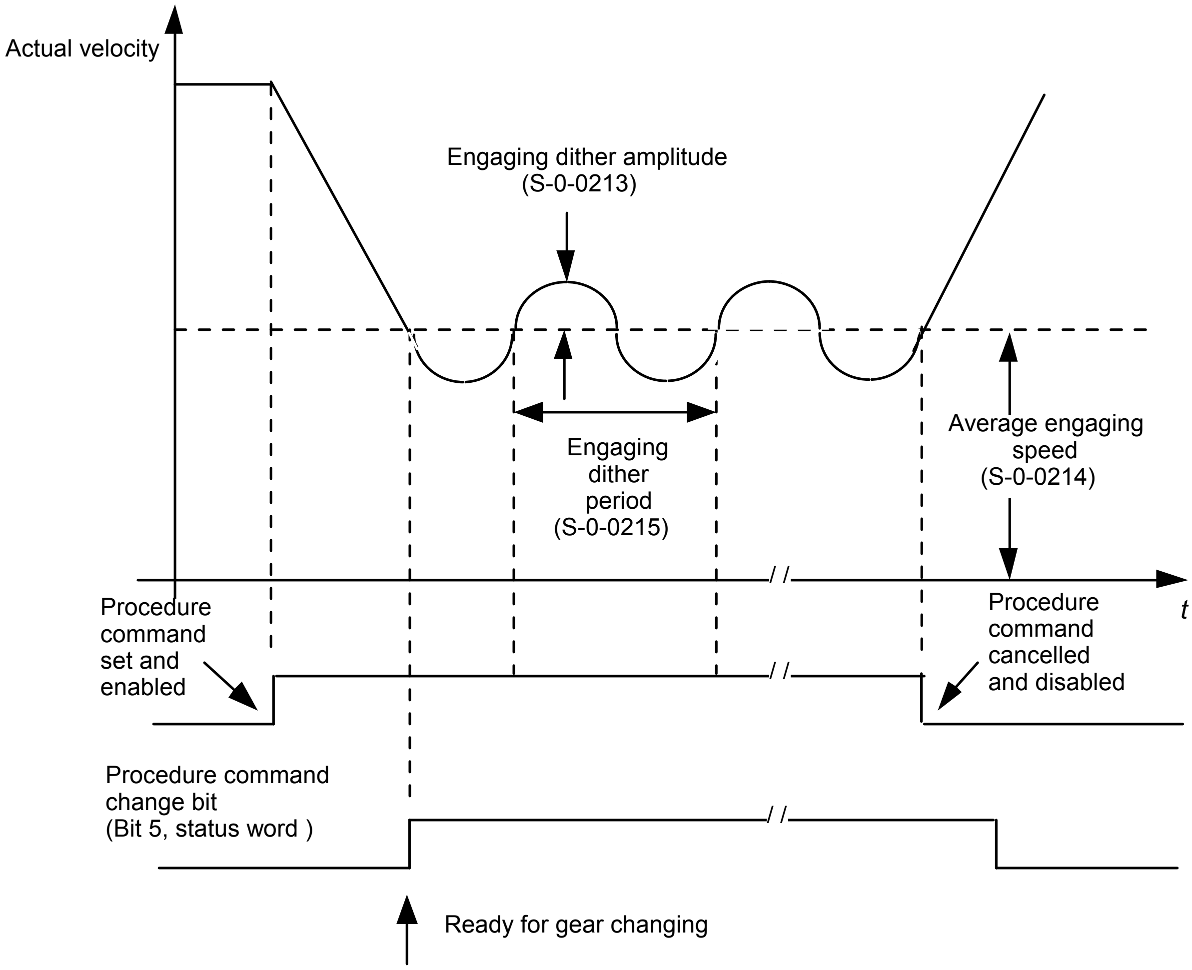


Figure 38 – Drive controlled gear engaging procedure command

8 Identification numbers in numerical order

IDNs shall have a range of 2^{16} which shall be subdivided into the two ranges for standard data and product data. Every range shall be subdivided into eight parameter sets. Each set shall thus have up to 4 095 IDNs.

NOTE 1 As en example, S–2–0100 is the standard IDN for "Velocity proportional gain" in parameter set 2.

NOTE 2 Operation data which are not included in standard data but which are required for a specific function of the product should be specified by the appropriate manufacturer in the product data record. Example: P-3-1234.

Table 36 and Figure 39 describe the structure of IDNs.

Table 36 – Detailed IDN structure

Bit No.	Value	Description
15		
	0	Standard data (normative)
	1	Product data (determined by manufacturer)
14 to 12		
	000 to 111	Parameter set 0 to 7
11 to0		
	0 000 to 4 095	Data block number

X	–	X	–	XXXX
S – Standard data P – Product data		Parameter set		Data block number

Figure 39 – General IDN structure

This specification encompasses only standardised operation data in parameter set 0 (S-0-0000 to S-0-4095).

Table 37 lists all IDNs referenced in this text in numerical order. They are specified in detail in Clause 9. Those that are marked "Reserved for communication" are described in the corresponding subclause of IEC 61158-4-16. All IDN's that are not mentioned in this list shall be reserved.

Table 37 – IDN list in numerical order

IDN (N°)	Name
S-0-0000	Reserved
S-0-0001	Reserved for communication
S-0-0002	Reserved for communication
S-0-0003	Reserved for communication
S-0-0004	Reserved for communication
S-0-0005	Minimum feedback processing time (t_5)
S-0-0006	Reserved for communication
S-0-0007	Feedback acquisition capture point (t_4)
S-0-0008	Reserved for communication
S-0-0009	Reserved for communication
S-0-0010	Reserved for communication
S-0-0011	Class 1 diagnostic
S-0-0012	Class 2 diagnostic
S-0-0013	Class 3 diagnostic
S-0-0014	Reserved for communication
S-0-0015	Reserved for communication
S-0-0016	Configuration list of AT
S-0-0017	IDN-list of all operation data
S-0-0018	IDN-list of operation data for CP2
S-0-0019	IDN-list of operation data for CP3
S-0-0020	IDN-list of operation data for CP4
S-0-0021	IDN-list of invalid operation data for CP2
S-0-0022	IDN-list of invalid operation data for CP3
S-0-0023	IDN-list of invalid operation data for CP4
S-0-0024	Reserved for communication
S-0-0025	IDN-list of all procedure commands
S-0-0026	Configuration list for signal status word
S-0-0027	Configuration list for signal control word

IDN (N°)	Name
S-0-0028	Reserved for communication
S-0-0029	Reserved for communication
S-0-0030	Manufacturer version
S-0-0031	Hardware version
S-0-0032	Primary operation mode
S-0-0033	Secondary operation mode 1
S-0-0034	Secondary operation mode 2
S-0-0035	Secondary operation mode 3
S-0-0036	Velocity command value
S-0-0037	Additive velocity command value
S-0-0038	Positive velocity limit value
S-0-0039	Negative velocity limit value
S-0-0040	Velocity feedback value 1
S-0-0041	Homing velocity
S-0-0042	Homing acceleration
S-0-0043	Velocity polarity parameter
S-0-0044	Velocity data scaling type
S-0-0045	Velocity data scaling factor
S-0-0046	Velocity data scaling exponent
S-0-0047	Position command value
S-0-0048	Additive position command value
S-0-0049	Positive position limit value
S-0-0050	Negative position limit value
S-0-0051	Position feedback value 1 (Motor feedback)
S-0-0052	Reference distance 1
S-0-0053	Position feedback value 2 (External feedback)
S-0-0054	Reference distance 2
S-0-0055	Position polarity parameter
S-0-0056	Reserved
S-0-0057	Position window
S-0-0058	Reversal clearance
S-0-0059	Position switch flag parameter
S-0-0060	Position switch point on 1
S-0-0061	Position switch point on 2
S-0-0062	Position switch point on 3
S-0-0063	Position switch point on 4
S-0-0064	Position switch point on 5
S-0-0065	Position switch point on 6
S-0-0066	Position switch point on 7
S-0-0067	Position switch point on 8
S-0-0068	Position switch point on 9

IDN (N°)	Name
S-0-0069	Position switch point on 10
S-0-0070	Position switch point on 11
S-0-0071	Position switch point on 12
S-0-0072	Position switch point on 13
S-0-0073	Position switch point on 14
S-0-0074	Position switch point on 15
S-0-0075	Position switch point on 16
S-0-0076	Position data scaling type
S-0-0077	Linear position data scaling factor
S-0-0078	Linear position data scaling exponent
S-0-0079	Rotational position resolution
S-0-0080	Torque command value
S-0-0081	Reserved
S-0-0082	Positive torque limit value
S-0-0083	Negative torque limit value
S-0-0084	Torque feedback value
S-0-0085	Torque polarity parameter
S-0-0086	Torque/force data scaling type
S-0-0087	Reserved for communication
S-0-0088	Reserved for communication
S-0-0089	Reserved for communication
S-0-0090	Reserved for communication
S-0-0091	Bipolar velocity limit value
S-0-0092	Bipolar torque limit value
S-0-0093	Torque/force data scaling factor
S-0-0094	Torque/force data scaling exponent
S-0-0095	Diagnostic message
S-0-0096	Reserved for communication
S-0-0097	Mask class 2 diagnostic
S-0-0098	Mask class 3 diagnostic
S-0-0099	Reset class 1 diagnostic
S-0-0100	Velocity loop proportional gain
S-0-0101	Velocity loop integral action time
S-0-0102	Velocity loop differential time
S-0-0103	Modulo value
S-0-0104	Position loop K_V-factor
S-0-0105	Position loop integral action time
S-0-0106	Current loop proportional gain 1
S-0-0107	Current loop integral action time 1
S-0-0108	Feedrate override
S-0-0109	Motor peak current

IDN (N°)	Name
S-0-0110	Amplifier peak current
S-0-0111	Motor continuous stall current
S-0-0112	Amplifier rated current
S-0-0113	Maximum motor speed
S-0-0114	Load limit of the motor
S-0-0115	Position feedback 2 type
S-0-0116	Resolution of feedback 1
S-0-0117	Resolution of feedback 2
S-0-0118	Resolution of linear feedback
S-0-0119	Current loop proportional gain 2
S-0-0120	Current loop integral action time 2
S-0-0121	Input revolutions of load gear
S-0-0122	Output revolutions of load gear
S-0-0123	Feed constant
S-0-0124	Standstill window
S-0-0125	Velocity threshold (n_{x})
S-0-0126	Torque threshold (T_{x})
S-0-0127	Reserved for communication
S-0-0128	Reserved for communication
S-0-0129	Manufacturer class 1 diagnostic
S-0-0130	Probe value 1 positive edge
S-0-0131	Probe value 1 negative edge
S-0-0132	Probe value 2 positive edge
S-0-0133	Probe value 2 negative edge
S-0-0134	Master control word
S-0-0135	Drive status word
S-0-0136	Positive acceleration limit value
S-0-0137	Negative acceleration limit value
S-0-0138	Bipolar acceleration limit value
S-0-0139	Park axis procedure command
S-0-0140	Controller type
S-0-0141	Motor type
S-0-0142	Application type
S-0-0143	Reserved for communication
S-0-0144	Signal status word
S-0-0145	Signal control word
S-0-0146	Control unit controlled homing procedure command
S-0-0147	Reserved
S-0-0148	Drive controlled homing procedure command
S-0-0149	Positive stop drive procedure command

IDN (N°)	Name
S-0-0150	Reference offset 1
S-0-0151	Reference offset 2
S-0-0152	Position spindle procedure command
S-0-0153	Spindle angle position
S-0-0154	Spindle positioning parameter
S-0-0155	Friction torque compensation
S-0-0156	Velocity feedback value 2
S-0-0157	Velocity window
S-0-0158	Power threshold (*P*x)
S-0-0159	Monitoring window
S-0-0160	Acceleration data scaling type
S-0-0161	Acceleration data scaling factor
S-0-0162	Acceleration data scaling exponent
S-0-0163	Weight counterbalance
S-0-0164	Acceleration feedback value 1
S-0-0165	Distance coded reference marks A
S-0-0166	Distance coded reference marks B
S-0-0167	Frequency limit of feedback 1
S-0-0168	Frequency limit of feedback 2
S-0-0169	Probe control parameter
S-0-0170	Probing cycle procedure command
S-0-0171	Calculate displacement procedure command
S-0-0172	Displacement to the referenced system procedure command
S-0-0173	Marker position A
S-0-0174	Marker position B
S-0-0175	Displacement parameter 1
S-0-0176	Displacement parameter 2
S-0-0177	Absolute distance 1
S-0-0178	Absolute distance 2
S-0-0179	Probe status
S-0-0180	Spindle relative offset
S-0-0181	Manufacturer class 2 diagnostic
S-0-0182	Manufacturer class 3 diagnostic
S-0-0183	Synchronisation velocity window
S-0-0184	Synchronisation velocity error limit
S-0-0185	Reserved for communication
S-0-0186	Reserved for communication
S-0-0187	Reserved for communication
S-0-0188	Reserved for communication
S-0-0189	Following distance
S-0-0190	Drive controlled gear engaging procedure command

IDN (N°)	Name
S-0-0191	Cancel reference point procedure command
S-0-0192	IDN-list of all backup operation data
S-0-0193	Positioning jerk
S-0-0194	Acceleration command value
S-0-0195	Acceleration feedback value 2
S-0-0196	Motor rated current
S-0-0197	Set coordinate system procedure command
S-0-0198	Initial coordinate value
S-0-0199	Shift coordinate system procedure command
S-0-0200	Amplifier warning temperature
S-0-0201	Motor warning temperature
S-0-0202	Cooling error warning temperature
S-0-0203	Amplifier shut-down temperature
S-0-0204	Motor shut-down temperature
S-0-0205	Cooling error shut-down temperature
S-0-0206	Drive on delay time
S-0-0207	Drive off delay time
S-0-0208	Temperature data scaling type
S-0-0209	Lower adaptation limit
S-0-0210	Upper adaptation limit
S-0-0211	Adaptation proportional gain
S-0-0212	Adaptation integral action time
S-0-0213	Engaging dither amplitude
S-0-0214	Average engaging speed
S-0-0215	Engaging dither period
S-0-0216	Switch parameter set procedure command
S-0-0217	Parameter set preselection
S-0-0218	Gear ratio preselection
S-0-0219	IDN-list of parameter set
S-0-0220	Minimum spindle speed
S-0-0221	Maximum spindle speed
S-0-0222	Spindle positioning speed
S-0-0223	Drive controlled synchronous operation procedure command
S-0-0224	Lead spindle address
S-0-0225	Synchronous operation parameter
S-0-0226	Lead spindle revolutions
S-0-0227	Synchronous spindle revolutions
S-0-0228	Synchronisation position window
S-0-0229	Synchronisation position error limit
S-0-0230	Synchronous position offset
S-0-0231	Reserved

IDN (N°)	Name
S-0-0232	Reserved
S-0-0233	Reserved
S-0-0234	Reserved
S-0-0235	Reserved
S-0-0236	Reserved
S-0-0237	Reserved
S-0-0238	Reserved
S-0-0239	Reserved
S-0-0240	Reserved
S-0-0241	Reserved
S-0-0242	Reserved
S-0-0243	Reserved
S-0-0244	Reserved
S-0-0245	Reserved
S-0-0246	Reserved
S-0-0247	Reserved
S-0-0248	Reserved
S-0-0249	Reserved
S-0-0250	Reserved
S-0-0251	Reserved
S-0-0252	Reserved
S-0-0253	Reserved
S-0-0254	Actual parameter set
S-0-0255	Actual gear ratio
S-0-0256	Multiplication factor 1
S-0-0257	Multiplication factor 2
S-0-0258	Target position
S-0-0259	Positioning velocity
S-0-0260	Positioning acceleration
S-0-0261	Coarse position window
S-0-0262	Load defaults procedure command
S-0-0263	Load working memory procedure command
S-0-0264	Backup working memory procedure command
S-0-0265	Language selection
S-0-0266	List of available languages
S-0-0267	Password
S-0-0268	Angular setting
S-0-0269	Storage mode
S-0-0270	IDN-list of selected backup operation data
S-0-0271	Drive ID
S-0-0272	Velocity window percentage

IDN (N°)	Name
S-0-0273	Maximum Drive off delay time
S-0-0274	Reserved
S-0-0275	Coordinate offset value
S-0-0276	Return to Module range procedure command
S-0-0277	Position feedback 1 type
S-0-0278	Maximum travel range
S-0-0279	IDN-list of password protected data
S-0-0280	Underflow threshold
S-0-0281	Overflow threshold
S-0-0282	Reserved
S-0-0283	Current coordinate offset
S-0-0284	Secondary operation mode 4
S-0-0285	Secondary operation mode 5
S-0-0286	Secondary operation mode 6
S-0-0287	Secondary operation mode 7
S-0-0288	Reserved
S-0-0289	Reserved
S-0-0290	Reserved
S-0-0291	Reserved
S-0-0292	List of supported operation modes
S-0-0293	Selectively backup working memory procedure command
S-0-0294	Divider modulo value
S-0-0295	Drive enable delay time
S-0-0296	Velocity feed forward gain
S-0-0297	Homing distance
S-0-0298	Suggest home switch distance
S-0-0299	Home switch offset 1
S-0-0300	Real-time control bit 1
S-0-0301	Allocation of real-time control bit 1
S-0-0302	Real-time control bit 2
S-0-0303	Allocation of real-time control bit 2
S-0-0304	Real-time status bit 1
S-0-0305	Allocation of real-time status bit 1
S-0-0306	Real-time status bit 2
S-0-0307	Allocation of real-time status bit 2
S-0-0308	Synchronisation operation status
S-0-0309	Synchronisation error status
S-0-0310	Overload warning
S-0-0311	Amplifier overtemperature warning
S-0-0312	Motor overtemperature warning
S-0-0313	Cooling error warning

IDN (N°)	Name
S-0-0314	Reserved
S-0-0315	Reserved
S-0-0316	(Reserved for class 2 diagnostic)
S-0-0317	(Reserved for class 2 diagnostic)
S-0-0318	(Reserved for class 2 diagnostic)
S-0-0319	(Reserved for class 2 diagnostic)
S-0-0320	(Reserved for class 2 diagnostic)
S-0-0321	(Reserved for class 2 diagnostic)
S-0-0322	(Reserved for class 2 diagnostic)
S-0-0323	Target position outside of travel range
S-0-0324	(Reserved for class 2 diagnostic)
S-0-0325	(Reserved for class 2 diagnostic)
S-0-0326	Reserved
S-0-0327	Reserved
S-0-0328	Bit number allocation list for signal status word
S-0-0329	Bit number allocation list for signal control word
S-0-0330	Status "$n_{\mathrm{feedback}} = n_{\mathrm{command}}$"
S-0-0331	Status "$n_{\mathrm{feedback}} = 0$"
S-0-0332	Status "$n_{\mathrm{feedback}} < n_{\mathrm{x}}$"
S-0-0333	Status "$T \geq T_{\mathrm{x}}$"
S-0-0334	Status "$T \geq T_{\mathrm{limit}}$"
S-0-0335	Status "$n_{\mathrm{command}} > n_{\mathrm{limit}}$"
S-0-0336	Status "In position"
S-0-0337	Status "$P \geq P_{\mathrm{x}}$"
S-0-0338	Status “Position feedback = active target position”
S-0-0339	Status "$n_{\mathrm{feedback}} \leq$ Minimum spindle speed"
S-0-0340	Status " $n_{\mathrm{feedback}} \leq$ Maximum spindle speed"
S-0-0341	Status “In coarse position”
S-0-0342	Status “Target position attained”
S-0-0343	Status “Interpolator halted”
S-0-0344	(Reserved for class 3 diagnostic)
S-0-0345	(Reserved for class 3 diagnostic)
S-0-0346	Reserved
S-0-0347	Velocity error
S-0-0348	Acceleration feed forward gain
S-0-0349	Bipolar jerk limit
S-0-0350	Reserved
S-0-0351	Reserved
S-0-0352	Reserved
S-0-0353	Reserved
S-0-0354	Reserved

IDN (N°)	Name
S-0-0355	Reserved
S-0-0356	Distance home switch - marker pulse
S-0-0357	Marker pulse distance
S-0-0358	Home switch offset 2
S-0-0359	Positioning deceleration
S-0-0360	MDT data container A1 (4 byte)
S-0-0361	MDT data container B (4 byte)
S-0-0362	MDT data container A list index
S-0-0363	MDT data container B list index
S-0-0364	AT data container A1 (4 byte)
S-0-0365	AT data container B (4 byte)
S-0-0366	AT data container A list index
S-0-0367	AT data container B list index
S-0-0368	Data container A pointer
S-0-0369	Data container B pointer
S-0-0370	MDT data container A1 configuration list
S-0-0371	AT data container A1 configuration list
S-0-0372	Drive Halt acceleration bipolar
S-0-0373	Service channel error list
S-0-0374	Procedure command error list
S-0-0375	Diagnostic numbers list
S-0-0376	Baud rate
S-0-0377	Velocity feedback monitoring window
S-0-0378	Absolute encoder range 1
S-0-0379	Absolute encoder range 2
S-0-0380	DC bus voltage
S-0-0381	DC bus current
S-0-0382	DC bus power
S-0-0383	Motor temperature
S-0-0384	Amplifier temperature
S-0-0385	Active power
S-0-0386	Active position feedback value
S-0-0387	Power overload
S-0-0388	Braking current limit
S-0-0389	Effective current
S-0-0390	Diagnostic number
S-0-0391	Position feedback monitoring window
S-0-0392	Velocity feedback filter
S-0-0393	Command value mode
S-0-0394	List IDN
S-0-0395	List index

IDN (N°)	Name
S-0-0396	Number of list elements
S-0-0397	List segment
S-0-0398	IDN-List of configurable data in signal status word
S-0-0399	IDN-List of configurable data in signal control word
S-0-0400	Home switch
S-0-0401	Probe 1
S-0-0402	Probe 2
S-0-0403	Position feedback value status
S-0-0404	Position command value status
S-0-0405	Probe 1 enable
S-0-0406	Probe 2 enable
S-0-0407	Homing enable
S-0-0408	Reference marker pulse registered
S-0-0409	Probe 1 positive latched (Counter)
S-0-0410	Probe 1 negative latched (Counter)
S-0-0411	Probe 2 positive latched (Counter)
S-0-0412	Probe 2 negative latched (Counter)
S-0-0413	Bit number allocation of real-time control bit 1
S-0-0414	Bit number allocation of real-time control bit 2
S-0-0415	Bit number allocation of real-time status bit 1
S-0-0416	Bit number allocation of real-time status bit 2
S-0-0417	Reserved
S-0-0418	Reserved
S-0-0419	Reserved
S-0-0420	Reserved
S-0-0421	Reserved
S-0-0422	Reserved
S-0-0423	Reserved
S-0-0424	Reserved
S-0-0425	Reserved
S-0-0426	Reserved
S-0-0427	Reserved
S-0-0428	Reserved
S-0-0429	Emergency stop deceleration
S-0-0430	Active target position
S-0-0431	Spindle positioning acceleration bipolar
S-0-0432	Serial number drive control
S-0-0433	Serial number power stage
S-0-0434	Serial number motor
S-0-0435	Operating time drive control
S-0-0436	Operating time power stage

IDN (N°)	Name
S-0-0437	Reserved
S-0-0438	Vendor name
S-0-0439	Vendor code
S-0-0440	Reserved
S-0-0441	Reserved
S-0-0442	Reserved
S-0-0443	Reserved
S-0-0444	Reserved
S-0-0445	Reserved
S-0-0446	Ramp reference velocity
S-0-0447	Reserved
S-0-0448	Reserved
S-0-0449	Reserved
S-0-0450	Reserved
S-0-0451	Reserved
S-0-0452	Reserved
S-0-0453	Reserved
S-0-0454	Reserved
S-0-0455	Reserved
S-0-0456	Reserved
S-0-0457	Reserved
S-0-0458	Reserved
S-0-0459	Reserved
S-0-0460	Position switch point off 1
S-0-0461	Position switch point off 2
S-0-0462	Position switch point off 3
S-0-0463	Position switch point off 4
S-0-0464	Position switch point off 5
S-0-0465	Position switch point off 6
S-0-0466	Position switch point off 7
S-0-0467	Position switch point off 8
S-0-0468	Position switch point off 9
S-0-0469	Position switch point off 10
S-0-0470	Position switch point off 11
S-0-0471	Position switch point off 12
S-0-0472	Position switch point off 13
S-0-0473	Position switch point off 14
S-0-0474	Position switch point off 15
S-0-0475	Position switch point off 16
S-0-0476	Position switch control
S-0-0477	Position switch hysteresis

IDN (N°)	Name
S-0-0478	Reserved
S-0-0479	Reserved
S-0-0480	Reserved
S-0-0481	Reserved
S-0-0482	Reserved
S-0-0483	Reserved
S-0-0484	Reserved
S-0-0485	Reserved
S-0-0486	Reserved
S-0-0487	Reserved
S-0-0488	Reserved
S-0-0489	Reserved
S-0-0490	Reserved
S-0-0491	Reserved
S-0-0492	Reserved
S-0-0493	Reserved
S-0-0494	Reserved
S-0-0495	Reserved
S-0-0496	Reserved
S-0-0497	Reserved
S-0-0498	Reserved
S-0-0499	Reserved
All other IDN numbers are reserved.	

9 Description of identification numbers

9.1 IDN S-0-0005 Minimum feedback processing time (t_5)

9.1.1 Attributes

Table 38 shows the possible attributes for this IDN.

Table 38 – Attributes of IDN S-0-0005

Attribute	Value
Name	Minimum feedback processing time (t_5)
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	µs

9.1.2 Description

The time required by a drive between the start of feedback acquisition and the end of the next MST. This value is declared by the drive such that feedback values are transferred to the control unit during the next drive telegram. The master reads this value during CP2 in order to synchronise the measurement times of the feedback acquisition capture point, t_4 (S-0-0007) appropriately for all drives.

9.2 IDN S-0-0007 Feedback acquisition capture point (t_4)

9.2.1 Attributes

Table 39 shows the possible attributes for this IDN.

Table 39 – Attributes for IDN S-0-0007

Attribute	Value
Name	Feedback acquisition capture point (t_4)
Version	
Length	2
Display Format	unsigned decimal
Min input value	0
Max input value	t_{Scyc}
Scaling/resolution	1
Unit	µs

9.2.2 Description

The acquisition capture point of the feedback is determined by the master after the MST. In this way, the master declares a default acquisition capture point for the feedback for all drives that work in coordination with each other. This ensures synchronised data acquisition of the feedback for the appropriate drives. The master sets the acquisition capture point of the feedback to be less than or equal to the difference between the communication cycle time (S-0-0002) and the requested minimum feedback processing time (S-0-0005).

$$t_4 \leq t_{Scyc} - t_5$$

The drive enables the acquisition capture point of the feedback during CP3.

9.3 IDN S-0-0011 Class 1 diagnostic (C1D)

9.3.1 Attributes

Table 40 shows the possible attributes for this IDN.

Table 40 – Attributes of IDN S-0-0011

Attribute	Value
Name	Class 1 diagnostic (C1D)
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.3.2 Description

Drive shut-down error.

A drive error situation of C1D leads to the following:

a) A best case deceleration followed by torque release at n_{min}.
b) The drive shut-down error bit for C1D is set to '1' in the drive status (bit 13). The error bit is reset to '0' by the drive only when no errors of C1D exists and after the command 'reset class 1 diagnostic' (S-0-0099) has been received by the drive via the service channel.

Table 41 shows the interpretation of C1D.

Table 41 – Structure of C1D

Bit[a]	Meaning
0	Overload shut-down (see S-0-0114)
1	Amplifier overtemperature shut-down (see S-0-0203)
2	Motor overtemperature shut-down (see S-0-0204)
3	Cooling error shut-down (see S-0-0205)
4	Control voltage error
5	Feedback error
6	Error in the “commutation“ system
7	Overcurrent error
8	Overvoltage error
9	Undervoltage error
10	Power supply phase error
11	Excessive position deviation (see S-0-0159)
12	Communication error (see S-0-0014)
13	Overtravel limit is exceeded (shut-down) (see S-0-0049, S-0-0050)
14	Reserved
15	Manufacturer-specific error (see S-0-0129)

[a] Bit = 0 = no error
Bit = 1 = error

9.4 IDN S-0-0012 Class 2 diagnostic (C2D)

9.4.1 Attributes

Table 42 shows the possible attributes for this IDN.

Table 42 – Attributes of IDN S-0-0012

Attribute	Value
Name	Class 2 diagnostic (C2D)
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.4.2 Description

Shut-down warning (warning)

When a warning is activated or cancelled in the C2D, this sets the change bit for C2D in the drive status (bit 12) to a binary ‘1’. When the C2D is read via the service channel, the C2D change bit is cancelled and reset to ‘0’. The mask associated with C2D can mask the effects on the change bit of the drive status when a warning condition changes (see S-0-0097).

NOTE Bits defined by C2D are also defined by IDNs.

Table 43 shows the interpretation of C2D.

Table 43 – Structure of C2D

Bit[a]	Meaning
0	Overload warning (see S-0-0310)
1	Amplifier overtemperature warning (see S-0-0311)
2	Motor overtemperature warning (see S-0-0312)
3	Cooling error warning (see S-0-0313)
4	Reserved
5	Positioning velocity ≥ n_{Limit} (S-0-0315)
6	Reserved
7	Reserved
8	Reserved
9	Undervoltage warning (bus voltage)
10	Reserved
11	Excessive velocity deviation (S-0-0377)
12	Reserved
13	Target position outside of travel range (S-0-0323)
14	Reserved
15	Manufacturer-specific warning (see S-0-0181)
[a] Bit = 0 no (shut-down) warning Bit = 1 (shut-down) warning	

9.5 IDN S-0-0013 Class 3 diagnostic (C3D)

9.5.1 Attributes

Table 44 shows the possible attributes for this IDN.

Table 44 – Attributes of IDN S-0-0013

Attribute	Value
Name	Class 3 diagnostic (C3D)
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.5.2 Description

Drive operation status flags.

When a condition changes in the drive, the corresponding bit changes in the C3D, this sets the change bit for C3D in the drive status (bit 11) to a binary '1'. When the C3D is read via the service channel, the C3D change bit is reset to '0'. The mask associated with C3D can mask the effects on the change bit of the drive status when an operating condition changes (see S-0-0098).

NOTE Bits defined by C3D are also defined by IDNs.

Table 45 shows the interpretation of C3D.

Table 45 – Structure of C3D

Bit[a]	Meaning
0	$n_{\text{feedback}} = n_{\text{command}}$ (see S-0-0330)
1	$n_{\text{feedback}} = 0$ (see S-0-0331)
2	$\lvert n_{\text{feedback}}\rvert < \lvert n_x\rvert$ (see S-0-0332)
3	$\lvert T\rvert \geq \lvert T_x\rvert$ (see S-0-0333)
4	$\lvert T\rvert \geq \lvert T_{\text{limit}}\rvert$ (see S-0-0334)
5	$\lvert n_{\text{command}}\rvert > \lvert n_{\text{limit}}\rvert$ (see S-0-0335)
6	in position (see S-0-0336)
7	$\lvert P\rvert \geq \lvert P_x\rvert$ (see S-0-0337)
8	Position feedback = Active target position |(S-0-0430 – S-0-0051/0053)| < S-0-0057 (see S-0-0338)
9	$\lvert n_{\text{feedback}}\rvert \leq$ minimum spindle speed (see S-0-0339)
10	$\lvert n_{\text{feedback}}\rvert \geq$ maximum spindle speed (see S-0-0340)
11	In coarse position (see S-0-0341)
12	Target position attained (see S-0-0342)
13	Interpolator halted (see S-0-0343)
14	Position feedback value status (see S-0-0403, bit 0)
15	Manufacturer-specific operation status (see S-0-0182)
[a] Bit = 0 condition does not exist Bit = 1 condition exists	

9.6 IDN S-0-0016 Configuration list of AT

9.6.1 Attributes

Table 46 shows the possible attributes for this IDN.

Table 46 – Attributes of IDN S-0-0016

Attribute	Value
Name	Configuration list of AT
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.6.2 Description

This IDN list contains the IDNs whose operation data will be transmitted cyclically in the AT in an application telegram. The drive needs to support this list only if it allows the application telegram in its telegram type parameter (see S-0-0015). Only operation data which are present in the "IDN list of configurable data in the AT" (S-0-0187) are allowed as cyclic data.

9.7 IDN S-0-0017 IDN-list of all operation data

9.7.1 Attributes

Table 47 shows the possible attributes for this IDN.

Table 47 – Attributes of IDN S-0-0017

Attribute	Value
Name	IDN-list of all operation data
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.7.2 Description

All IDNs of all operation data, procedure commands, parameters etc. of a given drive are stored in this IDN-list.

9.8 IDN S-0-0018 IDN-list of operation data for CP2

9.8.1 Attributes

Table 48 shows the possible attributes for this IDN.

Table 48 – Attributes for IDN S-0-0018

Attribute	Value
Name	IDN list of operation data for CP2
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.8.2 Description

IDNs of all operation data needed for CP2 are stored in this IDN-list and shall be transferred during CP2. Processing this list is required before switching to CP3.

9.9 IDN S-0-0019 IDN-list of operation data for CP3

9.9.1 Attributes

Table 49 shows the possible attributes for this IDN.

Table 49 – Attributes for IDN S-0-0019

Attribute	Value
Name	IDN-list of operation data for CP3
Version	
Length	2, variable
Display Format	
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.9.2 Description

IDNs of all operation data needed for CP3 are stored in this IDN-list and shall be transferred during CP3. Processing this list is required before switching to CP4.

9.10 IDN S-0-0020 IDN-list of operation data for CP4

9.10.1 Attributes

Table 50 shows the possible attributes for this IDN.

Table 50 – Attributes for IDN S-0-0020

Attribute	Value
Name	IDN-list of operation data for CP4
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.10.2 Description

IDNs of all operational data which can be changed during CP4 are stored in this IDN-list.

9.11 IDN S-0-0021 IDN-list of invalid operation data for CP2

9.11.1 Attributes

Table 51 shows the possible attributes for this IDN.

Table 51 – Attributes for IDN S-0-0021

Attribute	Value
Name	IDN-list of invalid operation data for CP2
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.11.2 Description

IDNs which are in the list "IDN-list of operation data for CP2" (S-0-0018) and which are considered invalid by the drive prior to switchover from CP2 to CP3 are stored in this IDN-list (see S-0-0127).

Case 1: procedure command S-0-0127 is performed correctly; the IDN-list (S-0-0021) contains no IDNs.

Case 2: procedure command S-0-0127 results in an error; the IDN-list (S-0-0021) contains all IDNs of invalid operation data.

9.12 IDN S-0-0022 IDN-list of invalid operation data for CP3

9.12.1 Attributes

Table 52 shows the possible attributes for this IDN.

Table 52 – Attributes for IDN S-0-0022

Attribute	Value
Name	IDN-list of invalid operation data for CP3
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.12.2 Description

IDNs which are in the list "IDN-list of operation data for CP3" (S-0-0019) and which are considered invalid by the drive prior to switchover from CP3 to CP4 are stored in this IDN-list (see S-0-0128).

Case 1: procedure command S-0-0128 is performed correctly; the IDN-list (S-0-0022) contains no IDNs.

Case 2: procedure command S-0-0128 results in an error; the IDN-list (S-0-0022) contains all IDNs of invalid operation data.

9.13 IDN S-0-0023 IDN-list of invalid operation data for CP4

9.13.1 Attributes

Table 53 shows the possible attributes for this IDN.

Table 53 – Attributes for IDN S-0-0023

Attribute	Value
Name	IDN-list of invalid operation data for CP4
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.13.2 Description

IDNs of all drive data which are considered invalid by the drive are stored in this IDN-list following switchover to CP4.

9.14 IDN S-0-0025 IDN-list of all procedure commands

9.14.1 Attributes

Table 54 shows the possible attributes for this IDN.

Table 54 – Attributes for IDN S-0-0025

Attribute	Value
Name	IDN-list of all procedure commands
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.14.2 Description

All IDNs of all drive procedure commands are stored in this IDN-list.

9.15 IDN S-0-0026 Configuration list for signal status word

9.15.1 Attributes

Table 55 shows the possible attributes for this IDN.

Table 55 – Attributes for IDN S-0-0026

Attribute	Value
Name	Configuration list for signal status word
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.15.2 Description

All IDNs of bits which are part of the signal status word (see S-0-0144) are found in the data of the configuration list. The sequence of the IDNs in the configuration list determines the bit numbering scheme in the signal status word. The initial IDN of the configuration list defines bit 0. The last IDN defines bit 15 of the signal status word (see S-0-0328). If the S-0-0328 of the drive is not supported, the bit 0 of the IDN is configured automatically.

9.16 IDN S-0-0027 Configuration list for signal control word

9.16.1 Attributes

Table 56 shows the possible attributes for this IDN.

Table 56 – Attributes for IDN S-0-0027

Attribute	Value
Name	Configuration list for signal control word
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.16.2 Description

All IDNs of bits which are part of the signal control word (see S-0-0145) are found in the data of the configuration list. The sequence of IDNs in the configuration list determines the bit numbering scheme in the signal control word. The initial IDN of the configuration list defines bit 0. The last IDN defines bit 15 of the signal control word (see S-0-0329). If the S-0-0329 of the drive is not supported, the bit 0 of the IDN is configured automatically.

9.17 IDN S-0-0030 Manufacturer version

9.17.1 Attributes

Table 57 shows the possible attributes for this IDN.

Table 57 – Attributes for IDN S-0-0030

Attribute	Value
Name	Manufacturer version
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Refer to operation data with variable length and data type characters.	

9.17.2 Description

The operation data of the manufacturer version contains the actual firmware version and additional information of the device. The structure of the manufacturer version is not specified.

9.18 IDN S-0-0031 Hardware version

9.18.1 Attributes

Table 58 shows the possible attributes for this IDN.

Table 58 – Attributes for IDN S-0-0031

Attribute	Value
Name	Hardware version
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Refer to operation data with variable length and data type characters.	

9.18.2 Description

The operation data of the hardware version contains the actual hardware version and additional information of the device. The structure of the hardware version is not specified.

9.19 IDN S-0-0032 to S-0-0035 Primary operation mode, secondary operation modes 1 to 3

9.19.1 Attributes

Table 59 shows the possible attributes for this IDN.

Table 59 – Attributes for IDN S-0-0032

Attribute	Value
Name	Primary operation mode, secondary operation modes 1 to 3
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.19.2 Description

The drive modes of operation defined by these parameters become active when the operation mode is selected via bits 9 and 8 in the control word of the MDT. The activated operation mode is indicated by bits 9 and 8 of the drive status in the AT.

9.20 IDN S-0-0036 Velocity command value

9.20.1 Attributes

Table 60 shows the possible attributes for this IDN.

Table 60 – Attributes for IDN S-0-0036

Attribute	Value
Name	Velocity command value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.20.2 Description

In the velocity control operating mode in the drive, the control unit transfers the velocity command values to the drive in the time pattern of the control unit cycle time.

9.21 IDN S-0-0037 Additive velocity command value

9.21.1 Attributes

Table 61 shows the possible attributes for this IDN.

Table 61 – Attributes for IDN S-0-0037

Attribute	Value
Name	Additive velocity command value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.21.2 Description

The additive velocity command value is an additional velocity offset which is to be added to the velocity command value.

9.22 IDN S-0-0038 Positive velocity limit value

9.22.1 Attributes

Table 62 shows the possible attributes for this IDN.

Table 62 – Attributes for IDN S-0-0038

Attribute	Value
Name	Positive velocity limit value
Version	
Length	4
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.22.2 Description

The positive velocity limit value describes the maximum allowable velocity in the positive direction. If the velocity limit value is exceeded, the drive responds by setting the status '$n_{\text{command}} > n_{\text{limit}}$' in C3D (see S-0-0013).

9.23 IDN S-0-0039 Negative velocity limit value

9.23.1 Attributes

Table 63 shows the possible attributes for this IDN.

Table 63 – Attributes for IDN S-0-0039

Attribute	Value
Name	Negative velocity limit value
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	0
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.23.2 Description

The negative velocity limit value describes the maximum allowable velocity in the negative direction. If the velocity limit value is exceeded, the drive responds by setting the status '$n_{\text{command}} > n_{\text{limit}}$' in C3D (see S-0-0013).

9.24 IDN S-0-0040 Velocity feedback value 1

9.24.1 Attributes

Table 64 shows the possible attributes for this IDN.

Table 64 – Attributes for IDN S-0-0040

Attribute	Value
Name	Velocity feedback value 1
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.24.2 Description

The velocity feedback value 1 is transferred from the drive to the control unit in order to allow the control unit to periodically display the velocity. The velocity feedback value 1 refers to the motor encoder.

9.25 IDN S-0-0041 Homing velocity

9.25.1 Attributes

Table 65 shows the possible attributes for this IDN.

Table 65 – Attributes for IDN S-0-0041

Attribute	Value
Name	Homing velocity
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.25.2 Description

The homing velocity is used during the procedure command 'drive controlled homing' (S-0-0148) when activated. The drive performs its own homing control.

9.26 IDN S-0-0042 Homing acceleration

9.26.1 Attributes

Table 66 shows the possible attributes for this IDN.

Table 66 – Attributes for IDN S-0-0042

Attribute	Value
Name	Homing acceleration
Version	
Length	4
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0160 Scaling factor: S-0-0161 Scaling exponent: S-0-0162
Unit	

9.26.2 Description

The homing acceleration is needed by the drive if the procedure command 'drive controlled homing' (S-0-0148) is activated.

9.27 IDN S-0-0043 Velocity polarity parameter

9.27.1 Attributes

Table 67 shows the possible attributes for this IDN.

Table 67 – Attributes for IDN S-0-0043

Attribute	Value
Name	Velocity polarity parameter
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.27.2 Description

This parameter is used to switch polarities of velocity data for specific applications. Polarities are not switched internally but externally (on the input and output) of a closed loop system. The motor shaft turns clockwise when there is a positive velocity command difference and no inversion is programmed.

Table 68 shows details of the legal values.

Table 68 – Structure of velocity polarity parameter

Bit	Meaning	Polarity	Value
0	Velocity command value		
		non-inverted	0
		inverted	1
1	Additive velocity command value		
		non-inverted	0
		inverted	1
2	Velocity feedback value 1		
		non-inverted	0
		inverted	1
3	Velocity feedback value 2		
		non-inverted	0
		inverted	1
15 to 4	(reserved)		

9.28 IDN S-0-0044 Velocity data scaling type

9.28.1 Attributes

Table 69 shows the possible attributes for this IDN.

Table 69 – Attributes for IDN S-0-0044

Attribute	Value
Name	Velocity data scaling type
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.28.2 Description

A variety of scaling methods can be selected by means of the scaling type parameter, as shown in Table 70. Bit 5 is set to 'minute' for preferred data.

Table 70 – Structure of velocity data scaling type

Bitrange	Type	Value	Meaning
2 to 0	Scaling method		
		000	no scaling
		001	linear scaling
		010	rotational scaling
3			
		0	preferred scaling

Bitrange	Type	Value	Meaning
		1	parameter scaling
4	Units for linear scaling		
		0	metres [m]
		1	(1 – inches [in])
5	Time units		
		0	minutes [min]
		1	seconds [s]
6	Data reference		
		0	at the motor shaft
		1	at the load
other	(reserved)		

9.29 IDN S-0-0045 Velocity data scaling factor

9.29.1 Attributes

Table 71 shows the possible attributes for this IDN.

Table 71 – Attributes for IDN S-0-0045

Attribute	Value
Name	Velocity data scaling factor
Version	
Length	2
Display Format	unsigned decimal
Min input value	1
Max input value	2^{16} to 1
Scaling/resolution	Structure of the scaling factor: bits 15-0 = factor
Unit	µs

9.29.2 Description

This parameter defines the scaling factor for all velocity data in a drive.

9.30 IDN S-0-0046 Velocity data scaling exponent

9.30.1 Attributes

Table 72 shows the possible attributes for this IDN.

Table 72 – Attributes for IDN S-0-0046

Attribute	Value
Name	Velocity data scaling exponent
Version	
Length	2
Display Format	signed decimal
Min input value	

Attribute	Value
Max input value	
Scaling/resolution	1
Unit	

9.30.2 Description

This parameter defines the scaling exponent for all velocity data in a drive.

Table 73 shows details of the legal values.

Table 73 – Structure of the scaling exponent

Bit	Type	Meaning	Value
15	Sign of the exponent		
		positive	0
		negative	1
14 to 0	Exponent		

9.31 IDN S-0-0047 Position command value

9.31.1 Attributes

Table 74 shows the possible attributes for this IDN.

Table 74 – Attributes for IDN S-0-0047

Attribute	Value
Name	Position command value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.31.2 Description

During the position control drive operation mode, the position command values are transferred from the control unit to the drive according to the time pattern of the control unit cycle.

9.32 IDN S-0-0048 Additive position command value

9.32.1 Attributes

Table 75 shows the possible attributes for this IDN.

Table 75 – Attributes for IDN S-0-0048

Attribute	Value
Name	Additive position command value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.32.2 Description

This IDN is used if an additional position offset is required during position control operation mode in the drive. The additive position command value is added to the position command value (S-0-0047), when the bit "IPOSYNC" toggles (control word, bit 10).

9.33 IDN S-0-0049 Positive position limit value

9.33.1 Attributes

Table 76 shows the possible attributes for this IDN.

Table 76 – Attributes for IDN S-0-0049

Attribute	Value
Name	Positive position limit value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.33.2 Description

The positive position limit value describes the maximum allowed distance in the positive direction. The positive position limit value is only enabled when all position data are based on the machine zero point. Position polarity parameter (see S-0-0055) can be used to disable the position limit values. When the positive position limit value is exceeded, the drive sets an error bit in C1D (S-0-0011).

9.34 IDN S-0-0050 Negative position limit value

9.34.1 Attributes

Table 77 shows the possible attributes for this IDN.

Table 77 – Attributes for IDN S-0-0050

Attribute	Value
Name	Negative position limit value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.34.2 Description

The negative position limit value describes the maximum allowed distance in the negative direction. The negative position limit value is only enabled when all position data are based on the machine zero point. Position polarity parameter (see S-0-0055) can be used to disable the position limit values. When the negative position limit value is exceeded, the drive sets an error bit in C1D (S-0-0011).

9.35 IDN S-0-0051 Position feedback value 1 (motor feedback)

9.35.1 Attributes

Table 78 shows the possible attributes for this IDN.

Table 78 – Attributes for IDN S-0-0051

Attribute	Value
Name	Position feedback value 1 (motor feedback)
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.35.2 Description

The position feedback value 1 is transferred from the drive to the control unit so that it is possible for the control unit to perform block stepping and display position information if necessary.

9.36 IDN S-0-0052 Reference distance 1

9.36.1 Attributes

Table 79 shows the possible attributes for this IDN.

Table 79 – Attributes for IDN S-0-0052

Attribute	Value
Name	Reference distance 1
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.36.2 Description

This parameter describes the distance between the machine zero point and the reference point related to the motor feedback. After the homing procedure, the position feedback value 1 is calculated by:

- reference distance 1;
- reference offset 1 (S-0-0150);
- marker position A/B (S-0-0173/00174).

9.37 IDN S-0-0053 Position feedback value 2 (external feedback)

9.37.1 Attributes

Table 80 shows the possible attributes for this IDN.

Table 80 – Attributes for IDN S-0-0053

Attribute	Value
Name	Position feedback value 2 (external feedback)
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.37.2 Description

The position feedback value 2 is transferred from the drive to the control unit so that it is possible for the control unit to perform block stepping and display position information if necessary.

9.38 IDN S-0-0054 Reference distance 2

9.38.1 Attributes

Table 81 shows the possible attributes for this IDN.

Table 81 – Attributes for IDN S-0-0053

Attribute	Value
Name	Reference distance 2
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.38.2 Description

This parameter describes the distance between the machine zero point and the reference point related to the external feedback. After the homing procedure, the position feedback value 2 is calculated by:

- reference distance 2;
- reference offset 2 (S-0-0151);
- marker position A/B (S-0-0173/00174).

9.39 IDN S-0-0055 Position polarity parameters

9.39.1 Attributes

Table 82 shows the possible attributes for this IDN.

Table 82 – Attributes for IDN S-0-0055

Attribute	Value
Name	Position polarity parameters
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.39.2 Description

This parameter is used to switch polarities of reported position data for specific applications. Polarities are switched outside (i.e., on the input and output) of a closed loop system. The motor shaft turns clockwise (as viewed from the output shaft) when there is a positive position command difference and no inversion is programmed.

Table 83 shows details of the legal values.

Table 83 – Structure of velocity polarity parameter

Bit	Meaning	Polarity	Value
0	Position command value		
		non-inverted	0
		inverted	1
1	Additive position command value		
		non-inverted	0
		inverted	1
2	Position feedback value 1		
		non-inverted	0
		inverted	1
3	Position feedback value 2		
		non-inverted	0
		inverted	1
4	Position limit values		
		disabled	0
		enabled	1
5	Underflow/Overflow threshold (S-0-0280, S-0-0281)		
		disabled	0
		enabled	1
15 to 6	(reserved)		

9.40 IDN S-0-0057 Position window

9.40.1 Attributes

Table 84 shows the possible attributes for this IDN.

Table 84 – Attributes for IDN S-0-0057

Attribute	Value
Name	Position window
Version	
Length	4
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.40.2 Description

When the difference between the accumulated position command value and the position feedback value is within the range of the position window, then the drive sets the status “in position” (S-0-0336). When needed, the status 'in position' is assigned to a real-time status bit within the drive status and then transferred to the control unit (see S-0-0305).

9.41 IDN S-0-0058 Reversal clearance

9.41.1 Attributes

Table 85 shows the possible attributes for this IDN.

Table 85 – Attributes for IDN S-0-0058

Attribute	Value
Name	Reversal clearance
Version	
Length	4
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.41.2 Description

The reversal clearance describes the amount of backlash between motor and load during reversal, relative to the position data.

9.42 IDN S-0-0059 Position switch flag parameter

9.42.1 Attributes

Table 86 shows the possible attributes for this IDN.

Table 86 – Attributes for IDN S-0-0059

Attribute	Value
Name	Position switch flag parameter
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.42.2 Description

Bit 0 = position switch point 1 (S-0-0060 and/or S-0-0460)

up to

Bit 15 = position switch point 16 (S-0-0075 and/or S-0-0475)

Refer to position switches (S-0-0060 to S-0-0075 and S-0-0460 to S-0-0475).

The function of the related bit is deactivated if the position switch point on (n+1) and the position switch point off (n+1) are 0.

Table 87 shows the meaning of the binary data.

Table 87 – Structure of the position switch flag parameter

Bit (n) (n = 0 to 15)	Position switch flag parameter
= 0	Position feedback value < position switch point on (n+1) S-0-0060 to S-0-0075
= 1	Position feedback value ≥ position switch point on (n+1) S-0-0060 to S-0-0075
= 1	Position feedback value < position switch point off (n+1) S-0-0460 to S-0-0475
= 0	Position feedback value ≥ position switch point off (n+1) S-0-0460 to S-0-0475

9.43 IDN S-0-0060 to S-0-0075 Position switch points on 1-16

9.43.1 Attributes

Table 88 shows the possible attributes for this IDN.

Table 88 – Attributes of IDN S-0-0060 to S-0-0075

Attribute	Value
Name	Position switch points on 1-16
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.43.2 Description

The position switches consist of a position switch point on and a position switch flag (S-0-0059). If the position feedback value is less than the position switch point on, the appropriate position switch flag is set to 0. If the position feedback value is equal to or greater than the position switch point on, the appropriate position switch flag is set to 1.

9.44 IDN S-0-0076 Position data scaling type

9.44.1 Attributes

Table 89 shows the possible attributes for this IDN.

Table 89 – Attributes for IDN S-0-0076

Attribute	Value
Name	Position data scaling type
Version	
Length	2
Display Format	binary
Min input value	62
Max input value	65 000
Scaling/resolution	1
Unit	µs

9.44.2 Description

A variety of scaling methods can be selected by means of the scaling type parameter, as shown in Table 90.

Table 90 – Structure of position data scaling type

Bitrange	Type	Value	Meaning
2 to 0	Scaling method		
		000	no scaling
		001	linear scaling

Bitrange	Type	Value	Meaning
		010	rotational scaling
3			
		0	preferred scaling
		1	parameter scaling
4	Units for linear scaling		
		0	metres [m]
		1	(1 – inches [in]) additional
4	Units for rotational scaling		
		0	degrees
		1	(reserved)
5	(reserved)		
6	Data reference		
		0	at the motor shaft
		1	at the load
7	Processing format		
		0	absolute format
		1	modulo format (see S-0-0103)
other	(reserved)		

9.45 IDN S-0-0077 Linear position data scaling factor

9.45.1 Attributes

Table 91 shows the possible attributes for this IDN.

Table 91 – Attributes for IDN S-0-0077

Attribute	Value
Name	Linear position data scaling factor
Version	
Length	2
Display Format	unsigned decimal
Min input value	1
Max input value	
Scaling/resolution	1
Unit	

9.45.2 Description

This parameter defines the scaling factor for all position data in a drive.

9.46 IDN S-0-0078 Linear position data scaling exponent

9.46.1 Attributes

Table 92 shows the possible attributes for this IDN.

Table 92 – Attributes for IDN S-0-0078

Attribute	Value
Name	Linear position data scaling exponent
Version	
Length	2
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Structure of the scaling exponent: Bit 15: Sign of the exponent 0 – positive 1 – negative Bits 14–0: Exponent
Unit	

9.46.2 Description

This parameter defines the scaling exponent for all position data in a drive.

Table 93 shows details of the legal values.

Table 93 – Structure of position data scaling type

Bit	Type	Meaning	Value
5	Sign of the exponent		
		positive	0
		negative	1
14 to 0	Exponent		

9.47 IDN S-0-0079 Rotational position resolution

9.47.1 Attributes

Table 94 shows the possible attributes for this IDN.

Table 94 – Attributes for IDN S-0-0079

Attribute	Value
Name	Rotational position resolution
Version	
Length	4
Display Format	unsigned decimal
Min input value	1
Max input value	
Scaling/resolution	1
Unit	

9.47.2 Description

This parameter defines the rotational position resolution for all position data in a drive.

9.48 IDN S-0-0080 Torque command value

9.48.1 Attributes

Table 95 shows the possible attributes for this IDN.

Table 95 – Attributes for IDN S-0-0080

Attribute	Value
Name	Torque command value
Version	
Length	2
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0086 Scaling factor: S-0-0093 Scaling exponent: S-0-0094
Unit	

9.48.2 Description

During the torque control operation mode of the drive, torque command values are transferred from the control unit to the drive.

9.49 IDN S-0-0082 Positive torque limit value

9.49.1 Attributes

Table 96 shows the possible attributes for this IDN.

Table 96 – Attributes for IDN S-0-0082

Attribute	Value
Name	Positive torque limit value
Version	
Length	2
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0086 Scaling factor: S-0-0093 Scaling exponent: S-0-0094
Unit	

9.49.2 Description

The positive torque limit value limits the maximum torque in the positive direction. If the torque limit value is exceeded, the drive sets the status '$T \geq T_{\text{limit}}$' in C3D (S-0-0013).

9.50 IDN S-0-0083 Negative torque limit value

9.50.1 Attributes

Table 97 shows the possible attributes for this IDN.

Table 97 – Attributes for IDN S-0-0083

Attribute	Value
Name	Negative torque limit value
Version	
Length	2
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0086 Scaling factor: S-0-0093 Scaling exponent: S-0-0094
Unit	

9.50.2 Description

The negative torque limit value limits the maximum torque in the negative direction. If the torque limit value is exceeded, the drive sets the status '$T \geq T_{\mathrm{limit}}$' in C3D (S-0-0013).

9.51 IDN S-0-0084 Torque feedback value

9.51.1 Attributes

Table 98 shows the possible attributes for this IDN.

Table 98 – Attributes for IDN S-0-0084

Attribute	Value
Name	Torque feedback value
Version	
Length	2
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0086 Scaling factor: S-0-0093 Scaling exponent: S-0-0094
Unit	

9.51.2 Description

The torque feedback value is transferred from the drive to the control unit.

9.52 IDN S-0-0085 Torque polarity parameter

9.52.1 Attributes

Table 99 shows the possible attributes for this IDN.

Table 99 – Attributes for IDN S-0-0085

Attribute	Value
Name	Torque polarity parameter
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.52.2 Description

This parameter is used to switch polarities of reported torque data for specific applications. Polarities are not switched internally but externally (on the input and output) of a closed loop system. The motor shaft turns clockwise when there is a positive torque command difference and no inversion. Table 100 shows details of the legal values.

Table 100 – Structure of torque polarity parameter

Bit	Meaning	Polarity	Value
0	Torque command value		
		non-inverted	0
		inverted	1
1	Additive torque command value		
		non-inverted	0
		inverted	1
2	Torque feedback value		
		non-inverted	0
		inverted	1
15 to 3	(reserved)		

9.53 IDN S-0-0086 Torque/force data scaling type

9.53.1 Attributes

Table 101 shows the possible attributes for this IDN.

Table 101 – Attributes for IDN S-0-0086

Attribute	Value
Name	Torque/force data scaling type
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.53.2 Description

A variety of scaling methods can be selected by means of this scaling type parameter as shown in Table 102.

Table 102 – Structure of torque/force data scaling type

Bitrange	Type	Value	Meaning
2 to 0	Scaling method		
		000	percentage scaling
		001	linear scaling (force)
		010	rotational scaling (torque)
3			
		0	preferred scaling
		1	parameter scaling
4	Units for linear force		
		0	Newton [N]
		1	(pound force [lbf] additional)
5	(reserved)		
6	Data reference		
		0	at the motor shaft
		1	at the load
other	(reserved)		

9.54 IDN S-0-0091 Bipolar velocity limit value

9.54.1 Attributes

Table 103 shows the possible attributes for this IDN.

Table 103 – Attributes for IDN S-0-0091

Attribute	Value
Name	Bipolar velocity limit value
Version	
Length	4
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.54.2 Description

The bipolar velocity limit value describes the maximum allowable velocity in both directions. If the velocity limit value is exceeded, the drive responds by setting the status '$n_{\text{command}} > n_{\text{limit}}$' in C3D (see S-0-0013).

9.55 IDN S-0-0092 Bipolar torque limit value

9.55.1 Attributes

Table 104 shows the possible attributes for this IDN.

Table 104 – Attributes for IDN S-0-0092

Attribute	Value
Name	Bipolar torque limit value
Version	
Length	2
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0086 Scaling factor: S-0-0093 Scaling exponent: S-0-0094
Unit	

9.55.2 Description

The bipolar torque limit value limits the maximum torque symmetrically in both directions. If the torque limit value is exceeded, the drive sets the status '$T \geq T_{\text{limit}}$' in C3D (S-0-0013).

9.56 IDN S-0-0093 Torque/force data scaling factor

9.56.1 Attributes

Table 105 shows the possible attributes for this IDN.

Table 105 – Attributes for IDN S-0-0093

Attribute	Value
Name	Torque/force data scaling factor
Version	
Length	2
Display Format	unsigned decimal
Min input value	1
Max input value	
Scaling/resolution	1
Unit	

9.56.2 Description

This parameter defines the scaling factor for all torque/force data in a drive.

9.57 IDN S-0-0094 Torque/force data scaling exponent

9.57.1 Attributes

Table 106 shows the possible attributes for this IDN.

Table 106 – Attributes for IDN S-0-0094

Attribute	Value
Name	Torque/force data scaling exponent
Version	
Length	2
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.57.2 Description

This parameter defines the scaling exponent for all torque/force data in a drive.

Table 107 shows details of the legal values.

Table 107 – Structure of the Torque/Force Data Scaling Exponent

Bit	Meaning	Polarity	Value
15	Sign of the exponent		
		positive	0
		negative	1
14 to 0	Exponent		

9.58 IDN S-0-0095 Diagnostic message

9.58.1 Attributes

Table 108 shows the possible attributes for this IDN.

Table 108 – Attributes for IDN S-0-0095

Attribute	Value
Name	Diagnostic message
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Refer to operation data of variable length and data type characters.	

9.58.2 Description

The currently relevant operating status is being monitored with diagnostic messages. The diagnostic messages are generated by the drive as a text and stored in the operation data of this IDN.

9.59 IDN S-0-0097 Mask class 2 diagnostic

9.59.1 Attributes

Table 109 shows the possible attributes for this IDN.

Table 109 – Attributes for IDN S-0-0097

Attribute	Value
Name	Mask class 2 diagnostic
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.59.2 Description

Using this mask, warnings in the class 2 diagnostic can be masked with respect to their effect on the change bit in drive status. When changing masked warnings, the change bit for class 2 diagnostic is not set in the drive status. The mask does not affect the operation data of class 2 diagnostic (see S-0-0012).

Table 110 shows details of the legal values.

Table 110 – Structure of Mask C2D

Bit	Meaning	Value
15 to 0		
	masked warning	all 0s
	unmasked warning	all 1a

9.60 IDN S-0-0098 Mask class 3 diagnostic

9.60.1 Attributes

Table 111 shows the possible attributes for this IDN.

Table 111 – Attributes for IDN S-0-0098

Attribute	Value
Name	Mask class 3 diagnostic
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.60.2 Description

Using this mask, condition flags in C3D can be masked with respect to their effect on the change bit in drive status (see Table 112). When masked condition flags change, the change bit for C3D is not set in the drive status. The mask does not affect the operation data of C3D (see S-0-0013).

Table 112 – Structure of Mask C3D

Bit	Meaning	Value
15 to 0		
	Masked condition flag	all 0s
	Unmasked condition flag	all 1a

9.61 IDN S-0-0099 Reset class 1 diagnostic

9.61.1 Attributes

Table 113 shows the possible attributes for this IDN.

Table 113 – Attributes for IDN S-0-0099

Attribute	Value
Name	Reset class 1 diagnostic
Version	
Length	2

Attribute	Value
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.61.2 Description

When this procedure command is received by the drive via the service channel and no error exists, C1D, the interface status, the manufacturer's C1D, the drive shut-down error (drive status bit 13), and the drive shut-down mechanism in the drive are all reset (see S-0-0011, S-0-0014, and S-0-0129).

9.62 IDN S-0-0100 Velocity loop proportional gain

9.62.1 Attributes

Table 114 shows the possible attributes for this IDN.

Table 114 – Attributes for IDN S-0-0100

Attribute	Value
Name	Velocity loop proportional gain
Version	
Length	2 or 4
Display Format	Unsigned decimal
Min input value	Attribute shall be checked by the control unit
Max input value	
Scaling/resolution	Defined by the drive manufacture
Unit	Defined by the drive manufacture

9.62.2 Description

The operational characteristic of the velocity loop proportional gain is defined by the drive manufacturer. The 4 byte data length is preferred for new implementations.

9.63 IDN S-0-0101 Velocity loop integral action time

9.63.1 Attributes

Table 115 shows the possible attributes for this IDN.

Table 115 – Attributes for IDN S-0-0101

Attribute	Value
Name	Velocity loop integral action time
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	0,1
Unit	ms

9.63.2 Description

The operational characteristic of the velocity loop integral action time is defined by the drive manufacturer. With the maximum value of 2^{16}–1, the integrator in the velocity loop regulator is switched off.

9.64 IDN S-0-0102 Velocity loop differential time

9.64.1 Attributes

Table 116 shows the possible attributes for this IDN.

Table 116 – Attributes for IDN S-0-0102

Attribute	Value
Name	Velocity loop differential time
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,1
Unit	ms

9.64.2 Description

The operational characteristic of the velocity loop differential time is defined by the drive manufacturer.

9.65 IDN S-0-0103 Modulo value

9.65.1 Attributes

Table 117 shows the possible attributes for this IDN.

Table 117 – Attributes for IDN S-0-0103

Attribute	Value
Name	Modulo value
Version	
Length	4
Display Format	unsigned decimal
Min input value	1
Max input value	

Attribute	Value
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-078 Rotational position resolution S-0-0079
Unit	

9.65.2 Description

If the Modulo format is selected in the position data scaling factor (S-0-0076), the Modulo value defines the range that the drive and control shall implement. When extrapolation is used for missing commands (MDTs), the position command difference between two consecutive cycles may not exceed half the Modulo value.

$$\frac{\text{IDN 00103}}{2} = \text{Maximum position command difference}$$

If extrapolation is not used for missing commands (MDT's), the position command difference between two consecutive cycles may not exceed one quarter the Modulo value.

$$\frac{\text{IDN 00103}}{4} = \text{Maximum position command difference}$$

This reduces the maximum possible velocity due to the position command difference. The spindle angle position in addition always is related on the physical modulo value to reach short positioning times. To compensate this disadvantage, the divider modulo value (S-0-0294) is programmed.

Example 1:

NC cycle time = 4 ms

Modulo value = 360°

Divider modulo value = 1

→ V_{max} = (360°/2)/4ms = 45 000°/s (7500 rpm)

Example 2:

NC cycle time = 4 ms

Modulo value = 1 080° (3 × 360°)

Divider modulo value = 3

→ V_{max} = (1 080°/2)/4ms = 135 000°/s (22 500 rpm)

9.66 IDN S-0-0104 Position loop K_V-factor

9.66.1 Attributes

Table 118 shows the possible attributes for this IDN.

Table 118 – Attributes for IDN S-0-0104

Attribute	Value
Name	Position loop K_V-factor
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,01
Unit	(m/min)/mm

9.66.2 Description

The K_V-factor determines the gain of the position loop regulator throughout the entire velocity range.

9.67 IDN S-0-0105 Position loop integral action time

9.67.1 Attributes

Table 119 shows the possible attributes for this IDN.

Table 119 – Attributes for IDN S-0-0105

Attribute	Value
Name	Position loop integral action time
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,1
Unit	ms

9.67.2 Description

The method of operation of the position loop integral action time is defined by the manufacturer.

9.68 IDN S-0-0106 Current loop proportional gain 1

9.68.1 Attributes

Table 120 shows the possible attributes for this IDN.

Table 120 – Attributes for IDN S-0-0106

Attribute[a]	Value
Name	Current loop proportional gain 1
Version	
Length	2 or 4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	defined by the drive manufacturer
Unit	defined by the drive manufacturer

[a] Attribute shall be checked by the control unit.

9.68.2 Description

The current loop proportional gain 1 influences the torque/force-producing current. The mode of operation is determined by the drive manufacturer. The 4 byte data length is preferred for new implementations.

9.69 IDN S-0-0107 Current loop integral action time 1

9.69.1 Attributes

Table 121 shows the possible attributes for this IDN.

Table 121 – Attributes for IDN S-0-0107

Attribute	Value
Name	Current loop integral action time 1
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	µs

9.69.2 Description

The current integral action time 1 influences the torque/force-producing current. The mode of operation is determined by the drive manufacturer.

9.70 IDN S-0-0108 Feedrate override

9.70.1 Attributes

Table 122 shows the possible attributes for this IDN.

Table 122 – Attributes for IDN S-0-0108

Attribute	Value
Name	Feedrate override
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,01
Unit	%

9.70.2 Description

The feedrate override is activated only with drive controlled procedure commands. In such a case, the velocity command value is calculated internally by the drive. The feedrate override has multiplying effects on the velocity command value.

9.71 IDN S-0-0109 Motor peak current

9.71.1 Attributes

Table 123 shows the possible attributes for this IDN.

Table 123 – Attributes for IDN S-0-0109

Attribute	Value
Name	Motor peak current
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,001
Unit	A

9.71.2 Description

If the motor peak current is less than that of the amplifier, the amplifier is automatically limited to the level of the motor peak current.

9.72 IDN S-0-0110 Amplifier peak current

9.72.1 Attributes

Table 124 shows the possible attributes for this IDN.

Table 124 – Attributes for IDN S-0-0110

Attribute	Value
Name	Amplifier peak current
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,001
Unit	A

9.72.2 Description

The amplifier peak current is limited by the hardware, which means that the current for the maximum attainable torque limit value is fixed as well.

9.73 IDN S-0-0111 Motor continuous stall current

9.73.1 Attributes

Table 125 shows the possible attributes for this IDN.

Table 125 – Attributes for IDN S-0-0111

Attribute	Value
Name	Motor continuous stall current
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,001
Unit	A

9.73.2 Description

The motor continuous stall current is the current at which the motor produces the continuous standstill torque according to the motor spec sheet. For all motors apart from asynchronous motors, this parameter is used as a reference for all torque data and for determining motor-related current values.

9.74 IDN S-0-0112 Amplifier rated current

9.74.1 Attributes

Table 126 shows the possible attributes for this IDN.

Table 126 – Attributes for IDN S-0-0112

Attribute	Value
Name	Amplifier rated current
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,001
Unit	A

9.74.2 Description

The amplifier rated current is equal to the allowable continuous current of the drive unit.

9.75 IDN S-0-0113 Maximum motor speed

9.75.1 Attributes

Table 127 shows the possible attributes for this IDN.

Table 127 – Attributes for IDN S-0-0113

Attribute	Value
Name	Maximum motor speed
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	10^{-4}
Unit	min^{-1}

9.75.2 Description

The maximum motor speed is listed in the motor spec sheet provided by the manufacturer.

9.76 IDN S-0-0114 Load limit of the motor

9.76.1 Attributes

Table 128 shows the possible attributes for this IDN.

Table 128 – Attributes for IDN S-0-0114

Attribute	Value
Name	Load limit of the motor
Version	
Length	2
Display Format	unsigned decimal

Attribute	Value
Min input value	
Max input value	
Scaling/resolution	1
Unit	%

9.76.2 Description

When the load limit is exceeded, the drive sets the overload warning bit in C2D (see S-0-0310). After a time period specified by the manufacturer, the overload shut-down bit is set in C1D (S-0-0011).

9.77 IDN S-0-0115 Position feedback 2 type

9.77.1 Attributes

Table 129 shows the possible attributes for this IDN.

Table 129 – Attributes for IDN S-0-0115

Attribute	Value
Name	Position feedback 2 type
Version	
Length	2
Display Format	binary
Min input value	62
Max input value	65 000
Scaling/resolution	1
Unit	µs

9.77.2 Description

The position feedback 2 type parameter refers only to an external feedback. This parameter is programmed to define the corresponding conditions which apply to the external feedback. Table 130 shows details of the legal values.

Table 130 – Structure of Position Feedback 2 Type

Bit	Meaning	Polarity	Value
0	Feedback type		
		rotational feedback (S-0-0117)	0
		linear feedback (S-0-0118)	1
1	Distance coded feedback		
		no distance coded reference marks	0
		distance coded reference marks (S-0-0165, S-0-0166)	1
2	Feedback resolution (S-0-0118)		
		resolution = metric	0
		resolution = inches	1
3	Direction polarity		

Bit	Meaning	Polarity	Value
		not inverted	0
		inverted	1
4	Marker pulse quantity		
		only one reference marker pulse	0
		multiple cyclic reference marker pulse	1
5	Structure of distance coded feedback		
		counting positive with positive direction	0
		counting negative with positive direction	1
6	Type of measuring system		
		relative (incremental) measuring system	0
		absolute measuring system	1
7	Usage		
		absolute measurements with an absolute measuring system	0
		relative (incremental) measurements with an absolute measuring system	1
15 to 8	(reserved)		

9.78 IDN S-0-0116 Resolution of feedback 1

9.78.1 Attributes

Table 131 shows the possible attributes for this IDN.

Table 131 – Attributes for IDN S-0-0116

Attribute	Value
Name	Resolution of feedback 1
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	1 [cycles/motor revolution] or µm

9.78.2 Description

The resolution parameter of feedback 1 (motor feedback) contains, for a rotary feedback, the cycles per revolution of the motor (see also S-0-0256). For a linear feedback, the grid constant is entered.

9.79 IDN S-0-0117 Resolution of feedback 2

9.79.1 Attributes

Table 132 shows the possible attributes for this IDN.

Table 132 – Attributes for IDN S-0-0117

Attribute	Value
Name	Resolution of feedback 2
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	1 [cycles/revolution] or µm

9.79.2 Description

The resolution parameter of feedback 2 (external feedback) contains, for a rotary feedback, the cycles per revolution (see also S-0-0257). For a linear feedback, the grid constant is entered.

9.80 IDN S-0-0118 Resolution of linear feedback

9.80.1 Attributes

Table 133 shows the possible attributes for this IDN.

Table 133 – Attributes for IDN S-0-0118

Attribute	Value
Name	Resolution of linear feedback
Version	
Length	4
Display Format	Unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Defined by the drive manufacturer, see S-0-0115
Unit	Defined by the drive manufacturer, see S-0-0115

9.80.2 Description

The resolution of linear feedback is calculated on the basis of:

– the grid constant for the linear scale, and
– the external multiplier of the digitisation unit.

$$\text{Linear feedback resolution} = \frac{\text{grid constant}}{\text{external multiplier}}$$

If there is no external multiplier (i.e., the multiplication is done in the amplifier), the external multiplier is to be set to 1 and the linear feedback resolution equals the grid constant.

Example 1:

Grid constant = 0,01 mm

external multiplier = 5

→ Linear feedback resolution = 0,002 mm

Example 2:

Grid constant = 0,01 mm

external multiplier = 1

→ Linear feedback resolution = 0,01 mm

9.81 IDN S-0-0119 Current loop proportional gain 2

9.81.1 Attributes

Table 134 shows the possible attributes for this IDN.

Table 134 – Attributes for IDN S-0-0119

Attribute[a]	Value
Name	Current loop proportional gain 2
Version	
Length	2 or 4
Display Format	Unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Defined by the drive manufacturer
Unit	Defined by the drive manufacturer
[a] Attribute shall be checked by the control unit	

9.81.2 Description

The current loop proportional gain 2 influences the flux producing current. The mode of operation is determined by the drive manufacturer. The 4 byte data length is preferred for new implementations.

9.82 IDN S-0-0120 Current loop integral action time 2

9.82.1 Attributes

Table 135 shows the possible attributes for this IDN.

Table 135 – Attributes for IDN S-0-0120

Attribute	Value
Name	Current loop integral action time 2
Version	
Length	2
Display Format	Unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	µs

9.82.2 Description

The current loop integral action time 2 influences the flux–producing current. The mode of operation is determined by the drive manufacturer.

9.83 IDN S-0-0121 Input revolutions of load gear

9.83.1 Attributes

Table 136 shows the possible attributes for this IDN.

Table 136 – Attributes for IDN S-0-0121

Attribute	Value
Name	Input revolutions of load gear
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	1 [input revolution]

9.83.2 Description

Input revolution values shall be entered as integers.

9.84 IDN S-0-0122 Output revolutions of load gear

9.84.1 Attributes

Table 137 shows the possible attributes for this IDN.

Table 137 – Attributes for IDN S-0-0122

Attribute	Value
Name	Output revolutions of load gear
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	1 [output revolution]

9.84.2 Description

Output revolution values shall be entered as integers.

9.85 IDN S-0-0123 Feed constant

9.85.1 Attributes

Table 138 shows the possible attributes for this IDN.

Table 138 – Attributes for IDN S-0-0123

Attribute	Value
Name	Feed constant
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	defined by the drive manufacturer
Unit	defined by the drive manufacturer

9.85.2 Description

The feed constant describes the machine element which converts a rotational motion into a linear motion. The feed constant indicates the linear distance during one revolution of the feed spindle.

9.86 IDN S-0-0124 Standstill window

9.86.1 Attributes

Table 139 shows the possible attributes for this IDN.

Table 139 – Attributes for IDN S-0-0124

Attribute	Value
Name	Standstill window
Version	
Length	4
Display Format	unsigned decimal
Min input value	62
Max input value	65 000
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.86.2 Description

The standstill window describes the amount of the deviation of the velocity from 0. If the velocity feedback value is within the standstill window the drive sets the status $n_{\text{feedback}} = 0$ (S-0-0331).

9.87 IDN S-0-0125 Velocity threshold (n_x)

9.87.1 Attributes

Table 140 shows the possible attributes for this IDN.

Table 140 – Attributes for IDN S-0-0125

Attribute	Value
Name	Velocity threshold (n_x)
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.87.2 Description

If the velocity feedback value falls below the velocity threshold n_x, the drive sets the status

'$n_{\text{feedback}} < n_x$' (S-0-0332) in C3D.

9.88 IDN S-0-0126 Torque threshold (T_x)

9.88.1 Attributes

Table 141 shows the possible attributes for this IDN.

Table 141 – Attributes for IDN S-0-0126

Attribute	Value
Name	Torque threshold (T_x)
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0086 Scaling factor: S-0-0093 Scaling exponent: S-0-0094
Unit	

9.88.2 Description

If the torque feedback value exceeds the torque threshold T_x, the drive sets the status '$T \geq T_x$' in C3D (S-0-0333).

9.89 IDN S-0-0129 Manufacturer class 1 diagnostic

9.89.1 Attributes

Table 142 shows the possible attributes for this IDN.

Table 142 – Attributes for IDN S-0-0129

Attribute	Value
Name	Manufacturer class 1 diagnostic
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.89.2 Description

The drive manufacturer can define additional shut-down errors in manufacturer class 1 diagnostic. If an error is set in the manufacturer class 1 diagnostic, the manufacturer-specific error bit in class 1 diagnostic (see S-0-0011) is set as well. The drive cancels the manufacturer-specific error and resets to '0' only if the error in manufacturer class 1 diagnostic has been eliminated upon receiving the command 'reset class 1 diagnostic' (see S-0-0099) via the service channel.

Table 143 shows the interpretation of class 1 diagnostic.

Table 143 – Structure of manufacturer Class 1 diagnostic

Bit	Meaning	Value
15 to 0		
	no error	all 0s
	error	all 1s

9.90 IDN S-0-0130 Probe value 1 positive edge

9.90.1 Attributes

Table 144 shows the possible attributes for this IDN.

Table 144 – Attributes for IDN S-0-0130

Attribute	Value
Name	Probe value 1 positive edge
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.90.2 Description

If an external feedback is present, the drive stores position feedback value 2 in the measuring cycle in this parameter following the positive edge of the input signal of probe 1 (see S-0-0401). If no external feedback is present, position feedback value 1 is stored. This allows the control unit to read 'probe value 1 positive edge' at a later time.

9.91 IDN S-0-0131 Probe value 1 negative edge

9.91.1 Attributes

Table 145 shows the possible attributes for this IDN.

Table 145 – Attributes for IDN S-0-0131

Attribute	Value
Name	Probe value 1 negative edge
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.91.2 Description

If an external feedback is present, the drive stores position feedback value 2 in the measuring cycle in this parameter following the negative edge of the input signal of probe 1 (see S-0-0401). If no external feedback is present, position feedback value 1 is stored. This allows the control unit to read 'probe value 1 negative edge' at a later time.

9.92 IDN S-0-0132 Probe value 2 positive edge

9.92.1 Attributes

Table 146 shows the possible attributes for this IDN.

Table 146 – Attributes for IDN S-0-0132

Attribute	Value
Name	Probe value 2 positive edge
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.92.2 Description

If an external feedback is present, the drive stores position feedback value 2 in the measuring cycle in this parameter following the positive edge of the input signal of probe 2 (see S-0-0402). If no external feedback is present, position feedback value 1 is stored. This allows the control unit to read 'probe value 2 positive edge' at a later time.

9.93 IDN S-0-0133 Probe value 2 negative edge

9.93.1 Attributes

Table 147 shows the possible attributes for this IDN.

Table 147 – Attributes for IDN S-0-0133

Attribute	Value
Name	Probe value 2 negative edge
Version	
Length	4

Attribute	Value
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.93.2 Description

If an external feedback is present, the drive stores position feedback value 2 in the measuring cycle in this parameter following the negative edge of the input signal of probe 2 (see S-0-0402). If no external feedback is present, position feedback value 1 is stored. This allows the control unit to read 'probe value 2 negative edge' at a later time.

9.94 IDN S-0-0134 Master control word

9.94.1 Attributes

Table 148 shows the possible attributes for this IDN.

Table 148 – Attributes for IDN S-0-0134

Attribute	Value
Name	Master control word
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.94.2 Description

Enables the display of the master control word on the control unit screen, via the service channel. (This can be useful during start-up and error recovery.)

9.95 IDN S-0-0135 Drive status word

9.95.1 Attributes

Table 149 shows the possible attributes for this IDN.

Table 149 – Attributes for IDN S-0-0135

Attribute	Value
Name	Drive status word
Version	
Length	2

Attribute	Value
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.95.2 Description

Enables the display of the drive status word on the control unit screen, via the service channel. (This can be useful during start-up and error recovery.)

9.96 IDN S-0-0136 Positive acceleration limit value

9.96.1 Attributes

Table 150 shows the possible attributes for this IDN.

Table 150 – Attributes for IDN S-0-0136

Attribute	Value
Name	Positive acceleration limit value
Version	
Length	4
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type: S-0-0160 Scaling factor: S-0-0161 Scaling exponent: S-0-0162
Unit	

9.96.2 Description

The positive acceleration parameter limits the maximum acceleration ability of the drive to the programmed value.

9.97 IDN S-0-0137 Negative acceleration limit value

9.97.1 Attributes

Table 151 shows the possible attributes for this IDN.

Table 151 – Attributes for IDN S-0-0137

Attribute	Value
Name	Negative acceleration limit value
Version	
Length	4
Display Format	unsigned decimal
Min input value	0

Attribute	Value
Max input value	
Scaling/resolution	Scaling type: S-0-0160 Scaling factor: S-0-0161 Scaling exponent: S-0-0162
Unit	

9.97.2 Description

The negative acceleration parameter limits the maximum acceleration ability of the drive to the programmed value. If the velocity decreases it is said to be a negative acceleration.

9.98 IDN S-0-0138 Bipolar acceleration limit value

9.98.1 Attributes

Table 152 shows the possible attributes for this IDN.

Table 152 – Attributes for IDN S-0-0138

Attribute	Value
Name	Bipolar acceleration limit value
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0160 Scaling factor: S-0-0161 Scaling exponent: S-0-0162
Unit	

9.98.2 Description

The bipolar acceleration parameter limits the maximum acceleration ability of the drive symmetrically to the programmed value in both directions.

9.99 IDN S-0-0139 Park axis procedure command

9.99.1 Attributes

Table 153 shows the possible attributes for this IDN.

Table 153 – Attributes for IDN S-0-0139

Attribute	Value
Name	Park axis procedure command
Version	
Length	2
Display Format	binary
Min input value	

Attribute	Value
Max input value	
Scaling/resolution	1
Unit	

9.99.2 Description

Setting and enabling the park axis procedure command causes all monitors associated with the feedback sensing system to shut down. This affects the position control, the transducer monitoring circuit (feedback hardware), and the monitoring of the position window (S-0-0057). While the command is active, the drive does not report a C1D error (S-0-0011). The position feedback value status (S-0-0403) is reset by the drive.

The command is positively acknowledged when the monitoring system mentioned above is turned off.

When the set command is cancelled, all monitors mentioned above are turned on again. In order to relate the position feedback values again to the reference point again, the control unit shall start a homing procedure.

9.100 IDN S-0-0140 Controller type

9.100.1 Attributes

Table 154 shows the possible attributes for this IDN.

Table 154 – Attributes for IDN S-0-0140

Attribute	Value
Name	Controller type
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.100.2 Description

The operation data of the controller type contains the manufacturer controller type.

9.101 IDN S-0-0141 Motor type

9.101.1 Attributes

Table 155 shows the possible attributes for this IDN.

Table 155 – Attributes for IDN S-0-0141

Attribute	Value
Name	Motor type
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Refer to operation data with variable length and data type characters.	

9.101.2 Description

The operation data of the motor type contains the manufacturer motor type.

9.102 IDN S-0-0142 Application type

9.102.1 Attributes

Table 156 shows the possible attributes for this IDN.

Table 156 – Attributes for IDN S-0-0142

Attribute	Value
Name	Application type
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Refer to operation data with variable length and data type characters.	

9.102.2 Description

The operation data of the application type contains the type of the drive application (e.g., main spindle drive, round axis).

9.103 IDN S-0-0144 Signal status word

9.103.1 Attributes

Table 157 shows the possible attributes for this IDN.

Table 157 – Attributes for IDN S-0-0144

Attribute	Value
Name	Signal status word
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Structure of signal status word: bits 15 to 0 are defined in configuration list S-0-0026.	

9.103.2 Description

Signals can be transmitted in real-time from the drives to the control unit by means of the signal status word. For this purpose, the signal status word needs to be integrated in the AT as cyclic data. Bits in the signal status word are definable by means of the configuration list of the signal status word (see S-0-0026).

9.104 IDN S-0-0145 Signal control word

9.104.1 Attributes

Table 158 shows the possible attributes for this IDN.

Table 158 – Attributes for IDN S-0-0145

Attribute	Value
Name	Signal control word
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Structure of signal control word: bits 15 to 0 are defined in configuration list S-0-0027.	

9.104.2 Description

Signals can be transmitted in real-time from the control unit to the drives by means of the signal control word. For this purpose, the signal control word needs to be integrated in the MDT as cyclic data. Bits in the signal control word are definable by means of the configuration list of the signal control word (see S-0-0027).

9.105 IDN S-0-0146 Control unit controlled homing procedure command

9.105.1 Attributes

Table 159 shows the possible attributes for this IDN.

Table 159 – Attributes for IDN S-0-0146

Attribute	Value
Name	Control unit controlled homing procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.105.2 Description

When the master sets and enables the control unit controlled homing procedure command, the drive shall react on the programmed or assigned signals (homing enable S-0-0407, home switch S-0-0400, reference marker pulse of the feedback system).

When it reaches the appropriate marker pulse of the feedback system, the drive shall store the position feedback value in the corresponding marker position (S-0-0173 and S-0-0174). Furthermore, the drive shall set the signal "reference marker pulse registered" (S-0-0408). Afterwards, the drive acknowledges the procedure command as performed correctly.

When an error of C1D occurs, the procedure command results in an error in the procedure command acknowledgment.

9.106 IDN S-0-0148 Drive controlled homing procedure command

9.106.1 Attributes

Table 160 shows the possible attributes for this IDN.

Table 160 – Attributes for IDN S-0-0148

Attribute	Value
Name	Drive controlled homing procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.106.2 Description

When the Master sets and enables the Drive Controlled homing procedure command, the drive automatically activates the drive internal position control and accelerates to the homing velocity (S-0-0041) taking the Homing acceleration (S-0-0042) into account. The drive resets the bit "position feedback value status" (S-0-0403). Further options for the homing procedure are programmed in the "homing parameter" (S-0-0147). All changes of the cyclic command values are ignored as long as the procedure command is activated.

After passing over the reference marker pulse, the drive decelerates to standstill, taking the homing acceleration into account, or travels to the reference position. The procedure command "drive controlled homing" is successfully completed when the drive has stopped and the position feedback value is referred to the reference point of the machine. The drive announces this by setting the bit "position feedback value status" (S-0-0403).

The drive internally calculates the commanded position value (S-0-0047) relationship to the reference mark and adjusts S-0-0047 accordingly. The control unit shall then either read the "position command value" (S-0-0047) of the drive via the service channel and resets it’s position command value to this position command value, or the control sets its position command off the reference distance (S-0-0052, S-0-0054), (S-0-0147 shall be set to 1). Afterwards, the procedure command is cancelled by the control unit and the drive once again follows the command values of the control unit.

An interrupt of this procedure command will result in the position feedback value not being referenced to the position feedback reference mark. Also the 'position feedback status value' bit will not be set.

When an error of C1D occurs, the procedure command results in an error in the procedure command acknowledgment.

9.107 IDN S-0-0149 Positive drive stop procedure command

9.107.1 Attributes

Table 161 shows the possible attributes for this IDN.

Table 161 – Attributes for IDN S-0-0149

Attribute	Value
Name	Positive drive stop procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.107.2 Description

The positive drive stop procedure command results in all feedback monitors being shut off which otherwise would result in a C1D shut-down error due to drive locking during the positive stop. Shutting off the feedback monitoring system applies to all drive operation modes.

The sequence of the positive stop drive procedure command is identical in both operation modes; velocity control and position control.

The command is positively acknowledged as soon as:

- monitoring of the feedback system is turned off;
- $|T| \geq |T_{\text{limit}}|$; and
- $n_{\text{feedback}} = 0$ is true.

9.108 IDN S-0-0150 Reference offset 1

9.108.1 Attributes

Table 162 shows the possible attributes for this IDN.

Table 162 – Attributes for IDN S-0-0150

Attribute	Value
Name	Reference offset 1
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.108.2 Description

This parameter describes the distance between the reference marker pulse of position feedback 1 and the reference point.

9.109 IDN S-0-0151 Reference offset 2

9.109.1 Attributes

Table 163 shows the possible attributes for this IDN.

Table 163 – Attributes for IDN S-0-0151

Attribute	Value
Name	Reference offset 2
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.109.2 Description

This parameter describes the distance between the reference marker pulse of position feedback 2 and the reference point.

9.110 IDN S-0-0152 Position spindle procedure command

9.110.1 Attributes

Table 164 shows the possible attributes for this IDN.

Table 164 – Attributes for IDN S-0-0152

Attribute	Value
Name	Position spindle procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.110.2 Description

This procedure command automatically switches the drive to internal position loop control, below the spindle positioning speed (S-0-0222), and references the spindle, if necessary.

While this command is active, all changes to cyclic command values are ignored.

Additionally, depending on the Spindle position parameter (S-0-0154), the drive positions the spindle absolute to the programmed angle position (S-0-0153) or rotates the spindle relative (incrementally) (S-0-0180). When the drive interpolator reaches the selected command value, the drive sets the status ‘Target position attained’(S-0-0342). The status ‘In coarse position’ (S-0-0341) or ‘In Position’ (S-0-0336) are updated by the drive.

While this procedure command is active, the drive maintains the position control and adjusts to every new command value (S-0-0153 or S-0-0180) which is transferred through the service channel.

When the control unit cancels this command, the drive switches over to the mode of operation set in the control word.

Refer to the Spindle position diagram.

9.111 IDN S-0-0153 Spindle angle position

9.111.1 Attributes

Table 165 shows the possible attributes for this IDN.

Table 165 – Attributes for IDN S-0-0153

Attribute	Value
Name	Spindle angle position
Version	
Length	4
Display Format	signed decimal
Min input value	

Attribute	Value
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.111.2 Description

This parameter is the absolute spindle angle position relative to the reference point. The parameter is enabled only in connection with the position spindle procedure command (see S-0-0152) or the drive-controlled synchronous operation procedure command (see S-0-0223).

9.112 IDN S-0-0154 Spindle positioning parameter

9.112.1 Attributes

Table 166 shows the possible attributes for this IDN.

Table 166 – Attributes for IDN S-0-0154

Attribute	Value
Name	Spindle positioning parameter
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.112.2 Description

When the velocity command value is equal to zero and the position spindle procedure command is active, the turning direction for reaching the spindle angle position can be given here. If the velocity command value is not equal to zero, the current turning direction is maintained in order to reach the spindle angle position. Table 167 shows details of the legal values.

Table 167 – Structure of Spindle Position Parameter

Bit	Meaning	Value
0 to 1		
	Rotate clockwise	00
	Rotate counter clockwise	01
	Take shortest path	10
	Last active rotational direction	11
2		
	Spindle angle position (S-0-0153)	0
	Spindle relative offset (S-0-0180)	1

Bit	Meaning	Value
3		
	Motor feedback	0
	External feedback	1
4		
	Homing is activated once for a spindle that has not already been activated. At every further start of the position spindle procedure command the spindle is positioning on the spindle angle position (S-0-0153).	0
	At every start of the position spindle procedure command the spindle activates the homing (with home switch or encoder reference) after this the spindle is positioned on the spindle angle position after activation of the position spindle procedure command.	1
15 to 5	(reserved)	

9.113 IDN S-0-0155 Friction torque compensation

9.113.1 Attributes

Table 168 shows the possible attributes for this IDN.

Table 168 – Attributes for IDN S-0-0155

Attribute	Value
Name	Friction torque compensation
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0086 Scaling factor: S-0-0093 Scaling exponent: S-0-0094
Unit	

9.113.2 Description

The friction torque compensation is overlaid additively to the torque command value. During addition, the friction torque compensation and torque command value need to have the same sign. The inclusion of friction torque compensation helps compensate for the frictional grip during acceleration from standstill, and during reversals.

9.114 IDN S-0-0156 Velocity feedback value 2

9.114.1 Attributes

Table 169 shows the possible attributes for this IDN.

Table 169 – Attributes for IDN S-0-0156

Attribute	Value
Name	Velocity feedback value 2
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.114.2 Description

The velocity feedback value 2 is transferred from the drive to the control unit in order to allow the control unit to periodically display the velocity. The velocity feedback value 2 refers to the external encoder.

9.115 IDN S-0-0157 Velocity window

9.115.1 Attributes

Table 170 shows the possible attributes for this IDN.

Table 170 – Attributes for IDN S-0-0157

Attribute	Value
Name	Velocity window
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.115.2 Description

The velocity window” relates the current velocity to the sum of the velocity command values. If the current velocity feedback value falls within the calculated velocity window, the drive sets the status '$n_{\text{feedback}} = n_{\text{command}}$' (S-0-0330).

9.116 IDN S-0-0158 Power threshold (P_x)

9.116.1 Attributes

Table 171 shows the possible attributes for this IDN.

Table 171 – Attributes for IDN S-0-0158

Attribute	Value
Name	Power threshold (P_x)
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	W

9.116.2 Description

The power threshold (P_x) parameter determines at which power level the drive generates the status

'$P \geq P_x$' (see S-0-0337)

9.117 IDN S-0-0159 Monitoring window

9.117.1 Attributes

Table 172 shows the possible attributes for this IDN.

Table 172 – Attributes for IDN S-0-0159

Attribute	Value
Name	Monitoring window
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.117.2 Description

By means of the monitoring window, the maximum position deviation, as referenced to the active position feedback value, can be defined for the position feedback value. When the position error value exceeds the maximum value of the monitoring window, the drive sets an error for excessive position deviation in C1D (S-0-0011).

9.118 IDN S-0-0160 Acceleration data scaling type

9.118.1 Attributes

Table 173 shows the possible attributes for this IDN.

Table 173 – Attributes for IDN S-0-0160

Attribute	Value
Name	Acceleration data scaling type
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.118.2 Description

A variety of scaling methods can be selected by means of the acceleration data scaling type parameter.

Table 174 shows details of the legal values.

Table 174 – Structure of the Acceleration Data Scaling Type

Bit	Meaning	Polarity	Value
2 to 0	Scaling method		
		no scaling	000
		linear scaling	001
		rotational scaling	010
		ramp time (see S-0-0446)	011
3	Ramp reference velocity		
		preferred scaling	0
		parameter scaling	1
4	Units for linear scaling		
		metres [m]	0
		inches [in] (additional)	1
4	Units for rotational scaling		
		radian [rad]	0
		(reserved)	1
5	Time units		
		seconds [s]	0
		(reserved)	1
6	Data reference		
		at the motor shaft	0
		at the load	1
all other	(reserved)		

9.119 IDN S-0-0161 Acceleration data scaling factor

9.119.1 Attributes

Table 175 shows the possible attributes for this IDN.

Table 175 – Attributes for IDN S-0-0161

Attribute	Value
Name	Acceleration data scaling factor
Version	
Length	2
Display Format	unsigned decimal
Min input value	1
Max input value	
Scaling/resolution	1
Unit	

9.119.2 Description

This parameter defines the scaling factor for all acceleration data in a drive.

9.120 IDN S-0-0162 Acceleration data scaling exponent

9.120.1 Attributes

Table 176 shows the possible attributes for this IDN.

Table 176 – Attributes for IDN S-0-0162

Attribute	Value
Name	Acceleration data scaling exponent
Version	
Length	2
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.120.2 Description

This parameter defines the scaling exponent for all acceleration data in a drive. Table 177 shows details of the legal values.

Table 177 – Structure of the Scaling Exponent

Bit	Meaning	Polarity	Value
15	Sign of the exponent		
		positive	0
		negative	1
14 to 0	Exponent		

9.121 IDN S-0-0163 Weight counterbalance

9.121.1 Attributes

Table 178 shows the possible attributes for this IDN.

Table 178 – Attributes for IDN S-0-0163

Attribute	Value
Name	Weight counterbalance
Version	
Length	2
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0086 Scaling factor: S-0-0093 Scaling exponent: S-0-0094
Unit	

9.121.2 Description

This parameter is used to program the counterbalance (torque) of vertically positioned (hanging) axes in the positive or negative effective direction.

9.122 IDN S-0-0164 Acceleration feedback value 1

9.122.1 Attributes

Table 179 shows the possible attributes for this IDN.

Table 179 – Attributes for IDN S-0-0164

Attribute	Value
Name	Acceleration feedback value 1
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0160 Scaling factor: S-0-0161 Scaling exponent: S-0-0162
Unit	

9.122.2 Description

The acceleration feedback value 1 is the velocity change referred to the motor encoder. Velocity increase is described as positive acceleration. Velocity decrease is described as negative acceleration.

9.123 IDN S-0-0165 and S-0-0166 Distance-coded reference marks A and B

9.123.1 Attributes

Table 180 shows the possible attributes for this IDN.

Table 180 – Attributes for IDN S-0-0165

Attribute	Value
Name	Distance-coded reference marks A and B
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	defined by the drive manufacturer
Unit	defined by the drive manufacturer

9.123.2 Description

When a measuring system with distance-coded reference marks is being used, parameter S-0-0165 contains the larger periodic distance between two of the reference marks and S-0-0166 contains the larger periodic distance between two of the reference marks.

9.124 IDN S-0-0167 Frequency limit of feedback 1/S-0-0168 Frequency limit of feedback 2

9.124.1 Attributes

Table 181 shows the possible attributes for this IDN.

Table 181 – Attributes for IDN S-0-0167, S-0-0168

Attribute	Value
Name	Frequency limit of feedback 1, respectively feedback 2
Version	
Length	4
Display Format	unsigned decimal
Min input value	1
Max input value	
Scaling/resolution	1
Unit	Hz

9.124.2 Description

The frequency limit of feedback 1 is the maximum frequency of the motor feedback signal, i.e., the maximum working frequency which the electronics can output in pulses per second.

The frequency limit of feedback 2 is the maximum frequency of the external feedback signal, i.e., the maximum working frequency which the electronics can output in pulses per second.

If these frequencies were exceeded, the drive would lose its reference to the machine zero point and bit 0 of the position feedback value status (S-0-0403) would be reset.

9.125 IDN S-0-0169 Probe control parameter

9.125.1 Attributes

Table 182 shows the possible attributes for this IDN.

Table 182 – Attributes for IDN S-0-0169

Attribute	Value
Name	Probe control parameter
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.125.2 Description

This parameter fixes which probes and which edges are activated for the probing cycle procedure command.

Table 183 shows details of the legal values.

Table 183 – Structure of the Probe Control Parameter

Bit	Meaning	Polarity	Value
0	Probe 1 positive edge		
		positive edge is not active	0
		positive edge is active	1
1	Probe 1 negative edge		
		negative edge is not active	0
		negative edge is active	1
2	Probe 2 positive edge		
		positive edge is not active	0
		positive edge is active	1
3	Probe 2 negative edge		
		negative edge is not active	0
		negative edge is active	1
all other	(reserved)		

9.126 IDN S-0-0170 Probing cycle procedure command

9.126.1 Attributes

Table 184 shows the possible attributes for this IDN.

Table 184 – Attributes for IDN S-0-0170

Attribute	Value
Name	Probing cycle procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.126.2 Description

When the master sets and enables the probing cycle procedure command, the drive reacts on the following parameters:

- probe 1/2 enable (S-0-0405, S-0-0406); and
- probe 1/2 (S-0-0401, S-0-0402) as programmed in the probe control parameter (S-0-0169).

While the procedure command is activated, the control unit can start multiple measurements.

If the control unit does not want any more measurements, the control unit cancels the procedure command.

9.127 IDN S-0-0171 Calculate displacement procedure command

9.127.1 Attributes

Table 185 shows the possible attributes for this IDN.

Table 185 – Attributes for IDN S-0-0171

Attribute	Value
Name	Calculate displacement procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.127.2 Description

When the master sets and enables the procedure command "calculate displacement" the drive takes the parameters:

- reference distance 1/2 (S-0-0052/S-0-0054);
- reference Offset 1/2 (S-0-0150/S-0-0151);

- marker position A and marker position B (S-0-0173/S-0-0174);

into account to calculate the displacement between the old and the new (referenced) command/feedback system.

The calculated displacement is stored in the parameters

- displacement parameter 1 (S-0-0175, motor feedback);
- displacement parameter 2 (S-0-0176, external feedback).

The feedback system for which the displacement shall be calculated is selected in the homing parameter (S-0-0147, bit 3).

When the drive recognises the displacement as invalid, the procedure command results in an error in the procedure command acknowledgment.

9.128 IDN S-0-0172 Displacement to the referenced system procedure command

9.128.1 Attributes

Table 186 shows the possible attributes for this IDN.

Table 186 – Attributes for IDN S-0-0172

Attribute	Value
Name	Displacement to the referenced system procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.128.2 Description

When the master sets and enables the procedure command "displacement to the referenced system", the drive switches to the referenced position feedback system and marks this by simultaneously setting the bit "position feedback value status" (S-0-0403).

To inform the control unit about the switching in real-time, the bit "position feedback value status" shall be assigned to a real-time status bit.

While the procedure command is activated, the control unit switches to the referenced command value system and marks this by simultaneously setting the bit "position command value status" (S-0-0404).

To inform the drive about the switching in real-time, the bit "position command value status" shall be assigned to a real-time control bit.

The bit "position command value status" shall be set by the control unit independently from the operation mode.

The procedure command is completed by the drive as soon as the bits "position feedback value status" and "position command value status" are set to 1. There is no fixed sequence to set the bits.

9.129 IDN S-0-0173 Marker position A

9.129.1 Attributes

Table 187 shows the possible attributes for this IDN.

Table 187 – Attributes for IDN S-0-0173

Attribute	Value
Name	Marker position A
Version	
Length	
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution S-0-0079
Unit	

9.129.2 Description

When the drive recognises the reference marker pulse of position feedback 1/2 during homing, it stores the instantaneous unreferenced position feedback value 1/2 in the parameter marker position A.

There are groups of two reference marker pulses with a distance coded feedback system.

When the drive recognises the first reference marker pulse of distance coded position feedback 1/2 during homing, it stores the instantaneous unreferenced position feedback value 1/2 in the parameter marker position A.

9.130 IDN S-0-0174 Marker position B

9.130.1 Attributes

Table 188 shows the possible attributes for this IDN.

Table 188 – Attributes for IDN S-0-0174

Attribute	Value
Name	Marker position B
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.130.2 Description

The marker position B is used additionally for distance coded feedback to be able to calculate the absolute position referred to the zero point of the feedback system.

There are groups of two reference marker pulses with a distance coded feedback system.

When the drive recognises the second reference marker pulse of distance coded position feedback 1/2 during homing, it stores the instantaneous unreferenced position feedback value 1/2 in the parameter marker position B.

9.131 IDN S-0-0176 Displacement parameter 2

9.131.1 Attributes

Table 189 shows the possible attributes for this IDN.

Table 189 – Attributes for IDN S-0-0176

Attribute	Value
Name	Displacement parameter 2
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.131.2 Description

When the procedure command "calculate displacement" (S-0-0171) is active, the drive calculates the difference between the old position feedback value and the new position feedback value. The drive stores the difference as the "displacement parameter 2" if external feedback is selected.

9.132 IDN S-0-0177 Absolute distance 1

9.132.1 Attributes

Table 190 shows the possible attributes for this IDN.

Table 190 – Attributes for IDN S-0-0177

Attribute	Value
Name	Absolute distance 1
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	defined by the drive manufacturer
Unit	defined by the manufacturer

9.132.2 Description

This parameter describes the distance between the machine zero point and the zero point of an absolute feedback system on the motor.

9.133 IDN S-0-0178 Absolute distance 2

9.133.1 Attributes

Table 191 shows the possible attributes for this IDN.

Table 191 – Attributes for IDN S-0-0178

Attribute	Value
Name	Absolute distance 2
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	defined by the manufacturer
Unit	defined by the manufacturer

9.133.2 Description

This parameter describes the distance between the machine zero point and the zero point of an absolute feedback system on the machine (external feedback system).

9.134 IDN S-0-0179 Probe status

9.134.1 Attributes

Table 192 shows the possible attributes for this IDN.

Table 192 – Attributes for IDN S-0-0179

Attribute	Value
Name	Probe status
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.134.2 Description

If the drive stores one or more measurement values while the procedure command "probing cycle” (S-0-0170) is activated, it simultaneously sets the assigned bit in the probe status.

If probe 1 enable (S-0-0405) is reset by the control unit, the drive resets bit 0 and bit 1 of probe status.

If probe 2 enable (S-0-0406) is reset by the control unit, the drive resets bit 2 and bit 3 of probe status.

The drive resets all bits of the probe status when the control unit cancels the "probing cycle procedure command" (S-0-0170).

Table 193 shows details of legal values.

Table 193 – Structure of Probe Status

Bit	Meaning	Polarity	Value
0	Probe 1 positive latched (see S-0-0409)		
		not latched	0
		latched	1
1	Probe 1 negative latched (see S-0-410)		
		not latched	0
		latched	1
2	Probe 2 positive latched (see S-0-0411)		
		not latched	0
		latched	1
3	Probe 2 negative latched (S-0-0412)		
		not latched	0
		latched	1
all other	(reserved)		

9.135 IDN S-0-0180 Spindle relative offset

9.135.1 Attributes

Table 194 shows the possible attributes for this IDN.

Table 194 – Attributes for IDN S-0-0180

Attribute	Value
Name	Spindle relative offset
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.135.2 Description

The parameter is enabled only in connection with the position spindle procedure command (see S-0-0152).

The spindle relative offset is added to the absolute position value while being processed.

This parameter is used to drive the spindle of a certain number of revolutions.

9.136 IDN S-0-0181 Manufacturer class 2 diagnostic

9.136.1 Attributes

Table 195 shows the possible attributes for this IDN.

Table 195 – Attributes for IDN S-0-0181

Attribute	Value
Name	Manufacturer class 2 diagnostic
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.136.2 Description

The drive manufacturer can define additional shut-down warnings in manufacturer class 2 diagnostics. If a warning is set or reset in the manufacturer class 2 diagnostic, the manufacturer-specific warning bit in class 2 diagnostic (see S-0-0012) is set as well. When the manufacturer class 2 diagnostic is read via the service channel, the manufacturer specific warning bit in class 2 diagnostic is reset to 0, but the change bit for C2D (bit 12) in the drive status is not changed. Table 196 shows details of legal values.

Table 196 – Structure of Manufacturer C2D

Bit	Meaning	Value
15 to 0		
	no warning	all 0s
	warning occured	all 1s

9.137 IDN S-0-0182 Manufacturer class 3 diagnostic

9.137.1 Attributes

Table 197 shows the possible attributes for this IDN.

Table 197 – Attributes for IDN S-0-0182

Attribute	Value
Name	Manufacturer class 3 diagnostic
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.137.2 Description

The drive manufacturer can define additional operation status conditions in the manufacturer class 3 diagnostic (see Table 198). If an operation status is set or reset in the manufacturer class 3 diagnostic, the manufacturer-specific operation status bit in class 3 diagnostic (see S-0-0013) is set as well. When the manufacturer class 3 diagnostic is read via the service channel, the manufacturer specific operation status bit in class 3 diagnostic is reset to 0, but the change bit for C3D (bit 11) in the drive status is not changed.

Table 198 – Structure of Manufacturer C3D

Bit	Meaning	Value
15 to 0		
	no conditions exist	all 0s
	operation condition(s) exist	any bit(s) set

9.138 IDN S-0-0183 Synchronisation velocity window

9.138.1 Attributes

Table 199 shows the possible attributes for this IDN.

Table 199 – Attributes for IDN S-0-0183

Attribute	Value
Name	Synchronisation velocity window
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.138.2 Description

If, during velocity synchronous operation, the difference between the synchronous velocity command value of the lead spindle and the velocity feedback value of the synchronous spindle falls within the synchronisation window, the drive sets the synchronisation operation status (see S-0-0308).

When necessary, the synchronisation operation status can be assigned to a real-time status bit in the drive status word and transferred to the control unit.

9.139 IDN S-0-0184 Synchronisation velocity error limit

9.139.1 Attributes

Table 200 shows the possible attributes for this IDN.

Table 200 – Attributes for IDN S-0-0184

Attribute	Value
Name	Synchronisation velocity error limit
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.139.2 Description

If, during velocity synchronous operation, the difference between the synchronous velocity command value of the lead spindle and the velocity feedback value of the synchronous spindle becomes greater than the synchronisation velocity error limit value, the drive sets the synchronisation error status (see S-0-0309).

When necessary, the synchronisation error status can be assigned to a real-time status bit in the drive status word and transferred to the control unit.

9.140 IDN S-0-0189 Following distance

9.140.1 Attributes

Table 201 shows the possible attributes for this IDN.

Table 201 – Attributes for IDN S-0-0189

Attribute	Value
Name	Following distance
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.140.2 Description

The drive uses the operation data of this IDN to store the distance between position command value and the appropriate position feedback value 1/2. Calculation of the following distance:

following distance = position command value – position feedback value 1/2

9.141 IDN S-0-0190 Drive controlled gear engaging procedure command

9.141.1 Attributes

Table 202 shows the possible attributes for this IDN.

Table 202 – Attributes for IDN S-0-0190

Attribute	Value
Name	Drive controlled gear engaging procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.141.2 Description

When the drive controlled gear engaging procedure command is activated, the drive ignores the cyclic command values and turns in the average engaging speed (S-0-0214). With this procedure command, the "gear engaging function" is activated in the drive using the parameters – engaging dither amplitude (S-0-0213) – average engaging speed (S-0-0214) – engaging dither period (S-0-0215) in order to improve the gear shifting.

When the relevant actual values fulfil the conditions of the gear engaging function, the drive signals the procedure command as performed correctly.

When the master cancels the procedure command, the drive turns off the gear engaging function and the cyclic command values are valid in the drive again.

9.142 IDN S-0-0191 Cancel reference point procedure command

9.142.1 Attributes

Table 203 shows the possible attributes for this IDN.

Table 203 – Attributes for IDN S-0-0191

Attribute	Value
Name	Cancel reference point procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.142.2 Description

When the master sets and enables the procedure command "cancel reference point" the drive resets the bit "position feedback value status" (S-0-0403).

The procedure command is completed successfully by the drive as soon as the bit "position feedback value status" is reset to 0.

9.143 IDN S-0-0192 IDN-list of all backup operation data

9.143.1 Attributes

Table 204 shows the possible attributes for this IDN.

Table 204 – Attributes for IDN S-0-0192

Attribute	Value
Name	IDN-list of all backup operation data
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.143.2 Description

The IDN-list stores IDNs of all drive data that shall be loaded in the drive in order to guarantee correct operation. The master uses this list to generate a backup copy of the drive parameters (e.g., on a floppy disk).

9.144 IDN S-0-0193 Positioning jerk

9.144.1 Attributes

Table 205 shows the possible attributes for this IDN.

Table 205 – Attributes for IDN S-0-0193

Attribute	Value
Name	Positioning jerk
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0160 Scaling factor S-0-0161 Scaling exponent S-0-0162
Unit	

9.144.2 Description

"Positioning jerk" is the maximum rate of change of acceleration in the operation modes "Interpolation" and "Positioning". Programming a value of zero will cause jerk limiting to be deactivated.

9.145 IDN S-0-0194 Acceleration command value

9.145.1 Attributes

Table 206 shows the possible attributes for this IDN.

Table 206 – Attributes for IDN S-0-0194

Attribute	Value
Name	Acceleration command value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0160 Scaling factor: S-0-0161 Scaling exponent: S-0-0162
Unit	

9.145.2 Description

The acceleration command value can be transferred on demand by the control unit as cyclic data or via the service channel.

9.146 IDN S-0-0195 Acceleration feedback value 2

9.146.1 Attributes

Table 207 shows the possible attributes for this IDN.

Table 207 – Attributes for IDN S-0-0195

Attribute	Value
Name	Acceleration feedback value 2
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0160 Scaling factor: S-0-0161 Scaling exponent: S-0-0162
Unit	

9.146.2 Description

The acceleration feedback value 2 is the velocity change referred to the external encoder. Velocity increase is described as positive acceleration. Velocity decrease is described as negative acceleration.

9.147 IDN S-0-0196 Motor rated current

9.147.1 Attributes

Table 208 shows the possible attributes for this IDN.

Table 208 – Attributes for IDN S-0-0196

Attribute	Value
Name	Motor rated current
Version	
Length	4
Display Format	signed decimal
Min input value	0
Max input value	
Scaling/resolution	0,001
Unit	A

9.147.2 Description

The motor rated current is the current at which the motor produces the rated torque according to the motor spec sheet. For all asynchronous motors, this parameter is used as a reference for all torque data and for determining motor related current values.

9.148 IDN S-0-0197 Set coordinate system procedure command

9.148.1 Attributes

Table 209 shows the possible attributes for this IDN.

Table 209 – Attributes for IDN S-0-0197

Attribute	Value
Name	Set coordinate system procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.148.2 Description

After activation of the “Set coordinate system procedure command”, the drive ignores the position command value and instead transfers the programmed “Initial coordinate value” (S-0-0198) into the drive-internal position command. Additionally, the drive re-calculates all absolute values (feedbacks, position limits, etc.), relating them to the “Initial coordinate value”.

The position feedback value status (S-0-0403) and position command value status (S-0-0404) are not affected by this procedure command.

This procedure command is successfully completed by the drive when all necessary calculations are completed, the “Current coordinate offset” (S-0-0283) is calculated, and the drive has based its coordinate system on the “Initial coordinate value” (S-0-0198).

Before the control clears the command, it shall also adjust its coordinate system to the same value the drive used. After clearing of the procedure command, the drive will once again act upon the position command.

The procedure command will terminate with a fault, when the drive detects an error during the command specific calculations.

9.149 IDN S-0-0198 Initial coordinate value

9.149.1 Attributes

Table 210 shows the possible attributes for this IDN.

Table 210 – Attributes for IDN S-0-0198

Attribute	Value
Name	Initial coordinate value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.149.2 Description

The drives coordinate system will be set to the value programmed as the initial coordinate value during the Set coordinate system procedure command (S-0-0197).

9.150 IDN S-0-0199 Shift coordinate system procedure command

9.150.1 Attributes

Table 211 shows the possible attributes for this IDN.

Table 211 – Attributes for IDN S-0-0199

Attribute	Value
Name	Shift coordinate system procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.150.2 Description

After activation of the “Shift coordinate system procedure command”, the drive ignores the position command value and instead adds the programmed “Coordinate offset value” (S-0-0275) to the drive-internal position command. Additionally, the drive re-calculates all absolute values (feedbacks, position limits, etc.), relating them to the “Coordinate offset value”.

The position feedback value status (S-0-0403) and position command value status (S-0-0404) are not affected by this procedure command.

This procedure command is successfully completed by the drive when all necessary calculations are completed, the “Current coordinate offset” (S-0-0283) is calculated, and the drive has adjusted its coordinate system based upon the “Coordinate offset value”.

Before the control clears the procedure command, it shall also adjust its coordinate system to the same value the drive used. After clearing of the procedure command, the drive will again act upon the position command.

The procedure command will terminate with a fault, when the drive detects an error during the command specific calculations.

9.151 IDN S-0-0200 Amplifier warning temperature

9.151.1 Attributes

Table 212 shows the possible attributes for this IDN.

Table 212 – Attributes for IDN S-0-0200

Attribute	Value
Name	Amplifier warning temperature
Version	
Length	2
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type, S-0-0208
Unit	

9.151.2 Description

When the amplifier temperature exceeds the amplifier warning temperature value, the drive sets the warning bit for amplifier overtemperature in C2D (S-0-0012).

9.152 IDN S-0-0201 Motor warning temperature

9.152.1 Attributes

Table 213 shows the possible attributes for this IDN.

Table 213 – Attributes for IDN S-0-0201

Attribute	Value
Name	Motor warning temperature
Version	
Length	2
Display Format	unsigned decimal
Min input value	0
Max input value	
Scaling/resolution	Scaling type, S-0-0208
Unit	

9.152.2 Description

When the motor temperature exceeds the motor warning temperature value, the drive sets the warning bit for motor overtemperature in C2D (S-0-0012).

9.153 IDN S-0-0202 Cooling error warning temperature

9.153.1 Attributes

Table 214 shows the possible attributes for this IDN.

Table 214 – Attributes for IDN S-0-0202

Attribute	Value
Name	Cooling error warning temperature
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type, S-0-0208
Unit	

9.153.2 Description

When an error occurs in the cooling system (e.g., the temperature inside the circuitry housing exceeds the cooling error warning temperature value), the drive sets the warning bit for cooling error in C2D (S-0-0012).

9.154 IDN S-0-0203 Amplifier shut-down temperature

9.154.1 Attributes

Table 215 shows the possible attributes for this IDN.

Table 215 – Attributes for IDN S-0-0203

Attribute	Value
Name	Amplifier shut-down temperature
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type, S-0-0208
Unit	

9.154.2 Description

When the amplifier temperature exceeds the amplifier shut-down temperature value, the drive sets the bit for amplifier overtemperature shut-down in C1D (S-0-0011).

9.155 IDN S-0-0204 Motor shut-down temperature

9.155.1 Attributes

Table 216 shows the possible attributes for this IDN.

Table 216 – Attributes for IDN S-0-0204

Attribute	Value
Name	Motor shut-down temperature
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type, S-0-0208
Unit	

9.155.2 Description

When the motor temperature exceeds the motor shut-down temperature value, the drive sets the bit for motor overtemperature shut-down in C1D (S-0-0011).

9.156 IDN S-0-0205 Cooling error shut-down temperature

9.156.1 Attributes

Table 217 shows the possible attributes for this IDN.

Table 217 – Attributes for IDN S-0-0205

Attribute	Value
Name	Cooling error shut-down temperature
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type, S 0-0208
Unit	

9.156.2 Description

When an error occurs in the cooling system (e.g., the temperature inside the circuitry housing exceeds the cooling error shut-down temperature value), the drive sets the bit for cooling error shut-down in C1D (S-0-0011).

9.157 IDN S-0-0206 Drive on delay time

9.157.1 Attributes

Table 218 shows the possible attributes for this IDN.

Table 218 – Attributes for IDN S-0-0206

Attribute	Value
Name	Drive on delay time
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,1
Unit	ms

9.157.2 Description

After torque is activated (bit 14, drive status is set) "drive on delay time" is started. The drive follows the command values after the "drive on delay time" has elapsed.

9.158 IDN S-0-0207 Drive off delay time

9.158.1 Attributes

Table 219 shows the possible attributes for this IDN.

Table 219 – Attributes for IDN S-0-0207

Attribute	Value
Name	Drive off delay time
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,1
Unit	ms

9.158.2 Description

After "drive off" (bit 15 of the master control word) is reset and n_{min} is reached, the drive off delay time is started and the locking of the brake is initiated. The torque remains activated in the drive until this drive off delay time has elapsed.

EXAMPLE Used as break delay time (clamping or release).

9.159 IDN S-0-0208 Temperature data scaling type

9.159.1 Attributes

Table 220 shows the possible attributes for this IDN.

Table 220 – Attributes for IDN S-0-0208

Attribute	Value
Name	Temperature data scaling type
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.159.2 Description

This scaling type parameter determines whether temperature is used in units of °C or °F. Temperature scaling is 0,1 °C or 0,1 F. The data length of temperature data is fixed to two bytes. Table 221 shows details of the legal values.

Table 221 – Structure of Temperature Data Scaling Type

Bit	Meaning	Value
0		
	entry in 0,1 °C	0
	entry in 0,1 °F	1
all other	(reserved)	

9.160 IDN S-0-0209 Lower adaptation limit

9.160.1 Attributes

Table 222 shows the possible attributes for this IDN.

Table 222 – Attributes for IDN S-0-0209

Attribute	Value
Name	Lower adaptation limit
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.160.2 Description

Below the lower adaptation limit, the proportional gain adaptation (S-0-0211) and the integral action time adaptation (S-0-0212) are enabled. Above the lower adaptation limit, the adaptation of proportional gain and the integral action time change linearly from the lower level to the values at the upper adaptation limit, as defined for the velocity loop proportional gain (S-0-0100) and the velocity loop integral action time (S-0-0101).

9.161 IDN S-0-0210 Upper adaptation limit

9.161.1 Attributes

Table 223 shows the possible attributes for this IDN.

Table 223 – Attributes for IDN S-0-0210

Attribute	Value
Name	Upper adaptation limit
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.161.2 Description

Above the upper adaptation limit, the velocity loop proportional gain (S-0-0100) and the velocity loop integral action time (see S-0-0101) are enabled. Below the upper adaptation limit, the proportional gain and the integral action time velocity loops change linearly from the higher level to the values at the lower adaptation limit as defined for the proportional gain adaptation (S-0-0211) and the integral action time adaptation (S-0-0212).

9.162 IDN S-0-0211 Adaptation proportional gain

9.162.1 Attributes

Table 224 shows the possible attributes for this IDN.

Table 224 – Attributes for IDN S-0-0211

Attribute	Value
Name	Adaptation proportional gain
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,1
Unit	%

9.162.2 Description

Adaptation proportional gain determines the percentage value below the lower adaptation limit, dependent on the velocity loop proportional gain (S-0-0100). Above the upper adaptation limit, adaptation proportional gain is not enabled. Between the upper and lower adaptation limits, the velocity loop proportional gain changes linearly, dependent on the adaptation proportional gain and the actual velocity.

9.163 IDN S-0-0212 Adaptation integral action time

9.163.1 Attributes

Table 225 shows the possible attributes for this IDN.

Table 225 – Attributes for IDN S-0-0212

Attribute	Value
Name	Adaptation integral action time
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,1
Unit	%

9.163.2 Description

Adaptation integral action time determines the percentage value below the lower adaptation limit, dependent on the velocity loop integral action time (S-0-0101). Above the upper adaptation limit, adaptation integral action time is not enabled. Between the lower and upper adaptation limits, the velocity loop integral action time changes linearly, dependent on the adaptation integral action time and the actual velocity.

9.164 IDN S-0-0213 Engaging dither amplitude

9.164.1 Attributes

Table 226 shows the possible attributes for this IDN.

Table 226 – Attributes for IDN S-0-0213

Attribute	Value
Name	Engaging dither amplitude
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	10^{-4}
Unit	min^{-1}

9.164.2 Description

The engaging dither amplitude defines the maximum speed of the drive in both directions during the drive controlled gear engaging procedure command. Data reference is the motor shaft.

9.165 IDN S-0-0214 Average engaging speed

9.165.1 Attributes

Table 227 shows the possible attributes for this IDN.

Table 227 – Attributes for IDN S-0-0214

Attribute	Value
Name	Average engaging speed
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	10^{-4}
Unit	min^{-1}

9.165.2 Description

During the drive controlled gear engaging procedure command, the drive adds the programmed average engaging speed to the engaging dither amplitude. Data reference is the motor shaft.

9.166 IDN S-0-0215 Engaging dither period

9.166.1 Attributes

Table 228 shows the possible attributes for this IDN.

Table 228 – Attributes for IDN S-0-0215

Attribute	Value
Name	Engaging dither period
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,1
Unit	ms

9.166.2 Description

During the drive controlled gear engaging procedure command, the drive oscillates at its programmed engaging dither amplitude, average engaging speed, and engaging dither period.

9.167 IDN S-0-0216 Switch parameter set procedure command

9.167.1 Attributes

Table 229 shows the possible attributes for this IDN.

Table 229 – Attributes for IDN S-0-0216

Attribute	Value
Name	Switch parameter set procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.167.2 Description

This procedure command allows the system to switch parameter sets and/or gear ratio. The drive switches to the parameter set which is programmed in the parameter set preselection (S-0-0217). If a gear ratio has also been programmed in the gear ratio preselection (S-0-0218), the gear ratio is switched as well.

9.168 IDN S-0-0217 Parameter set preselection

9.168.1 Attributes

Table 230 shows the possible attributes for this IDN.

Table 230 – Attributes for IDN S-0-0217

Attribute	Value
Name	Parameter set preselection
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.168.2 Description

The parameter set of the drive is selected by means of the parameter set preselection. The switch parameter set procedure command (see S-0-0216) is used to switch parameter sets. If the drive has no switchable parameter sets, it will only accept parameter set 0. Therefore, parameter set 0 shall be available in every drive and will be activated during initialisation.

Table 231 shows details of the legal values.

Table 231 – Structure of Parameter set preselection

Bit	Meaning	Value
2 to 0		
	parameter set 0	000
	parameter set 1	001
	parameter set 2	010
	parameter set 3	011
	parameter set 4	100
	parameter set 5	101
	parameter set 6	110
	parameter set 7	111
all other	(reserved)	

9.169 IDN S-0-0218 Gear ratio preselection

9.169.1 Attributes

Table 232 shows the possible attributes for this IDN.

Table 232 – Attributes for IDN S-0-0218

Attribute	Value
Name	Gear ratio preselection
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.169.2 Description

The gear ratio preselection selects the gear ratio of the drive. The switch parameter set procedure command (see S-0-0216) is used to switch the gear ratio. If the drive switches to another gear ratio, additional parameters (see S-0-0217, S-0-0219) can be activated.

Table 233 shows details of the legal values.

Table 233 – Structure of the Gear ratio preselection

Bit	Polarity	Value
2 to 0		
	gear ratio 0	000
	gear ratio 1	001
	gear ratio 2	010
	gear ratio 3	011
	gear ratio 4	100

Bit	Polarity	Value
	gear ratio 5	101
	gear ratio 6	110
	gear ratio 7	111
all other	(reserved)	

9.170 IDN S-0-0219 IDN–list of parameter set

9.170.1 Attributes

Table 234 shows the possible attributes for this IDN.

Table 234 – Attributes for IDN S-0-0219

Attribute	Value
Name	IDN–list of parameter set
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.170.2 Description

IDN-list of S-0-0219 contains all IDNs of parameter set 0 which are also supported in the parameter sets 1 to 7.

IDN-list S-X-0219 (X = 1 to 7) contains all the IDNs of operation data which are changed automatically when parameter set X is activated.

An IDN-list S–X–0219 (X = 1 to 7) can contain only parameters of parameter set 0.

9.171 IDN S-0-0220 Minimum spindle speed

9.171.1 Attributes

Table 235 shows the possible attributes for this IDN.

Table 235 – Attributes for IDN S-0-0220

Attribute	Value
Name	Minimum spindle speed
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	10^{-4}
Unit	min^{-1}

9.171.2 Description

When the speed falls below minimum spindle speed, the drive can shift to another gear (see also S-0-0216).

9.172 IDN S-0-0221 Maximum spindle speed

9.172.1 Attributes

Table 236 shows the possible attributes for this IDN.

Table 236 – Attributes for IDN S-0-0221

Attribute	Value
Name	Maximum spindle speed
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	10^{-4}
Unit	min^{-1}

9.172.2 Description

The maximum spindle speed indicates the limiting speed for the actual gear.

9.173 IDN S-0-0222 Spindle positioning speed

9.173.1 Attributes

Table 237 shows the possible attributes for this IDN.

Table 237 – Attributes for IDN S-0-0222

Attribute	Value
Name	Spindle positioning speed
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	10^{-4}
Unit	min^{-1}

9.173.2 Description

When the position spindle procedure command (see S-0-0152) is received, the drive accelerates or decelerates to the spindle positioning speed, depending upon the current speed.

9.174 IDN S-0-0223 Drive controlled synchronous operation procedure command

9.174.1 Attributes

Table 238 shows the possible attributes for this IDN.

Table 238 – Attributes for IDN S-0-0223

Attribute	Value
Name	Drive controlled synchronous operation procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.174.2 Description

When the master activates the drive controlled synchronous operation procedure command, the synchronous spindle is synchronised on the lead spindle as programmed in the synchronous operation parameter (S-0-0225).

The synchronous operation is cancelled by disabling the procedure command. The command is executed correctly when synchronised operation status (S-0-0308) has been reached. If the synchronous spindle generates an error of C1D, the procedure command results in an error in the procedure command acknowledgment. If the lead spindle generates errors of C1D, synchronised operation continues.

The master transfers the drive controlled synchronous operation procedure command only to the synchronous spindle. Synchronisation between lead and synchronous spindle shall be maintained during speed changes.

9.175 IDN S-0-0224 Lead spindle address

9.175.1 Attributes

Table 239 shows the possible attributes for this IDN.

Table 239 – Attributes for IDN S-0-0224

Attribute	Value
Name	Lead spindle address
Version	
Length	2
Display Format	unsigned decimal
Min input value	1
Max input value	254
Scaling/resolution	1
Unit	

9.175.2 Description

This parameter contains the drive address of the lead spindle responsible for synchronous operation. Command values are taken from this address during the synchronous operation command.

9.176 IDN S-0-0225 Synchronous operation parameter

9.176.1 Attributes

Table 240 shows the possible attributes for this IDN.

Table 240 – Attributes for IDN S-0-0225

Attribute	Value
Name	Synchronous operation parameter
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.176.2 Description

This parameter contains the control commands for the synchronous operation function.

Table 241 shows details of the legal values.

Table 241 – Structure of the Synchronous Operation Parameter

Bit	Meaning	Value
0 to 1		
	Velocity synchronous mode: for the synchronisation only the parameters synchronisation velocity window (S-0-0183) and synchronisation velocity error limit (S-0-0184) are necessary.	00
	(reserved)	01
	Relative angle synchronous mode without regard to a reference point and synchronous position offset (S-0-0230).	10
	Absolute angle-synchronous mode with regard to a reference point and position-dependent parameter of the synchronous spindle: synchronous position offset (S-0-0230) and spindle angle position (S-0-0153).	11
2		
	Changing speed ratio from lead spindle revolutions (S-0-0226) to synchronous spindle revolutions (S-0-0227).	0
	Changing of the speed ratio is complete and the synchronous spindle accepts the ratio. Therefore, new parameters can be issued during the active synchronous operation function.	1
all other	(reserved)	

9.177 IDN S-0-0226 Lead spindle revolutions

9.177.1 Attributes

Table 242 shows the possible attributes for this IDN.

Table 242 – Attributes for IDN S-0-0226

Attribute	Value
Name	Lead spindle revolutions
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	1 [lead spindle revolution]

9.177.2 Description

The speed ratio between the lead spindle and the synchronous spindle is calculated from the revolution ratio between the lead spindle and the synchronous spindle.

$$\text{Speed ratio} = \frac{\text{lead spindle revolutions}}{\text{synchronous spindle revolutions}}$$

Lead spindle revolutions shall be entered as integers.

9.178 IDN S-0-0227 Synchronous spindle revolutions

9.178.1 Attributes

Table 243 shows the possible attributes for this IDN.

Table 243 – Attributes for IDN S-0-0227

Attribute	Value
Name	Synchronous spindle revolutions
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	1 [synchronous spindle revolution]

9.178.2 Description

Refer to lead spindle revolutions (S-0-0226) for speed ratio.

Synchronous spindle revolutions shall be entered as integers.

9.179 IDN S-0-0228 Synchronisation position window

9.179.1 Attributes

Table 244 shows the possible attributes for this IDN.

Table 244 – Attributes for IDN S-0-0228

Attribute	Value
Name	Synchronisation position window
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.179.2 Description

If, during synchronisation, the difference between the synchronous position command value of the lead spindle and the position feedback value of the synchronous spindle falls within the synchronisation window, the drive sets the status for synchronisation (see S-0-0308). When necessary, the synchronisation operation status can be assigned to a real-time status bit in the drive status word and transferred to the control unit.

9.180 IDN S-0-0229 Synchronisation position error limit

9.180.1 Attributes

Table 245 shows the possible attributes for this IDN.

Table 245 – Attributes for IDN S-0-0229

Attribute	Value
Name	Synchronisation position error limit
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.180.2 Description

If, during synchronisation, the difference between the synchronous position command value of the lead spindle and the position feedback value of the synchronous spindle becomes greater than the synchronisation error limit value, the drive sets the synchronisation error status (see S-0-0309). When necessary, the synchronisation error status can be assigned to a real-time status bit in the drive status word and transferred to the control unit.

9.181 IDN S-0-0230 Synchronous position offset

9.181.1 Attributes

Table 246 shows the possible attributes for this IDN.

Table 246 – Attributes for IDN S-0-0230

Attribute	Value
Name	Synchronous position offset
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.181.2 Description

This parameter describes the offset angle between the reference points for lead and synchronous spindle.

9.182 IDN S-0-0254 Actual parameter set

9.182.1 Attributes

Table 247 shows the possible attributes for this IDN.

Table 247 – Attributes for IDN S-0-0254

Attribute	Value
Name	Actual parameter set
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.182.2 Description

This parameter stores the current active parameter set in the drive. If a parameter set is to be switched, it is important that the next consecutive parameter set be updated and correct, and preselected in the parameter set preselection (S-0-0217). Parameter set 0 shall be active in every drive before and during initialisation. Table 248 shows details of the legal values.

Table 248 – Structure of the Actual Parameter Set

Bit	Meaning	Value
2 to 0		
	parameter set 0 active	000
	parameter set 1 active	001
	parameter set 2 active	010
	parameter set 3 active	011
	parameter set 4 active	100
	parameter set 5 active	101
	parameter set 6 active	110
	parameter set 7 active	111
all other	(reserved)	

9.183 IDN S-0-0255 Actual gear ratio

9.183.1 Attributes

Table 249 shows the possible attributes for this IDN.

Table 249 – Attributes for IDN S-0-0255

Attribute	Value
Name	Actual gear ratio
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.183.2 Description

This parameter stores the current active gear ratio in the drive. If the gear ratio is to be switched, it is important that the next consecutive gear ratio is updated and correct and it shall be preselected in the gear ratio preselection (S-0-0218).

Table 250 shows details of the legal values.

Table 250 – Structure of the Actual Gear Ratio

Bit	Meaning	Value
2 to 0		
	gear ratio 0 active	000
	gear ratio 1 active	001
	gear ratio 2 active	010
	gear ratio 3 active	011
	gear ratio 4 active	100
	gear ratio 5 active	101
	gear ratio 6 active	110
	gear ratio 7 active	111
all other	(reserved)	

9.184 IDN S-0-0256 Multiplication factor 1

9.184.1 Attributes

Table 251 shows the possible attributes for this IDN.

Table 251 – Attributes for IDN S-0-0256

Attribute	Value
Name	Multiplication factor 1
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.184.2 Description

"Multiplication Factor 1" defines the factor that the motor feedback signal is multiplied by in the drive (see S-0-0116). Multiplication factor 1 can also be determined by the drive, taking the "Maximum travel range" (S-0-0278) into account.

The drive-internal resolution for the motor encoder is determined from the resolution of feedback 1 (S-0-0116) and multiplication factor 1.

9.185 IDN S-0-0257 Multiplication factor 2

9.185.1 Attributes

Table 252 shows the possible attributes for this IDN.

Table 252 – Attributes for IDN S-0-0257

Attribute	Value
Name	Multiplication factor 2
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.185.2 Description

“Multiplication Factor 2” defines the factor that the EXTERNAL feedback signal is multiplied by in the drive (see S-0-0117). Multiplication factor 2 can also be determined by the drive, taking the “Maximum travel range” (S-0-0278) into account.

The drive-internal resolution for the external encoder is determined from the resolution of feedback 2 (S-0-0117) and multiplication factor 2.

9.186 IDN S-0-0258 Target position

9.186.1 Attributes

Table 253 shows the possible attributes for this IDN.

Table 253 – Attributes for IDN S-0-0258

Attribute	Value
Name	Target position
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.186.2 Description

In the “Interpolation”, the control sends the “Target position” as a command to the drive. The drive travels to the target position, taking into account the positioning velocity (S-0-0259), positioning acceleration (S-0-0260), and positioning jerk (S-0-0193).

9.187 IDN S-0-0259 Positioning velocity

9.187.1 Attributes

Table 254 shows the possible attributes for this IDN.

Table 254 – Attributes for IDN S-0-0259

Attribute	Value
Name	Positioning velocity
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0044 Scaling factor: S-0-0045 Scaling exponent: S-0-0046
Unit	

9.187.2 Description

The “positioning velocity” is used in the operation modes “Interpolation” and "Positioning" as the velocity to travel to the “Active target position” (S-0-0430).

9.188 IDN S-0-0260 Positioning acceleration

9.188.1 Attributes

Table 255 shows the possible attributes for this IDN.

Table 255 – Attributes for IDN S-0-0260

Attribute	Value
Name	Positioning acceleration
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0160 Scaling factor S-0-0161 Scaling exponent S-0-0162
Unit	

9.188.2 Description

The “positioning acceleration” is used in the operation modes “Interpolation” and "Positioning" as the rate to accelerate to and decelerate from the positioning velocity (S-0-0259).

If the drive supports the positioning deceleration (S-0-0359), then a separate deceleration can be adjusted.

9.189 IDN S-0-0261 Coarse position window

9.189.1 Attributes

Table 256 shows the possible attributes for this IDN.

Table 256 – Attributes for IDN S-0-0261

Attribute	Value
Name	Coarse position window
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.189.2 Description

When the difference between the accumulated position command value and the position feedback value is within the range of the “coarse position window”, then the drive sets the status “In coarse position” (S-0-0341). When needed, the status 'in coarse position' is assigned to a real-time status bit within the drive status and then transferred to the control unit (see S-0-0305).

9.190 IDN S-0-0262 Load defaults procedure command

9.190.1 Attributes

Table 257 shows the possible attributes for this IDN.

Table 257 – Attributes for IDN S-0-0262

Attribute	Value
Name	Load defaults procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.190.2 Description

When the master sets and enables the “load defaults” procedure command, the default parameters (basic parameter set) will be activated. The scope and contents of the default parameters (for example limit values, velocity loop settings, etc.) are determined by the drive supplier. The default parameters are not optimised for the respective application; rather they permit a problem free inter-operation between the amplifier and motor.

NOTE This parameter may cause optimised parameters to be overwritten, and the control-registered “Drive ID” (S-0-0271) to be erased.

9.191 IDN S-0-0263 Load working memory procedure command

9.191.1 Attributes

Table 258 shows the possible attributes for this IDN.

Table 258 – Attributes for IDN S-0-0263

Attribute	Value
Name	Load working memory procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.191.2 Description

When the master sets and enables the “Load working memory” procedure command, all data necessary for operation (see “IDN-list of all backup operation data“ S-0-0192) will be loaded from the drive’s non-volatile memory into its “active memory”.

After power on, the drive automatically transfers the data from non-volatile memory into the active memory.

NOTE This procedure command will cause active parameters to be overwritten.

9.192 IDN S-0-0264 Backup working memory procedure command

9.192.1 Attributes

Table 259 shows the possible attributes for this IDN.

Table 259 – Attributes for IDN S-0-0264

Attribute	Value
Name	Backup working memory procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.192.2 Description

When the master sets and enables the “Backup working memory” procedure command, all data necessary for operation (see “IDN-list of all backup operation data“ S-0-0192) will be loaded from the drive’s “active memory” into its non-volatile memory.

NOTE This procedure command will cause previously saved parameters to be overwritten.

9.193 IDN S-0-0265 Language selection

9.193.1 Attributes

Table 260 shows the possible attributes for this IDN.

Table 260 – Attributes for IDN S-0-0265

Attribute	Value
Name	Language selection
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.193.2 Description

This parameter can be used to select one of the languages available in the drive (see S-0-0266). By changing the language selection, text from the drive such as

- NAME (Data block element 2)
- UNITS (Data block element 4) and
- Diagnostic (S-0-0095)

will be displayed in the new language.

Table 261 shows details of the legal values.

Table 261 – Structure of the Language Selection: Language Codes

Bit	Meaning	Value
4 to 0		
	German	00000
	English	00001
	French	00010
	Spanish	00011
	Italian	00100
	Portuguese	00101
	Polish	00110
	Hungarian	00111
	Russian (individual character set)	01000
	Swedish	01001
	Danish	01010
	Norwegian	01011
7 to 5	reserved	
11 to 8		
	SERCOS interface character set (ASCII)	0000
15 to 12	reserved	

9.194 IDN S-0-0266 List of available languages

9.194.1 Attributes

Table 262 shows the possible attributes for this IDN.

Table 262 – Attributes for IDN S-0-0266

Attribute	Value
Name	List of available languages
Version	
Length	2, variable
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Language Codes: see S-0-0265.	

9.194.2 Description

This list contains codes for all languages currently available in the drive for language election (See S-0-0265). This list is required if the drive cannot manage or save all languages in his memory simultaneously.

9.195 IDN S-0-0267 Password

9.195.1 Attributes

Table 263 shows the possible attributes for this IDN.

Table 263 – Attributes for IDN S-0-0267

Attribute	Value
Name	Password
Version	
Length[a]	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE See operation data with variable length and ASCII character data type.	
[a] Data length: maximum 32 characters.	

9.195.2 Description

SERCOS interface supports passwords that can be used to write protect selected parameters stored in the drive. S-0-0267 is used to modify passwords, as well as enable and disable write protection.

A password shall be between 3 and 10 ASCII characters long. Acceptable characters include the 26 character alphabet, both upper and lower case (A to Z, a to z). Character recognition is case sensitive. The numeric characters 0 to 9 are also acceptable. The password is stored in non-volatile drive memory.

If a control or operator interface attempts to modify a password listed in the "IDN list of password protected data" (S-0-0279), The drive will generate the following error message in the Service Channel:

Error Code: 0x7009 “Operation data is password write-protected”.

Reading the current password:

Passwords cannot be read. If an attempt is made to read S-0-0267 over the service channel, the drive will not send the password. A string of 10 asterisk characters (ASCII code $2A_H$=*) will be sent instead (“**********”)

Modifying the password

To modify the password, the currently active password, the new password, and a second verification of the new password are transmitted via the service channel to the drive (see Figure 40). A space (ASCII 0x20) character is used to delimit the passwords. The new parameter and the verification copy shall match for the drive to accept the change. Modifying the password will cause write-protection to be activated.

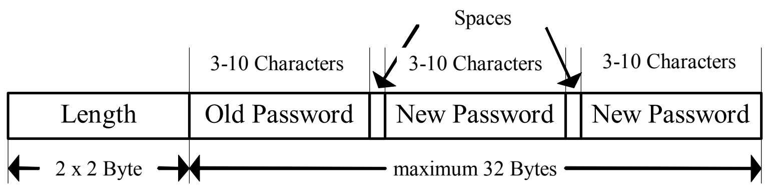


Figure 40 – Password modification

Activating password write protection

Password write-protection will be activated:

- by cycling (removing and reapplying) power to the drive
- by attempting to send S-0-0267 to the drive with anything other than the current password

Activating password write protection does not change bits 28, 29 or 39 in the attribute, and affects all parameters specified by the drive supplier or user in the ”IDN list of password protected data” (S-0-0279).

Deactivating password write-protection

Sending S-0-0267 to the drive with the currently active password will deactivate write-protection. Parameters affected by password write protection may then be altered.

With every write access that does not change the password, deactivate password write-protection, or activates password write protection, the drive returns the error message “Invalid data” (Element 7, 0111, code 1000) via the service channel. In the case of an unknown password, a supplier designed master password shall be available to deactivate password write protection. This password shall always be available as a “current password”, in addition to the user specified password. The drive supplier shall provide this or another password in documentation shipped with the drive, so that the user is able to set up their own password.

9.196 IDN S-0-0268 Angular setting

9.196.1 Attributes

Table 264 shows the possible attributes for this IDN.

Table 264 – Attributes for IDN S-0-0268

Attribute	Value
Name	Angular setting
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.196.2 Description

This parameter describes an absolute angular setting related to the reference point of the synchronous spindle. This parameter allows the synchronous spindle to be rotated a specific amount in relation to the lead spindle. Situations such as arrangements where the tool change spindle orientation is different than the spindle transfer position can make use of this parameter.

9.197 IDN S-0-0269 Storage mode

9.197.1 Attributes

Table 265 shows the possible attributes for this IDN.

Table 265 – Attributes for IDN S-0-0269

Attribute	Value
Name	Storage mode
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.197.2 Description

The storage mode parameter setting determines whether data received over the service channel is stored temporarily (e.g., in RAM), or permanently (e.g., EEPROM). Which data (IDN numbers) are affected by the storage mode setting shall be defined by the drive supplier in the drive documentation. Only bit 0 is defined in the operation data (see Table 266).

Table 266 – Structure of Storage Mode

Bit	Meaning	Value
0		
	data stored permanently	0
	data stored temporarily	1

9.198 IDN S-0-0270 IDN list of selected backup operation data

9.198.1 Attributes

Table 267 shows the possible attributes for this IDN.

Table 267 – Attributes for IDN S-0-0270

Attribute	Value
Name	IDN list of selected backup operation data
Version	
Length	2, variable
Display Format	IDN

Attribute	Value
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.198.2 Description

This IDN is used to define a subset of a drive's entire parameter set that should be backed up into the drive's non-volatile memory. The command procedure "Selectively backup working memory procedure command" (S-0-0293), will only store the operation data of these IDN numbers into non-volatile memory.

9.199 IDN S-0-0271 Drive ID

9.199.1 Attributes

Table 268 shows the possible attributes for this IDN.

Table 268 – Attributes for IDN S-0-0271

Attribute	Value
Name	Drive ID
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.199.2 Description

This IDN is provided by the drive for the control's use. The parameter shall be stored by the drive in non-volatile memory.

Controls can use this parameter to store a unique ID in each drive. By comparing the value of this IDN in each drive with a control-stored list, the control can determine if a drive or its software has been exchanged. If the two values are not equal, the control can generate a diagnostic intended for startup personnel with recommendations for recovery.

The load defaults procedure command (S-0-0262) erases the Drive ID, setting all bits to 0.

9.200 IDN S-0-0272 Velocity window percentage

9.200.1 Attributes

Table 269 shows the possible attributes for this IDN.

Table 269 – Attributes for IDN S-0-0272

Attribute	Value
Name	Velocity window percentage
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,01
Unit	%

9.200.2 Description

The velocity window percentage refers to a percentage of the “Velocity command value” (S-0-0036). See IDN 330 for additional information. If the velocity feedback value (S-0-0040) is found to be within a window of the velocity command defined by this percentage, the drive will set the status '$n_{\text{feedback}} = n_{\text{command}}$' (S-0-0330)

9.201 IDN S-0-0273 Maximum drive off delay time

9.201.1 Attributes

Table 270 shows the possible attributes for this IDN.

Table 270 – Attributes for IDN S-0-0273

Attribute	Value
Name	Maximum drive off delay time
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	0,1
Unit	ms

9.201.2 Description

After "drive off" (bit 15, control word) is reset, the "maximum drive off delay time" is started. After the "maximum drive off delay time" is elapsed, the locking of the brake is initiated and the torque is disabled.

9.202 IDN S-0-0275 Coordinate offset value

9.202.1 Attributes

Table 271 shows the possible attributes for this IDN.

Table 271 – Attributes for IDN S-0-0275

Attribute	Value
Name	Coordinate offset value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.202.2 Description

Using the Shift coordinate system procedure command (S-0-0199), the coordinate system of the drive is shifted by coordinate offset value.

9.203 IDN S-0-0276 Return to Modulo range procedure command

9.203.1 Attributes

Table 272 shows the possible attributes for this IDN.

Table 272 – Attributes for IDN S-0-0276

Attribute	Value
Name	Return to Modulo range procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.203.2 Description

Activating the command “Return to Modulo range procedure command” causes positive and negative commanded and actual positions, as well as angular values, to be recalculated, based upon the Modulo value (S-0-0103), into a positive command and actual positions.

While the command is active, the drive will ignore cyclic command values.

The bits “Position feedback value status” (S-0-0403) and “Position command value status” (S-0-0404) are not affected by this command.

This command is successfully completed by the drive when all necessary calculations are completed.

Before the control clears the command, it shall also adjust its position command to the value the drive calculates.

After clearing of the command, the drive will again act upon the command for the selected operation mode.

The command will terminate with a fault, when the drive detects an error during the command specific calculations.

This command is only effective in the drive, when the parameter “Position data scaling type” (S-0-0076) is programmed for absolute format.

9.204 IDN S-0-0277 Position feedback 1 type

9.204.1 Attributes

Table 273 shows the possible attributes for this IDN.

Table 273 – Attributes for IDN S-0-0277

Attribute	Value
Name	Position feedback 1 type
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.204.2 Description

The position feedback 1 type parameter refers only to a motor feedback. This parameter is programmed to define the corresponding conditions which apply to the motor feedback (see also S-0-0115).

Table 274 shows details of the legal values.

Table 274 – Structure of the Position Feedback 1 Type

Bit	Meaning	Polarity	Value
0	Feedback type		
		rotation feedback (S-0-0117)	0
		linear feedback (S-0-0118)	1
1	Distance coded feedback		
		no distance coded reference marks	0
		distance coded reference marks (S-0-0165, S-0-0166)	1
2	Feedback resolution (S-0-0118)		
		resolution = metric	0
		resolution = inches	1
3	Direction polarity		

Bit	Meaning	Polarity	Value
		not inverted	0
		inverted	1
4	Marker pulse quantity		
		only one reference marker pulse	0
		multiple cyclic reference marker pulse	1
5	Structure of distance coded feedback		
		counting positive with positive direction	0
		counting negative with positive direction	1
6	Type of measuring system		
		relative (incremental) measuring system	0
		absolute measuring system	1
7	Usage		
		absolute measurements with an absolute measuring system	0
		relative (incremental) measurements with an absolute measuring system	1
18 – 8	(reserved)		

9.205 IDN S-0-0278 Maximum travel range

9.205.1 Attributes

Table 275 shows the possible attributes for this IDN.

Table 275 – Attributes for IDN S-0-0278

Attribute	Value
Name	Maximum travel range
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.205.2 Description

Via this parameter, the valid range of position data is defined. For Modulo axes, the Modulo value (S-0-0103) shall be programmed at the minimum. Using the gear ratio, the feed constant, and the motor feedback resolution, the drive calculates Multiplication factor 1 (S-0-0256). Using the gear ratio, the feed constant, and the external feedback resolution, the drive calculates Multiplication factor 2 (S-0-0257).

9.206 IDN S-0-0279 IDN list of password protected data

9.206.1 Attributes

Table 276 shows the possible attributes for this IDN.

Table 276 – Attributes for IDN S-0-0279

Attribute	Value
Name	IDN list of password protected data
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.206.2 Description

The user can enter into this IDN list the IDN numbers whose operation data should be write-protected via the Password (S-0-0267).

9.207 IDN S-0-0280, S-0-0281 Underflow threshold

9.207.1 Attributes

Table 277 shows the possible attributes for this IDN.

Table 277 – Attributes for IDN S-0-0280, S-0-0281

Attribute	Value
Name	Underflow threshold
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.207.2 Description

The underflow and overflow parameters are only required when Position, Drive controlled interpolation, or Block modes are used with an endless turning axis.

When the underflow or overflow values are reached or exceeded, the drive conducts an automatic correction calculation on both the actual and commanded position systems.

Underflow and Overflow thresholds are activated in the Position polarity parameter (S-0-0055) when the Position data scaling type parameter (S-0-0076) is set for absolute format.

The difference between "old" and "new" position commands may not be more than one-half the difference between the underflow and overflow thresholds.

$$\frac{\text{IDN 00281 - IDN 00280}}{2} = \text{Maximum position command difference}$$

9.208 IDN S-0-0283 Current coordinate offset

9.208.1 Attributes

Table 278 shows the possible attributes for this IDN.

Table 278 – Attributes for IDN S-0-0283

Attribute	Value
Name	Current coordinate offset
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.208.2 Description

Via the "Set coordinate system procedure command" (S-0-0197) and the "Shift coordinate system procedure command" (S-0-0199), the drive calculates the offset from the current system to the new coordinate system (referenced to the machine reference point). The control is then always able to reference the absolute position to the machine reference point, even when the coordinate system has been shifted several times.

9.209 IDN S-0-0284 to S-0-0287 Secondary operation mode 4 to 7

9.209.1 Attributes

Table 279 shows the possible attributes for this IDN.

Table 279 – Attributes for IDN S-0-0284 to IDN S-0-0287

Attribute	Value
Name	Secondary operation mode 4 to 7
Version	
Length	2
Display Format	binary
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	1
Unit	

9.209.2 Description

The drive modes of operation defined by this parameter become active when the operation mode is selected via bits 11, 9, and 8 in the control word of the MDT. If a drive supports secondary operation modes 4 through 7, it shall also support bit 11 in the control word and bit 10 in the drive status word. The activated operation mode is indicated by bits 10, 9 and 8 of the drive status in the AT.

9.210 IDN S-0-0292 List of supported operation modes

9.210.1 Attributes

Table 280 shows the possible attributes for this IDN.

Table 280 – Attributes for IDN S-0-0292

Attribute	Value
Name	List of supported operation modes
Version	
Length	2
Display Format	hexadecimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.210.2 Description

In this list, the drive enters the codes (see Table 41) for all operation modes it supports. Thus, not only the SERCOS interface specified operation modes supported, but also supplier designated coding of operation modes. Using this list, the control as well as the operator interface can determine what operation modes the drive supports.

9.211 IDN S-0-0293 Selectively backup working memory procedure command

9.211.1 Attributes

Table 281 shows the possible attributes for this IDN.

Table 281 – Attributes for IDN S-0-0293

Attribute	Value
Name	Selectively backup working memory procedure command
Version	
Length	2
Display Format	binary
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	1
Unit	

9.211.2 Description

When the master sets and enables the "Selectively backup working memory" procedure command, all data programmed in the "IDN list of selected backup operation data" S-0-0270) will be loaded from the drive’s "active memory" into its non-volatile memory.

NOTE This command will cause previously saved parameters to be overwritten.

9.212 IDN S-0-0294 Divider modulo value

9.212.1 Attributes

Table 282 shows the possible attributes for this IDN.

Table 282 – Attributes for IDN S-0-0294

Attribute	Value
Name	Divider modulo value
Version	
Length	2
Display Format	unsigned decimal
Min input value	1
Max input value	
Scaling/resolution	1
Unit	

9.212.2 Description

If the physical modulo value is not programmed in the modulo value (S-0-0103), a factor can be entered in this parameter to adapt the modulo value on the physical modulo value.

If the modulo value corresponds to the physical modulo value, then the factor shall be programmed on the value 1.

9.213 IDN S-0-0295 Drive enable delay time

9.213.1 Attributes

Table 283 shows the possible attributes for this IDN.

Table 283 – Attributes for IDN S-0-0295

Attribute	Value
Name	Drive enable delay time
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	0,1
Unit	ms

9.213.2 Description

When "drive enable" is set (bits 14, control word) the "drive enable delay time" is started. Motor current (torque) will first be activated after this time delay. The enable delay is required at use of a contactor in the motor cable.

9.214 IDN S-0-0296 Velocity feed forward gain

9.214.1 Attributes

Table 284 shows the possible attributes for this IDN.

Table 284 – Attributes for IDN S-0-0296

Attribute[a]	Value
Name	Velocity feed forward gain
Version	
Length	2 or 4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	defined by the drive manufacturer
Unit	defined by the drive manufacturer
[a] Attribute shall be checked by the control unit.	

9.214.2 Description

Velocity feed forward is effective in the operation mode “Position control without following error (lag-less)”, and serves to reduce the velocity-dependent following error.

9.215 IDN S-0-0297 Homing distance

9.215.1 Attributes

Table 285 shows the possible attributes for this IDN.

Table 285 – Attributes for IDN S-0-0297

Attribute	Value
Name	Homing distance
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.215.2 Description

The homing distance is necessary to also use the "drive controlled homing procedure command" (S-0-0148) (e.g. distance coded measurement systems) on mechanical coupled axes (e.g. gantry axes). The procedure command shall be synchronised via the drive start/stop bit.

The function is selected via bit 8 in the homing parameter (S-0-0147).

Remark:

On distance coded measurement systems, the homing distance shall be chosen long enough for the drive to be able to clearly recognise two distance coded reference marks (S-0-0165, S-0-0166).

After activation of "drive controlled homing procedure command", the drive travels the homing distance. At the first reference mark, the actual feedback value is saved into the marker position A (S-0-0173), at the second reference mark, the actual feedback value is saved into the marker position B (S-0-0174).

9.216 IDN S-0-0298 Suggest home switch distance

9.216.1 Attributes

Table 286 shows the possible attributes for this IDN.

Table 286 – Attributes for IDN S-0-0298

Attribute	Value
Name	Suggest home switch distance
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.216.2 Description

There is an optimum distance between the marker pulse of a feedback and the home switch. To assist setup personnel in adjusting this during the first commissioning, this parameter displays the distance the home switch is from the ideal point. The home switch shall be either mechanically or electronically shifted by this value. For electronic shifting, this value is entered into the "home switch offset 1 or 2" parameter (S-0-0299 or S-0-0358).

9.217 IDN S-0-0299 Home switch offset 1

9.217.1 Attributes

Table 287 shows the possible attributes for this IDN.

Table 287 – Attributes for IDN S-0-0299

Attribute	Value
Name	Home switch offset 1
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.217.2 Description

With digital drives, it is no longer technically possible to mechanically rotate the feedback system on the motor in order to shift the relationship between the marker pulse and home switch.

Based on these conditions, the home switch offset 1 parameter is programmed during startup so that the home position is unambiguous.

The required offset between the home switch and marker pulse is provided by the drive with the aid of the programmed home switch offset 1.

The "suggest home switch distance" (S-0-0298) can be transferred into this parameter.

9.218 IDN S-0-0300 Real-time control bit 1

9.218.1 Attributes

Table 288 shows the possible attributes for this IDN.

Table 288 – Attributes for IDN S-0-0300

Attribute	Value
Name	Real-time control bit 1
Version	
Length	2
Display Format	binary
Min input value	

Attribute	Value
Max input value	
Scaling/resolution	1
Unit	

9.218.2 Description

This parameter defines an IDN for the real-time control bit 1 of the control word. In this way, the real-time control bit 1 can be assigned to certain functions by its IDN. Only bit 0 is defined for the operation data.

Table 289 shows details of the legal values.

Table 289 – Structure of real-time control bit 1

Bit	Meaning	Value
0		
	bit reset	0
	bit set	1

9.219 IDN S-0-0301 Allocation of real-time control bit 1

9.219.1 Attributes

Table 290 shows the possible attributes for this IDN.

Table 290 – Attributes for IDN S-0-0301

Attribute	Value
Name	Allocation of real-time control bit 1
Version	
Length	2
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.219.2 Description

In order to assign a signal to the real-time control bit 1, the IDN of the signal is written to the operation data allocation for real-time control bit 1. After the allocation of IDN and bit number (see S-0-0413), the assigned signal appears in the real-time control bit 1. If the S-0-0413 of the drive is not supported, the bit 0 of the IDN is configured automatically.

9.220 IDN S-0-0302 Real-time control bit 2

9.220.1 Attributes

Table 291 shows the possible attributes for this IDN.

Table 291 – Attributes for IDN S-0-0302

Attribute	Value
Name	Real-time control bit 2
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.220.2 Description

This parameter defines an IDN for the real-time control bit 2 of the control word. In this way, the real-time control bit 2 can be assigned to certain functions by its IDN. Only bit 0 is defined for the operation data.

Table 292 shows details of the legal values.

Table 292 – Structure of the Real-Time Control Bit 2

Bit	Meaning	Value
0		
	bit reset	0
	bit set	1

9.221 IDN S-0-0303 Allocation of real-time control bit 2

9.221.1 Attributes

Table 293 shows the possible attributes for this IDN.

Table 293 – Attributes for IDN S-0-0303

Attribute	Value
Name	Allocation of real-time control bit 2
Version	
Length	2
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.221.2 Description

In order to assign a signal to the real-time control bit 2, the IDN of the signal is written to the operation data allocation for real-time control bit 2. After the allocation of IDN and bit number (see S-0-0414), the assigned signal appears in the real-time control bit 2. If the S-0-0414 of the drive is not supported, the bit 0 of the IDN is configured automatically.

9.222 IDN S-0-0304 Real-time status bit 1

9.222.1 Attributes

Table 294 shows the possible attributes for this IDN.

Table 294 – Attributes for IDN S-0-0304

Attribute	Value
Name	Real-time status bit 1
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.222.2 Description

This parameter defines an IDN for the real-time status bit 1 of the drive status. In this way, the real-time status bit 1 can be assigned to certain functions by its IDN. Only bit 0 is defined for the operation data.

Table 295 shows details of the legal values.

Table 295 – Structure of Real-Time Status Bit 1

Bit	Meaning	Value
0		
	bit reset	0
	bit set	1

9.223 IDN S-0-0305 Allocation of real-time status bit 1

9.223.1 Attributes

Table 296 shows the possible attributes for this IDN.

Table 296 – Attributes for IDN S-0-0305

Attribute	Value
Name	Allocation of real-time status bit 1
Version	
Length	2
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1

Attribute	Value
Unit	

9.223.2 Description

In order to assign a signal to the real-time status bit 1, the IDN of the signal is written to the operation data allocation for real-time status bit 1. After the allocation of IDN and bit number (see S-0-0415), the assigned signal appears in the real-time status bit 1. If the S-0-0415 of the drive is not supported, the bit 0 of the IDN is configured automatically.

9.224 IDN S-0-0306 Real-time status bit 2

9.224.1 Attributes

Table 297 shows the possible attributes for this IDN.

Table 297 – Attributes for IDN S-0-0306

Attribute	Value
Name	Real-time status bit 2
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.224.2 Description

This parameter defines an IDN for the real-time status bit 2 of the drive status. In this way, the real-time status bit 2 can be assigned to certain functions by its IDN. Only bit 0 is defined for the operation data.

Table 298 shows details of the legal values.

Table 298 – Structure of Real-Time Status Bit 2

Bit	Meaning	Value
0		
	bit reset	0
	bit set	1

9.225 IDN S-0-0307 Allocation of real-time status bit 2

9.225.1 Attributes

Table 299 shows the possible attributes for this IDN.

Table 299 – Attributes for IDN S-0-0307

Attribute	Value
Name	Allocation of real-time status bit 2
Version	
Length	2
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.225.2 Description

In order to assign a signal to the real-time status bit 2, the IDN of the signal is written to the operation data allocation for real-time status bit 2. After the allocation of IDN and bit number (see S-0-0416), the assigned signal appears in the real-time status bit 2. If the S-0-0416 of the drive is not supported, the bit 0 of the IDN is configured automatically.

9.226 IDN S-0-0308 Synchronisation operation status

9.226.1 Attributes

Table 300 shows the possible attributes for this IDN.

Table 300 – Attributes for IDN S-0-0308

Attribute	Value
Name	Synchronisation operation status
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.226.2 Description

This parameter defines an IDN for the synchronisation operation status. Therefore, the synchronisation operation status can be assigned to a real-time status bit (see S-0-0305).

Case 1, Angle synchronous mode: The synchronisation operation status is set when the difference between the synchronous position command value of the lead spindle and the position feedback value of the synchronous spindle is within the value range of the synchronisation position window (S-0-0228).

Case 2, Velocity synchronous mode: The synchronisation operation status is also set when the difference between the synchronous velocity command value of the lead spindle and the velocity feedback value of the synchronous spindle is within the value range of the synchronisation velocity window (S-0-0183).

Only bit 0 is defined within the operation data.

Table 301 shows details of the legal values.

Table 301 – Structure of the Synchronisation Operation Status

Bit	Meaning	Value
0		
	bit reset	0
	bit set	1
all other	0	

9.227 IDN S-0-0309 Synchronisation error status

9.227.1 Attributes

Table 302 shows the possible attributes for this IDN.

Table 302 – Attributes for IDN S-0-0309

Attribute	Value
Name	Synchronisation error status
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.227.2 Description

This parameter defines an IDN for the synchronisation error status. Therefore, the synchronisation error status can be assigned to a real-time status bit (see S-0-0305).

Case 1, Angle synchronous mode: The synchronisation error status is set when the difference between the synchronous position command value of the lead spindle and the position feedback value of the synchronous spindle falls outside the value range of the synchronisation position error limit value (S-0-0229).

Case 2, Velocity synchronous mode: The synchronisation error status is also set when the difference between the synchronous velocity command value of the lead spindle and the velocity feedback value of the synchronous spindle falls outside the value range of the synchronisation velocity error limit value (S-0-0184).

Only bit 0 is defined within the operation data.

Table 303 shows details of legal values.

Table 303 – Structure of the Synchronisation Error Status

Bit	Meaning	Value
0		
	synchronisation error limit not exceed	0
	synchronisation error limit exceed	1
all other	0	

9.228 IDN S-0-0310 Overload warning

9.228.1 Attributes

Table 304 shows the possible attributes for this IDN.

Table 304 – Attributes for IDN S-0-0310

Attribute	Value
Name	Overload warning
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.228.2 Description

This parameter is used to define an IDN for the overload warning. This allows the overload warning to be assigned, for instance, to a real-time status bit (see S-0-0305). The overload warning is defined as a C2D bit (S-0-0012) and is set appropriately according to the overload limit value (see S-0-0114). Bit 0 is defined for operation data only.

Table 305 shows details of the legal values.

Table 305 – Structure of Overload Warning

Bit	Meaning	Value
0		
	no overload warning	0
	overload warning	1

9.229 IDN S-0-0311 Amplifier overtemperature warning

9.229.1 Attributes

Table 306 shows the possible attributes for this IDN.

Table 306 – Attributes for IDN S-0-0311

Attribute	Value
Name	Amplifier overtemperature warning
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.229.2 Description

This parameter is used to define an IDN for the amplifier overtemperature warning. This allows the amplifier overtemperature warning to be assigned, for instance, to a real-time status bit (see S-0-0305). The amplifier overtemperature warning is defined as a C2D bit (S-0-0012) and is set appropriately according to the amplifier temperature warning (see S-0-0200). Bit 0 is defined for operation data only.

Table 307 shows details of legal values.

Table 307 – Structure of amplifier overtemperature warning

Bit	Meaning	Value
0		
	no amplifier overtemperature warning	0
	amplifier overtemperature warning	1

9.230 IDN S-0-0312 Motor overtemperature warning

9.230.1 Attributes

Table 308 shows the possible attributes for this IDN.

Table 308 – Attributes for IDN S-0-0312

Attribute	Value
Name	Motor overtemperature warning
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.230.2 Description

This parameter is used to define an IDN for the motor overtemperature warning. This allows the motor overtemperature warning to be assigned, for instance, to a real-time status bit (see

S-0-0305). The motor overtemperature warning is defined as a C2D bit (S-0-0012) and is set appropriately according to the motor temperature warning (see S-0-0201). Bit 0 is defined for operation data only.

Table 309 shows details of legal values.

Table 309 – Structure of Motor Overtemperature Warning

Bit	Meaning	Value
0		
	No motor overtemperature warning	0
	Motor overtemperature warning	1

9.231 IDN S-0-0313 Cooling error warning

9.231.1 Attributes

Table 310 shows the possible attributes for this IDN.

Table 310 – Attributes for IDN S-0-0313

Attribute	Value
Name	Cooling error warning
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.231.2 Description

This parameter is used to define an IDN for the cooling error warning. This allows the cooling error warning to be assigned, for instance, to a real-time status bit (see S-0-0305). The cooling error warning is defined as a C2D bit (S-0-0012) and is set appropriately according to the cooling error warning temperature (see S-0-0202). Bit 0 is defined for operation data only.

Table 311 shows details of the legal values.

Table 311 – Cooling error warning

Bit	Meaning	Value
0		
	No cooling error warning	0
	Cooling error warning	1

9.232 IDN S-0-0323 Target position outside of travel range

9.232.1 Attributes

Table 312 shows the possible attributes for this IDN.

Table 312 – Attributes for IDN S-0-0323

Attribute	Value
Name	Target position outside of travel range
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.232.2 Description

This parameter is used to define an IDN for the target position outside of travel range warning. This allows the warning to be assigned, for instance, to a real-time status bit (for example S-0-0305). The target position outside of travel range warning is defined as a C2D bit (S-0-0012) and is set appropriately when the active target position (S-0-0430) is outside the position limit values (positive or negative, S-0-0049, S-0-0050).

NOTE If the actual position exceeds a position limit value, the C1D bit “overtravel limit is exceeded (shut-down)” (drive status, bit 13) is set.

Bit 0 is defined for operation data only.

Table 313 shows details of the legal values.

Table 313 – Structure of the Warning Target Position Outside of Travel Range

Bit	Meaning	Value
0		
	Target position within position limit values	0
	Target position outside of position limit values	1

9.233 IDN S-0-0328 Bit number allocation list for signal status word

9.233.1 Attributes

Table 314 shows the possible attributes for this IDN.

Table 314 – Attributes for IDN S-0-0328

Attribute	Value
Name	Bit number allocation list for signal status word
Version	
Length	2, variable
Display Format	unsigned decimal (bit number)
Min input value	
Max input value	63
Scaling/resolution	1
Unit	

9.233.2 Description

In this configuration list, the bit numbers of the operation data which are copied into the signal status word (S-0-0144) are programmed. The sequence of the bit numbers in the configuration list sets the numerical order in the signal status word. The first bit number in the configuration list sets bit 0, the last bit number sets bit 15 into the signal status word. Not more than 16 bit number can be taken into this list. (See also S-0-0026).

9.234 IDN S-0-0329 Bit number allocation list for signal control word

9.234.1 Attributes

Table 315 shows the possible attributes for this IDN.

Table 315 – Attributes for IDN S-0-0329

Attribute	Value
Name	Bit number allocation list for signal control word
Version	
Length	2, variable
Display Format	unsigned decimal (bit number)
Min input value	
Max input value	63
Scaling/resolution	1
Unit	

9.234.2 Description

In this configuration list, the bit numbers of the operation data which are contained in the signal control word (S-0-0145) are programmed. The sequence of the bit numbers in the configuration list sets the numerical order in the signal control word. The first bit number in the configuration list sets bit 0, the last bit number sets bit 15 in the signal control word. Not more than 16 bit number can be taken into this list (see also S-0-0027).

9.235 IDN S-0-0330 Status '$n_{feedback} = n_{command}$'

9.235.1 Attributes

Table 316 shows the possible attributes for this IDN.

Table 316 – Attributes for IDN S-0-0330

Attribute	Value
Name	Status '$n_{feedback} = n_{command}$'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.235.2 Description

This parameter is used to define an IDN for the status '$n_{feedback} = n_{command}$' This allows the status '$n_{feedback} = n_{command}$' to be assigned to a real-time status bit (see S-0-0305). The status '$n_{feedback} = n_{command}$' is defined as a C3D bit (S-0-0013) and is set when the velocity feedback value (S-0-0040) lies within the calculated command value for the velocity window (S-0-0157 and/or S-0-0272) which is based upon the velocity command values (see S-0-0036, S-0-0037, etc.). Bit 0 is defined for operation data only.

Calculation of '$n_{feedback} = n_{command}$':

$$| n_{feedback} - n_{command} | \leq | n_{command} | \times \text{S-0-0272} + \text{S-0-0157}$$

Table 317 shows details of legal values.

Table 317 – Structure of status '$n_{feedback} = n_{command}$'

Bit	Meaning	Value
0		
	$n_{feedback} \neq n_{command}$	0
	$n_{feedback} = n_{command}$	1

9.236 IDN S-0-0331 Status '$n_{feedback} = 0$'

9.236.1 Attributes

Table 318 shows the possible attributes for this IDN.

Table 318 – Attributes for IDN S-0-0331

Attribute	Value
Name	Status '$n_{feedback} = 0$'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.236.2 Description

This parameter is used to define an IDN for the status '$n_{feedback} = 0$'. This allows the status '$n_{feedback} = 0$' to be assigned to a real-time status bit (see S-0-0305).

The status '$n_{feedback} = 0$' is defined as a C3D bit (S-0-0013) and is set when the velocity feedback value (S-0-0040) is within the standstill window (see S-0-0124). Bit 0 is defined for operation data only.

Table 319 shows details of legal values.

Table 319 – Structure of Status '$n_{feedback}$ = 0

Bit	Meaning	Value
0		
	$n_{feedback} \neq 0$	0
	$n_{feedback} = 0$	1

9.237 IDN S-0-0332 Status '$n_{feedback} < n_x$'

9.237.1 Attributes

Table 320 shows the possible attributes for this IDN.

Table 320 – Attributes for IDN S-0-0332

Attribute	Value
Name	Status '$n_{feedback} < n_x$'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.237.2 Description

This parameter is used to define an IDN for the status '$n_{feedback} < n_x$'. This allows the status '$n_{feedback} < n_x$' to be assigned to a real-time status bit (see S-0-0305). The status '$n_{feedback} < n_x$' is defined as a C3D bit (S-0-0013) and is set when the velocity feedback value (see S-0-0040) is smaller than the velocity threshold n_x (see S-0-0125). Bit 0 is defined for operation data only. Table 321 shows details of legal values.

Table 321 – Structure of status '$n_{feedback} < n_x$'

Bit	Meaning	Value
0		
	$\lvert n_{feedback}\rvert \geq \lvert n_x\rvert$	0
	$\lvert n_{feedback}\rvert < \lvert n_x\rvert$	1

9.238 IDN S-0-0333 Status '$T \geq T_x$'

9.238.1 Attributes

Table 322 shows the possible attributes for this IDN.

Table 322 – Attributes for IDN S-0-0333

Attribute	Value
Name	Status '$T \geq T_x$'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.238.2 Description

This parameter is used to define an IDN for the status '$T \geq T_x$'. This allows the status '$T \geq T_x$' to be assigned to a real-time status bit (see S-0-0305). The status '$T \geq T_x$' is defined as a C3D bit (S-0-0013) and is set when the torque feedback value (see S-0-0084) is greater than the torque threshold value T_x (see S-0-0126). Bit 0 is defined for operation data only.

Table 323 shows details of the legal values.

Table 323 – Structure of Status '$T \geq T_x$'

Bit	Meaning	Value
0		
	$\lvert T \rvert < \lvert T_x \rvert$	0
	$\lvert T \rvert \geq \lvert T_x \rvert$	1

9.239 IDN S-0-0334 Status '$T \geq T_{limit}$'

9.239.1 Attributes

Table 324 shows the possible attributes for this IDN.

Table 324 – Attributes for IDN S-0-0334

Attribute	Value
Name	Status '$T \geq T_{limit}$'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.239.2 Description

This parameter is used to define an IDN for the status '$T \geq T_{limit}$.' This allows the status '$T \geq T_{limit}$' to be assigned to a real-time status bit (see S-0-0305). The status '$T \geq T_{limit}$' is defined as a C3D bit (S-0-0013) and is set when the torque feedback value (see S-0-0084) lies beyond the programmed torque limits (see S-0-0082, S-0-0083, S-0-0092). Bit 0 is defined for operation data only.

Table 325 shows details of the legal values.

Table 325 – Structure of Status '$T \geq T_{limit}$'

Bit	Meaning	Value
0		
	$\|T\| < \|T_{limit}\|$	0
	$\|T\| \geq \|T_{limit}\|$	1

9.240 IDN S-0-0335 Status '$n_{command} > n_{limit}$'

9.240.1 Attributes

Table 326 shows the possible attributes for this IDN.

Table 326 – Attributes for IDN S-0-0335

Attribute	Value
Name	Status '$n_{command} > n_{limit}$'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.240.2 Description

This parameter is used to define an IDN for the status '$n_{command} > n_{limit}$'. This allows the status '$n_{command} > n_{limit}$' to be assigned to a real-time status bit (see S-0-0305). The status '$n_{command} > n_{limit}$' is defined as a C3D bit (S-0-0013) and is set when the sum of velocity command values (see S-0-0036, S-0-0037, etc.) is greater than the velocity limit value (see S-0-0038, S-0-0039, S-0-0091). Bit 0 is defined for operation data only.

Table 327 shows details of the legal values.

Table 327 – Structure of Status '$n_{command} > n_{limit}$'

Bit	Meaning	Value
0		
	$\|n_{command}\| \leq \|n_{limit}\|$	0
	$\|n_{command}\| > \|n_{limit}\|$	1

9.241 IDN S-0-0336 Status 'In position'

9.241.1 Attributes

Table 328 shows the possible attributes for this IDN.

Table 328 – Attributes for IDN S-0-0336

Attribute	Value
Name	Status 'In position'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.241.2 Description

This parameter is used to define an IDN for the status 'in position' to be assigned to a real-time status bit (see IDN 305). The status 'in position' is defined as a C3D bit (S-0-0013) and is set when the position feedback value falls within the position window (see S-0-0057) relative to the position command value (see S-0-0047). Bit 0 is defined for operation data only.

Table 329 shows details of the legal values.

Table 329 – Structure of Status 'in position'

Bit	Meaning	Value
0		
	outside of position window	0
	within position window	1

9.242 IDN S-0-0337 Status '$P \geq P_x$'

9.242.1 Attributes

Table 330 shows the possible attributes for this IDN.

Table 330 – Attributes for IDN S-0-0337

Attribute	Value
Name	Status '$P \geq P_x$'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.242.2 Description

This parameter is used to define an IDN for the status '$P \geq P_x$.' This allows the status '$P \geq P_x$' to be assigned to a real-time status bit (see S-0-0305). The status '$P \geq P_x$' is defined as a C3D bit (S-0-0013) and is set when the actual supplied power exceeds the power threshold P_x (see S-0-0158). Bit 0 is defined for operation data only.

Table 331 shows details of the legal values.

Table 331 – Structure of Status '$P \geq P_x$'

Bit	Meaning	Value
0		
	$\vert P \vert < \vert P_x \vert$	0
	$\vert P \vert \geq \vert P_x \vert$	1

9.243 IDN S-0-0338 Status “Position feedback = active target position

9.243.1 Attributes

Table 332 shows the possible attributes for this IDN.

Table 332 – Attributes for IDN S-0-0338

Attribute	Value
Name	Status “Position feedback = active target position
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.243.2 Description

This parameter is used to define an IDN for the status "position feedback = active target position“. This allows the status "position feedback = active target position“ to be assigned to a real-time status bit (see S-0-0305).

The status "position feedback = active target position“ is defined as a C3D bit (S-0-0013) and is set when position feedback value falls within the position window (see S-0-0057) relative to the active target position (see S-0-0430).

Bit 0 is defined for operation data only.

Table 333 shows details of the legal values.

Table 333 – Structure of Position Feedback = active target position

Bit	Meaning	Value
0		
	position feedback outside position window	0
	|(S-0-0430 – S-0-0386)| < S-0-0057	1

9.244 IDN S-0-0339 Status '$n_{feedback}$ ≤ minimum spindle speed'

9.244.1 Attributes

Table 334 shows the possible attributes for this IDN.

Table 334 – Attributes for IDN S-0-0339

Attribute	Value
Name	Status '$n_{feedback}$ ≤ minimum spindle speed'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.244.2 Description

This parameter is used to define an IDN for the status '$n_{feedback}$ ≤ minimum spindle speed'. This allows the status '$n_{feedback}$ ≤ minimum spindle speed' to be assigned to a real-time status bit (see S-0-0305).

The status '$n_{feedback}$ ≤ minimum spindle speed' is defined as a C3D bit (S-0-0013) and is set when the velocity feedback value (S-0-0040) is lower than or equal to the programmed minimum spindle speed (S-0-0220).

Bit 0 is defined for operation data only.

Table 335 shows details of the legal values.

Table 335 – Structure of '$n_{feedback}$ ≤ minimum spindle speed'

Bit	Meaning	Value
0		
	$\|n_{feedback}\|$ > minimum spindle speed	0
	$\|n_{feedback}\|$ ≤ minimum spindle speed	1

9.245 IDN S-0-0340 Status '$n_{feedback}$ ≥ maximum spindle speed'

9.245.1 Attributes

Table 336 shows the possible attributes for this IDN.

Table 336 – Attributes for IDN S-0-0340

Attribute	Value
Name	Status '$n_{feedback}$ ≥ maximum spindle speed'
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.245.2 Description

This parameter is used to define an IDN for the status '$n_{feedback}$ ≥ maximum spindle speed'. This allows the status '$n_{feedback}$ ≥ maximum spindle speed' to be assigned to a real–time status bit (see S-0-0305).

The status '$n_{feedback}$ ≥ maximum spindle speed' is defined as a C3D bit (S-0-0013) and is set when the velocity feedback value (S-0-0040) is greater than or equal to the programmed maximum spindle speed (S-0-0221).

Bit 0 is defined for operation data only.

Table 337 shows details of the legal values.

Table 337 – Structure of '$n_{feedback}$ ≥ maximum spindle speed'

Bit	Meaning	Value
0		
	$\|n_{feedback}\|$ < maximum spindle speed	0
	$\|n_{feedback}\|$ ≥ maximum spindle speed	1

9.246 IDN S-0-0341 Status “In coarse position”

9.246.1 Attributes

Table 338 shows the possible attributes for this IDN.

Table 338 – Attributes for IDN S-0-0341

Attribute	Value
Name	Status “In coarse position”
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.246.2 Description

This parameter is used to define an IDN for the ‘in coarse position’ status. This allows the status to be assigned, for instance, to a real-time status bit (for example S-0-0305). The status 'in coarse position' is defined as a C3D bit (S-0-0013) and is set when the position feedback value falls within the coarse position window (see S-0-0261) relative to the position command value (see S-0-0047). Bit 0 is defined for operation data only.

Table 339 shows details of legal values.

Table 339 – Structure of Status ‘in position’

Bit	Meaning	Value
0		
	outside of coarse position window	0
	within coarse position window	1

9.247 IDN S-0-0342 Status “Target position attained”

9.247.1 Attributes

Table 340 shows the possible attributes for this IDN.

Table 340 – Attributes for IDN S-0-0342

Attribute	Value
Name	Status “Target position attained”
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.247.2 Description

This parameter is used to define an IDN for the 'target position attained' status. This allows the status to be assigned, for instance, to a real-time status bit (for example S-0-0305). The status 'target position attained' is defined as a C3D bit (S-0-0013) and is set when the position command of the drive interpolator (S-0-0047) is equal to the Active target position (S-0-0430) Bit 0 is defined for operation data only.

Table 341 shows details of the legal values.

Table 341 – Structure of status ‘target position attained’

Bit	Meaning	Value
0		
	target position not reached	0
	target position reached (position command = active target position)	1

9.248 IDN S-0-0343 Status “Interpolator halted”

9.248.1 Attributes

Table 342 shows the possible attributes for this IDN.

Table 342 – Attributes for IDN S-0-0343

Attribute	Value
Name	Status “Interpolator halted”
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.248.2 Description

This parameter is used to define an IDN for the 'interpolator halted' status. This allows the status to be assigned, for instance, to a real-time status bit (for example S-0-0305). The status 'interpolator halted' is defined as a C3D bit (S-0-0013) and is set when the drive interpolator (IPO) has not yet attained the Active target position (S-0-0430), but the position command is not changing. The control can stop the interpolator with bit 13 in the control word. Bit 0 is defined for operation data only.

Table 343 shows details of the legal values.

Table 343 – Structure of Status 'Interpolator Halted'

Bit	Meaning	Value
0		
	interpolator not halted	0
	interpolator halted (target position not attained, position command not changing)	1

9.249 IDN S-0-0347 Velocity error

9.249.1 Attributes

Table 344 shows the possible attributes for this IDN.

Table 344 – Attributes for IDN S-0-0347

Attribute	Value
Name	Velocity error
Version	
Length	4
Display Format	signed decimal
Min input value	

Attribute	Value
Max input value	
Scaling/resolution	Scaling type S-0-0044 Scaling factor S-0-0045 Scaling exponent S-0-0046
Unit	

9.249.2 Description

The actual difference between the commanded velocity and actual velocity is place in this parameter.

9.250 IDN S-0-0348 Acceleration feed forward gain

9.250.1 Attributes

Table 345 shows the possible attributes for this IDN.

Table 345 – Attributes for IDN S-0-0348

Attribute[a]	Value
Name	Acceleration feed forward gain
Version	
Length	2 or 4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	defined by the drive manufacturer
Unit	defined by the drive manufacturer
[a] Attribute shall be checked by the control unit.	

9.250.2 Description

Acceleration feed forward is effective in the operation mode “Position control without following error (lag-less)”, and serves to reduce acceleration/deceleration-dependent following error.

9.251 IDN S-0-0349 Bipolar jerk limit

9.251.1 Attributes

Table 346 shows the possible attributes for this IDN.

Table 346 – Attributes for IDN S-0-0349

Attribute	Value
Name	Bipolar jerk limit
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	Scaling type S-0-0160 Scaling factor S-0-0161 Scaling exponent S-0-0162
Unit	

9.251.2 Description

"Bipolar jerk" limits the maximum rate of change of acceleration. Programming a value of zero will cause jerk limiting to be deactivated.

9.252 IDN S-0-0356 Distance home switch – marker pulse

9.252.1 Attributes

Table 347 shows the possible attributes for this IDN.

Table 347 – Attributes for IDN S-0-0356

Attribute	Value
Name	Distance home switch – marker pulse
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.252.2 Description

For the relative position of the home switch to the marker pulse of the encoder an optimal distance exists. In order to make the commissioning easy for the user, the distance from the home switch to the marker pulse is measured by the drive and shown in this parameter. The user shall then calculate a value following the indications of the drive manufacturer and set this value in the home switch offset 1/2 (S-0-0299, S-0-0358), or mechanically shift the home switch corresponding to the calculated value.

9.253 IDN S-0-0357 Marker pulse distance

9.253.1 Attributes

Table 348 shows the possible attributes for this IDN.

Table 348 – Attributes for IDN S-0-0357

Attribute	Value
Name	Marker pulse distance
Version	
Length	4
Display Format	signed decimal

Attribute	Value
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.253.2 Description

In order to calculate the optimal distance between marker pulse and home switch in the drive, the distance between two marker pulses is set in this parameter.

9.254 IDN S-0-0358 Home switch offset 2

9.254.1 Attributes

Table 349 shows the possible attributes for this IDN.

Table 349 – Attributes for IDN S-0-0358

Attribute	Value
Name	Home switch offset 2
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.254.2 Description

With digital drives, it is no longer technically possible to mechanically shift the external feedback system in order to shift the relationship between the marker pulse and home switch.

Based on these conditions, the home switch offset 2 parameter is programmed during startup so that the home position is unambiguous.

The required offset between the home switch and marker pulse is provided by the drive with the aid of the programmed home switch offset 2.

The "suggest home switch distance" (S-0-0298) can be transferred into this parameter.

9.255 IDN S-0-0359 Positioning deceleration

9.255.1 Attributes

Table 350 shows the possible attributes for this IDN.

Table 350 – Attributes for IDN S-0-0359

Attribute	Value
Name	Positioning deceleration
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0160 Scaling factor S-0-0161 Scaling exponent S-0-0162
Unit	

9.255.2 Description

With the "positioning deceleration" the positioning velocity (S-0-0259) is reduced during the stop function in the operation modes "Interpolation" and "Positioning".

9.256 IDN S-0-0360 and IDN S-0-0361 MDT data containers A1 (4 byte) and B (4 byte)

9.256.1 Attributes

Table 351 shows the possible attributes for these IDNs.

Table 351 – Attributes for IDN S-0-0360, IDN S-0-0361

Attribute	Value
Name	MDT data container A1 (4 byte) MDT data container B (4 byte)
Version	
Length	4
Display Format	
Min input value	
Max input value	
Scaling/resolution	1, or the scaling of the configured data
Unit	

9.256.2 Description

Two data containers (4 bytes long) are defined for the MDT, A1 and B, serving as placeholders in the MDT. The contents of the data containers can be dynamically changed by the control as necessary, or based upon the operation mode. Additionally, a data container pointer is required for each of the containers (S-0-0364 and S-0-0365), as well as a configuration list for the MDT container (S-0-0370). If the configured operation data is only 2 bytes long, it is placed in the low word of the MDT data container. The high word is not used.

In configuring data container operation data, the control can select between a minimum requirement and maximum requirement.

Minimum required data block (access via service channel):

The configured operation data is represented in the data container in hexadecimal, without the units.

Attribute: ‘Data type and display format’ are set hexadecimal (bits 22-20 = 011)

Units: Not present

Maximum required data block (access via service channel):

The configured operation data is represented in the data container not with the data block of the data container itself, but rather with the configured operation data’s data block. In this case, the operation data will be displayed with the IDN of the data container exactly the same as it would be with its own IDN.

9.257 IDN S-0-0362 and IDN S-0-0363 MDT data container A and B list indexes

9.257.1 Attributes

Table 352 shows the possible attributes for these IDNs.

Table 352 – Attributes for IDN S-0-0362, S-0-0363

Attribute	Value
Name	MDT data container A list index MDT data container B list index
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.257.2 Description

If in the MDT-data container A or B, an IDN with a variable length is configured, the corresponding data element of this list will be addressed via the list index.

The list index of the MDT data container consists of a 16 bit address. Via index 65 535, the data container can be defined as not valid by the control.

The control sets the addressed list element into the MDT data container.

The list index of MDT data container can be configured in the cyclic data of the MDT. Thereby, a switching of the list elements in the data container during a communication cycle is possible. During writing on the MDT data container with the list index, the length of a list cannot be changed.

The list index of MDT data container can also be configured into the cyclic data of the ATs. In this way, an acknowledgement of the MDT data container is possible. The drive reads the list index of MDT data container from the MDT and acknowledges it in the AT.

If the list index is situated outside of the list, the list index of MDT will be set in the AT (acknowledgement) on value 65 535 and the pointer of data container in AT (acknowledgement) on value 255. All data in the MDT data container will be ignored.

Table 353 shows details of the legal values for container A.

Table 353 – MDT Data Container A List Index Structure

Bit	Meaning	Value
15 to 0		
	index of the configured list	0 to 65 534
	MDT data container A not valid	65 535

Table 354 shows details of the legal values for container B.

Table 354 – MDT Data Container B List Index Structure

Bit	Meaning	Value
0		
	index of the configured list	0 to 65 534
	MDT data container B not valid	65 535

9.258 IDN S-0-0364 and IDN S-0-0365 AT data containers A1 (4 byte) and B (4 byte)

9.258.1 Attributes

Table 355 shows the possible attributes for these IDNs.

Table 355 – Attributes for IDN S-0-0364, IDN S-0-0365

Attribute	Value
Name	
Version	
Length	4
Display Format	
Min input value	
Max input value	
Scaling/resolution	1, or the scaling of the configured data
Unit	

9.258.2 Description

2 data containers (4 bytes long) are defined for the AT, A and B, serving as placeholders in the AT. The contents of the data containers can be dynamically changed by the control as necessary, or based upon the operation mode. Additionally, a data container pointer is required for each of the containers (S-0-0368 and S-0-0369), as well as a configuration list for the AT container (S-0-0371). If the configured operation data is only 2 bytes long, it is placed in the low word of the AT data container. The high word is not used.

In configuring data container operation data, the drive can select between a minimum requirement and maximum requirement.

Minimum required data block (access via service channel)

The configured operation data is represented in the data container in hexadecimal, without the units.

Attribute: ‘Data type and display format’ are set hexadecimal (bits 22-20 = 011)

Units: Not present

Maximum required data block (access via service channel)

The configured operation data is represented in the data container not with the data block of the data container itself, but rather with the configured operation data’s data block. In this case, the operation data will be displayed with the IDN of the data container exactly the same as it would be with its own IDN.

9.259 IDN S-0-0366 and IDN S-0-0367 AT data container A and B list indexes

9.259.1 Attributes

Table 356 shows the possible attributes – Attributes for these IDNs.

Table 356 – Attributes for IDN S-0-0366, IDN S-0-0367

Attribute	Value
Name	AT data container A list index AT data container B list index
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.259.2 Description

If, in the AT-data container A or B, an IDN with a variable length is configured, the corresponding data element of this list will be addressed via the list index.

The list index of the AT data container consists of a 16 bit address. Via index 65 535, the data container can be defined as not valid by the control.

The drive sets the addressed list element into the AT data container.

The list index of AT data container can be configured in the cyclic data of the MDT. Thereby, a switching of the list elements in the data container during a communication cycle is possible. Through the AT data container, data can be read only within the configured IDN list.

The list index of AT data container can also be configured into the cyclic data of the ATs. In this way, an acknowledgement of the AT data container is possible. The drive reads the list index of AT data container from the MDT and acknowledges it in the AT.

If the list index is situated outside of the list, the list index of AT will be set in the AT (acknowledgement) on value 65535 and the pointer of data container in AT (acknowledgement) on value 255. All data in the AT data container will be ignored.

Table 357 shows details of the legal values for the container A.

Table 357 – AT Data Container A List Index Structure

Bit	Meaning	Value
0		
	index of the configured list	0 to 65 534
	AT data container A not valid	65 535

Table 358 shows details of the legal values of the container B.

Table 358 – AT Data Container B List Index Structure

Bit	Meaning	Value
0		
	index of the configured list	0 to 65 534
	AT data container B not valid	65 535

9.260 IDN S-0-0368 and IDN S-0-0369 Data container A and B pointers

9.260.1 Attributes

Table 359 shows the possible attributes for these IDNs.

Table 359 – Attributes for IDN S-0-0368, S-0-0369

Attribute	Value
Name	Data container A pointer Data container B pointer
Version	
Length	2
Display Format	hexadecimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.260.2 Description

The data container pointers contain an 8-bit pointer, which defines what operation data should be placed in the MDT and AT data container. The pointer is the offset, within the data container configuration list (S-0-0370 or S-0-0371). Thus, inside the configuration list, an IDN is addressed for the MDT data container or AT data container. With value 255, the control can declare the data containers as not valid.

The control sets the addressed operation data into the MDT data container. The drive sets the addressed operation data into the AT data container.

The IDN "Data container A pointer and B pointer" (S-0-0368, S-0-0369) can be configured in the cyclic data of the MDT. Thereby, a switching of the operation data in the data containers within a communication cycle is possible.

The IDN "Data container A pointer and B pointer" (S-0-0368, S-0-0369) can also be configured in the cyclic data of the AT. In this case, the addressing (acknowledgement) according to the contents of the data container will be transmitted. The drive generates the acknowledgement by copying the pointer of MDT to the pointer of AT.

If the pointer of the data container is situated outside of the configuration list for the MDT or AT data container or the data does not fit in the data container, the contents of the data container are not valid. The drive sets the pointer (acknowledgement) in the AT on 255. The data in MDT or AT data container will be ignored.

Table 360 shows details of the legal values for data container A.

Table 360 – Data Container A Pointer Structure

Bit	Meaning	Value
7 to 0		
	address for MDT data container A	0 to 254
	MDT data container A not valid	255
15 to 8		
	address for AT data container A	0 to 254
	AT data container A not valid	255

Table 361 details of the legal values for data container B.

Table 361 – Data Container B Pointer Structure

Bit	Meaning	Value
7 to 0		
	address for MDT data container B	0 to 254
	MDT data container B not valid	255
15 to 8		
	address for AT data container B	0 to 254
	AT data container B not valid	255

9.261 IDN S-0-0370 MDT data container configuration list

9.261.1 Attributes

Table 362 shows the possible attributes for this IDN.

Table 362 – Attributes for IDN S-0-0370

Attribute	Value
Name	MDT data container configuration list
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.261.2 Description

The control enters into the MDT data container configuration list the IDN numbers for the operation data that are to be sent via the MDT data container as needed from the control to the drive.

This IDN list is generated either from S-0-0188 or S-0-0445.

9.262 IDN S-0-0371 AT data container configuration list

9.262.1 Attributes

Table 363 shows the possible attributes for this IDN.

Table 363 – Attributes for IDN S-0-0371

Attribute	Value
Name	AT data container configuration list
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.262.2 Description

The control enters into the AT data container configuration list the IDN numbers for the operation data that are to be sent via the AT data container as needed from the drive to the control.

This IDN list is generated either from S-0-0187 or S-0-0444.

9.263 IDN S-0-0372 Drive Halt acceleration bipolar

9.263.1 Attributes

Table 364 shows the possible attributes for this IDN.

Table 364 – Attributes for IDN S-0-0372

Attribute	Value
Name	Drive Halt acceleration bipolar
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0160 Scaling factor S-0-0161 Scaling exponent S-0-0162
Unit	

9.263.2 Description

This parameter is only activated if no internal drive interpolator is active and “Drive Halt (control word, bit13) is changed by the control unit.

9.264 IDN S-0-0373 Service channel error list

9.264.1 Attributes

Table 365 shows the possible attributes for this IDN.

Table 365 – Attributes for IDN S-0-0373

Attribute	Value
Name	Service channel error list
Version	
Length	4, variable
Display Format	hexadecimal (error codes)
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.264.2 Description

With every service channel error, the drive records the IDN and the specific error code into this list. The list is organised as a ring buffer. When the list is read via the service channel, the drive will position the last error recorded as the first element of the list. The display format of the list elements is hexadecimal.

Table 366 shows the meanings of the bits.

Table 366 – Service channel error list structure

Bit	Meaning
31 to 16	error code
15 to 0	IDN

9.265 IDN S-0-0374 Procedure command error list

9.265.1 Attributes

Table 367 shows the possible attributes for this IDN.

Table 367 – Attributes for IDN S-0-0374

Attribute	Value
Name	Procedure command error list
Version	
Length	4, variable
Display Format	hexadecimal (error codes)
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.265.2 Description

With every procedure command error, the drive records the IDN and a manufacturer specific error code into this list. The list is organised as a ring buffer. When the list is read via the service channel, the drive will position the last error recorded as the first element of the list. The display format of the list elements is hexadecimal.

Table 368 shows the meanings of the bits.

Table 368 – Procedure Command Error List Structure

Bit	Meaning
31 to 16	manufacturer specific error code
15 to 0	IDN

9.266 IDN S-0-0375 Diagnostic numbers list

9.266.1 Attributes

Table 369 shows the possible attributes for this IDN.

Table 369 – Attributes for IDN S-0-0375

Attribute	Value
Name	Diagnostic numbers list
Version	
Length	4, variable
Display Format	hexadecimal (diagnostic numbers)
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.266.2 Description

The drive records every change of the diagnostic number into this list. The list is organised as a ring buffer. When the list is read via the service channel, the drive will position the last diagnostic recorded as the first element of the list.

9.267 IDN S-0-0376 Baud rate

9.267.1 Attributes

Table 370 shows the possible attributes for this IDN.

Table 370 – Attributes for IDN S-0-0376

Attribute	Value
Name	Baud rate
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.267.2 Description

The drive places the supported transmission rates in this parameter. The transmission rate of 2 Mbit/s shall always be supported.

Table 371 shows details of the legal values.

Table 371 – Baud Rate Structure

Bit	Meaning	Value
0		
	2 Mbit/s available	1
1		
	4 Mbit/s not available	0
	4 Mbit/s available	1
2		
	8 Mbit/s not available	0
	8 Mbit/s available	1
3		
	16 Mbit/s not available	0
	16 Mbit/s available	1
7 to 4	(reserved)	
8		
	automatic baudrate recognition is not supported	0
	automatic baudrate recognition is supported	1
15 to 9	(reserved)	

9.268 IDN S-0-0377 Velocity feedback monitoring window

9.268.1 Attributes

Table 372 shows the possible attributes for this IDN.

Table 372 – Attributes for IDN S-0-0377

Attribute	Value
Name	Velocity feedback monitoring window
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0044 Scaling factor S-0-0045 Scaling exponent S-0-0046
Unit	

9.268.2 Description

With help of the "Velocity feedback monitoring window" the maximum velocity deviation between velocity feedback value 1 (S-0-0040) and velocity feedback value 2 (S-0-0156) can be monitored. If the velocity deviation exceeds the monitoring window, the drive will generate either a warning (excessive velocity deviation) in class 2 diagnostics (S-0-0012) or an error in class 1 diagnostics (S-0-0011).

With this function, defects in the mechanics can be monitored. With the value "0" the monitoring is switched off.

9.269 IDN S-0-0378 Absolute encoder range 1

9.269.1 Attributes

Table 373 shows the possible attributes for this IDN.

Table 373 – Attributes for IDN S-0-0378

Attribute	Value
Name	Absolute encoder range 1
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.269.2 Description

If the motor encoder is an absolute measuring system, then the absolute range taking into consideration the mechanics and programming will be displayed or entered in this parameter.

9.270 IDN S-0-0379 Absolute encoder range 2

9.270.1 Attributes

Table 374 shows the possible attributes for this IDN.

Table 374 – Attributes for IDN S-0-0379

Attribute	Value
Name	Absolute encoder range 2
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.270.2 Description

If the external encoder is an absolute measuring system, then the absolute range taking into consideration the mechanics and programming will be displayed or entered in this parameter.

9.271 IDN S-0-0380 DC bus voltage

9.271.1 Attributes

Table 375 shows the possible attributes for this IDN.

Table 375 – Attributes for IDN S-0-0380

Attribute	Value
Name	DC bus voltage
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	V

9.271.2 Description

The drive's DC (intermediate) bus voltage value is placed in this parameter.

9.272 IDN S-0-0381 DC bus current

9.272.1 Attributes

Table 376 shows the possible attributes for this IDN.

Table 376 – Attributes for IDN S-0-0381

Attribute	Value
Name	DC bus current
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	0,001
Unit	A

9.272.2 Description

The drive places the measured (actual) DC (intermediate) bus current in this parameter.

9.273 IDN S-0-0382 DC bus power

9.273.1 Attributes

Table 377 shows the possible attributes for this IDN.

Table 377 – Attributes for IDN S-0-0382

Attribute	Value
Name	DC bus power
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	W

9.273.2 Description

The drive places the measured (actual) DC (intermediate) bus power in this parameter.

9.274 IDN S-0-0383 Motor temperature

9.274.1 Attributes

Table 378 shows the possible attributes for this IDN.

Table 378 – Attributes for IDN S-0-0383

Attribute	Value

Name	Motor temperature
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: see S-0-0208
Unit	

9.274.2 Description

The drive places the measured (actual) motor temperature in this parameter.

9.275 IDN S-0-0384 Amplifier temperature

9.275.1 Attributes

Table 379 shows the possible attributes for this IDN.

Table 379 – Attributes for IDN S-0-0384

Attribute	Value
Name	Amplifier temperature
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0208
Unit	

9.275.2 Description

The drive places the measured (actual) amplifier temperature (output stage) in this parameter.

9.276 IDN S-0-0385 Active power

9.276.1 Attributes

Table 380 shows the possible attributes for this IDN.

Table 380 – Attributes for IDN S-0-0385

Attribute	Value
Name	Active power
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	1
Unit	W

9.276.2 Description

The drive places the calculated active power of the motor in this parameter.

9.277 IDN S-0-0386 Active position feedback value

9.277.1 Attributes

Table 381 shows the possible attributes for this IDN.

Table 381 – Attributes for IDN S-0-0386

Attribute	Value
Name	Active position feedback value
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.277.2 Description

The "Active position feedback value" is necessary when the drive changes in the operation modes between position feedback value 1 and 2 automatically. The position feedback value which is activated by the operation mode is written in this IDN. To use this function, the control unit shall configure S-0-0386 in the AT.

9.278 IDN S-0-0387 Power overload

9.278.1 Attributes

Table 382 shows the possible attributes for this IDN.

Table 382 – Attributes for IDN S-0-0387

Attribute	Value
Name	Power overload
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	

Attribute	Value
Scaling/resolution	0,01
Unit	%

9.278.2 Description

The drive places the calculated power overload in this parameter.

9.279 IDN S-0-0388 Braking current limit

9.279.1 Attributes

Table 383 shows the possible attributes for this IDN.

Table 383 – Attributes for IDN S-0-0388

Attribute	Value
Name	Braking current limit
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	0,001
Unit	A

9.279.2 Description

With this parameter, the user can reduce the braking current limit during the deceleration phase (active braking).

9.280 IDN S-0-0389 Effective current

9.280.1 Attributes

Table 384 shows the possible attributes for this IDN.

Table 384 – Attributes for IDN S-0-0389

Attribute	Value
Name	Effective current
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	0,001
Unit	A

9.280.2 Description

The drive places the measured (actual) or calculated effective current (Root Mean Square) in this parameter.

9.281 IDN S-0-0390 Diagnostic number

9.281.1 Attributes

Table 385 shows the possible attributes for this IDN.

Table 385 – Attributes for IDN S-0-0390

Attribute	Value
Name	Diagnostic number
Version	
Length	4
Display Format	hexadecimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.281.2 Description

For every diagnostic, the drive stores a manufacturer specific code in the diagnostic number parameter. Using this, the operator interface has the ability to display diagnostic message text in languages not supported by the drive.

9.282 IDN S-0-0391 Position feedback monitoring window

9.282.1 Attributes

Table 386 shows the possible attributes for this IDN.

Table 386 – Attributes for IDN S-0-0391

Attribute	Value
Name	Position feedback monitoring window
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.282.2 Description

Using the position feedback monitoring window, the maximum permissible position error between actual position 1 and actual position 2 can be defined. If the position difference between these two feedback devices exceeds the limit in this parameter, the drive generates an error for excessive actual position difference in C1D (S-0-0011). Entering the value ‘0’ disables the monitoring.

9.283 IDN S-0-0392 Velocity feedback filter

9.283.1 Attributes

Table 387 shows the possible attributes for this IDN.

Table 387 – Attributes for IDN S-0-0392

Attribute	Value
Name	Velocity feedback filter
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	µs

9.283.2 Description

The time constant for the velocity feedback filter is entered into this parameter. If the filter time constant is 0, the filter is inactive.

9.284 IDN S-0-0393 Command value mode

9.284.1 Attributes

Table 388 shows the possible attributes for this IDN.

Table 388 – Attributes for IDN S-0-0393

Attribute	Value
Name	Command value mode
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.284.2 Description

When the Modulo function is active, the interpretation of position commands is dependent upon the command value mode setting. In operation modes "Interpolation" and "Positioning" active only.

Table 389 shows details of the legal values.

Table 389 – Command Value Mode Structure

Bit	Meaning	Value
1 to 0	Direction with modulo function	
	clockwise, positive direction	00
	counter-clockwise, negative direction	01
	shortest path	10
	reserved	11
15 to 2	(reserved)	

9.285 IDN S-0-0394 List IDN

9.285.1 Attributes

Table 390 shows the possible attributes for this IDN.

Table 390 – Attributes for IDN S-0-0394

Attribute	Value
Name	List IDN
Version	
Length	2
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.285.2 Description

The identification number of an operation data with variable length shall be set into the List IDN. After this, access to the list elements of the operation data via "List index" (S-0-0395) and "number of list elements" (S-0-0396) is possible.

9.286 IDN S-0-0395 List index

9.286.1 Attributes

Table 391 shows the possible attributes for this IDN.

Table 391 – Attributes for IDN S-0-0395

Attribute	Value
Name	List index
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.286.2 Description

The list index specifies the starting address inside the list. With list index = 0, the first list element is accessed after the lengths indication. The list index is always programmed according to the list elements.

List index = 0 refers to first list element (1, 2, 4 or 8 bytes long)

List index = 1 refers to second list element (1, 2, 4 or 8 bytes long)

9.287 IDN S-0-0396 Number of list elements

9.287.1 Attributes

Table 392 shows the possible attributes for this IDN.

Table 392 – Attributes for IDN S-0-0396

Attribute	Value
Name	Number of list elements
Version	
Length	2
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.287.2 Description

The IDN specifies how many list elements beginning at the list index are written or read via the list segment.

9.288 IDN S-0-0397 List segment

9.288.1 Attributes

Table 393 shows the possible attributes for this IDN.

Table 393 – Attributes for IDN S-0-0397

Attribute	Value
Name	List segment
Version	
Length	1, 2, 4 or 8
Display Format	like configured data
Min input value	
Max input value	
Scaling/resolution	1, or scaling like configured data
Unit	

9.288.2 Description

In the list segment, the data which are selected by list IDN, list index and number of list elements are transmitted.

In order to show the list segment, the drive can choose between minimal requirement and maximal requirement.

Minimal requirement of list segment:

The list segment is shown hexadecimal and without unit.

Attribute: Data type and display format are set on hexadecimal (Bit 22-20 = 011).

Unit: not present

Maximal requirement of lists segment:

Herewith the list segment is shown with the data block of the programmed list.

9.289 IDN S-0-0398 IDN list of configurable data in the signal status word

9.289.1 Attributes

Table 394 shows the possible attributes for this IDN.

Table 394 – Attributes for IDN S-0-0398

Attribute	Value
Name	IDN list of configurable data in the signal status word
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.289.2 Description

This IDN list contains identification numbers, whose operation data (bits) are configurable in the signal status word. If one of the identification numbers in this list contains several bits, the bits shall be configurable by S-0-0328.

9.290 IDN S-0-0399 IDN list of configurable data in the signal control word

9.290.1 Attributes

Table 395 shows the possible attributes for this IDN.

Table 395 – Attributes for IDN S-0-0399

Attribute	Value
Name	IDN list of configurable data in the signal control word
Version	
Length	2, variable
Display Format	IDN
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.290.2 Description

This IDN list contains identification numbers, whose operation data (bits) are configurable in the signal control word. If one of the identification numbers in this list contains several bits, the bits shall be configurable by S-0-0329.

9.291 IDN S-0-0400 Home switch

9.291.1 Attributes

Table 396 shows the possible attributes for this IDN.

Table 396 – Attributes for IDN S-0-0400

Attribute	Value
Name	Home switch
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.291.2 Description

This parameter is used to assign an IDN to the home switch (external signal). This allows the home switch to be allocated to a real-time status bit (see S-0-0305). If the procedure command "control unit controlled homing" (S-0-0146) is active, the "home switch" is only valid if the signal "homing enable" (S-0-0407) is set. Bit 0 is defined for operation data only.

Table 397 shows details of legal values.

Table 397 – Structure of Home Switch

Bit	Meaning	Value
0		
	inactive switch	0
	active switch	1

9.292 IDN S-0-0401 Probe 1

9.292.1 Attributes

Table 398 shows the possible attributes for this IDN.

Table 398 – Attributes for IDN S-0-0401

Attribute	Value
Name	Probe 1
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.292.2 Description

This parameter is used to assign an IDN to probe 1 (external signal). This allows probe 1 to be assigned to a real-time status bit (see S-0-0305). Additional parameters are S-0-0130 and S-0-0131.

The signal "probe 1" is checked and updated by the drive only if the procedure command "probing cycle" (S-0-0170) is active and the signal "probe 1 enable" (S-0-0405) is set.

Bit 0 is defined for operation data only (see Table 399).

Table 399 – Structure of Probe 1

Bit	Meaning	Value
0		
	inactive probe	0
	active probe	1

9.293 IDN S-0-0402 Probe 2

9.293.1 Attributes

Table 400 shows the possible attributes for this IDN.

Table 400 – Attributes for IDN S-0-0402

Attribute	Value
Name	Probe 2
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.293.2 Description

This parameter is used to assign an IDN to probe 2 (external signal). This allows probe 2 to be assigned to a real-time status bit (see S-0-0305). Additional parameters are S-0-0132 and S-0-0133.

The signal "probe 2" is checked and updated by the drive only if the procedure command "probing Cycle" (S-0-0170) is active and the signal "probe 2 enable" (S-0-0406) is set.

Bit 0 is defined for operation data only.

Table 401 shows details of legal values.

Table 401 – Structure of Probe 2

Bit	Meaning	Value
0		
	inactive probe	0
	active probe	1

9.294 IDN S-0-0403 Position feedback value status

9.294.1 Attributes

Table 402 shows the possible attributes for this IDN.

Table 402 – Attributes for IDN S-0-0403

Attribute	Value
Name	Position feedback value status
Version	
Length	2
Display Format	binary
Min input value	

Attribute	Value
Max input value	
Scaling/resolution	1
Unit	

9.294.2 Description

When the drive switches the position feedback values to the coordinates referred to the machine zero point, the drive sets bit 0 of this parameter in order to inform the control unit that all actual position values are based on the zero point of the machine. Bit 0 is reset when either the procedure command "displacement to the referenced system" (S-0-0172) or the procedure command "drive controlled homing procedure" (S-0-0148) or the procedure command "cancel reference point" (S-0-0191) is started or when the drive loses its reference to the zero point of the machine. The position feedback value status can be assigned to a real-time status bit and therefore, it can be permanently signalled to the control unit in the drive status word (see S-0-0305). Bit 0 is defined for operation data only.

Table 403 shows details of the legal values.

Table 403 – Structure of Position Feedback Values Status

Bit	Meaning	Polarity	Value
0	Status of activated position feedback value (see S-0-0013, Bit 14)		
		not referenced to machine zero point	0
		referenced to machine zero point	1
1	Status of position feedback value 1		
		not referenced to machine zero point	0
		referenced to machine zero point	1
2	Status of position feedback value 2		
		not referenced to machine zero point	0
		referenced to machine zero point	1
15 to 3	(reserved)		

9.295 IDN S-0-0404 Position command value status

9.295.1 Attributes

Table 404 shows the possible attributes for this IDN.

Table 404 – Attributes for IDN S-0-0404

Attribute	Value
Name	Position command value status
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.295.2 Description

When the position command values are switched to the coordinates referred to the machine zero point, the control unit sets bit 0 of this parameter. This signals to the drive that all position command values are based on the zero point of the machine. Simultaneously, the control unit transfers the new position command values in the cyclic data. Bit 0 is reset when the procedure command "displacement to the referenced system" (S-0-0172) is started. The position command value status can be assigned to a real-time control bit and therefore it can be permanently signalled to the drive in the control word (see S-0-0301). Bit 0 is defined for operation data only.

Table 405 shows details of the legal values.

Table 405 – Structure of position command value status

Bit	Meaning	Value
0		
	position command value not referenced to machine zero point	0
	position command value referenced to machine zero point	1

9.296 IDN S-0-0405 Probe 1 enable

9.296.1 Attributes

Table 406 shows the possible attributes for this IDN.

Table 406 – Attributes for IDN S-0-0405

Attribute	Value
Name	Probe 1 enable
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.296.2 Description

This parameter is used to assign an IDN to probe 1 enable. This allows the status "probe 1 enable" to be assigned to a real-time control bit (see S-0-0301).

Probe 1 enable is checked by the drive only as long as the procedure command "probing cycle" (S-0-0170) is active. For a new probing cycle with the same edge of probe 1, the control unit shall reset probe 1 enable to "0" and set it to "1".

Bit 0 is defined for operation data only (see Table 407). For more details, see S-0-0179.

Table 407 – Structure of Probe 1 Enable

Bit	Meaning	Value
0		
	probe 1 not enable	0
	probe 1 enabled	1

9.297 IDN S-0-0406 Probe 2 enable

9.297.1 Attributes

Table 408 shows the possible attributes for this IDN.

Table 408 – Attributes for IDN S-0-0406

Attribute	Value
Name	Probe 2 enable
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.297.2 Description

This parameter is used to assign an IDN to probe 2 enable. This allows the status "probe 2 enable" to be assigned to a real-time control bit (see S-0-0301). Probe 2 enable is checked by the drive only as long as the procedure command "probing cycle" (S-0-0170) is active. For a new probing cycle with the same edge of probe 2, the control unit shall reset probe 2 enable to "0" and set it to "1". Bit 0 is defined for operation data only. (For more details, see S-0-0179.)

Table 409 shows details of the legal values.

Table 409 – Structure of Probe 2 Enable

Bit	Meaning	Value
0		
	probe 2 not enabled	0
	probe 2 enabled	1

9.298 IDN S-0-0407 Homing enable

9.298.1 Attributes

Table 410 shows the possible attributes for this IDN.

Table 410 – Attributes for IDN S-0-0407

Attribute	Value
Name	Homing enable
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.298.2 Description

This parameter is used to assign an IDN to the status homing enable. This allows the status "homing enable" to be assigned to a real-time control bit (see S-0-0301). The drive interprets the homing enable only while the procedure command "control unit controlled homing" (S-0-0146) is active. Bit 0 is defined for operation data only.

Table 411 shows details of the legal values.

Table 411 – Structure of Homing Enable

Bit	Meaning	Value
0		
	homing not enabled	0
	homing enabled	1

9.299 IDN S-0-0408 Reference marker pulse registered

9.299.1 Attributes

Table 412 shows the possible attributes for this IDN.

Table 412 – Attributes for IDN S-0-0408

Attribute	Value
Name	Reference marker pulse registered
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.299.2 Description

This parameter is used to assign an IDN to reference marker pulse registered. This allows the status "reference marker pulse registered" to be assigned to a real-time status bit (see S-0-0305). The drive sets this bit to 1 if the procedure command "control unit controlled homing"

(S-0-0146) is active, if the homing is enabled (S-0-0407) and the marker pulse of the feedback (external signal) is registered. Simultaneously, the drive stores the unreferenced position feedback value in the related marker position (S-0-0173 or S-0-0174). The drive resets this bit to 0 when the control unit activates the procedure command “control unit controlled homing” (S-0-0146). While the procedure command (S-0-0146) is active, the ”reference marker pulse registered” is valid. The procedure command ”drive controlled homing” (S-0-0148) has no effect on this bit (S-0-0408). Bit 0 is defined for operation data only.

Table 413 shows details of the legal values.

Table 413 – Structure of Reference Marker Pulse Registered

Bit	Meaning	Value
0		
	reference marker pulse not registered	0
	reference marker pulse registered	1

9.300 IDN S-0-0409 Probe 1 positive latched

9.300.1 Attributes

Table 414 shows the possible attributes for this IDN.

Table 414 – Attributes for IDN S-0-0409

Attribute	Value
Name	Probe 1 positive latched
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.300.2 Description

This parameter is used to assign an IDN to probe 1 positive latched. This allows the status "probe 1 positive latched" to be assigned to a real-time status bit (see S-0-0305). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (S-0-0170) is active, the signal "probe 1 enable" (S-0-0405) is set to 1 and the positive edge of "probe 1" (S-0-0401) is registered. Simultaneously, the drive stores the position feedback value in "probe 1 positive edge" (S-0-0130). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 1 enable is reset to 0. Bit 0 is defined for operation data only. (For more details, see S-0-0179.)

Table 415 shows details of the legal values.

Table 415 – Structure of Probe 1 Positive Latched

Bit	Meaning	Value
0		
	probe 1 positive not latched	0
	probe 1 positive latched	1

9.301 IDN S-0-0410 Probe 1 negative latched

9.301.1 Attributes

Table 416 shows the possible attributes for this IDN.

Table 416 – Attributes for IDN S-0-0410

Attribute	Value
Name	Probe 1 negative latched
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.301.2 Description

This parameter is used to assign an IDN to probe 1 negative latched. This allows the status "probe 1 negative latched" to be assigned a real-time status bit (see S-0-0305). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (S-0-0170) is active, the signal "probe 1 enable" (S-0-0405) is set to 1 and the negative edge of "probe 1" (S-0-0401) is registered. Simultaneously, the drive stores the position feedback value in "probe 1 negative edge" (S-0-0131). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 1 enable is reset to 0. Bit 0 is defined for operation data only. (For more details, see S-0-0179.)

Table 417 shows details of the legal values.

Table 417 – Structure of Probe 1 Negative Latched

Bit	Meaning	Value
0		
	probe 1 negative not latched	0
	probe 1 negative latched	1

9.302 IDN S-0-0411 Probe 2 positive latched

9.302.1 Attributes

Table 418 shows the possible attributes for this IDN.

Table 418 – Attributes for IDN S-0-0411

Attribute	Value
Name	Probe 2 positive latched
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.302.2 Description

This parameter is used to assign an IDN to probe 2 positive latched. This allows the status "probe 2 positive latched" to be assigned to a real-time status bit (see S-0-0305). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (S-0-0170) is active, the signal "probe 2 enable" (S-0-0406) is set to 1 and the positive edge of "probe 2" (S-0-0402) is registered. Simultaneously, the drive stores the position feedback value in "probe 2 positive edge" (S-0-0132). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 2 enable is reset to 0. Bit 0 is defined for operation data only. (For more details, see S-0-0179.)

Table 419 shows details of the legal values.

Table 419 – Structure of Probe 2 Positive Latched

Bit	Meaning	Value
0		
	probe 2 positive not latched	0
	probe 2 positive latched	1

9.303 IDN S-0-0412 Probe 2 negative latched

9.303.1 Attributes

Table 420 shows the possible attributes for this IDN.

Table 420 – Attributes for IDN S-0-0412

Attribute	Value
Name	Probe 2 negative latched
Version	
Length	2
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.303.2 Description

This parameter is used to assign an IDN to probe 2 negative latched. This allows the status "probe 2 negative latched" to be assigned to a real-time status bit (see S-0-0305). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (S-0-0170) is active, the signal "probe 2 enable" (S-0-0406) is set to 1 and the negative edge of "probe 2" (S-0-0402) is registered. Simultaneously, the drive stores the position feedback value in "probe 2 negative edge" (S-0-0133). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 2 enable is reset to 0. Bit 0 is defined for operation data only. (For more details, see S-0-0179.)

Table 421 shows details of the legal values.

Table 421 – Structure of Probe 2 Negative Latched

Bit	Meaning	Value
0		
	probe 2 negative not latched	0
	probe 2 negative latched	1

9.304 IDN S-0-0413 Bit number allocation of real-time control bit 1

9.304.1 Attributes

Table 422 shows the possible attributes for this IDN.

Table 422 – Attributes for IDN S-0-0413

Attribute	Value
Name	Bit number allocation of real-time control bit 1
Version	
Length	2
Display Format	unsigned decimal (bit number)
Min input value	0
Max input value	63
Scaling/resolution	1
Unit	

9.304.2 Description

This identification number contains the bit number of the operation data assigned in the S-0-0301. The bit assigned by S-0-0301 and bit number (S-0-0413) is copied into the real-time control bit 1.

9.305 IDN S-0-0414 Bit number allocation of real-time control bit 2

9.305.1 Attributes

Table 423 shows the possible attributes for this IDN.

Table 423 – Attributes for IDN S-0-0414

Attribute	Value
Name	Bit number allocation of real-time control bit 2
Version	
Length	2
Display Format	unsigned decimal (bit number)
Min input value	0
Max input value	63
Scaling/resolution	1
Unit	

9.305.2 Description

This identification number contains the bit number of the operation data assigned in the S-0-0303. The bit assigned by S-0-0303 and bit number (S-0-0414) is copied into the real-time control bit 2.

9.306 IDN S-0-0415 Bit number allocation of real-time status bit 1

9.306.1 Attributes

Table 424 shows the possible attributes for this IDN.

Table 424 – Attributes for IDN S-0-0415

Attribute	Value
Name	Bit number allocation of real-time status bit 1
Version	
Length	2
Display Format	unsigned decimal (bit number)
Min input value	0
Max input value	63
Scaling/resolution	1
Unit	

9.306.2 Description

This identification number contains the bit number of the operation data assigned in the S-0-0305. The bit assigned by S-0-0305 and bit number (S-0-0415) is copied into the real-time status bit 1.

9.307 IDN S-0-0416 Bit number allocation of real-time status bit 2

9.307.1 Attributes

Table 425 shows the possible attributes for this IDN.

Table 425 – Attributes for IDN S-0-0416

Attribute	Value
Name	Bit number allocation of real-time status bit 2
Version	
Length	2
Display Format	unsigned decimal (bit number)
Min input value	0
Max input value	63
Scaling/resolution	1
Unit	

9.307.2 Description

This identification number contains the bit number of the operation data assigned in the S-0-0307. The bit assigned by S-0-0307 and bit number (S-0-0416) is copied into the real-time status bit 2.

9.308 IDN S-0-0429 Emergency stop deceleration

9.308.1 Attributes

Table 426 shows the possible attributes for this IDN.

Table 426 – Attributes for IDN S-0-0429

Attribute	Value
Name	Emergency stop deceleration
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0160 Scaling factor S-0-0161 Scaling exponent S-0-0162
Unit	

9.308.2 Description

When the control unit activates “Drive OFF“ (control word, bit 15 = 0, bit 14 = 1), the drive decelerates as best as possible limited by the “emergency stop deceleration“, followed by disabling of the torque at n_{min}.

9.309 IDN S-0-0430 Active target position

9.309.1 Attributes

Table 427 shows the possible attributes for this IDN.

Table 427 – Attributes for IDN S-0-0430

Attribute	Value
Name	Active target position
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0076 Scaling factor S-0-0077 Scaling exponent S-0-0078 Rotational position resolution S-0-0079
Unit	

9.309.2 Description

At the operating mode interpolation, the drive writes the target position (S-0-0258) into the active target position.

At the operating mode positioning, the drive writes the positioning command value (S-0-0282) either into the target position (absolute position data) or the positioning command value is added (relative position data) to the active target position. See control word positioning (S-0-0346).

Active target position is only an intermediate memory in the drive, therefore cannot be configured in the MDT and is readable only over the service channel.

9.310 IDN S-0-0431 Spindle positioning acceleration bipolar

9.310.1 Attributes

Table 428 shows the possible attributes for this IDN.

Table 428 – Attributes for IDN S-0-0431

Attribute	Value
Name	Spindle positioning acceleration bipolar
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0160 Scaling factor S-0-0161 Scaling exponent S-0-0162
Unit	

9.310.2 Description

When the position spindle procedure command (see S-0-0152) is received, the drive accelerates or decelerates to the spindle positioning speed (S-0-0222), depending on the spindle positioning acceleration bipolar.

9.311 IDN S-0-0432 Serial number drive control

9.311.1 Attributes

Table 429 shows the possible attributes for this IDN.

Table 429 – Attributes for IDN S-0-0432

Attribute	Value
Name	Serial number drive control
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Refer to operation data of variable length and data type characters.	

9.311.2 Description

This IDN contains the serial number of the drive control.

9.312 IDN S-0-0433 Serial number power stage

9.312.1 Attributes

Table 430 shows the possible attributes for this IDN.

Table 430 – Attributes for IDN S-0-0433

Attribute	Value
Name	Serial number power stage
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Refer to operation data of variable length and data type characters.	

9.312.2 Description

This IDN contains the serial number of the power stage.

9.313 IDN S-0-0434 Serial number motor

9.313.1 Attributes

Table 431 shows the possible attributes for this IDN.

Table 431 – Attributes for IDN S-0-0434

Attribute	Value
Name	Serial number motor
Version	
Length	1, variable
Display Format	text
Min input value	
Max input value	
Scaling/resolution	1
Unit	
NOTE Refer to operation data of variable length and data type characters.	

9.313.2 Description

This IDN contains the serial number of the motor.

9.314 IDN S-0-0435 Operating time drive control

9.314.1 Attributes

Table 432 shows the possible attributes for this IDN.

Table 432 – Attributes for IDN S-0-0435

Attribute	Value
Name	Operating time drive control
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	defined by the drive manufacturer
Unit	defined by the drive manufacturer

9.314.2 Description

This IDN contains the operating time of the drive control.

9.315 IDN S-0-0436 Operating time power stage

9.315.1 Attributes

Table 433 shows the possible attributes for this IDN.

Table 433 – Attributes for IDN S-0-0436

Attribute	Value
Name	Operating time power stage
Version	
Length	4
Display Format	unsigned decimal
Min input value	
Max input value	
Scaling/resolution	defined by the drive manufacturer
Unit	defined by the drive manufacturer

9.315.2 Description

This IDN contains the operating time of the power stage.

9.316 IDN S-0-0446 Ramp reference velocity

9.316.1 Attributes

Table 434 shows the possible attributes for this IDN.

Table 434 – Attributes for IDN S-0-0446

Attribute	Value
Name	Ramp reference velocity
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type S-0-0044 Scaling factor S-0-0045 Scaling exponent S-0-0046
Unit	

9.316.2 Description

This parameter is used as the reference for specifying accelerations.

Acceleration parameter [ms] = ramp reference velocity/acceleration.

9.317 IDN S-0-0460 to S-0-0475 Position switches (position switch points off 1-16)

9.317.1 Attributes

Table 435 shows the possible attributes for this IDN.

Table 435 – Attributes for IDN S-0-0460 to S-0-0475

Attribute	Value
Name	Position switches (position switch points off 1-16)
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.317.2 Description

The position switches consist of a **position switch point off** and a position switch flag (S-0-0059). If the position feedback value is less than the position switch point off, the appropriate position switch flag is set to 1. If the position feedback value is equal to or greater than the position switch point off, the appropriate position switch flag is set to 0.

9.318 IDN S-0-0476 Position switch control

9.318.1 Attributes

Table 436 shows the possible attributes for this IDN.

Table 436 – Attributes for IDN S-0-0476

Attribute	Value
Name	Position switch control
Version	
Length	4
Display Format	binary
Min input value	
Max input value	
Scaling/resolution	1
Unit	

9.318.2 Description

In this parameter, the position switches 1 to 16 are enabled with bits 0 to 15 respectively. The drive shall process only the herewith enabled position switches.

Furthermore, the adjustment bits 16 to 31 define if these are position or cam switches. Cam switches require the “Position switch on” (S-0-0060 to S-0-0075) and “Position switch off” (S-0-0460 to S-0-0475) in addition.

Table 437 shows details of the legal values.

Table 437 – Structure of the Position Switch Control

Bit	Meaning	Polarity	Value
0	Position switch flag 1 (S-0-0060, S-0-0460)		
		disabled	0
		enabled	1
and so on until			
15	Position switch flag 16 (S-0-0075, S-0-0475)		
		disabled	0
		enabled	1
16	Cam switch 1 (S-0-0060, S-0-0460)		
		no cam switch → only S-0-0060 is active	0
		cam switch enabled → S-0-0060 and S-0-0460 are active	1
and so on until			
31	Cam switch 16 (S-0-0075, S-0-0475)		
		no cam switch → only S-0-0075 is active	0
		cam switch enabled → S-0-0075 and S-0-0475 are active	1

9.319 IDN S-0-0477 Position switch hysteresis

9.319.1 Attributes

Table 438 shows the possible attributes for this IDN.

Table 438 – Attributes for IDN S-0-0476

Attribute	Value
Name	Position switch control
Version	
Length	4
Display Format	signed decimal
Min input value	
Max input value	
Scaling/resolution	Scaling type: S-0-0076 Scaling factor: S-0-0077 Scaling exponent: S-0-0078 Rotational position resolution: S-0-0079
Unit	

9.319.2 Description

The hysteresis influences those position flags (S-0-0059), which are enabled by parameter S-0-0476.

Bibliography

IEC 60050-351, *International Electrotechnical Vocabulary – Part 351: Control technology*[15]

IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61499-1:2005, *Function blocks – Part 1: Architecture*

IEC 61800 (all parts), *Adjustable speed electrical power drive systems*

IEC 61800-7 (all parts), *Adjustable speed electrical power drive systems – Generic interface and use of profiles for power drive systems*[16]

IEC 61800-7-1:—, *Adjustable speed electrical power drive systems – Part 7-1: Generic interface and use of profiles for power drive systems – Interface definition*[16]

IEC 61800-7-201:—, *Adjustable speed electrical power drive systems – Part 7-201: Generic interface and use of profiles for power drive systems – Profile type 1 specification*[16]

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*[16]

IEC 61800-7-203:—, *Adjustable speed electrical power drive systems – Part 7-203: Generic interface and use of profiles for power drive systems – Profile type 3 specification*[16]

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*[16]

IEC 61800-7-302:—, *Adjustable speed electrical power drive systems – Part 7-302: Generic interface and use of profiles for power drive systems – Mapping of profile type 2 to network technologies*[16]

IEC 61800-7-303:—, *Adjustable speed electrical power drive systems – Part 7-303: Generic interface and use of profiles for power drive systems – Mapping of profile type 3 to network technologies*[16]

IEC/TS 61915, *Low-voltage switchgear and controlgear – Principles for the development of device profiles for networked industrial devices*

IEC 62026-3, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 3:DeviceNet™*

IEC/TR 62390:2005, *Common Automation Device - Profile Guideline*

ISO/IEC 2382-15:1999, *Information technology, Vocabulary – Part 15: Programming languages*

ISO/IEC 19501, *Information technology – Open Distributed Processing – Unified Modeling Language (UML) Version 1.4.2*

---

[15] See also the IEC Multilingual Dictionary – Electricity, Electronics and Telecommunications.

[16] To be published

ISO 15745-1:2003, *Industrial automation systems and integration – Open systems application integration framework – Part 1: Generic reference description*

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

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