

## PROGRAMMERS MANUAL

### CANopen Programmiers Manual

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## 1 Introduction

### 1.1 Overview

This manual describes the CANopen implementation developed by Brunner Elektronik AG for the ac-Servo Drives. It contains useful information for anyone who participates in the evaluation or design of a distributed motion control system. The reader should have prior knowledge of motion control, networks, and CANopen. Some objects, such as I/O will be not available in any configuration.

### 1.2 Related Documentation

The CAN interface of the BEH ac-servo drives follows the CiA DS301 communication profile and the CiA DSP402 device profile (Device Profile for Drives and Motion Control). This document supplements DS301 and DSP402, which must be purchased separately from CiA (international users and manufacturers group).  
CiA (Can in Automation e.V.) can be contacted at <http://www.can-cia.org>.

### 1.3 Copyright

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### 1.4 Document Validity

We reserve the right to modify our products. The information in this document is subject to change without notice and does not represent a commitment by BEH assumes no responsibility for any errors that may appear in this document.

### 1.5 Product Warning



The programmer is responsible for creating program code that operates safely for the amplifiers and motors in any given machine.

Failure to heed this warning can cause equipment damage, injury, or death.

### 1.6 Object Description Conventions

The following object descriptions follow the same format used in DS301 and DSP402. The “Access” attribute also indicates when an object can be accessed to write: **ALW** (always) or **DIS** (in any drive state where power is disabled). All readable (Read-only and Read-Write) objects can always be read. The objects that are stored in non-volatile memory are marked by **SNVM** in the access attribute.

## 2 Communication

### 2.1 Communication Object (COB)

See /4/ for a detailed description of the CAN physical layer. A CAN communication message is formatted as follows (CAN2.0A):

Field	Description	Number Of Bits
Start	Start	bit 1
ID	11-bit (CAN 2.0A)	11
RTR	Remote Transmission Request	(typically 0) 1
CTRL	Control field	6
Data	0...8 bytes	0...64
CRC	16-bit Cyclic Redundancy Check	16
ACK	Acknowledge	2
EOF	End of field	7
IFS	Interframe Space	3
	Stuff bits Up to	19

Only the ID, RTR and Data fields are used directly by the application. The CAN controller sets the other fields.

The ID is formatted as follows (CAN2.0A):

Bit 0...6 Module-ID; this corresponds to the node address (bit0 = LSB)

Bit 7...10 Message type; determines the object priority (0000 corresponds to the highest priority)

### 2.2 Communication Model

See /2/ and /3/ for a detailed description of SDO (Service Data Object) and PDO (Process Data Object).

Dictionary objects are grouped according to the drive architecture described in /3/:

PREDEFINED COMMUNICATION OBJECTS (DS301)

NMT services

SYNC Messages

HEARTBEAT Protocol

EMERGENCY Messages

PDO Messages

SDO Messages

COMMUNICATION PROFILE OBJECTS (DS301)

DRIVE PROFILE OBJECTS (DSP402)

Common Objects

Device Control Objects

Factor Group Objects

Profile Position Mode Objects

Homing Mode Objects

Position Control Function Objects

Profile Velocity Mode Objects

Profile Torque Mode Objects

Force Feedback Mode Objects

Each group contains a description of both the standard objects and the manufacturer specific objects.

A detailed description of the standard objects can be found in /2/ and /3/. This document will provide additional information if needed. Standard objects without pre-defined functionality are described in detail, as well as all manufacturer specific objects.

#### 2.2.1 Predefined Communication Objects

The BEH ac-servo drives are minimum capability devices from the communication profile point of view (see /2/). They support the pre-defined master/slave connection set, defined in /2/.

### 2.2.2 NMT Service

The Network Management (NMT) is used to control the network behaviour. The mechanism used for NMT is based on a master/slave relationship. The NMT requires that during start up/runtime there is only one master at the very same time

Ac-servo drives from BEH support the NMT Slave State Machine, as required by the CANOpen Communication Profile

There are four main state

Initialisation  
Pre-Operational  
Operational  
Stopped

And five NMT Commandos

Start Remote Node:	COB-ID=0 / Command Specifier =1
Stop Remote Node:	COB-ID=0 / Command Specifier =2
Enter PreOperational State:	COB-ID=0 / Command Specifier =128
Reset Node:	COB-ID=0 / Command Specifier =129
Reset Communication	COB-ID=0 / Command Specifier =130

See /2/ for a detailed description

### 2.2.3 SYNC Messages

The SYNC message is a standard CANOpen message used to synchronize multiple devices and to trigger the synchronous transmission of PDOs. This object is implemented per /2/.

### 2.2.4 HEARTBEAT Protocol

The heartbeat protocol allows the network manager application to detect problems with a device or its network connection. The CANOpen master configures the device to periodically transmit a heartbeat message indicating the device's current state (pre-operational, operational, or stopped). The network manager monitors the heartbeat messages. Failure to receive a node's heartbeat messages indicates a problem with the device or its connection to the network. This object is implemented per /2/.

### 2.2.5 EMERGENCY Messages

A device sends an 8-byte emergency message (EMCY) when an error occurs in the device. It contains information about the error type, and beh-specific information. A device need only send one EMCY message per event. Any device can be configured to accept EMCY messages. This object is implemented per /2/.

### 2.2.6 SDO Messages

Service Data Objects are mainly used for transferring non-time-critical data, e.g. parameter values. SDOs provide access to the entries in the device Object Dictionary

If 4 bytes or less data is to be transmitted, an 'expedited' SDO message can be used  
Larger quantities of data can be segmented, i.e. split between several CAN messages

See /2/ for a detailed description

### 2.2.7 PDO Messages

PDOs are message in an unconfirmed service. They are used for the transfer of real-time data to and from drive. There are two kinds of use for PDOs. The first is data transmission and the second data reception. It is distinguished in Transmit-PDOs (TPDOs) and Receive-PDOs (RPDOs).

PDO Communication Parameters

RPDO communication parameter index = 1400h + RPDO-number -1

TPDO communication parameter index = 1800h + TPDO-number -1

PDO Mapping Parameters

RPDO mapping parameter index = 1600h + RPDO-number -1

TPDO mapping parameter index = 1A00h + TPDO-number -1

See /2/ for a detailed description

## 2.3 Common Communication profile objects

Used in devices with EtherCat or CANbus

### 2.3.1 Object 1000h Device Type

The device type specifies the kind of device. The lower 16 bit contain the device profile number and the upper 16 bit an additional information. See /2/ and /3/ for a detailed description.

#### 2.3.1.1 Object Description

Index	1000h
Name	Device Type
Object Code	Variable
Data Type	UNSIGNED32
Category	Mandatory
Access	RO
PDO Mapping	No
Default Value	0xFF790192
Lower Limit	0x00000000
Upper Limit	0xFFFFFFFF

### 2.3.2 Object 1001h Error Register

The error register is a field of 8 bits, each for a certain error type. If an error occurs the bit has to be set.

Bit Meaning:

0 generic error

1 current

2 voltage

3 temperature

4 communication error (overflow, error state)

5 device profile specific

6 reserved

7 manufacturer specific

#### 2.3.2.1 Object Description

Index	1001h
Name	Error Register
Object Code	Variable
Data Type	UNSIGNED8
Category	Mandatory
Access	RO
PDO Mapping	No
Default Value	0x00
Lower Limit	0x00
Upper Limit	0xFF



### 2.3.3 Object 1002h Manufacturer Status Register

This register indicates which errors have occurred.

Bit	Name	Description	Error Option Code
0	Over voltage	Indicates an over voltage condition.	See * below
1	Under voltage	Indicates an under voltage condition.	See * below
2	Power supply error	Indicates Power supply error	See * below
3	Over curr. / Short circuit	Indicates an over current condition	See * below
4	Over temperature drive	Indicates a drive over temperature	See * below
5	Force Feedback Error	Indicates Force Feedback Error	See * below
6-16	Reserved		
17	Following error	Indicates a position following error.	2150h sub 2
18	Over temperature motor	Indicates a motor over temperature	2150h sub 3
19	Negative limit switch	Negative limit switch input is active.	2150h sub 4
20	Positive limit switch	Positive limit switch input is active	2150h sub 4
21	Feedback error	Indicates a feedback error	2150h sub 5
22	Negative software limit	Negative software limit is active.	2150h sub 6
23	Positive software limit	Positive software limit is active.	2150h sub 6
24	CAN Communication error	Lost Can Communication	6007h
25	USB Communication error	Indicates USB com. error	No action
26-31	Reserved		

\* These errors are fatal errors that will cause the drive to go into a fault state and disable the power bridge immediately as they represent abnormal operating conditions (see also objects 6041h).

#### 2.3.3.1 Object Description

Index	1002h
Name	Manufacturer Status Register
Object Code	Variable
Data Type	UNSIGNED32
Category	Optional
Access	RO
PDO Mapping	YES
Default Value	0x00
Lower Limit	0x00
Upper Limit	0xFFFFFFFF

### 2.3.4 Object 1003h Pre- defined Error Field

This object holds errors that have occurred on the device and have been signalled via Emergency Object. It is an error history. Writing to sub index 0 deletes the entire error history.

#### 2.3.4.1 Object Description

Index	1003h
Name	Pre-defined Error Field
Object Code	Array
Number of Elements	10
Data Type	UNSIGNED32
Category	Mandatory

#### 2.3.4.2 Entry Description

Sub-Index	1-10
Description	Standard Error Field
PDO Mapping	No
Access	RO
PDO Mapping	No
Default Value	0x00000000
Lower Limit	0x00000000
Upper Limit	0xFFFFFFFF

#### 2.3.4.3 Predefined Error Field Error Codes

Code	Description
0x0000	No Error
0x1000	Generic Error
0x1001	Emergency Stop
0x2320	Overcurrent Power stage
0x3210	DC Link Overvoltage
0x3220	DC Link Under voltage
0x4210	Excess Temperature Motor
0x4310	Excess Temperature Drive
0x5113	Internal 5V Power Supply to low
0x5114	Resolver Error
0x8611	Following Window Error
0x8620	Hardware Negative Limit Switch
0x8621	Hardware Positive Limit Switch
0x8622	Software Limit Switch
0xFF01	Force Sensor Error
0xFF02	Synch Error IP Mode
0xFF03	Synch Error CSP Mode
0xFF04	Synch Error CSV Mode

### 2.3.5 Object 1008h Manufacturer Device Name

Contains the device name.

#### 2.3.5.1 Object Description

Index	1008h
Name	Manufacturer
Object Code	Variable
Data Type	VISIBLE STRING
Category	Optional
Access	RO
PDO Mapping	No
Default Value	GER.10XX.0XXX

### 2.3.6 Object 1009h Manufacturer Hardware Version

Contains the device hardware version.

#### 2.3.6.1 Object Description

Index	1009h
Name	Manufacturer Hardware Version
Object Code	Variable
Data Type	VISIBLE STRING
Category	Optional
Access	RO
PDO Mapping	No
Default Value	X

### 2.3.7 Object 100Ah Manufacturer Software Version

Contains the device software version.

#### 2.3.7.1 Object Description

Index	100Ah
Name	Manufacturer Software Version
Object Code	Variable
Data Type	VISIBLE STRING
Category	Optional
Access	RO
PDO Mapping	No
Default Value	PRG.1014.010X.XXXX

### 2.3.8 Object 1010h Store Parameter Field

This entry supports saving of parameters in non-volatile memory. With a read access the device provides information about its saving capabilities. Several parameter groups are distinguished.  
For saving the signature "save" (0x65766173) must be written.

Sub index 1: all parameters

Sub index 2: communication parameters

Sub index 3: application parameters

Sub index 4: manufacturer defined parameters

#### 2.3.8.1 Object Description

Index	1010h
Name	Store Parameter Field
Object Code	Array
Number of Elements	4
Data Type	UNSIGNED32
Category	Optional

#### 2.3.8.2 Entry Description

Sub-Index	001-004
Description	See above
Access	RW – ALW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

### 2.3.9 Object 1011h Restore Default Parameter

This entry supports restoring of default parameters. With a read access the device provides information about its capabilities to restore these values. Several parameter groups are distinguished.  
For restoring the signature "load" (0x64616663) must be written

Sub index 1-4: See Store parameter field above

#### 2.3.9.1 Object Description

Index	1011h
Name	Restore Default Parameter
Object Code	Array
Number of Elements	4
Data Type	UNSIGNED32
Category	Optional

#### 2.3.9.2 Entry Description

Sub-Index	001-004
Description	See above
Access	RW – ALW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

### 2.3.10 Object 1015h Inhibit Time Emergency

Inhibit Time used for emergency message (Emergency Server).  
 The time has to be a multiple of 100 msec.

#### 2.3.10.1 Object Description

Index	1015h
Name	Inhibit Time Emergency
Object Code	Variable
Data Type	UNSIGNED16
Category	Optional
Access	RW - ALW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 2.3.11 Object 1018h Identity Object

This object contains general information about the device.

#### 2.3.11.1 Object Description

Index	1018h
Name	Identity Object
Object Code	Record
Number of Elements	4
Data Type	IDENTITY
Category	Mandatory

#### 2.3.11.2 Entry Description

Sub-Index	001
Description	Vendor Id Contains a unique value allocated each manufacturer
Data Type	UNSIGNED32
Access	RO
PDO Mapping	No
Default Value	0x000001A1
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Product Code identifies the manufacturer specific product code (device version).
Access	RO
PDO Mapping	No
Default Value	0x00000FA2 (Modula Drive) 0x00000FA3 (Micro Drive CAN) 0x00000FA4 (Micro Drive EtherCat) 0x00000FA5 (MDS Drive CAN) 0x00000FA6 (MDS Drive EtherCat) 0x00000FA7 (LCM Drive CAN) 0x00000FA8 (LC Micro Drive CAN) 0x00000FA9 (LC Micro Drive EtherCat)

Sub-Index	003
Description	Revision number Contains the revision number
Access	RO
PDO Mapping	No
Default Value	0x1

Sub-Index	004
Description	Serial number
Access	RO
PDO Mapping	No
Default Value	0x1

### 2.3.12 Object 1600h Receive PDO Mapping Parameter 1

It contains the mapping parameters of the first PDO the device is able to receive.

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.12.1 Object Description

Index	1600h
Name	RPDO Mapping Parameter 1
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.12.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
PDO Mapping	No
Default Value	0x2

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
PDO Mapping	No
Default Value	0x60400010
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Mapping Entry 2
Default Value	0x607A0020

Mapping Entry 2 to 16 Default Value 0 (Sub-Index 2-16)

### 2.3.13 Object 1601h Receive PDO Mapping Parameter 2

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.13.1 Object Description

Index	1601h
Name	RPDO Mapping Parameter 2
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.13.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x2

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x60400010
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Mapping Entry 2
Default Value	0x60600008

Mapping Entry 3 to 16 Default Value 0 (Sub-Index 3-16)



### 2.3.14 Object 1602h Receive PDO Mapping Parameter 3

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.14.1 Object Description

Index	1602h
Name	RPDO Mapping Parameter 3
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.14.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x2

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x60400010
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Mapping Entry 2
Default Value	0x607A0020

Mapping Entry 3 to 16 Default Value 0 (Sub-Index 3-16)

### 2.3.15 Object 1606h Receive PDO Mapping Parameter 7

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.15.1 Object Description

Index	1606h
Name	RPDO Mapping Parameter 7
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.15.2 Entry Description

Sub-Index	000
Description	Number of Entries
Entry Category	Mandatory
Access	RW – ALW
Default Value	0x3

Sub-Index	001
Description	Mapping Entry 1
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x21030010
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Mapping Entry 2
Default Value	0x2104002

Sub-Index	003
Description	Mapping Entry 3
Default Value	0x21110010

Mapping Entry 4 to 16 Default Value 0 (Sub-Index 4-16)

### 2.3.16 Object 1610h Receive PDO Mapping Parameter 17

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.16.1 Object Description

Index	1610h
Name	RPDO Mapping Parameter 17
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.16.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x3

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x21160020
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Mapping Entry 2
Default Value	0x21140010

Sub-Index	003
Description	Mapping Entry 3
Default Value	0x21010410

Mapping Entry 2 to 16 Default Value 0 (Sub-Index 4-16)

### 2.3.17 Object 1611h Receive PDO Mapping Parameter 18

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.17.1 Object Description

Index	1611h
Name	RPDO Mapping Parameter 18
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.17.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x1

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x21170020
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Mapping Entry 2
Default Value	0x60810020

Mapping Entry 2 to 16 Default Value 0 (Sub-Index 3-16)

### 2.3.18 Object 1A00h Transmit PDO Mapping Parameter 1

It contains the mapping parameters of the first PDO the device is able to transmit.

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.18.1 Object Description

Index	1A00h
Name	TPDO Mapping Parameter 1
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.18.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x3

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x60410010
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Default Value	0x60640020

Sub-Index	003
Default Value	0x20310110

Mapping Entry 4 to 16 Default Value 0 (Sub-Index 4-16)

### 2.3.19 Object 1A01h Transmit PDO Mapping Parameter 2

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.19.1 Object Description

Index	1A01h
Name	TPDO Mapping Parameter 2
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.19.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x2

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x60410010
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Default Value	0x60610008

Mapping Entry 3 to 16 Default Value 0 (Sub-Index 3-16)

### 2.3.20 Object 1A02h Transmit PDO Mapping Parameter 3

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.20.1 Object Description

Index	1A02h
Name	TPDO Mapping Parameter 3
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.20.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x2

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x60410010
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Mapping Entry 2
Default Value	0x60640020

Mapping Entry 3 to 16 Default Value 0 (Sub-Index 3-16)

### 2.3.21 Object 1A06h Transmit PDO Mapping Parameter 7

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.21.1 Object Description

Index	1A06h
Name	TPDO Mapping Parameter 7
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.21.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x2

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x60410010
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Mapping Entry 2
Default Value	0x60440010

Mapping Entry 3 to 16 Default Value 0 (Sub-Index 3-16)



### 2.3.22 Object 1A10h Transmit PDO Mapping Parameter 17

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.22.1 Object Description

Index	1A10h
Name	TPDO Mapping Parameter 17
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.22.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x1

Sub-Index	001
Description	Mapping Entry 1
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x20310110
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Mapping Entry 2 to 16 Default Value 0 (Sub-Index 2-16)

### 2.3.23 Object 1A11h Transmit PDO Mapping Parameter 18

Sub-index 0 contains the number of the mapped data objects.

The structure of a mapping entry is: index (16bit), subindex (8bit), length (8bit)

#### 2.3.23.1 Object Description

Index	1A11h
Name	TPDO Mapping Parameter 18
Object Code	Record
Number of Elements	16
Data Type	PDO_MAPPING
Category	Optional

#### 2.3.23.2 Entry Description

Sub-Index	000
Description	Number of Entries
Access	RW – ALW
Default Value	0x0

Mapping Entry 1 to 16 Default Value 0 (Sub-Index 1-16)

## 2.4 Can Communication profile objects

Used only in devices with CANbus

### 2.4.1 Object 1005h COB-ID SYNC

COB-ID of the Synchronization object. The device generates a SYNC message if bit 30 is set. The meaning of other bits is equal to the other communication objects.

#### 2.4.1.1 Object Description

Index	1005h
Name	COB-ID SYNC
Object Code	Variable
Data Type	UNSIGNED32
Category	Optional
Access	RW – ALW
PDO Mapping	No
Default Value	0x80000080
Lower Limit	0x00000000
Upper Limit	0xFFFFFFFF

### 2.4.2 Object 1006h Communication Cycle Period

This entry defines the communication cycle period in us. It is 0, if not used.

#### 2.4.2.1 Object Description

Index	1006h
Name	Communication Cycle Period
Object Code	Variable
Data Type	UNSIGNED32
Category	Optional
Access	RW – ALW
PDO Mapping	No
Default Value	0x00002710
Lower Limit	0x00000000
Upper Limit	0xFFFFFFFF

### 2.4.3 Object 1007h Synchronous Window Length

It contains the length of the time window for synchronous messages in us. It is 0, if not used.

#### 2.4.3.1 Object Description

Index	1007h
Name	Synchronous Window Length
Object Code	Variable
Data Type	UNSIGNED32
Category	Optional
Access	RW – ALW
PDO Mapping	No
Default Value	0x00000000
Lower Limit	0x00000000
Upper Limit	0xFFFFFFFF
Unit	us

#### 2.4.4 Object 1014h COB-ID EMCY

COB-ID used for emergency message (Emergency Server).

##### 2.4.4.1 Object Description

Index	1014h
Name	COB-ID EMCY
Object Code	Variable
Data Type	UNSIGNED32
Category	Optional
Access	RO
PDO Mapping	No
Default Value	0x00000080
Lower Limit	0x00000001
Upper Limit	0xFFFFFFFF
Unit	

#### 2.4.5 Object 1016h Heartbeat Consumer Entries

The consumer heartbeat time defines the expected heartbeat cycle time and thus has to be higher than the corresponding producer heartbeat time configured on the device producing this heartbeat.

The bits 31 - 24 of each sub-index has to be 0.

The bits 23 - 16 contain the node-id.

The lower 16 bits contain the heartbeat time.

##### 2.4.5.1 Object Description

Index	1016h
Name	Heartbeat Consumer Entries
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED32
Category	Optional

##### 2.4.5.2 Entry Description

Sub-Index	001-002
Description	Consumer Heartbeat Time 1 / 2
Data Type	UNSIGNED32
Access	RW – ALW
PDO Mapping	No
Default Value	1:0x000203E8 / 2: 0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

## 2.4.6 Object 1017h Producer Heartbeat Time

The producer heartbeat time defines the cycle time of the heartbeat. If the time is 0 it is not used. The time has to be a multiple of 1 msec

### 2.4.6.1 Object Description

Index	1017h
Name	Producer Heartbeat Time
Object Code	Variable
Data Type	UNSIGNED16
Category	Optional
Access	RW - ALW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	ms

### 2.4.7 Object 1400h-1402 / 1406h / 1410h / 1411h Receive PDO Com. Parameter

It contains the communication parameters of the PDOs the device is able to receive.

See /2/ for a detailed description.

#### 2.4.7.1 Object Description

Index	1400h-1402h / 1406h / 1410h / 1411h
Name	Receive PDO Communication Parameters
Object Code	Record
Number of Elements	3
Data Type	PDO_COMM_PAR
Category	Optional

#### 2.4.7.2 Entry Description

Sub-Index	001
Description	COB-ID If bit 31 is set the PDO is disabled.
Data Type	UNSIGNED32
Access	RW – ALW
PDO Mapping	No
Default Value	0x80000000
Lower Limit	0x1
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Transmission Type
Data Type	UNSIGNED8
Access	RW – ALW
PDO Mapping	No
Default Value	0xFE 1-240 Synchronous 254 Asynchronous 1410h: 1
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	003
Description	Inhibit Time
Data Type	UNSIGNED16
Access	RW – ALW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	100 us

## 2.4.8 Object 1800h-1802h / 1806 / 1810h / 1811h Transmit PDO Com. Parameter

It contains the communication parameters of the PDOs the device is able to transmit.  
See /2/ and /3/ for a detailed description.

### 2.4.8.1 Object Description

Index	1800h-1802h / 1806h / 1810h / 1811h
Name	TPDO Communication Para.
Object Code	Record
Number of Elements	6
Data Type	PDO_COMM_PAR
PDO Mapping	No
Category	Optional

### 2.4.8.2 Entry Description

Sub-Index	001
Description	COB-ID
Data Type	UNSIGNED32
Access	RW – ALW
Default Value	0x80000000
Lower Limit	0x1
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Transmission Type
Data Type	UNSIGNED8
Access	RW – ALW
Default Value	0xFE
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	003
Description	Inhibit Time
Data Type	UNSIGNED16
Access	RW – ALW
Default Value	0x0 / 1806h: 5 / 1810h: 5000 / 1811h: 5000
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	100 us

Sub-Index	005
Description	Event Timer
Data Type	UNSIGNED16
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	ms

## 2.5 EtherCAT Communication profile objects

Used only in devices with EtherCAT

### 2.5.1 EtherCAT- Interface

This device is an EtherCAT slave according EtherCAT Slave Device Description

### 2.5.2 EtherCAT-specific communication

This communication is in the EtherCAT specification. The supported features can be found in the Device Description Data (. XML).

### 2.5.3 Device-specific communication

To configure the device-specific functions and for the transfer of user data, the "CANopen over EtherCAT (CoE) is used.

### 2.5.4 Object 1C00h Sync Manager Communication Type

Subindex (1-4) defines communication type of the corresponding Sync Manager channel

0=unused

1=mailbox out (MS)

2=mailbox in (SM)

3=process data out (RxPDO)

4=process data in (TxPDO)

#### 2.5.4.1 Object Description

Index	1C00h
Name	Sync Manager Communication Type
Object Code	Array
Number of Elements	4
Data Type	UNSIGNED32
PDO Mapping	No
Category	Optional

#### 2.5.4.2 Entry Description

Sub-Index	001
Description	Communication Type 1
Access	RO
Default Value	1

Sub-Index	002
Description	Communication Type 2
Access	RO
Default Value	2

Sub-Index	002
Description	Communication Type 2
Access	RO
Default Value	3

Sub-Index	003
Description	Communication Type 4
Access	RO
Default Value	4

### 2.5.5 Object 1C12h Sync Manager RX PDO Assignment

Assigned RX PDO in Subindex 1 to n describe the process data parts of the Sync Manager channel

#### 2.5.5.1 Object Description

Index	1C12h
Name	Sync Manager RX PDO Assignment
Object Code	Array
Number of Elements	9
Data Type	UNSIGNED16
PDO Mapping	No
Category	Optional

#### 2.5.5.2 Entry Description

Sub-Index	001-009
Description	PDO1-PDO9
Access	RW – ALW
Default Value	0x1600-0x1606 / 0x1610 / 0x1611

### 2.5.6 Object 1C13h Sync Manager TX PDO Assignment

Assigned TX PDO in Subindex 1 to n describe the process data parts of the Sync Manager channel

#### 2.5.6.1 Object Description

Index	1C13h
Name	Sync Manager TX PDO Assignment
Object Code	Array
Number of Elements	9
Data Type	UNSIGNED16
PDO Mapping	No
Category	Optional

#### 2.5.6.2 Entry Description

Sub-Index	001-009
Description	PDO1-PDO9
Access	RW – ALW
Default Value	0x+A00-0x1A06 / 0x1A10 / 0x1A11



## 2.5.7 1C32h Sync Manager Output Parameter

Sync Manager Parameter

### 2.5.7.1 Object Description

Index	1C32h
Name	Sync Manager Output Parameter
Object Code	Array
Number of Elements	9
Data Type	RECORD
PDO Mapping	No
Category	Optional

### 2.5.7.2 Entry Description

Sub-Index	001
Description	Sync Mode 0: Not synchronized 1: Synchron –synchronized with AL Event on this Sync Ma. 2: DC Sync0 –synchronized with AL Event Sync0 3: DC Sync1 –synchronized with AL Event Sync1 0x20+n: SyncSM(n) synchronized with all Event of SM(n)
Data Type	UNSIGNED16
Access	RW – ALW
Default Value	0x1 (SYNCTYPE_SYNCHRON)
Lower Limit	0x0
Upper Limit	0xFFFF

Sub-Index	002
Description	Cycle Time Time between two events in ns
Data Type	UNSIGNED32
Access	RO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	003
Description	Shift Time Only important for DC Mode: Contains the Time Shift between the SYNC0 (SYNC1) Signal and when the Outputs are put to the Hardware to allow the Master a very exact Calculation of Delay Times
Data Type	UNSIGNED32
Access	RO
Default Value	0x0

Sub-Index	004
Description	Sync Mode Supported contains the supported Synchronization Types
Data Type	UNSIGNED32
Access	RO
Default Value	0x4003

Sub-Index	005
Description	Minimum cycle time Contains the minimum Cycle Time the Slave is able to support It will be calculated dynamically, because it depends on the connected Modules
Data Type	UNSIGNED32
Access	RO
Default Value	0x0

Sub-Index	006
Description	Calc and copy time Only for DC Mode important: Contains the minimum Delay Time the Slave needs after receiving the SM2-Event before the SYNC0 (SYNC1) can be received without Delays. It will be calculated dynamically because it depends on the connected Modules
Data Type	UNSIGNED32
Access	RO
Default Value	0x0

Sub-Index	007-032
Description	Reserve

### 2.5.8 1C33h Sync Manager Input Parameter

Same as 1C32h Sync Manager Output Parameter see above

## 3 Drive Profile Objects

### 3.1 Common

#### 3.1.1 Object 6402h Motor Type

The type of motor connected with the controller

##### 3.1.1.1 Object Description

Index	6402h
Name	Motor Type
Object Code	Variable
Data Type	UNSIGNED16
Category	Optional
Access	RW - ALW (SNVM)
PDO Mapping	No
Default Value	0x3
Lower Limit	0x3 0x3 PM synchronous motor 0x3 0x7 Squirrel cage induction motor / AC asynchronous induction squirrel cage
Upper Limit	0x7

#### 3.1.2 Object 6502h Supported Drive Modes

This object documents all operational modes which are supported by the drive.

Bit 31-16 = manufacturer specific / Bit 15-09 & 04 = reserved

Bit 8 = csv

Bit 7 = csp

Bit 6 = ip

Bit 5 = hm

Bit 3 = tq

Bit 2 = pv

Bit 1 = vl

Bit 0 = pp

##### 3.1.2.1 Object Description

Index	6502h
Name	Supported Drive Modes
Object Code	Variable
Data Type	UNSIGNED32
Category	Optional
Access	RO
PDO Mapping	No
Default Value	0x10080
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

### 3.1.3 Object 2001h Error Code Memory

Store the last 4 errors in memory. See also chapter 2.3.4.3 (Error Codes)

#### 3.1.3.1 Object Description

Index	2001h
Name	Error Code Memory
Object Code	Array
Number of Elements	4
Data Type	UNSIGNED16
Category	Manufacturer specific

#### 3.1.3.2 Entry Description

Sub-Index	001-04
Description	Error Code
Access	RO – ALW
PDO Mapping	No
Default Value	0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	

### 3.1.4 Object 2002h Motor Cable Settings

Change Encoder / Hall or Motor Phase polarity

#### 3.1.4.1 Object Description

Index	2002h
Name	Motor Cable Settings
Object Code	Array
Number of Elements	3
Data Type	INTEGER16
PDO Mapping	No
Category	Manufacturer specific

#### 3.1.4.2 Entry Description

Sub-Index	001
Description	Encoder Direction 0 Normal 1 Reverse
Access	RW – ALW (SNVM)
Default Value	0
Lower Limit	0x0
Upper Limit	0x1

#### 3.1.4.3 Entry Description

Sub-Index	002
Description	Hall Direction 0 Normal 1 Reverse
Access	RW – ALW (SNVM)
Default Value	0
Lower Limit	0x0
Upper Limit	0x1

### 3.1.4.4 Entry Description

Sub-Index	001
Description	Motor Phase Direction 0 Normal 1 Reverse
Access	RW – ALW (SNVM)
Default Value	0
Lower Limit	0x0
Upper Limit	0x1

### 3.1.5 Object 2003h Select Release Input

Selected Input must be active to enable the motor

#### 3.1.5.1 Object Description

Index	2003h
Name	Select Release Input
Object Code	Variable
Data Type	INTEGER16
Category	Optional
Access	RW - ALW (SNVM)
PDO Mapping	No
Default Value	0x0 = OFF / 1= Input1 / 2= Input2
Lower Limit	0x0
Upper Limit	0x2

### 3.1.6 2005h Signal Time Curve

Set an Output (0-3) in Motion Curve after a specified time before end

#### 3.1.6.1 Object Description

Index	2005h
Name	Signal Time Curve
Object Code	Array
Number of Elements	4
Data Type	UNSIGNED16
Category	Manufacturer specific

#### 3.1.6.2 Entry Description

Sub-Index	001
Description	Signal Time Before End / Time before End Motion to set the selected Output
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	us

### 3.1.6.3 Entry Description

Sub-Index	002
Description	Signal Length, Length of the Signal
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	us

### 3.1.6.4 Entry Description

Sub-Index	003
Description	Signal State On or Off
Access	RO – ALW
PDO Mapping	Yes
Default Value	0
Lower Limit	0x0
Upper Limit	0x1

### 3.1.6.5 Entry Description

Sub-Index	004
Description	Output mapping / Output 1-4
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0 / Off
Lower Limit	0x0
Upper Limit	0x4

### 3.1.7 Object 2010h Chopper Settings

Settings for internal chopper resistance

#### 3.1.7.1 Object Description

Index	2010h
Name	Chopper Settings
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED16
Category	Manufacturer specific

#### 3.1.7.2 Entry Description

Sub-Index	001
Description	Enable / Disable
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0
Lower Limit	0x0
Upper Limit	0x1
Unit	ON / OFF

Sub-Index	002
Description	Chopper On Voltage DC Link Voltage (when Link Voltage is over that value Chopper resistance is switched on )
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	3300 (330VDC)
Lower Limit	2000 (200VDC)
Upper Limit	4000
Unit	100mV

### 3.1.8 Object 2015h-2019h Cam Controller

Settings for internal cam controller

If actual position > On Position (Sub-index1) and < Off Position (Sub-index2) Status=1 otherwise Status=0

Sub-index4: Select Output 1-4 if Status==1 Output=On

#### 3.1.8.1 Object Description

Index	2015h-2019h
Name	Cam Controllers
Object Code	Array
Number of Elements	3
Data Type	UNSIGNED32
Category	Manufacturer specific

#### 3.1.8.2 Entry Description

Sub-Index	001
Description	On Position
Access	RW – ALW (SNVM only 2015h& 2016h)
PDO Mapping	No
Default Value	0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	user

Sub-Index	002
Description	Off Position
Access	RW – ALW (SNVM only 2015h& 2016h)
PDO Mapping	No
Default Value	0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	user

Sub-Index	003
Description	Status
Access	RO
PDO Mapping	YES
Default Value	0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	004
Description	Output mapping
Access	RW – ALW
PDO Mapping	No
Default Value	0
Lower Limit	0x0
Upper Limit	0x1



### 3.1.9 Object 2020h Resolver Settings

#### 3.1.9.1 Object Description

Index	2020h
Name	Resolver Settings
Object Code	Record
Number of Elements	5
Data Type	RESOLVER
Category	Manufacturer specific

#### 3.1.9.2 Entry Description

Sub-Index	001
Description	Reserve

Sub-Index	002
Description	Resolver pos
Data Type	UNSIGNED16
Access	RO
PDO Mapping	No
Default Value	0

Sub-Index	003
Description	Resolver dir. (Resolver actual direction)
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Default Value	0

Sub-Index	004
Description	Resolver error on off (Switch off Errors from Resolver)
Data Type	UNSIGNED8
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	005
Description	Resolver frequency Resolver Frequency 0=10kHz / 1=12kHz / 2=15kHz / 3=20kHz
Data Type	UNSIGNED8
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0
Lower Limit	0x0
Upper Limit	0x3

### 3.1.10 Object 2021h Drive State

Drive Status information for debug purpose

Bit1: Task Stop move

Bit2: Motor Position in Window

Bit3: Motor Position Overload

Bit4: Max Current reached

Bit5: Nom Current reached

Bit6: Resolver Error

Bit7: Ip mode speed max reached

#### 3.1.10.1 Object Description

Index	2021h
Name	Drive State
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0

### 3.1.11 Object 2022h Space Vector

Enable/Disable Space Vector Modulation

#### 3.1.11.1 Object Description

Index	2022h
Name	Space Vector
Object Code	Variable
Data Type	UNSIGNED8
Category	Optional
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x1 (Enable)
Lower Limit	0x0
Upper Limit	0x1

### 3.1.12 Object 2030h ADC Channels

ADC Channel Monitor for debug purpose

#### 3.1.12.1 Object Description

Index	2030h
Name	ADC Channels
Object Code	Array
Number of Elements	16
Data Type	INTEGER16
Category	Manufacturer specific

#### 3.1.12.2 Entry Description

Sub-Index	001-016
Description	ADC0-ADC15
Access	RO
PDO Mapping	No
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.1.13 Object 2031h Temperature Monitor

Display temperatures

#### 3.1.13.1 Object Description

Index	2031h
Name	Temperature Monitor
Object Code	Array
Number of Elements	2
Data Type	INTEGER16
Category	Manufacturer specific

#### 3.1.13.2 Entry Description

Sub-Index	001
Description	Drive Temperature
Access	RO
PDO Mapping	YES
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF
Unit	°C

Sub-Index	002
Description	Motor Temperature (if supported on Motor)
Access	RO
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF
Unit	specific

### 3.1.14 Object 2032h Voltage Monitor

Shows the voltage of internal power supply for debug purpose

#### 3.1.14.1 Object Description

Index	2032h
Name	Voltage Monitor
Object Code	Array
Number of Elements	8
Data Type	INTEGER16
Category	Manufacturer specific

#### 3.1.14.2 Entry Description

Sub-Index	001
Description	Max Link Voltage
Access	RO
PDO Mapping	No
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF
Unit	1/10V

Sub-Index	002
Description	Min Link Voltage
Unit	1/10V

Sub-Index	003
Description	Link Voltage
Unit	1/10V

Sub-Index	004
Description	24V Supply Voltage
Unit	10mV

Sub-Index	005-008
005 Description	5V Supply Voltage
006 Description	3.3V Supply Voltage
007 Description	1.9V Supply Voltage
008 Description	1V Supply Voltage
Unit	mV

### 3.1.15 Object 2033h Debug Monitor

Only for debug purpose

#### 3.1.15.1 Object Description

Index	2033h
Name	Debug Monitor
Object Code	Array
Number of Elements	8
Data Type	INTEGER16
Category	Manufacturer specific

#### 3.1.15.2 Entry Description

Sub-Index	001-008
Description	Debug0-Debug7
Access	RO
PDO Mapping	Yes
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.1.16 Object 2035h Profile Curve

Only for debug purpose

#### 3.1.16.1 Object Description

Index	2035h
Name	Profile Curve
Object Code	Array
Data Type	DOMAIN
Number of Elements	4
Category	Manufacturer specific

#### 3.1.16.2 Entry Description

Sub-Index	001-004
Description	Profile Curve 0-3
Entry Category	Optional
Data Type	DOMAIN
Access	RW
PDO Mapping	No
Default Value	0x0

### 3.1.17 Object 2036h ANIN1

Analog Input1 (see also Object 2086h Analog In Settings)

#### 3.1.17.1 Object Description

Index	2036h
Name	ANIN1
Object Code	Variable
Data Type	INTEGER32
Category	Manufacturer specific
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	User

### 3.1.18 Object 2037h ANIN1 Filter

Average Filter Settings for ANIN1. Drive must be reboot after change.

#### 3.1.18.1 Object Description

Index	2037h
Name	ANIN1 Filter
Object Code	Variable
Data Type	UNSIGNED8
Category	Manufacturer specific
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x5
Lower Limit	0x2
Upper Limit	0x64
Unit	100us

### 3.1.19 Object 2038h ANIN2

Analog Input2

#### 3.1.19.1 Object Description

Index	2038h
Name	ANIN2
Object Code	Variable
Data Type	INTEGER32
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	User

### 3.1.20 Object 2039h ANIN2 Setup

Setup of Analog input 2

Bit 0-7

Value=0 Normal Analog Input No filtering

Value=1 Serial Mode (Make digital inputs)

Value=2 Parallel Mode (Make 3 digital inputs)

Value=3 Temperature measurement via 10k NTC

Value=4 Serial Mode inverted (Make digital inputs)

Bit 8-11

Number of digital inputs (only serial mode)

Bit 12-15 Special Mode

Bit12 = 1 / 2 Inputs Make Bits =11 from 100 (only serial mode)

#### 3.1.20.1 Object Description

Index	2039h
Name	ANIN2 Setup
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0100
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.1.21 Object 203Ah ANIN2 Mask

Make 3 Digital Inputs with one Analog

Bit 0-7                Enter Max Value (no Input pressed)

Bit 8-15 1.        Digital Input

Bit 16-23        2. Digital Input

Bit 24-32        3. Digital Input

#### 3.1.21.1 Object Description

Index	203Ah
Name	Anin2 Mask
Object Code	Variable
Data Type	INTEGER32
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

### 3.1.22 Object 203Bh ANIN3

Analog Input3

#### 3.1.22.1 Object Description

Index	203Bh
Name	ANIN3
Object Code	Variable
Data Type	INTEGER32
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	User



### 3.1.23 Object 203Ch ANIN3 Setup

Bit 0-7

Value=0 Normal Analog Input //No filtering

Value=1 Serial Mode (Make digital inputs)

Value=2 unused

Value=3 Temperature measurement via 10k NTC

Value=4 Serial Mode inverted (Make digital inputs)

Bit 8-15

Number of digital

#### 3.1.23.1 Object Description

Index	203Ch
Name	ANIN3 Setup
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0100
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.1.24 Object 2040h Motor Temperature Options

Settings for Motor Temperature Sensor

#### 3.1.24.1 Object Description

Index	2040h
Name	Motor Temperature Options
Object Code	Array
Data Type	UNSIGNED16
Number of Elements	5
Category	Manufacturer specific
PDO Mapping	No

#### 3.1.24.2 Entry Description

Sub-Index	001
Description	Motor Over temperature Monitoring Switch ON/OFF motor temperature monitoring
Access	RW – ALW (SNVM)
Default Value	0 (OFF) 1=ON
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	002
Description	Switch On threshold Motor Over temperature
Access	RW – ALW (SNVM)
Default Value	0xBB8
Lower Limit	0x0
Upper Limit	0x1000
Unit	12Bit (ADC)

Sub-Index	003
Description	Switch Off threshold Motor Over temperature
Access	RW – ALW (SNVM)
Default Value	0x7D0
Lower Limit	0x0
Upper Limit	0x1000
Unit	12Bit (ADC)

Sub-Index	004
Description	Scale
Access	RW – ALW (SNVM)
Default Value	0x1
Lower Limit	0x1
Upper Limit	0xFFFF
Unit	user

Sub-Index	005
Description	Offset
Access	RW – ALW (SNVM)
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	user

### 3.1.25 2043h Velocity Demand

This object is the actual velocity provided by the profile generator scaled to internal unit.

#### 3.1.25.1 Object Description

Index	2043h
Name	Velocity Demand
Object Code	Variable
Data Type	INTEGER32
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	
Lower Limit	0x80000000
Upper Limit	0xFFFFFFFF
Unit	internal

### 3.1.26 Object 2045h Actual Motor speed

This object is the actual motor speed in rpm.

#### 3.1.26.1 Object Description

Index	2045h
Name	Actual Motor speed
Object Code	Variable
Data Type	INTEGER32
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	
Lower Limit	0x80000000
Upper Limit	0xFFFFFFFF
Unit	Rpm

### 3.1.27 Object 2053h EtherCAT Cycle

Parameters for real-time measurement of EtherCAT system

#### 3.1.27.1 Object Description

Index	2053h
Name	EtherCAT Cycle
Object Code	Array
Data Type	UNSIGNED16
PDO Mapping	No
Number of Elements	3
Category	Manufacturer specific

#### 3.1.27.2 Entry Description

Sub-Index	001
Description	Enable Check
Access	RW – ALW
Default Value	0 (OFF) 1=ON Cycle Check is running
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	002
Description	Actual Latency
Access	RO – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF
Unit	us

Sub-Index	003
Description	Maximum Latency (over the measurement time) Reset value by writing
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF
Unit	us

Sub-Index	004
Description	Minimum Latency (over the measurement time) Reset value by writing
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF
Unit	us

Sub-Index	005
Description	1st Cycle (actual cycle time)
Access	RO – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF
Unit	us

Sub-Index	006
Description	Master Cycle (Referenc Cycle)
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF
Unit	us

### 3.1.28 Object 2060h Motor Max Current Time

Time the Motor Current can be on Max Current (6073h) after the current fall down to Motor Rated Current (6075h)

#### 3.1.28.1 Object Description

Index	2060h
Name	Motor Max Current Time
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific

#### 3.1.28.2 Entry Description

Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0xA
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	s

### 3.1.29 Object 2061h ISR Flux Torq

Flux Torq Regulator. All Values in IQ16 Format

Example: Data=2.5000 / DataSend= 2.5\*0xFFFF=163837

#### 3.1.29.1 Object Description

Index	2061h
Name	ISR Flux Torq
Object Code	Array
Number of Elements	0xE
Data Type	UNSIGNED32 (iq16)
Category	Manufacturer specific

#### 3.1.29.2 Entry Description

Sub-Index	001
Description	mot_res
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x00020000
Lower Limit	0x00000000
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Offs_Ang
Default Value	0x3FFE

Sub-Index	003
Description	Flux_Kp
Default Value	0x0

Sub-Index	004
Description	Flux_Ki
Default Value	0x0

<b>Sub-Index</b>	<b>005</b>
Description	Flux_Kc
Default Value	0x0

<b>Sub-Index</b>	<b>006</b>
Description	Flux_Kd
Default Value	0x0

<b>Sub-Index</b>	<b>007</b>
Description	Flux_phase
Default Value	0x0

<b>Sub-Index</b>	<b>008</b>
Description	Torq_Kp
Default Value	0x0

<b>Sub-Index</b>	<b>09</b>
Description	Torq_Ki
Default Value	0x0

<b>Sub-Index</b>	<b>010</b>
Description	Torq_Kc
Default Value	0x0

<b>Sub-Index</b>	<b>011</b>
Description	Torq_Kd
Default Value	0x0

<b>Sub-Index</b>	<b>012</b>
Description	Torq_Emk_val
Default Value	0x25800000

<b>Sub-Index</b>	<b>013</b>
Description	Torq_R_val
Default Value	0x007E0000

<b>Sub-Index</b>	<b>014</b>
Description	Torq_Uz_val
Default Value	0x008C0000

### 3.1.30 Object 2062h Vel PID Regulator

Velocity PID Regulator. All Values in IQ16 Format

Example: Data=2.5000 / DataSend= 2.5\*0xFFFF=163837

#### 3.1.30.1 Object Description

Index	2062h
Name	Vel PID Regulator
Object Code	Array
Number of Elements	0x5
Data Type	UNSIGNED32 (iq16)
Category	Manufacturer specific

#### 3.1.30.2 Entry Description

Sub-Index	001
Description	Vel_Acc
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	

Sub-Index	002
Description	Vel_Kp
Default Value	0x0

Sub-Index	003
Description	Vel_Ki
Default Value	0x0

Sub-Index	004
Description	Vel_Kc
Default Value	0x0

Sub-Index	005
Description	Vel_Kd
Default Value	0x0

### 3.1.31 Object 2063h Test Mode

Only for debug purpose

Sub-index1

Bit1: Set Flux to Test\_Value

Bit2: Set Torq to Test\_Value

Bit3: Set Torq soll to Test\_Value

Bit4: Set Motor Angle to Test\_Value Motor Angle => Test Result

Bit5: Start Test on after 16 Samples

Bit6: Test on

Bit7: Start Trace

Bit8: TraceA Stom Regler Werte

Bit9: TraceB Velocity Regler Werte

Bit10: Trace\_C Reserve

Bit11: Trace\_D Reserve

Bit12: Resolver Angle => Test Result

Bit13: Set Torque Profile Mode

Bit14: Set Freerun

#### 3.1.31.1 Object Description

Index	2063h
Name	Test Mode
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED16
Category	Manufacturer specific

#### 3.1.31.2 Entry Description

Sub-Index	001
Description	All
Access	RW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

Sub-Index	002
Description	Length
Access	RW
PDO Mapping	No
Default Value	0x600
Lower Limit	0x0
Upper Limit	0xFFFF



### 3.1.32 Object 2064h Test Mode iq Test Value

Only for debug purpose.

#### 3.1.32.1 Object Description

Index	2064h
Name	Test Mode iq Test Value
Object Code	Variable
Data Type	UNSIGNED32
Category	Manufacturer specific
Access	RW
PDO Mapping	NO
Default Value	0x3FFF
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

### 3.1.33 Object 2065h Test Res Angle

Only for debug purpose.

#### 3.1.33.1 Object Description

Index	2065h
Name	Test Res Angle
Object Code	Variable
Data Type	INTEGER16
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.1.34 Object 2066h Test Mot Angle

Only for debug purpose.

#### 3.1.34.1 Object Description

Index	2066h
Name	Test Mot Angle
Object Code	Variable
Data Type	UNSIGNED32
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

### 3.1.35 Object 2067h Auto Run

Bit 0=1 the Drive will automatically switch in operation enable state and run. Active in pp and pv mode  
Bit 0: Enable / Disable / Bit 1: Change Direction/ Bit 2-12: Cycle Time in 10ms steps

#### 3.1.35.1 Object Description

Index	2067h
Name	Auto Run
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.1.36 Object 2068h Following Error Ist

Only for debug purpose.

#### 3.1.36.1 Object Description

Index	2068h
Name	Following Error Ist
Object Code	Variable
Data Type	INTEGER32
Category	Manufacturer specific
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

### 3.1.37 Object 2077h Int Task Status

Only for debug purpose.

#### 3.1.37.1 Object Description

Index	2077h
Name	Int Task Status
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.1.38 Object 2087h Limit Switch Soft

Simulation of Negative and positive limit switch

#### 3.1.38.1 Object Description

Index	2087h
Name	Set Negative limit switch
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED8
Category	Manufacturer specific

#### 3.1.38.2 Entry Description

Sub-Index	001
Description	Set Positive limit switch
Access	RW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	002
Access	RW
Description	Positive limit switch

### 3.1.39 Object 2126h Profile Curve Size

Size of Profile Curve. Only for debug purpose.

#### 3.1.39.1 Object Description

Index	2126h
Name	Profile Curve Size
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific
Access	RW – ALW
PDO Mapping	NO
Default Value	0x200
Lower Limit	0x0
Upper Limit	0x4E20

### 3.1.40 Object 2127h Profile D objects

Map user specific objects to Profile D. Only for debug purpose.

#### 3.1.40.1 Object Description

Index	2127h
Name	Profile D objects
Object Code	Array
Number of Elements	4
Data Type	UNSIGNED32
Category	Manufacturer specific

#### 3.1.40.2 Entry Description

Sub-Index	001-4
Description	Trace A-D First 16Bit Index Second 16Bit SubIndex Example: 60C1.1 Value = 0x60C10001
Access	RW – ALW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

### 3.1.41 Object 2201h Node ID

The node ID which will become valid for that device after a restart (it's not the actual value).

#### 3.1.41.1 Object Description

Index	2201h
Name	Node ID
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	1
Lower Limit	0x0
Upper Limit	0x7F

### 3.1.42 Object 2360h Modes

Interface Mode

#### 3.1.42.1 Object Description

Index	2086h
Name	Modes
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED8
Category	Manufacturer specific

#### 3.1.42.2 Entry Description

Sub-Index	002
Description	Interface Mode 0=messages over can PDO, emergency 1=messages over sci PDO, emergency Auto setback to 0 if any can message receive
Access	RW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

### 3.1.43 Object 2400h EEPROM Raw Access

Direct access to eeprom (Password protected)

#### 3.1.43.1 Object Description

Index	2400h
Name	EEPROM Raw Access
Object Code	Array
Number of Elements	5
Data Type	UNSIGNED16
Category	Manufacturer specific

#### 3.1.43.2 Entry Description

Sub-Index	001
Description	EE Data
Access	RW
PDO Mapping	No
Default Value	0xFFFF
Lower Limit	0x0
Upper Limit	0xFFFF

Sub-Index	002
Description	EE Address
Access	RW
Default Value	0xFF
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	003
Description	OD Index
Access	RW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

Sub-Index	004
Description	OD Subindex
Access	RW
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	005
Description	OD DataOffset
Access	RW
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.1.44 Object 2401h Password

Direct access to eeprom (Password protected)

#### 3.1.44.1 Object Description

Index	2401h
Name	Password
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED32
Category	Manufacturer specific

#### 3.1.44.2 Entry Description

Sub-Index	001
Description	Password
Access	RW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Password Status
Entry Category	Optional
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

### 3.1.45 Object 3000h Total Operation Time

Total operation time

#### 3.1.45.1 Object Description

Index	3000h
Name	Total Operation Time
Object Code	Variable
Data Type	UNSIGNED32
Category	Manufacturer specific
Access	RO (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	s

### 3.1.46 Object 3001h Input Voltage Offset

Offset for Analog Inputs

#### 3.1.46.1 Object Description

Index	3001h
Name	Input Voltage Offset
Object Code	Array
Number of Elements	5
Data Type	INTEGER16
PDO Mapping	No (all)
Access	RO (SNVM) , (all)
Category	Manufacturer specific
Unit	user

#### 3.1.46.2 Entry Description

Sub-Index	001
Description	Link Voltage Offset
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	002
Description	ANIN0 Voltage Offset
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	003
Description	Ext Force Sensor Offset
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	004
Description	ANIN1 Voltage Offset
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	005
Description	ANIN2 Voltage Offset
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF



### 3.1.47 Object '3002h FAN Type

0 = 12V Ventilator (50% PWM default)

1 = 24V Ventilator (100% PWM)

2 = 5V Ventilator (23% PWM)

#### 3.1.47.1 Object Description

Index	3002h
Name	FAN Type
Object Code	Variable
Data Type	UNSIGNED8
Category	Manufacturer specific
Access	RO (SNVM)
PDO Mapping	NO
Default Value	0x1
Lower Limit	0x0
Upper Limit	0x2

### 3.1.48 Object '3007h Feedback System

0 = Resolver

1 = Incremental with Hall

2 = HIPERFACE®

#### 3.1.48.1 Object Description

Index	3007h
Name	Feedback System
Object Code	Variable
Data Type	INTEGER16
Category	Manufacturer specific
Access	RO (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x2

### 3.1.49 Object '3008h Digital Input Mask

Available Digital Inputs

#### 3.1.49.1 Object Description

Index	3008h
Name	Digital Input Mask
Object Code	Variable
Data Type	UNSIGNED16
Category	Manufacturer specific
Access	RO (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.1.50 Object '3018h Software Version

Installed Software

#### 3.1.50.1 Object Description

Index	3018h
Name	Software Version
Object Code	Variable
Data Type	INTEGER16
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.1.51 Object '3019h Hardware Revision

Combination between product code and revision number

Product Code = 0xFA3

Revision Number = 1

Hardware Revision = 0x1FA3

#### 3.1.51.1 Object Description

Index	3019h
Name	Hardware Revision
Object Code	Variable
Data Type	INTEGER16
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.1.52 Object '3020h Firmware CRC

CRC32 generated during the Firmware Update. Used to identify an exact Firmware Version.

#### 3.1.52.1 Object Description

Index	3020h
Name	Firmware CRC
Object Code	Variable
Data Type	UNSIGNED32
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

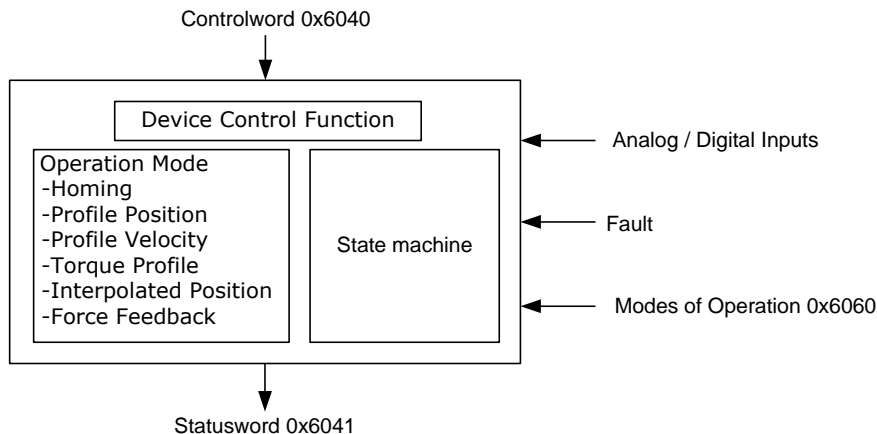
## 3.2 Device Control

### 3.2.1 Device Control Function Block

The Profile for Drives and Motion Control describes control of the amplifier in terms of a control function block with two major sub-elements: the operation modes and the state machine.

### 3.2.2 Control and Status Words

As illustrated below, the Control Word object (index 0x6040) manages device mode and state changes. The Status Word object (index 0x6041) identifies the current state of the amplifier.



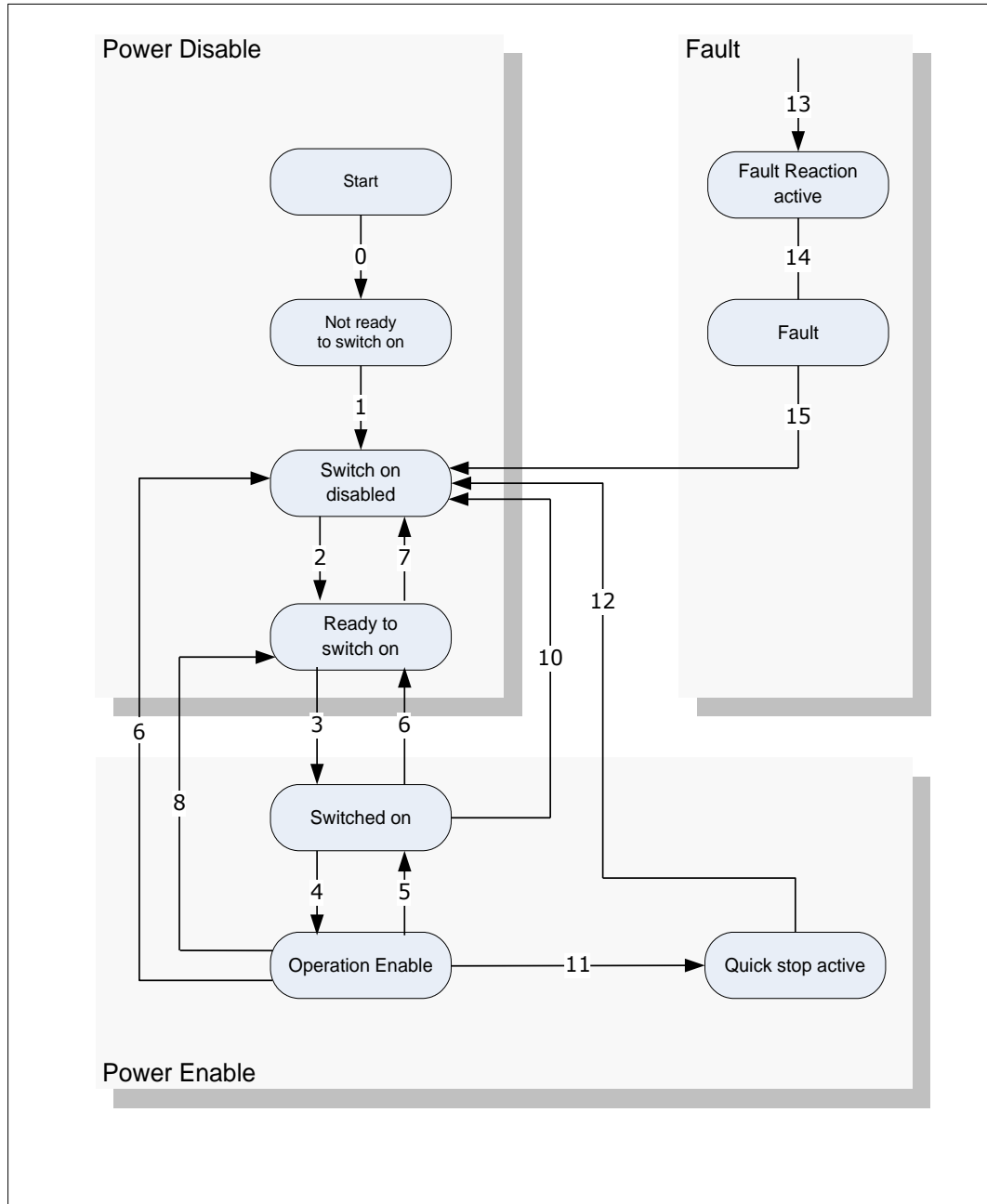
Other factors affecting control functions include: Analog / Digital input signals, fault conditions, and settings in various dictionary objects.

### 3.2.3 Operation Modes

As mentioned elsewhere in this manual BEH CANopen drives support homing, profile position, profile velocity, profile torque, interpolated position, and force feedback modes.

### 3.2.4 State Machine

The following diagram from the Profile for Drives and Motion Control shows the possible state change sequences of a drive. Each transition is numbered and described in the legend below.



### 3.2.4.1 State Machine Legend

	From State	To State	Event/Action
0	Startup	Not Ready to Switch On	Event: Reset. Action: The drive self-tests and/or self-initializes.
1	Not Ready to Switch On	Switch On Disabled	Event: The drive has initialized successfully. Action: Activate communication
2	Switch On Disabled	Ready to Switch On	Event: 'Shutdown' command received from host. Action: None
3	Ready to Switch On	Switched On	Event: 'Switch On' command received from host. Action: The power section is switched on
4	Switched On	Operation Enable	Event: 'Enable Operation' command received Action: The drive function is enabled.
5	Operation Enable	Switched On	Event: 'Disable Operation' command received Action: The drive operation is disabled.
6	Switched On	Ready to Switch On	Event: 'Shutdown' command received from host. Action: The power section is switched off.
7	Ready to Switch On	Switch On Disabled	Event: 'Quick stop' command received from host. Action: None
8	Operation Enable	Ready to Switch On	Event: 'Shutdown' command received from host. Action: The power section is switched off immediately, and the motor is free to rotate if unbraked
9	Operation Enable	Switch On Disabled	Event: 'Disable Voltage' command received from host. Action: The power section is switched off immediately, and the motor is free to rotate if unbraked
10	Switched On	Switch On Disabled	Event: 'Disable Voltage' or 'Quick Stop' command received from host. Action: The power section is switched off immediately, and the motor is free to rotate if unbraked
11	Operation Enable	Quick Stop Active	Event: 'Quick Stop' command received from host. Action: The Quick Stop function is executed.
12	Quick Stop Active	Switch On Disabled	Event: 'Quick Stop' is completed or 'Disable Voltage' command received from host. Action: The power section is switched off.
13	FAULT	Fault Reaction Active	A fatal fault has occurred in the drive. Action: Execute appropriate fault reaction.
14	Fault Reaction Active	FAULT	Event: The fault reaction is completed. Action: The drive function is disabled. The power section may be switched off.
15	FAULT	Switch On Disabled	Event: 'Fault Reset' command received from host. Action: A reset of the fault condition is carried out if no fault exists currently on the drive. After leaving the 'Fault' state the Bit 'Fault Reset' of the Control Word has to be cleared by the host.

See also 3.2.7 Object 6040h Controlword & 3.2.8 Object 6041h Statusword

### 3.2.5 Object 6007h Abort Connection Option Code

This object selects the function to be performed when the connection to the network is lost.

0 = No action

1 = Malfunction

2 = Device control command 'Disable Voltage'

3 = Device control command 'Quick Stop'

-x = Manufacturer specific

#### 3.2.5.1 Object Description

Index	6007h
Name	Abort Connection Option Code
Object Code	Variable
Data Type	INTEGER16
Category	Optional
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.2.6 Object 603Fh Error Code

This object captures the code of the last error that occurred in the drive.

#### 3.2.6.1 Object Description

Index	603Fh
Name	Error Code
Object Code	Variable
Data Type	UNSIGNED16
Category	Optional
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.2.7 Object 6040h Controlword

The drive will to control by this object. This object operates the state machine and the modes.

#### Value definition


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

MSB

LSB

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

#### 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
Fault reset		X	X	X	X	15
NOTE Automatic transition to Enable operation state after executing SWITCHED ON state functionality.						

#### 3.2.7.1 Object Description

Index	6040h
Name	Controlword
Object Code	Variable
Data Type	INTEGER16
Category	Optional
Access	RW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

See /2/ for a detailed description of Controlword

### 3.2.8 Object 6041h Statusword

This object indicates the current state of the drive.

Bit	Description																								
0	Ready to switch on																								
1	Switched on																								
2	Operation enabled																								
3	Fault. If set, a latched fault condition is present in the drive																								
4	Voltage enabled. Set if the drive bus voltage is above the minimum necessary. for normal operation.																								
5	Quick Stop. When clear, the amplifier is performing a quick stop.																								
6	Switch on disabled																								
7	Warning																								
8	Manufacturer specific																								
9	Remote (unused)																								
10	PP Mode Target reached / CSP & CSV Mode Status Toggle																								
11	Internal limit active																								
12-13	<table><tr><th>Bit</th><th>PP Mode</th><th>PV Mode</th><th>TQ Mode</th><th>HM Mode</th><th>IP Mode</th><th>FF Mode</th><th>CSP &amp; CSV Mode</th></tr><tr><td>12</td><td>Setpoint acknowledge.</td><td>Speed=0</td><td>Reserved</td><td>Homing attained</td><td>Ip Mode active</td><td>Init</td><td>Drives follows command</td></tr><tr><td>13</td><td>Following error.</td><td>Max slippage error</td><td>Reserved</td><td>Homing error</td><td>Reserved</td><td>Following error</td><td>Following error</td></tr></table>	Bit	PP Mode	PV Mode	TQ Mode	HM Mode	IP Mode	FF Mode	CSP & CSV Mode	12	Setpoint acknowledge.	Speed=0	Reserved	Homing attained	Ip Mode active	Init	Drives follows command	13	Following error.	Max slippage error	Reserved	Homing error	Reserved	Following error	Following error
	Bit	PP Mode	PV Mode	TQ Mode	HM Mode	IP Mode	FF Mode	CSP & CSV Mode																	
	12	Setpoint acknowledge.	Speed=0	Reserved	Homing attained	Ip Mode active	Init	Drives follows command																	
13	Following error.	Max slippage error	Reserved	Homing error	Reserved	Following error	Following error																		
14	Negative Limit active																								
15	Positive Limit active																								

#### 3.2.8.1 Object Description

Index	6041h
Name	Statusword
Object Code	Variable
Data Type	UNSIGNED16
Category	Optional
Access	RW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

See /2/ for a detailed description of Statusword



### 3.2.9 Object 605Ah Quick Stop Option Code

This object determines what action should be taken if the quick stop function is active.

Negative value = disable drive function / brake engine (short-circuit phases)

0 = disable drive function

1 = slow down on slow down ramp

2 = slow down on quick stop ramp.

#### 3.2.9.1 Object Description

Index	605Ah
Name	Quick Stop Option Code
Object Code	Variable
Data Type	INTEGER16
Category	Optional
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2
Lower Limit	0x8000
Upper Limit	0x2

### 3.2.10 Object 605Ch Disable Operation Option Code

This object determines what action should be taken if there is a transition

OPERATION ENABLE => SWITCHED ON.

0 = disable drive function

1 = slow down on slow down ramp

#### 3.2.10.1 Object Description

Index	605Ch
Name	Dis. Ope. Option Code
Object Code	Variable
Data Type	INTEGER16
Category	Optional
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x1
Lower Limit	0x0
Upper Limit	0x1

### 3.2.11 Object 605Dh Halt Option Code

This object determines what action should be taken if the halt bit in the Controlword is set.

Negative value = disable drive function / brake engine (short-circuit phases)

0 = disable drive function

1 = slow down on slow down ramp

2 = slow down on quick stop ramp.

#### 3.2.11.1 Object Description

Index	605Dh
Name	Halt Option Code
Object Code	Variable
Data Type	INTEGER16
Category	Optional
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x1
Lower Limit	0x0
Upper Limit	0x1

### 3.2.12 Object 605Eh Fault Reaction Option Code

This object determines what action should be taken if a fault occurs in the drive.

Negative value = disable drive function / brake engine (short-circuit phases)

0 = disable drive function

1 = slow down on slow down ramp

2 = slow down on quick stop ramp.

#### 3.2.12.1 Object Description

Index	605Eh
Name	Fault Reaction Op. Code
Object Code	Variable
Data Type	INTEGER16
Category	Optional
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2
Lower Limit	0x0
Upper Limit	0x2

### 3.2.13 Object 2150h Manufacturer Error Option Codes

This object determines what action should be taken if there is following event

Sub-index 1 Overload Option Code:

- 0: Do nothing Set Warning in Statusword (default)
- 1: Disable Operation and set Warning in Statusword
- 2: Fault reaction -> FAULT

Sub-index 2 Following error:

- 0: Do nothing Set Warning in Statusword (default)
- 1: Disable Operation and set Warning in Statusword
- 2: Fault reaction -> FAULT / Set Warning in Statusword

Sub-index 3 Over Temperature Motor:

- 0: Do nothing Set Warning in Statusword
- 1: Disable Operation and set Warning in Statusword
- 2: Fault reaction -> FAULT / Set Warning in Statusword (default)

Sub-index 4 Limit Switch:

- 0: Velocity=0 / Set Warning in Statusword (default)
- 1: Disable operation and set Warning in Statusword
- 2: Fault reaction -> FAULT / Set Warning in Statusword

Sub-index 5 Feedback error:

- 0: Do nothing / Set Warning in Statusword (default)
- 1: Disable operation and set Warning in Statusword
- 2: Fault reaction -> FAULT / Set Warning in Statusword

Sub-index 6 Software Limit Switch:

- 0: Limit Position / Set Warning in Statusword (default)
- 1: Limit Position / Disable operation and set Warning in Statusword
- 2: Limit Position / Fault reaction -> FAULT / Set Warning in Statusword

Sub-index 7 Overvoltage:

- 0: Velocity = 0 / Set Warning in Statusword
- 1: Disable operation and set Warning in Statusword
- 2: Fault reaction -> FAULT / Set Warning in Statusword (default)

#### 3.2.13.1 Object Description

Index	2150h
Name	Manufacturer Error Option Codes
Object Code	Array
Number of Elements	6
Data Type	UNSIGNED8
Category	Manufacturer specific

#### 3.2.13.2 Entry Description

Sub-Index	001-007
Description	Option Codes
Access	RW – ALW (SNVM)

### 3.2.14 Object 6060h Modes of Operation

The operational mode is selectable by this object.

- 1 = Force feedback Mode
- 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

#### 3.2.14.1 Object Description

Index	6060h
Name	Modes of Operation
Object Code	Variable
Data Type	INTEGER8
Category	Optional
Access	RW – ALW (SNVM)
PDO Mapping	YES
Default Value	0x3
Lower Limit	0xFF
Upper Limit	0x7

### 3.2.15 Object 6061h Modes of Operation Display

The actual operational mode is reflected by this object.

#### 3.2.15.1 Object Description

Index	6061h
Name	Modes of Operation Display
Object Code	Variable
Data Type	INTEGER8
Category	Optional
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80
Upper Limit	0x7F

### 3.3 Factor Group

#### 3.3.1 Object 608Fh Position Encoder Resolution

This object defines the ratio of feed in position units per driving shaft revolutions.  
 Position encoder resolution = encoder increments/ motor revolutions

##### 3.3.1.1 Object Description

Index	608Fh
Name	Position Encoder Resolution
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED32
Category	Optional

##### 3.3.1.2 Entry Description

Sub-Index	001
Description	Encoder Increments
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x1
Lower Limit	0x1
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Motor Revolutions
Access	RO

### 3.3.2 Object 6091h Gear Ratio

This object defines the ratio of feed in position units per driving shaft revolutions.

#### 3.3.2.1 Object Description

Index	6091h
Name	Gear Ratio
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED32
Category	Optional

#### 3.3.2.2 Entry Description

Sub-Index	001
Description	Motor Revolutions
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x1
Lower Limit	0x1
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Shaft Revolutions
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x1
Lower Limit	0x1
Upper Limit	0xFFFFFFFF

### 3.3.3 Object 6092h Feed Constant

This object defines the ratio of feed in position units per driving shaft revolutions.

#### 3.3.3.1 Object Description

Index	6092h
Name	Feed Constant
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED32
Category	Optional

#### 3.3.3.2 Entry Description

Sub-Index	001
Description	Feed
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x1
Lower Limit	0x1
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Shaft Revolutions
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x1
Lower Limit	0x1
Upper Limit	0xFFFFFFFF

### 3.4 Profile Position Mode (pp)

This section describes control of the amplifier in profile position mode (6060h set to 1).

#### 3.4.1 Overview

In profile position mode, an amplifier receives set points from the trajectory generator to define a target position and moves the axis to that position at a specified velocity and acceleration. This is known as a point-to-point move.

#### 3.4.2 Functional description

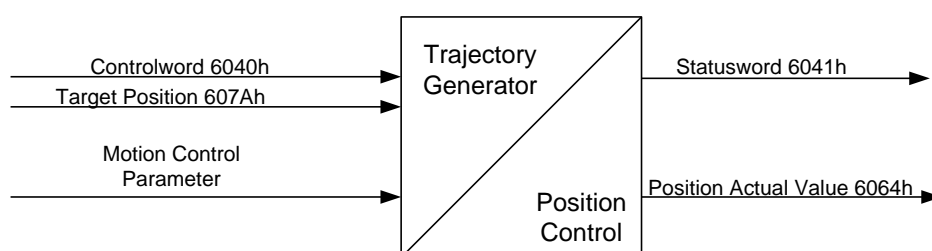
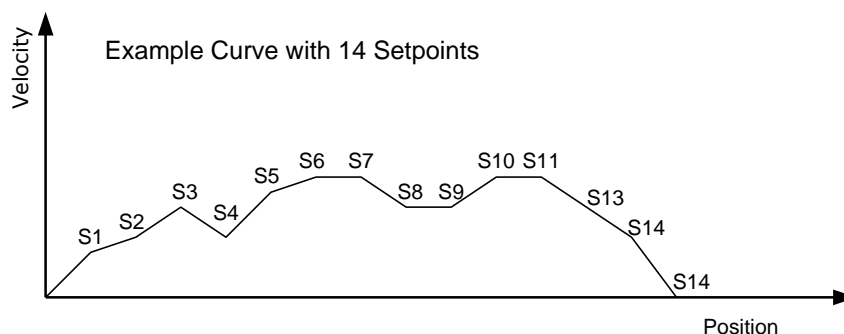
Two different means of applying target positions to a drive are supported by this device profile:

##### Single set-point:

After reaching the target position, the drive unit signals this status to a host computer and then receives a new set-point. After reaching a target position, the velocity is normally reduced to zero before starting a move to the next set-point.

##### Curve set-points (optional):

After reaching the target position, the drive unit signals this status to a host computer and then receives a new set-point (curve data) 5 curves with up to 4096 Position / Velocity Data can be set in the drive Set Motion Profile Type 6086h to -1 (see also 2120h-2125h)



Note that a number of bits of the Control Word (6040h) and Status Word (6041h) are mode specific here.

#### 3.4.3 Control Word Function (pp)

Bit 4 (0->1), the drive starts moving to the new set point  
 Bit 5 set to 1 change set immediately (Set of set-points not supported)  
 Bit 6 set to 0 select Absolute Positioning, set to 1 select Relative Positioning  
 Bit 8 set to 1 halts the motion

#### 3.4.4 Status Word Bits (pp)

Bit 10 is set when the drive has reached the position target



Bit 12 shows that set point was acknowledged  
Bit 13 is set when a following error has occurred

See /3/ for additional information.

### 3.4.5 Object 2005h Signal Time Curve

Settings for Cycle Mode. Valid for Cycle Data 1 to 5

#### 3.4.5.1 Object Description

Index	2005h
Name	Signal Time Curve
Object Code	Array
Number of Elements	4
Data Type	UNSIGNED16
Category	Optional

#### 3.4.5.2 Entry Description

Sub-Index	001
Description	Signal Time Before End. Time point before end of curve to set Signal State. If value=0 Function is off.
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	100us

Sub-Index	002
Description	Signal Length. Time Signal State is on. If SubIndex 2 = SubIndex1 Signal State remains on until next start
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x5
Lower Limit	0x1
Upper Limit	0xFFFF
Unit	100us

Sub-Index	003
Description	Signal State
Access	RO – ALW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	004
Description	Output mapping. Select Output (1-4) to map Signal State
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x0 (no mapping)
Lower Limit	0x0
Upper Limit	0x4

### 3.4.6 Object 2120h-2124h Cycle Data

Settings for Cycle Mode

#### 3.4.6.1 Object Description

Index	2120h -2124h
Name	Cycle Data 1-5
Object Code	Array
Number of Elements	10
Data Type	UNSIGNED32
Category	Manufacturer specific

#### 3.4.6.2 Entry Description

Sub-Index	001
Description	Mirror
Access	RW – ALW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	002
Description	Negative
Access	RW – ALW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	003
Description	Scale
Access	RW – ALW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF (iq16 format 0.0000-1.0000)

Sub-Index	004
Description	File Size
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1000

Sub-Index	005
Description	Velocity Size
Access	RO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1000

Sub-Index	007
Description	Data
Access	RW – ALW
PDO Mapping	YES
Lower Limit	0x0
Upper Limit	0xFFFFFFFF (iq9 see description below)

Sub-Index	008
Description	DataPointer
Access	RW – ALW
PDO Mapping	YES
Lower Limit	0x0
Upper Limit	0x1000

Sub-Index	009
Description	Sync Polarity
Access	RW – ALW
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	010
Description	Sync Position
Access	RW – ALW
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	011
Description	Total_inc
Access	RO
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	012
Description	Switch Cycle
Access	RW – ALW
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	013
Description	Cycle Counter
Access	RW – ALW
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	014
Description	Scale_Acc
Access	RW – ALW
Lower Limit	0x1
Upper Limit	0xFFFFFFFF

### 3.4.6.3 Cycle Velocity IQ9 Format

Velocity Cycle values during the run of the trajectory interpreted as increments per sample.  
 Samplettime=400us

Velocity Cycle identified by their bit 0 = 0

Bit	Description
31	Sign
30	Integer part (22 bit) Max = 4194303 inc/Sample
..	
..	
9	
8	Fractional part (8 bit) Min = 0.003 906 250 inc/Sample
..	
..	
1	
0	If Bit = 1 then Command

### Cycle Velocity Examples:

1.0 inc/Sample	= (1*256) << 1	= 512	= 0x00000200
1.5 inc/Sample	= (1.5*256) << 1	= 768	= 0x00000300
7.125 inc/Sample	= (7.125*256) << 1	= 3648	= 0x00000E40
-7.125 inc/Sample	= (-7.125*256) << 1	= -3648	= 0xFFFFF1C0

3000RPM = ((3000\*4096)/60)\*0.0004=81.92 inc/Sample = 81.92\*512=0x0000A3D7

### 3.4.6.4 Cycle File Data

The files begin and end each cycle with a stop cycle.  
 Between the stop cycle at the beginning and end are Velocity Cycle Data and Cycle Command Data.

### 3.4.6.5 Example

cycle_file[0][0] = 0x00000001;	Cycle Command / 0x2120.8=0 /0x2120.7=1 (Stop Cycle)
cycle_file[0][1] = _IQ(20.0);	Cycle Velocity / 0x2120.8=1 /0x2120.7=0x2800 (40*512)
cycle_file[0][2] = _IQ(40.0);	Cycle Velocity / 0x2120.8=2 /0x2120.7=0x5000 (40*512)
cycle_file[0][3] = _IQ(40.0);	Cycle Velocity / 0x2120.8=3 /0x2120.7=0x5000 (40*512)
cycle_file[0][4] = 0x00000007;	Cycle Command / 0x2120.8=4 /0x2120.7=0x7 (Sync Window Open)
cycle_file[0][3] = _IQ(40.0);	Cycle Velocity / 0x2120.8=5 /0x2120.7=0x5000 (40*512)
cycle_file[0][3] = _IQ(40.0);	Cycle Velocity / 0x2120.8=6 /0x2120.7=0x5000 (40*512)
cycle_file[0][5] = 0x00000008;	Cycle Command / 0x2120.8=7 /0x2120.7=0x9 (Sync Window Close)
cycle_file[0][6] = _IQ(40.0);	Cycle Velocity / 0x2120.8=8 /0x2120.7=0x5000
cycle_file[0][7] = _IQ(40.0);	Cycle Velocity / 0x2120.8=9 /0x2120.7=0x5000
cycle_file[0][8] = _IQ(20.0);	Cycle Velocity / 0x2120.8=10 /0x2120.7=0x2800
cycle_file[0][9] = 0x00000001;	Cycle Command /0x2120.8=0 /0x2120.7=1

### 3.4.6.6 Cycle Commands

Cycle Command are commands that are executed during the run of the trajectory by the interpreter as a command. Cycle Command is identified by their bit 0 = 1

0x00000001	Stop Cycle
0x00000007	Sync Window Open
0x00000009	Sync Window Close

The cycle files begin and end with a stop cycle

### 3.4.7 Object 2125h Select Cycle

Select Cycle 1-5

#### 3.4.7.1 Object Description

Index	2125h
Name	Select Cycle
Object Code	Variable
Data Type	UNSIGNED32
Category	O:pp
Access	RW – ALW
PDO Mapping	NO
Default Value	0x1
Lower Limit	0x1
Upper Limit	0x5

### 3.4.8 Object 2129h Sync Ist Position

Sync Position

#### 3.4.8.1 Object Description

Index	2127h
Name	Sync Ist Position
Object Code	Variable
Data Type	INTEGER32
Category	O:pp
Access	RW – ALW
PDO Mapping	NO
Default Value	0x80000000
Lower Limit	0x0
Upper Limit	0x7FFFFFFF

### 3.4.9 Object 2130h Mark Sync Mode Setup

Settings for Mark Sync in cycle mode

Sub-index 1 Sync Mode Setup:

Bit 0: Value = 0 / Marksyc Mode off Input 3 = Standard  
 Value = 1 / Marksyc Mode on Input 3 = MarkSync

Bit 1: Value = 0 / Sync correction off  
 Value = 1 / Sync correction runs

Bit 2: Value = 0 / Positive Sync polarity in abs/rel mode (no curve)  
 Value = 1 / Negative Sync polarity in abs/rel mode (no curve)

Set this value to 3 when operating in mark sync mode

#### 3.4.9.1 Object Description

Index	2130h
Name	Mark Sync Mode
Object Code	Array
Number of Elements	5
Data Type	UNSIGNED16
PDO Mapping	No
Category	Manufacturer specific

### 3.4.9.2 Entry Description

Sub-Index	001
Description	Sync Mode Setup
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x3

Sub-Index	002
Description	Input Delay Compensation (not implemented)
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	003
Description	Sync Counter (for debug purpose only)
Access	RW – ALW
Lower Limit	0x0
Upper Limit	0xFFFF

Sub-Index	004
Description	Sync Lost Counter (for debug purpose only)
Access	RW – ALW
Lower Limit	0x0
Upper Limit	0xFFFF

Sub-Index	005
Description	Sync Error Counter (for debug purpose only)
Access	RW – ALW
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.4.10 Object 2131h Sync Window Position

Sync Window 1st position (for debug purpose only)

#### 3.4.10.1 Object Description

Index	2131h
Name	Sync Window Position
Object Code	Array
Number of Elements	10
Data Type	INTEGER32
PDO Mapping	No
Category	Manufacturer specific

#### 3.4.10.2 Entry Description

Sub-Index	001/003/005/007/009
Description	Sync Window Open Position 1-5
Access	RO – ALW
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

Sub-Index	002/004/006/008/010
Description	Sync Window Close Position 1-5
Access	RO – ALW
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

### 3.4.11 Object 607Ah Target Position

This object is the target position that the drive should move to in profile position mode. The target position is interpreted as absolute or relative, depending on the Abs/Rel flag in the Controlword.

#### 3.4.11.1 Object Description

Index	607Ah
Name	Target Position
Object Code	Variable
Data Type	INTEGER32
Category	M:pp
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

### 3.4.12 Object 607Dh Software Position Limit

Active in all modes. See /3/ for additional information.

#### 3.4.12.1 Object Description

Index	607Dh
Name	Software Position Limit
Object Code	Array
Number of Elements	2
Data Type	INTEGER32
Category	O:pp,ff

#### 3.4.12.2 Entry Description

Sub-Index	001
Description	Min Position Limit
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x80000000
Lower Limit	0x80000000
Upper Limit	0xFFFFFFFF
Unit	user

Sub-Index	002
Description	Max Position Limit
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x7FFFFFFF
Lower Limit	0x80000000
Upper Limit	0xFFFFFFFF
Unit	user



### 3.4.13 Object 607Fh Max Profile Velocity

This object specifies the maximal allowed velocity.

#### 3.4.13.1 Object Description

Index	607Fh
Name	Max Profile Velocity
Object Code	Variable
Data Type	INTEGER32
Category	O:pp,ip,pv,hm,ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x7FFFFFFF
Lower Limit	0x0
Upper Limit	0x7FFFFFFF
Unit	um/s

### 3.4.14 Object 6080h Max Motor Speed

This object describes the maximal allowable speed for the motor in either direction and is given in revolution per minute (rpm). The value is given in the motor manual.

#### 3.4.14.1 Object Description

Index	6080h
Name	Max Motor Speed
Object Code	Variable
Data Type	INTEGER32
Category	O:pp,ip,pv,hm,ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x1770
Lower Limit	0x0
Upper Limit	0x7FFFFFFF
Unit	rpm

### 3.4.15 Object 6081h Profile Velocity in pp-mode

This object is the velocity in the profile position mode.

#### 3.4.15.1 Object Description

Index	6081h
Name	Profile Velocity
Object Code	Variable
Data Type	UNSIGNED32
Category	M:pp
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	user

### 3.4.16 Object 6083h Profile Acceleration

This object is the linear acceleration.

#### 3.4.16.1 Object Description

Index	6083h
Name	Profile Acceleration
Object Code	Variable
Data Type	UNSIGNED32
Category	M:pp,pv   O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2710
Lower Limit	0x1
Upper Limit	0xFFFFFFFF
Unit	mm/s <sup>2</sup>

### 3.4.17 Object 6084h Profile Deceleration

This object is the linear deceleration.

#### 3.4.17.1 Object Description

Index	6084h
Name	Profile Deceleration
Object Code	Variable
Data Type	UNSIGNED32
Category	O:pp,pv,ff,ip,hm
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2710
Lower Limit	0x1
Upper Limit	0xFFFFFFFF
Unit	mm/s <sup>2</sup>

### 3.4.18 Object 6085h Quick Stop Deceleration

This object is used to stop the drive in the state QUICK STOP.

#### 3.4.18.1 Object Description

Index	6085h
Name	Quick Stop Deceleration
Object Code	Variable
Data Type	UNSIGNED32
Category	O:pp,pv,ff,ip,hm
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2710
Lower Limit	0x1
Upper Limit	0xFFFFFFFF
Unit	mm/s <sup>2</sup>

### 3.4.19 Object 6086h Motion Profile Type

This object is used to select the type of the motion profile.

-1 = manufacturer specific (curve profile)

0 = Linear ramp (trapezoidal profile)

1 = sin 2 ramp,

2 = Jerk-free ramp, not supported

3 = Jerk-limited ramp, not supported

4-32767 = reserved, not supported

#### 3.4.19.1 Object Description

Index	6086h
Name	Motion Profile Type
Object Code	Variable
Data Type	INTEGER16
Category	O:pp
Access	RW – ALW (SNVM)
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x1
Upper Limit	0x8000
Unit	

### 3.4.20 Object 60C5h Max Acceleration

To prevent the motor and the application from being destroyed, the max acceleration can be used to limit the acceleration to an acceptable value.

#### 3.4.20.1 Object Description

Index	60C5h
Name	Max Acceleration
Object Code	Variable
Data Type	UNSIGNED32
Category	O:pp,pv,ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0xFFFFFFFF
Lower Limit	0x1
Upper Limit	0xFFFFFFFF
Unit	mm/s <sup>2</sup>

### 3.4.21 Object 60C6h Max Deceleration

To prevent the motor and the application from being destroyed, the max deceleration can be used to limit the deceleration to an acceptable value.

#### 3.4.21.1 Object Description

Index	60C6h
Name	Max Deceleration
Object Code	Variable
Data Type	UNSIGNED32
Category	O:pp,pv,ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0xFFFFFFFF
Lower Limit	0x1
Upper Limit	0xFFFFFFFF
Unit	mm/s <sup>2</sup>

### 3.5 Homing Mode (hm)

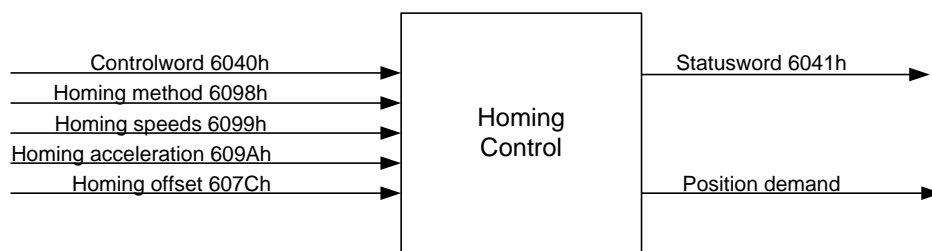
This section describes control of the amplifier in homing mode (6060h set to 6).

#### 3.5.1 Overview

Homing is the method by which a drive seeks the home position (also called the datum, reference point, or zero point).

#### 3.5.2 Functional description

The homing function provides a set of trajectory parameters to the position loop, as shown below. A homing move is started by setting bit 4 of the Control Word (6040h). The results of a homing operation can be accessed in the Status Word (6041h).



Note that a number of bits of the Control Word (6040h) and Status Word (6041h) are mode specific here.

#### 3.5.3 Control Word Function (hm)

Positive edge of the Bit 4 (0->1), the drive starts performing the homing procedure

Bit 8 set to 1 halts the motion

#### 3.5.4 Status Word Bits (hm)

Bit 10 is set when the drive has reached the setpoint.

Bit 12 is set when the homing procedure was successfully completed

Bit 13 is set when an error occurred during the homing procedure

See /3/ for additional information.

### 3.5.5 Object 2056h Homing Mode Time Out

This object is the Time Out in the homing mode. Homing must be attained after before this time otherwise “Homing error” will be generated

#### 3.5.5.1 Object Description

Index	2056h
Name	Homing Mode Time Out
Object Code	Variable
Data Type	UNSIGNED16
Category	O:hm
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x3C
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	s

### 3.5.6 Object 2057h Homing Delay

Delay used for homing to a current limit mode.

#### 3.5.6.1 Object Description

Index	2057h
Name	Homing Delay
Object Code	Variable
Data Type	UNSIGNED16
Category	O:hm
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x2710
Unit	ms

### 3.5.7 Object 2058h Homing Current Limit

Current in current limit mode, in which the drive moves the motor to the mechanical end of travel.

#### 3.5.7.1 Object Description

Index	2058h
Name	Homing Current Limit
Object Code	Variable
Data Type	UNSIGNED16
Category	O:hm
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x2710
Unit	mA

### 3.5.8 Object 607Ch Home Offset

The homing offset is the difference between the zero position for the application and the machine home position (found during homing). During homing the home position is found and once the homing is completed the zero position is offset from the home position by adding the Homing offset to the home position. All subsequent absolute moves shall be taken relative to this new zero position.

#### 3.5.8.1 Object Description

Index	607Ch
Name	Home Offset
Object Code	Variable
Data Type	INTEGER32
Category	O:hm
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	user

### 3.5.9 Object 6098h Homing Method

This object determines the method that will be used during the homing mode.  
Methods -2,-1,17,18,35 are supported by the drive

- x = manufacturer specific
- 0 = No homing operation required
- 1-35 = Methods 1 to 35 (see DSP-402)
- 36-127 = reserved

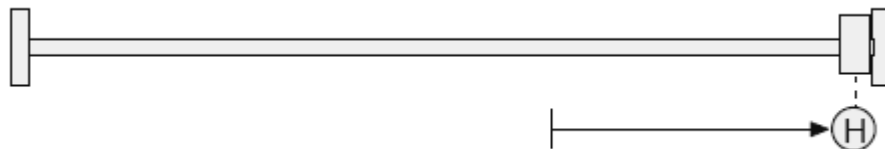
#### Current Limit Move Negative (-2):

Home is the negative hard stop. Direction of motion is negative. The hard stop is reached when the amplifier outputs the homing Current Limit continuously for the amount of time specified in the Delay Time. If a negative limit switch is activated before the hard stop, an error is generated.



#### Current Limit Move Positive (-1)

Home is the positive hard stop. Direction of motion is positive. The hard stop is reached when the amplifier outputs the homing Current Limit continuously for the amount of time specified in the Delay Time. If a positive limit switch is activated before the hard stop, an error is generated.



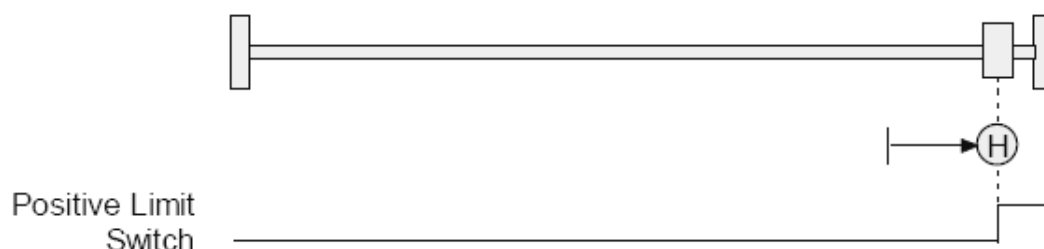
#### Limit Switch Move Negative (17)

Home is the transition of negative limit switch. Initial direction of motion is negative if the negative limit switch is inactive.



#### Limit Switch Move Positive (18):

Home is the transition of the positive limit switch. Initial direction of motion is positive if the positive limit switch is inactive.





### Home is Current Position (35)

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.

### 3.5.10 Object 6099h Homing Speeds

This object defines a slow and a fast velocity used during the homing mode.

#### 3.5.10.1 Object Description

Index	6099h
Name	Homing Speeds
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED32
PDO Mapping	No
Category	M:hm

#### 3.5.10.2 Entry Description

Sub-Index	001
Description	Fast Homing Speed
Access	RW – ALW (SNVM)
Default Value	0x190
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	user

Sub-Index	002
Description	Slow Homing Speed
Access	RW – ALW (SNVM)
Default Value	0xC8
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

### 3.5.11 Object 609Ah Homing Acceleration

This object is the acceleration used in the homing mode. Acceleration to be used for all accelerations and decelerations with the standard homing modes, in acceleration units.

#### 3.5.11.1 Object Description

Index	607Ch
Name	Home Offset
Object Code	Variable
Data Type	INTEGER32
Category	O:hm
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x3A98
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	user

### 3.6 Position Control Function

#### 3.6.1 Object 2050h Pp target position intern

##### 3.6.1.1 Object Description

Index	2050h
Name	Pp target position intern
Object Code	Variable
Data Type	INTEGER32
Category	O:pp,ip
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	inc

#### 3.6.2 Object 2051h Position Window intern

This object defines a symmetrical range of accepted positions relatively to the target position in inc. If the actual position is within the range, the target position is regarded as reached.

##### 3.6.2.1 Object Description

Index	6051h
Name	Position Window intern
Object Code	Variable
Data Type	UNSIGNED32
Category	O:pp
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	inc

#### 3.6.3 Object 6063h Position Actual Internal Value

This object reflects the current position in increments.

##### 3.6.3.1 Object Description

Index	6063h
Name	Position Actual Internal Value
Object Code	Variable
Data Type	INTEGER32
Category	O:pp,pv,ff,ip,hm
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	inc

### 3.6.4 Object 6064h Position Actual Value in User Unit

This object represents the actual value of the position measurement device in user defined units.

#### 3.6.4.1 Object Description

Index	6064h
Name	Position Actual Value in User Unit
Object Code	Variable
Data Type	INTEGER32
Category	O:pp,pv,ff,ip,hm
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	user

### 3.6.5 Object 6065h Following Error Window

The following error window defines the range of tolerated position values symmetrical to the target position. If the current position is out of range a following error occurs.

#### 3.6.5.1 Object Description

Index	6065h
Name	Following Error Window
Object Code	Variable
Data Type	INTEGER32
Category	O:pp,pv,ff,ip,hm,pv.pt
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x7FFFFFFF
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	user

### 3.6.6 Object 6066h Following Error Time Out

When a following error occurs longer than the defined time in this object the following error handling will started. (Given in milliseconds), the corresponding bit 13 following error in the Statusword will be set to 1.

#### 3.6.6.1 Object Description

Index	6066h
Name	Following Error Time Out
Object Code	Variable
Data Type	UNSIGNED16
Category	O:pp,pv,ff,ip,hm,pv.pt
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x7FFFFFFF
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	user

### 3.6.7 Object 6067h Position Window

This object defines a symmetrical range of accepted positions relatively to the target position. If the actual position is within the range, the target position is regarded as reached.

#### 3.6.7.1 Object Description

Index	6067h
Name	Position Window
Object Code	Variable
Data Type	UNSIGNED32
Category	O:pp,ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x64
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	user

### 3.6.8 Object 6068h Position Window Time

When the actual position is within the position window during the defined position window time, the target position is reached.

#### 3.6.8.1 Object Description

Index	6068h
Name	Position Window Time
Object Code	Variable
Data Type	UNSIGNED16
Category	O:pp
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	0.4ms

### 3.6.9 60B0h Position Offset

This object shall provide the offset of the target position. The offset shall be given in userdefined position units.

#### 3.6.9.1 Object Description

Index	6068h
Name	Position Offset
Object Code	Variable
Data Type	INTEGER32
Category	O:pp
Access	RW – ALW (SNVM)
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	user

### 3.7 Interpolated Position Mode (ip)

This section describes control of the amplifier in interpolated position mode (6060h set to 7).  
See /3/ for additional information.

#### 3.7.1 Overview

The interpolated position mode is used to control multiple coordinated axes or a single axle with the need for time-interpolation of set-point data. The IP uses time synchronisation mechanisms like the SYNC object. For synchronous operation the interpolation cycle time is defined by an object: interpolation time period.

#### 3.7.2 Functional description

A IP move is started using Control Word settings (6040h) and Status Word settings (6041h).  
The transition of Control Word bit 4 from 0 to 1 causes the amplifier to start the move.  
See Example (below)

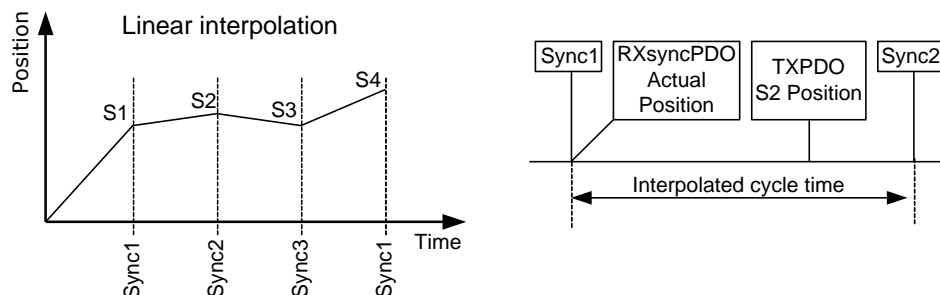
During one interpolation cycle time period the CAN Master has to transmit some CAN messages:

Transmitting sequential Tx-PDOs with interpolated nominal positions to all connected axes

Receiving sync Rx-PDOs from axes with actual values

Transmitting SYNC message (broadcast) to all axes

The drawing below shows the timings in interpolation position mode.



Note that a number of bits of the Control Word (6040h) and Status Word (6041h) are mode specific here.

#### 3.7.3 Control Word Function (ip)

Bit 4 set to 1 enables drive internal interpolation  
Bit 8 set to 1 halts the motion

#### 3.7.4 Status Word Bits (ip)

Bit 12 is set as the interpolation is enable  
Bit 13 is set if a following error occurs

### 3.7.5 Example IP Mode

Action	CAN Object
Select ip mode	6060h_0h = 7
Set time unit 5ms	60C2h_1h = 03
Set time index 1ms	60C2h_2h = 05
Buffer clear 1	60C4h_6h = 1
Set profile deceleration to 10000(mm/s <sup>2</sup> ) This ramp is use to stop the motion when no SYNC data receive or IP Mode stops	COB-ID=0 / Command Specifier =128
Set NMT state preoperational	COB-ID=0 Command Specifier =128
MAP interpolation data record and control word to receive PDO1 See /2/ for a detailed description	60C1_1h -> 1600h_01h 6040_0h -> 1600h_02h
MAP actual position to transmit PDO1 (Synchronous) See /2/ for a detailed description	6064_0h -> 1A00h_01h
Set NMT state operational	COB-ID=0 Command Specifier =1
Enable SYNC	SYNC every 5ms
Shutdown	6040_0h=6
Operation enable	6040_0h=Fh
Start interpolation	Set Bit 4 object 6040_0h
New position data must be send by the master between to SYNC Messages	1400h
If no position data is received by RPDO the motion will stop after 2 SYNC messages	2055h_0=2
Stop interpolation	Reset Bit 4 object 6040_0h

### 3.7.6 Object 2055h IP Mode Stop Motor

Define after how many interpolated time cycle with no new position data the motor stops

#### 3.7.6.1 Object Description

Index	2055h
Name	IP Mode Stop Motor
Object Code	Variable
Data Type	UNSIGNED8
Category	O:ip
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2
Lower Limit	0x0
Upper Limit	0xFF

### 3.7.7 Object 60C1h Interpolation Data Record

This object contains the data words which are necessary to perform the interpolation algorithm. For linear interpolation each record is simply a new set-point

#### 3.7.7.1 Object Description

Index	60C1h
Name	Interpolation Data Record
Object Code	Array
Number of Elements	1
Data Type	INTEGER32
Category	M:hm

#### 3.7.7.2 Entry Description

Sub-Index	001
Description	Data Record 1
Access	RW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	user

### 3.7.8 Object 60C2h Interpolation Time Period

This object shall indicates the configured interpolation cycle time

#### 3.7.8.1 Object Description

Index	60C2h
Name	Interpolation Time Period
Object Code	Record
Number of Elements	2
Data Type	P402_IP_PERIOD_T
Category	M:ip

#### 3.7.8.2 Entry Description

Sub-Index	001
Description	timeUnits
Data Type	UNSIGNED8
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0xA
Lower Limit	0x0
Upper Limit	0xFF
Unit	According to ip_time index

Sub-Index	002
Description	timeIndex
Data Type	INTEGER8
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	-4
Lower Limit	-4
Upper Limit	-3
Unit	According to ip_time_index

Exampel1      timeIndex= -3 (ms)  
                    timeUnits = 10  
                    interpolation cycle time = 1ms\*10=10ms

Exampel2      timeIndex= -4 (0.1ms)  
                    timeUnits = 30  
                    interpolation cycle time = 0.1ms\*30=3ms

### 3.7.9 Object 60C4h Interpolation Data Configuration

This object services the storage of a lot of records in the Interpolated Position Mode.  
Only Subindex 6 is used in this drive.

#### 3.7.9.1 Object Description

Index	60C2h
Name	Interpolation Data Configuration
Object Code	Record
Number of Elements	6
Data Type	P402_IP_CONFIG_T
Category	M:ip

#### 3.7.9.2 Entry Description

Sub-Index	001
Description	MaxBuffSize (unused)
Data Type	UNSIGNED32
Access	RW

Sub-Index	002
Description	ActBuffSize (unused)
Data Type	UNSIGNED32
Access	RW

Sub-Index	003
Description	BuffOrg (unused)
Data Type	UNSIGNED8
Access	RW



Sub-Index	004
Description	BuffPos (unused)
Data Type	UNSIGNED16
Access	RW

Sub-Index	004
Description	BuffPos (unused)
Data Type	UNSIGNED16
Access	RW

Sub-Index	005
Description	DataRecordSize
Data Type	UNSIGNED8
Access	RW
PDO Mapping	NO
Default Value	0x4
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	006
Description	BufferClear 0 = Clear input buffer, Access disabled, Clear all ip data records 1 = Enable access to the input buffer for the drive functions
Data Type	UNSIGNED8
Access	RW
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

### 3.8 Cyclic Synchronous Position Mode (csp)

This section describes control of the amplifier in cyclic synchronous position mode (6060h set to 8).

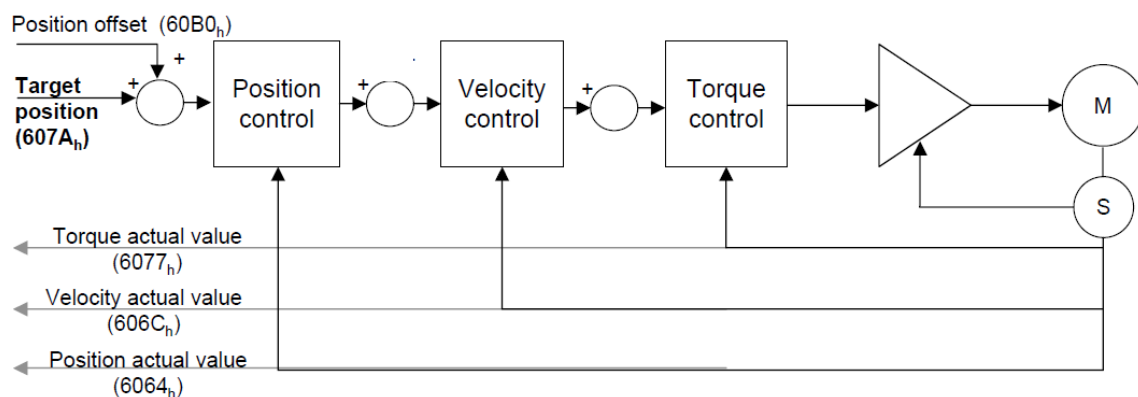
#### 3.8.1 Overview

The motor controller receives an absolute positional specification at fixed time intervals via the field bus. In this case, the motor controller no longer computes ramps but only follows the specifications.

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

See also [3.7.8 Object 60C2h Interpolation Time Period](#)

#### 3.8.2 Functional description



#### 3.8.3 Control Word Bits (csp)

The cyclic synchronous position mode uses no mode specific bits of the Controlword and

#### 3.8.4 Status Word Bits (csp)

Bit10: Status Toggle

Bit 12: 0 = Target position ignored  
1 = Target position shall be used as input to position control loop

Bit13: 0 = Following error  
1= No following error

### 3.9 Cyclic Synchronous Velocity Mode (csv)

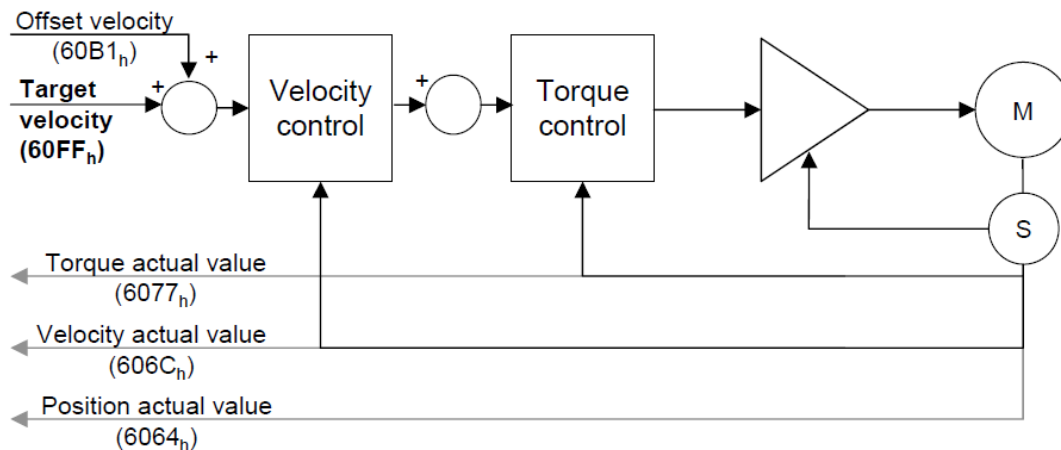
This section describes control of the amplifier in cyclic synchronous position mode (6060h set to 9).

#### 3.9.1 Overview

The motor controller receives a speed specification at fixed time intervals via the field bus. In this case, the motor controller no longer computes ramps but only follows the specifications.

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

See also [3.7.8 Object 60C2h Interpolation Time Period](#)



#### 3.9.2 Control Word Bits (csp)

The cyclic synchronous velocity mode uses no mode specific bits of the Controlword.

#### 3.9.3 Status Word Bits (csv)

Bit10: Status Toggle

Bit 12: 0 = Target velocity ignored  
1 = Target velocity shall be used as input to velocity control loop

Bit13: 0 = Following error  
1 = No following error

### 3.10 Profile Velocity Mode (pv)

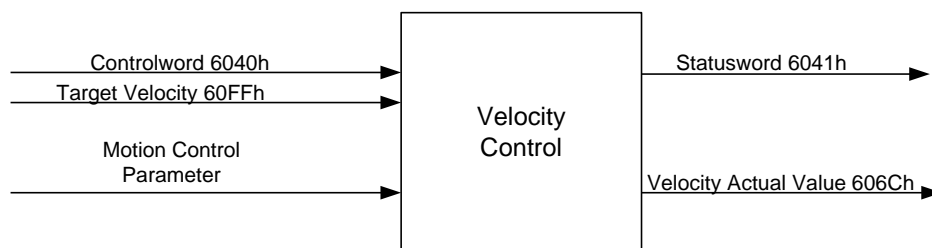
This section describes control of the amplifier in profile velocity mode (6060h set to 3).  
See /3/ for additional information.

#### 3.10.1 Overview

Profile Velocity Mode performs remote control of the motor speed

#### 3.10.2 Functional description

To start a move in profile velocity mode, set the profile parameters  
profile acceleration (6083h), profile deceleration (6084h), and target velocity (60FFh).  
The amplifier will generate a move as long as the halt bit (Control Word bit 8) is not set. If the halt bit is set,  
the amplifier will stop the move using the deceleration value.



Note that a number of bits of the Control Word (6040h) and Status Word (6041h) are mode specific here.

#### 3.10.3 Control Word Function (pv)

Bit 8 set to 1 halts the motion

#### 3.10.4 Status Word Bits (pv)

Bit 10 is set when the drive has reached the setpoint.  
Bit 12 states when the drive is moving or stationary, based on Min Speed

### 3.10.5 Object 6069h Velocity Sensor Actual Value

This object documents the actual velocity detected by a velocity analyser.

#### 3.10.5.1 Object Description

Index	6069h
Name	Velocity Sensor Actual Value
Object Code	Variable
Data Type	INTEGER32
Category	M:pv   O:pp,ip,pv,hm,tq,ff
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	Inc/s

### 3.10.6 Object 606Ch Velocity Actual Value

This object reflects the actual velocity per sample period.

#### 3.10.6.1 Object Description

Index	606C h
Name	Velocity Sensor Actual Value
Object Code	Variable
Data Type	INTEGER32
Category	M:pv   O:pp,ip,pv,hm,tq,ff
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	user

### 3.10.7 Object 606Dh Velocity Window

This object monitors whether the required process velocity has been achieved after an eventual acceleration or deceleration phase.

#### 3.10.7.1 Object Description

Index	606Ch
Name	Velocity Window
Object Code	Variable
Data Type	UNSIGNED16
Category	O:pv
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x32
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	user

### 3.10.8 Object 606Eh Velocity Window Time

The statusword bit "target reached" (10) is set when the difference between target velocity and the actual velocity is within the velocity window longer than the velocity window time (in ms).

#### 3.10.8.1 Object Description

Index	606Eh
Name	Velocity Window Time
Object Code	Variable
Data Type	UNSIGNED16
Category	O:pv
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x5
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	ms

### 3.10.9 Object 60FFh Target Velocity

This object indicate the configured target velocity

#### 3.10.9.1 Object Description

Index	60FFh
Name	Target Velocity
Object Code	Variable
Data Type	INTEGER32
Category	M:pv
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0
Lower Limit	0x7FFFFFFF
Upper Limit	0x80000000
Unit	user

### 3.11 Profile Torque Mode (tq)

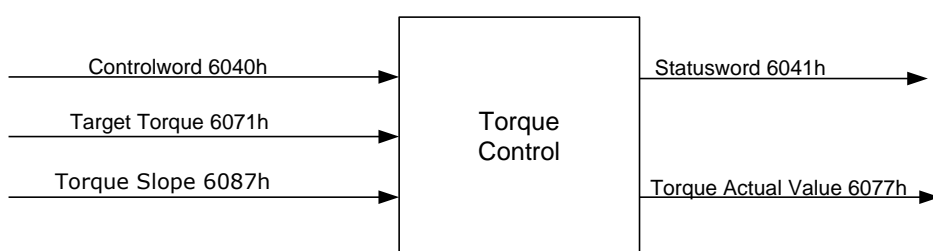
This section describes control of the amplifier in profile torque mode (6060h set to 4).

#### 3.11.1 Overview

Profile Torque Mode performs remote torque control of the motor shaft

#### 3.11.2 Functional description

In profile torque mode, the current loop is used to reach the torque programmed in the Target Torque object (6071h). When the amplifier is enabled, or the torque command is changed, the motor torque ramps to the new value at the rate programmed in Torque Slope (6087h). When the amplifier is halted, the torque ramps down at the same rate.



Note that a number of bits of the Control Word (6040h) and Status Word (6041h) are mode specific.

#### 3.11.3 Control Word Function (tq)

Bit 8 set to 1 halts the motion

#### 3.11.4 Status Word Bits (tq)

Bit 10 is set when the drive has reached the setpoint.

#### 3.11.5 Object 2090h Torque To Current

This object describes the factor for scale torque to internal value  
 $\text{Torque\_Intern} = (\text{Target\_Torque} * \text{Numerator}) / \text{Denominator}$

##### 3.11.5.1 Object Description

Index	2090h
Name	Torque To Current
Object Code	Array
Number of Elements	2
Data Type	INTEGER16
Category	O:tq

### 3.11.6 Entry Description

Sub-Index	001
Description	Numerator
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x1
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	002
Description	Denominator
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	1
Lower Limit	1
Upper Limit	0x7FFF

### 3.11.7 Object 6071h Target Torque

This object is the input value for the torque controller.

#### 3.11.7.1 Object Description

Index	6071h
Name	Target Torque
Object Code	Variable
Data Type	INTEGER16
Category	M:tg
Access	RW – ALW (SNVM)
PDO Mapping	YES
Default Value	0
Lower Limit	0x7FFF
Upper Limit	0x8000
Unit	Per thousand of rated torque

### 3.11.8 Object 6072h Max Torque

This object represents the maximum permissible torque in the motor.

#### 3.11.8.1 Object Description

Index	6072h
Name	Max Torque
Object Code	Variable
Data Type	UNSIGNED16
Category	M:tg
Access	RW – ALW (SNVM)
PDO Mapping	YES
Default Value	0
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	Per thousand of rated torque



### 3.11.9 Object 6073h Max Current

This value corresponds to the drive maximum current

#### 3.11.9.1 Object Description

Index	6073h
Name	Max Current
Object Code	Variable
Data Type	UNSIGNED16
Category	O:pp,ip,pv,hm,tq,ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x3FFF
Lower Limit	0x0
Upper Limit	0x3FFF
Unit	mA

### 3.11.10 Object 6075h Motor Rated Current

This value corresponds to the drive continuous current

#### 3.11.10.1 Object Description

Index	6075h
Name	Motor Rated Current
Object Code	Variable
Data Type	UNSIGNED16
Category	O:pp,ip,pv,hm,tq,ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2710
Lower Limit	0x0
Upper Limit	0x3FFF
Unit	mA

### 3.11.11 Object 6077h Torque Actual Value

This object provide the actual value of the torque.

#### 3.11.11.1 Object Description

Index	6077h
Name	Torque Actual Value
Object Code	Variable
Data Type	INTEGER16
Category	O:pp,ip,pv,hm,tq,ff
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF
Unit	Per thousand of rated torque

### 3.11.12 Object 6078h Current Actual Value

This object provide the actual value of the current.

#### 3.11.12.1 Object Description

Index	6078h
Name	Current Actual Value
Object Code	Variable
Data Type	INTEGER16
Category	O:pp,ip,pv,hm,tq,ff
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF
Unit	mA

### 3.11.13 Object 6079h DC Link Circuit Voltage

This object describes the actual DC link current voltage at the drive controller.

#### 3.11.13.1 Object Description

Index	6079h
Name	DC Link Circuit Voltage
Object Code	Variable
Data Type	UNSIGNED32
Category	O:pp,ip,pv,hm,tq,ff
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	mV

### 3.11.14 Object 6087h Torque Slope

This parameter describes the rate of change of torque

#### 3.11.14.1 Object Description

Index	6087h
Name	Torque Slope
Object Code	Variable
Data Type	UNSIGNED32
Category	M:tq
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFFFFFF
Unit	Per thousand of rated torque

### 3.12 Force Feedback Mode (ff)

#### 3.12.1 2196h FF Master Slave Param Ist

This parameter is needed for the synchronization of two units

##### 3.12.1.1 Object Description

Index	2196h
Name	FF Master Slave Param Ist
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW
PDO Mapping	YES
Default Value	0x00
Lower Limit	0x8000
Upper Limit	0x7FFF

#### 3.12.2 2197h FF Master Slave Param Soll

This parameter is needed for the synchronization of two units

##### 3.12.2.1 Object Description

Index	2197h
Name	FF Master Slave Param Soll
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW
PDO Mapping	YES
Default Value	0x00
Lower Limit	0x8000
Upper Limit	0x7FFF

#### 3.12.3 2198h FF Autopilot Speed

Set the max speed for autopilot mode

##### 3.12.3.1 Object Description

Index	2198h
Name	FF Autopilot Speed
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW
PDO Mapping	YES
Default Value	0x00
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.12.4 2199h FF Turbulence Force 2

Set turbulence force2 (motor vibrations)

#### 3.12.4.1 Object Description

Index	2199h
Name	FF Turbulence Force 2
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW
PDO Mapping	No
Default Value	0x00
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.12.5 219Ah FF Turbulence Time 2

Set turbulence time2 (motor vibrations)

#### 3.12.5.1 Object Description

Index	219Ah
Name	FF Turbulence Time 2
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW
PDO Mapping	No
Default Value	0x0064
Lower Limit	0x000A
Upper Limit	0x008C
Unit	100us

### 3.12.6 219Bh FF User Force Offset

Set a user specific force offset

#### 3.12.6.1 Object Description

Index	219Bh
Name	FF User Force Offset
Object Code	Variable
Data Type	INTEGER32
Category	O:ff
Access	RW – ALW
PDO Mapping	No
Default Value	0x0
Lower Limit	-30000
Upper Limit	30000

### 3.12.7 219Ch FF Neg Software Limit

Set a user specific negative software limit

#### 3.12.7.1 Object Description

Index	219Ch
Name	FF Neg Software Limit
Object Code	Variable
Data Type	INTEGER32
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	0x0
Lower Limit	-2147483648
Upper Limit	0

### 3.12.8 219Dh FF Node ID Force Sensor

Node Id of the external force sensor

#### 3.12.8.1 Object Description

Index	219Dh
Name	FF Node ID Force Sensor
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	No
Default Value	20
Lower Limit	0
Upper Limit	126

### 3.12.9 219Eh FF Force Sensor Sync

#### 3.12.9.1 Object Description

Index	219Eh
Name	FF Force Sensor Sync
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW
PDO Mapping	YES
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.12.10 219Fh FF Force Sensor

Force of the external force sensor

#### 3.12.10.1 Object Description

Index	219Eh
Name	FF Force Sensor
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW
PDO Mapping	YES
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.12.11 Object 2100h FF Regulator

This object contains the regulator parameter for the ff mode

#### 3.12.11.1 Object Description

Index	2100
Name	FF Regulator
Object Code	Array
Number of Elements	10
Data Type	INTEGER16
PDO Mapping	No
Category	O:ff

#### 3.12.11.2 Entry Description

Sub-Index	001
Description	P Factor Force Numerator
Access	RW – ALW (SNVM)
Default Value	0xF
Lower Limit	0x1
Upper Limit	0x7FFF

Sub-Index	002
Description	P Factor Force Denominator
Access	RW – ALW (SNVM)
Default Value	1
Lower Limit	1
Upper Limit	0x7FFF

Sub-Index	003
Description	Correction Factor Velocity Sync Mode2
Access	RW – ALW (SNVM)
Default Value	4
Lower Limit	1
Upper Limit	0x7FFF

Sub-Index	004
Description	Correction Factor Velocity Position Mode
Access	RW – ALW (SNVM)
Default Value	15
Lower Limit	1
Upper Limit	0x7FFF

Sub-Index	005
Description	Regulator Type 0= Standard Mode 2= Master / Slave Mode (2 Units)
Access	RW – ALW
Default Value	0
Lower Limit	0
Upper Limit	0x7FFF

Sub-Index	006
Description	Force Scale Numerator
Access	RW – ALW (SNVM)
Default Value	1
Lower Limit	1
Upper Limit	0x7FFF

Sub-Index	007
Description	Force Scale Denominator
Access	RW – ALW (SNVM)
Default Value	1
Lower Limit	1
Upper Limit	0x7FFF

Sub-Index	008
Description	Soft Limit Stop Regulator
Access	RW – ALW (SNVM)
Default Value	3
Lower Limit	0 (Hard Stop)
Upper Limit	0x8 (Very Soft Stop)

Sub-Index	009
Description	Trim Ramp
Access	RW – ALW (SNVM)
Default Value	5
Lower Limit	1 (Fast Ramp)
Upper Limit	0x14 (Slow Ramp)

Sub-Index	010
Description	Offset DMS Correction
Access	RW – ALW (SNVM)
Default Value	100
Lower Limit	1
Upper Limit	0xC8

Sub-Index	011
Description	Permanent Offset
Access	RW – ALW
Default Value	0
Lower Limit	-256
Upper Limit	256

Sub-Index	012
Description	Profile Mode 0=standard 1=unbalanced Software End stops enabled / gradient force profile does not change (slope + - always balanced) 2=unbalanced Software End Stops enabled / maximum force at the position of the SW stops achieved (slope + - may be unbalanced)
Access	RW – ALW (SNVM)
Default Value	0
Lower Limit	0
Upper Limit	2

Sub-Index	013
Description	Reduce Vibration 0=off 1= ON
Access	RW – ALW (SNVM)
Default Value	0
Lower Limit	0
Upper Limit	1

Sub-Index	014
Description	Misc Options
Access	RW – ALW (SNVM)
Default Value	0
Lower Limit	0
Upper Limit	0x7FFF



### 3.12.12 Object 2101h FF Settings

This parameter describes the Settings in ff Mode

#### Sub-index 1

- Bit 0: Move Back to 0 Position with Move Back speed
- Bit 1: Constant force
- Bit 2: Linear increase force to endForce (depend on position)
- Bit 3: Make Turbulence Parameters 1(Turbulence strength & force)
- Bit 4: Make Turbulence Parameters 2(Turbulence strength & force)
- Bit 5: Move Positive Position Limit
- Bit 6: Move Negative Position Limit
- Bit 7: Sync Mode Bit1
- Bit 8: Sync Mode Bit2
- Bit 9: Auto Init Pdo / Set NmtState
- Bit 10: FF State Auto Switch On
- Bit 11: Offset FF Sensor
- Bit 12: Invert FF Sensor
- Bit 13: Init command (move to limit switch and set position homing mode 17)
- Bit 14: No Init (initialize is not need)
- Bit 15: Inverted Position

**Sub-index 2:** Destination NodeId for Transmit PDOs in Sync Mode

**Sub-index 3:** Update Bit if>0 only selected bit in FF Mode will be changed

**Sub-index 4:** Enable / Disable Autopilot Mode

#### 3.12.12.1 Object Description

Index	2101
Name	FF Settings
Object Code	Array
Number of Elements	3
Data Type	INTEGER16
PDO Mapping	NO
Category	O:ff

#### 3.12.12.2 Entry Description

Sub-Index	001
Description	FF Mode
Access	RW – ALW (SNVM)
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	002
Description	FF Destination Sync Node ID
Access	RW – ALW (SNVM)
Default Value	2
Lower Limit	0x0
Upper Limit	0x7F

Sub-Index	003
Description	Update Bit
Access	RW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x10

Sub-Index	004
Description	Autopilot Mode
Access	RW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	005
Description	Config Offset
Access	RW
Default Value	0x0 Value=1 Start Zero Offset
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	006
Description	Human Master
Access	RO
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

### 3.12.13 Object 2102h FF Move Back Gain

This parameter describes the move back gain when Move Back Mode is enable

#### 3.12.13.1 Object Description

Index	2102h
Name	Max Move Back Gain
Object Code	Variable
Data Type	UNSIGNED32
Category	0:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	150
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

### 3.12.14 Object 2103h FF Sync Target Torque

This parameter describes the Target Torque from Torque Sensor in Sync Mode (received by RPDO).

#### 3.12.14.1 Object Description

Index	2103h
Name	FF Sync Target Torque
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW
PDO Mapping	YES
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF
Unit	internal

### 3.12.15 Object 2104h FF Sync Tharget Position

This parameter describes the Target Position in Sync Mode. The value is received by RPDO.

#### 3.12.15.1 Object Description

Index	2105h
Name	FF Sync Target Position
Object Code	Variable
Data Type	INTEGER32
Category	O:ff
Access	RW
PDO Mapping	YES
Default Value	0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	internal

### 3.12.16 Object 2105h FF Sync Actual Torque

This parameter describes the Actual Torque from Torque Sensor in Sync Mode (transmitted by TPDO).

#### 3.12.16.1 Object Description

Index	2105h
Name	FF Sync Actual Torque
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW
PDO Mapping	YES
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF
Unit	internal

### 3.12.17 Object 2106h FF Sync Actual Position

This parameter describes the Actual Position in Sync Mode. The value is transmitted by TPDO.

#### 3.12.17.1 Object Description

Index	2106h
Name	FF Sync Actual Position
Object Code	Variable
Data Type	INTEGER32
Category	O:ff
Access	RW
PDO Mapping	YES
Default Value	0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	internal

### 3.12.18 Object 2107h FF Torque Sensor

This parameter select the active Torque Sensor

0: External Sensor

1: Internal (Motor Torque)

#### 3.12.18.1 Object Description

Index	2107h
Name	FF Torque Sensor
Object Code	Variable
Data Type	UNSIGNED8
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0
Lower Limit	0x0
Upper Limit	0x1

### 3.12.19 Object 2108h FF Turbulence Force

This parameter describes the Force in Turbulence Mode

#### 3.12.19.1 Object Description

Index	2108h
Name	FF Turbulence Force
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW
PDO Mapping	NO
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.12.20 Object 2109h FF Turbulence Time

This parameter describes the Time Turbulence is active

#### 3.12.20.1 Object Description

Index	2109h
Name	Turbulence Time
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x64
Lower Limit	0x0
Upper Limit	0x7FFF
Unit	100us

### 3.12.21 Object 2110h FF State Ist

Bit1: Master / Slave / Bit2: Move back is running/Bit3-16: Actual Target Torque in Sync Mode2

#### 3.12.21.1 Object Description

Index	2110h
Name	FF State Ist
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.12.22 Object 2111h FF State Soll

Bit1: Master / Slave / Bit2: Move back is running / Bit3-16: Actual Target Torque in Sync Mode2

#### 3.12.22.1 Object Description

Index	2111h
Name	FF State Soll
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.12.23 Object 2112h FF Sync Delta

Delta position between Drive1 & Drive2 im Sync Mode

#### 3.12.23.1 Object Description

Index	2112h
Name	FF Sync Delta
Object Code	Variable
Data Type	INTEGER32
Category	O:ff
Access	RO
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x7FFFFFFF
Upper Limit	0x80000000
Unit	inc

### 3.12.24 Object 2113h FF Force Profile

Force Profile for Linear Increase Mode

#### 3.12.24.1 Object Description

Index	2113
Name	FF Force Profile
Object Code	Array
Number of Elements	9
Data Type	UNSIGNED16
PDO Mapping	NO
Category	O:ff

#### 3.12.24.2 Entry Description

Sub-Index	001
Description	Start Force
Access	RW – ALW (SNVM)
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	intern

Sub-Index	002-009
Description	Force 2-9
Access	RW – ALW (SNVM)
Lower Limit	0
Upper Limit	0x7FFF
Unit	intern

### 3.12.25 Object 2114h FF Force Profile Scale Factor

Force Profile Scale Factor for Linear Increase Mode

#### 3.12.25.1 Object Description

Index	2114h
Name	FF Force Profile Scale Factor
Object Code	Variable
Data Type	UNSIGNED16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x64
Lower Limit	0x0
Upper Limit	0x3E8
Unit	%

### 3.12.26 Object 2116h FF Trim Position

Trimming position

#### 3.12.26.1 Object Description

Index	2116h
Name	FF Trim Position
Object Code	Variable
Data Type	INTEGER32
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF
Unit	inc

### 3.12.27 Object 2117h FF Autopilot Position

Target Position when Autopilot Mode is enabled. Velocity is set by object 0x60FF Target Velocity

#### 3.12.27.1 Object Description

Index	2117h
Name	FF Autopilot Position
Object Code	Variable
Data Type	INTEGER32
Category	O:ff
Access	RW – ALW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x7FFFFFFF
Upper Limit	0x80000000
Unit	inc

### 3.12.28 Object 2118h FF Autopilot Position Force

Force when Autopilot Mode is enabled.

#### 3.12.28.1 Object Description

Index	2118h
Name	FF Autopilot Position Force
Object Code	Variable
Data Type	UNSIGNED16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0xC8
Lower Limit	0x0
Upper Limit	0xFFFF
Unit	

### 3.12.29 Object 2119h FF Soft Limit

User Limit of position. Force profile is scaled to this limit

#### 3.12.29.1 Object Description

Index	2119h
Name	FF Soft Limit
Object Code	Variable
Data Type	INTEGER32
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x2710
Lower Limit	0x0
Upper Limit	0x7FFFFFFF
Unit	inc



### 3.12.30 Object 211Ah FF Manual Offset Force

Manual Offset Adjust for force sensor

#### 3.12.30.1 Object Description

Index	211Ah
Name	FF Manual Offset Force
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF
Unit	

### 3.12.31 Object 211Bh FF Sensor Error

Maximum Force Value

#### 3.12.31.1 Object Description

Index	211Bh
Name	FF Sensor Error
Object Code	Variable
Data Type	UNSIGNED16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x76C
Lower Limit	0x0
Upper Limit	0x776
Unit	

### 3.12.32 Object 211Ch FF Trim Step

Maximum Trim Step on change.

Example Value=100: FF Trim Position 0x2116 change from 0 to 3000

Time = (3000-0)/100\*10ms=300ms / 0x2116 needs 300ms to reach (0...100...200.....1500.....3000)

#### 3.12.32.1 Object Description

Index	211Ch
Name	FF Trim Step
Object Code	Variable
Data Type	UNSIGNED16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x64
Lower Limit	0x0 (Step off)
Upper Limit	0xFFFF
Unit	

### 3.12.33 Object 211Dh FF Friction Regulator

Settings for Friction Regulator

#### 3.12.33.1 Object Description

Index	211D
Name	FF Friction Regulator
Object Code	Array
Number of Elements	10
Data Type	INTEGER16
PDO Mapping	NO
Category	O:ff

#### 3.12.33.2 Entry Description

Sub-Index	001
Description	Enable
Access	RW – ALW (SNVM)
Lower Limit	0x0
Upper Limit	0x4
Unit	0: Disable 1: Enable

Sub-Index	002
Description	Friction Value
Access	RW – ALW (SNVM)
Lower Limit	0
Upper Limit	0x7FFF
Unit	(force)

Sub-Index	003
Description	Detect Friction Value
Access	RW – ALW
Lower Limit	0
Upper Limit	0x1
Unit	0: Do nothing 1: Detect Value

Sub-Index	004
Description	Max Friction
Access	RW – ALW
Lower Limit	0
Upper Limit	0x00C8
Unit	(force)

Sub-Index	005
Description	Friction Time
Access	RW – ALW
Lower Limit	0
Upper Limit	0x7FFF
Unit	ms

Sub-Index	006
Description	Move Sensor Offset Value
Access	RW – ALW
Lower Limit	0
Upper Limit	0x0064
Unit	(force)
Sub-Index	007
Description	Force Compensation Max
Access	RW – ALW (SNVM)
Lower Limit	0
Upper Limit	0x03E8
Unit	(force)

Sub-Index	008
Description	Force Compensation Ist
Access	RO
Lower Limit	0
Upper Limit	0x0
Unit	(force)

Sub-Index	009
Description	Force Compensation Gear Factor
Access	RW – ALW (SNVM)
Lower Limit	1
Upper Limit	0x7FFF
Unit	(force)

Sub-Index	010
Description	Wait Init Time (Wait Time after init)
Access	RW – ALW (SNVM)
Lower Limit	0
Upper Limit	0x1E
Unit	s

Sub-Index	011
Description	Constant Friction (Set an additional Friction)
Access	RW – ALW (SNVM)
Lower Limit	0
Upper Limit	0x7FFF
Unit	(force)

### 3.12.34 Object 0x211E FF Scale Factor Step

Maximum Scale Factor Step on change.

Example Value=5: FF Force Profile Scale Factor 0x2114 change from 100% to 200%

Time =  $(200-100)/5 \cdot 10\text{ms} = 200\text{ms}$  / 0x2114 needs 200ms to reach (100...105...110.....150.....200%)

#### 3.12.34.1 Object Description

Index	211Eh
Name	FF Scale Factor Step
Object Code	Variable
Data Type	UNSIGNED16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x5
Lower Limit	0x0 (Step off)
Upper Limit	0xFFFF
Unit	Change/10ms

### 3.12.35 Object 0x211F Manual Offset off Position

Off Position FF Manual Offset Force

#### 3.12.35.1 Object Description

Index	211Fh
Name	FF Scale Factor Step
Object Code	Variable
Data Type	INTEGER16
Category	O:ff
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0x28
Lower Limit	0x14
0x7FFF	0x7FFF
Unit	

### 3.13 Digital I/O

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

#### 3.13.1 Object 2080h Inputs Debounce Time

Adjustable Debounce time for all inputs

##### 3.13.1.1 Object Description

Index	2080h
Name	Inputs Debounce Time
Object Code	Array
Number of Elements	6
Data Type	UNSIGNED16
Category	Manufacturer specific

##### 3.13.1.2 Entry Description

Sub-Index	001-008
Description	IN1-IN8
Access	RW – ALW
PDO Mapping	No
Default Value	0x1
Lower Limit	0x00000000
Upper Limit	0xFFFF
Unit	50us

Sub-Index	009
Access	RO
Description	Reset Taster
Default Value	0x64

Sub-Index	010
Access	RO
Description	Exdchin Debounce Time
Default Value	0x64

### 3.13.2 Object 2088h Digital inputs from Analog

Bit 0-7 Analog Input 2

Bit 8-15 Analog Input 3

#### 3.13.2.1 Object Description

Index	2088h
Name	Limit Switch Option Code
Object Code	Variable
Data Type	INTEGER16
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Default Value	0
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.13.3 Object 2081h-2084h Input1-4 Mapping

Mapping of Input to an Object when state is change

#### 3.13.3.1 Object Description

Index	2081h -2084h
Name	Input 1-4 Mapping
Object Code	Record
Number of Elements	6
Data Type	INPUTS
Category	Manufacturer specific

#### 3.13.3.2 Entry Description

Sub-Index	001
Description	State of input
Data Type	BOOLEAN
Access	RO
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	002
Description	Trigger cond Bit0 Edge Negative 0 Bit1 Edge Positive 0 Bit2 Edge Negative 1 Bit3 Edge Positive 1
Data Type	UNSIGNED8
Access	RW – ALW (SNVM 0x2081/0x2082)
PDO Mapping	No
Default Value	0x2081/0x2082=0x9 0x2083/0x2084=0x0
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	003
Description	Object index (if Value=0 no mapping)
Data Type	UNSIGNED16
Access	RW – ALW (SNVM 0x2081/0x2082)
PDO Mapping	No
Default Value	0x2081/0x2082=0x2085 0x2083/0x2084=0x0
Lower Limit	0x0
Upper Limit	0xFFFF

Sub-Index	004
Description	Sub index
Data Type	UNSIGNED8
Access	RW – ALW (SNVM 0x2081/0x2082)
PDO Mapping	No
Default Value	0x2081=1 0x2082=2 0x2083/0x2084=0
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	005
Description	Data on
Data Type	UNSIGNED16
Access	RW – ALW (SNVM 0x2081/0x2082)
PDO Mapping	No
Default Value	0x2081/0x2082=0x1 0x2083/0x2084=0x0
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	006
Description	Data off
Data Type	UNSIGNED16
Access	RW – ALW (SNVM 0x2081/0x2082)
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFF

### 3.13.4 Object 2085h Limit switch

Negative and positive limit switch objects

#### 3.13.4.1 Object Description

Index	2085h
Name	Limit Switch
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED8
Category	Manufacturer specific

#### 3.13.4.2 Entry Description

Sub-Index	001
Description	Negative limit switch
Access	RO
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

Sub-Index	002
Access	RO
Description	Positive limit switch

### 3.13.5 Object 2086h Analog In Settings

Sub-index 1&2:  $ANIN0(2032.9) = ANIN0 * ScaleFactorNum / ScaleFactorDenom$

Sub-index 3&4: Object in which Data from ANIN0 is mapped

Example: Object=60FF (p402\_target\_velocity)

Subindex=0; Anin0 will control the velocity in PV Mode

#### 3.13.5.1 Object Description

Index	2086h
Name	Analog In Settings
Object Code	Array
Number of Elements	6
Data Type	INTEGER16
PDO Mapping	No
Category	Manufacturer specific

#### 3.13.5.2 Entry Description

Sub-Index	001
Description	Scale Factor Numerator
Access	RW – ALW (SNVM)
Default Value	0x1
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	002
Description	Scale Factor Denominator
Access	RW – ALW (SNVM)
Default Value	0x1
Lower Limit	0x1
Upper Limit	0x7FFF



Sub-Index	003
Description	Map to Object
Access	RW – ALW (SNVM)
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFF

Sub-Index	004
Description	Map to Subindex
Access	RW – ALW (SNVM)
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFF

Sub-Index	005
Description	Delta Min delta on ANIN0 from last value to write new value
Access	RW – ALW (SNVM)
Default Value	0x64
Lower Limit	0x0
Upper Limit	0x7FFF

Sub-Index	006
Description	Update Mode Bit1 Update ProfileVelocity Mode Objects Bit2 Update ProfilePosition Mode Objects Bit3 Update ProfileTorque Mode Objects
Access	RW – ALW (SNVM)
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFF

### 3.13.6 Object 2187h Polarity Input

Set Polarity for Digital Inputs

#### 3.13.6.1 Object Description

Index	2187h
Name	Polarity input 01h to 08h
Object Code	Variable
Data Type	UNSIGNED8
Category	Manufacturer specific
Access	RW – ALW (SNVM)
PDO Mapping	NO
Default Value	0xFF (XXXX1111) all normal (XXXX0000) all invers
Lower Limit	0x00
Upper Limit	0xFF
Unit	Bit

### 3.13.7 Object 2223h Digital Outputs Mirror

A mirror of Object 0x60FE.1

#### 3.13.7.1 Object Description

Index	2223h
Name	Limit Switch
Object Code	Array
Number of Elements	4
Data Type	BOOLEAN
PDO Mapping	No
Category	Manufacturer specific

#### 3.13.7.2 Entry Description

Sub-Index	001-004
Description	Digital Output 1-4
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1

### 3.13.8 Object 60FDh Digital Input

This object gives the present value of the digital inputs of the amplifier. The lower 16 bits are defined by the device profile and are unused in this device. The upper 16 bits give the raw values of the inputs connected to the amplifier. Input1 to 4 can be mapped to any object see 3.13.3 Object 2081h-2084h Input1-4 Mapping

Bits	Description
Bit 0	Negative Limit Switch
Bit 1	Positive Limit Switch
Bit 2-15	Reserved
Bit 16	Input1 (external)
Bit 17	Input2 (external)
Bit 18	Input3 (external)
Bit 19	Input4 (external)
Bit 20	Input5 (external)
Bit 21	Input6 (external)
Bit 22	Input7 (external)
Bit 23	Input8 (external)
Bit 24	Reset Taster (internal)
Bit 25	DCHIN (internal)
Bit 26-31	Unused

#### 3.13.8.1 Object Description

Index	60FDh
Name	Digital Input
Object Code	Variable
Data Type	UNSIGNED32
Category	O: Optional
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x0
Upper Limit	0xFFFF

### 3.13.9 Object 60FEh Digital Outputs

Settings for Digital Outputs

Bits	Description
Bit 0-15	Unused
Bit 16	Output1 (external)
Bit 17	Output 2 (external)
Bit 18	Output 3 (external)
Bit 19	FAN (internal)
Bit 20	PR_E (internal)
Bit 21	DCH_OUT (external)
Bit 22	LED1 (internal)
Bit 23	Output 4 (external)
Bit 24-31	Unused

#### 3.13.9.1 Object Description

Index	60FEh
Name	Digital Output
Object Code	Array
Number of Elements	2
Data Type	UNSIGNED32
Category	O: Optional

#### 3.13.9.2 Entry Description

Sub-Index	001
Description	Physical outputs 0=Switch Off / 1=Switch On
Access	RW – ALW (SNVM)
PDO Mapping	YES
Lower Limit	0x0
Upper Limit	0xFFFFFFFF

Sub-Index	002
Description	Output Mask 0=Disable output / 1= Enable Output
Access	RW – ALW (SNVM)
PDO Mapping	NO
Lower Limit	0
Upper Limit	0xFFFFFFFF

### 3.14 OMR (Optical mark recognition)

This section describes the Objects OMR Reading for paper cutters in the drive  
For detail description see the OMR Reading manual for AC Servo Drive

#### 3.14.1 Object 2140 OMR Track 1

Settings for the first OMR Reader

##### 3.14.1.1 Object Description

Index	2140h
Name	OMR Track 1
Object Code	Array
Number of Elements	14
Data Type	INTEGER32
Category	Manufacturer specific
Access	RW – ALW
PDO Mapping	No

##### 3.14.1.2 Entry Description

Sub-Index	001
Description	Window ON Number of clocks to activate the reading after the start
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF

Sub-Index	002
Description	Window OFF Number of clocks to deactivate the reading after the start
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF

Sub-Index	003
Description	Number of marks / Maximum number of marks
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x40

Sub-Index	004
Description	Open Window Number of minimum clocks to recognized a mark as valid
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF

Sub-Index	005
Description	Close Window Number of maximum clocks to recognized a mark as valid
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF

Sub-Index	006
Description	First Mark / Number of maximum clocks to wait for first mark
Access	RW – ALW
PDO Mapping	No
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF

Sub-Index	007
Description	T Count / Theoretical distance between two marks
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x7FFFFFFF

Sub-Index	008
Description	Mode Bit0 : SW Start Start of mark reading Bit1: Turn direction of encoder Bit2: Reserved Bit3: Reserved Bit4: Polarity of Reader1 Input (0=normal) Bit5: Polarity of Reader2 Input (0=normal) Bit6: Activation of the Reader1 (0=disabled) Bit6: Activation of the Reader2 (0=disabled)
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

Sub-Index	009
Description	Data0 0 / LSB Reading Data OMR1 (64Bit)
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

Sub-Index	010
Description	Data0 1 / MSB Reading Data OMR1 (64Bit)
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

Sub-Index	011
Description	Data0 0 / LSB Reading Data OMR2 (64Bit)
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

Sub-Index	012
Description	Data0 1 / MSB Reading Data OMR2 (64Bit)
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

Sub-Index	013
Description	Status
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x80000000
Upper Limit	0x7FFFFFFF

Sub-Index	015
Description	Input selection for OMR1
Default Value	0x5
Lower Limit	0x0
Upper Limit	0x8

Sub-Index	016
Description	Input selection for OMR2
Default Value	0x6
Lower Limit	0x0
Upper Limit	0x8

### 3.14.2 Object 2141 OMR Track 2

Settings for the second OMR Track. See Object 2140 OMR Track1

### 3.15 Hole Sync

This section describes the Objects Hole Sync for paper cutters in the drive  
For detail description see the Hole Sync manual for AC Servo Drive

#### 3.15.1 Object 2160 Hole Sync

Settings for Hole Sync

##### 3.15.1.1 Object Description

Index	2160h
Name	Hole Sync
Object Code	Array
Number of Elements	7
Data Type	INTEGER16
Category	Manufacturer specific

##### 3.15.1.2 Entry Description

Sub-Index	001
Description	Hole Min
Access	RW – ALW
PDO Mapping	No
Default Value	0x78
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	002
Description	Hole Max
Access	RW – ALW
PDO Mapping	No
Default Value	0xC8
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	003
Description	Centre Hole Min
Access	RW – ALW
PDO Mapping	No
Default Value	0x1B0
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	004
Description	Hole Counter
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF



Sub-Index	005
Description	Distance To Last Centre
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	006
Description	State (unused)
Access	RO
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

Sub-Index	007
Description	Hole Command 0=Stop 1=Start 4=Init
Access	RW – ALW
PDO Mapping	YES
Default Value	0x0
Lower Limit	0x8000
Upper Limit	0x7FFF

### 3.16 Safety

Objects for safety, for reference read the manual for the appropriate AC-Servo Drive

#### 3.16.1 Object 2024 Redundant Safety Module CPU1

Setup for the Safety Module on CPU1

##### 3.16.1.1 Object Description

Index	2024h
Name	Redundant Safety Module
Object Code	Array
Number of Elements	13
Data Type	UNSIGNED16
Category	Manufacturer specific

##### 3.16.1.2 Entry Description

Sub-Index	001
Description	Reset Safety
Access	RW – ALW
PDO Mapping	Yes
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1 (Reset a safety error)

Sub-Index	002
Description	STO / SS1 Options
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1 (1 = STO / 2 = SS1)

Sub-Index	003
Description	SBC Options (Safe Brake Control)
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1 (1 = SBC Enabled)

Sub-Index	004
Description	SLS Options (Safely Limited Speed)
Access	RW – ALW
Default Value	0x0
Lower Limit	0x0
Upper Limit	0x1 (1 = SLS Enabled)

Sub-Index	005
Description	Safety State CPU2
Access	RO
Description	Bit0 (STO Active ) Bit1 (SS1 Active) Bit 2 (SLS Active) Bit 3 (COM Error)

Sub-Index	006
Description	Safety State CPU1
Access	RO
Description	Bit0 (STO Active ) Bit1 (SS1 Active) Bit 2 (SLS Active) Bit 3 (SBC Active) Bit 4 (COM Error) Bit 5 (SBC OVC Error) Bit 6 (SBC Drv Error) Bit 7 (CPU2 Ready) Bit 8 (STO IN Error) Bit 9 (SLS IN Error) Bit 10 (Checksum Error) Bit 11 (Relay State)

Sub-Index	008
Description	Reserved for SBC Wait Time

Sub-Index	009
Description	SLS Wait Time (Time to Safe Speed after activation)
Access	RW – ALW
Default Value	0x3E8
Lower Limit	0x0
Upper Limit	0x2710
Unit	ms

Sub-Index	010
Description	SLS Speed Limit (Time to Safe Speed after activation)
Access	RW – ALW
Default Value	0x3E8
Lower Limit	0x0
Upper Limit	0x2710
Unit	ms

Sub-Index	011
Description	SLS Speed Upper Limit
Access	RW – ALW
Default Value	0x64 (100% = SLS Speed Limit)
Lower Limit	0x64 (100%)
Upper Limit	0xC8 (200% 2x SLS Speed Limit)
Unit	%

Sub-Index	012
Description	SLS Response Time
Access	RW – ALW
Default Value	0x64
Lower Limit	0x0
Upper Limit	0x3E8
Unit	ms

Sub-Index	013
Description	Checksum Master (Checksum of the settings) must be equal to Checksum of CPU2
Access	RO

### 3.16.2 Object 2025 Redundant Safety State CPU2

State of the Safety CPU2

#### 3.16.2.1 Object Description

Index	2025h
Name	Redundant Safety State CPU2
Object Code	Array
9	9
Data Type	UNSIGNED16
Category	Manufacturer specific

Sub-Index	001
Description	State CPU2
Access	RO
Description	<div> <div> Bit0 (STO/SS1 IN )  Bit1 (SLS IN)  Bit 2 (Driver Enabled IN)  Bit 3 (STO Master)  Bit 4 (SS1 Master)  Bit 5 (SLS Master)  Bit 6 (COM Master)  Bit 7 (SUPPLY ERROR)  Bit 11 (Relay State) </div> <div> Bit 8 (STO Out)  Bit 9 (Brake Out)  Bit 10 (State LED)  Bit 11 (STO/SS1 LED)  Bit 12 (SLS LED)  Bit 13 (SBC LED)  Bit 14 (Self Test Run)  Bit 15 (Ready) </div> </div>

Sub-Index	02
Description	On Time
Access	RO
Unit	s

Sub-Index	03
Description	Software Version
Access	RO

Sub-Index	04
Description	Hardware Version
Access	RO

Sub-Index	05
Description	Power Supply 3.3V
Access	RO
Unit	mV

Sub-Index	06
Description	Power Supply 15V
Access	RO
Unit	mV

Sub-Index	07
Description	Temperature CPU2
Access	RO
Unit	°C

Sub-Index	08
Description	Motor Speed CPU2
Access	RO
Unit	RPM

Sub-Index	09
Description	Checksum Slave (Checksum CPU2) must be equal to Checksum of CPU1
Access	RO

### 3.16.3 Object 2026 Redundant Safety Speed CPU1

Safety Speed CPU1

#### 3.16.3.1 Object Description

Index	2026h
Name	Redundant Safety Autoreset
Object Code	Variable
Data Type	INTEGER32
Category	Manufacturer specific
Access	RO
PDO Mapping	NO
Unit	RPM

### 3.16.4 Object 2027 Redundant Safety Autoreset

#### 3.16.4.1 Object Description

Index	2027h
Name	Redundant Safety Autoreset
Object Code	Variable
Data Type	INTEGER16
Category	Manufacturer specific
Access	RW – ALW (SNVM)
PDO Mapping	NO
Description	0=1 Autoreset Off / 1 = Autoreset On

## 4 Info

### 4.1 REFERENCES

- /1/ CiA DS301 Communication Profile for Industrial Systems
- /2/ CiA DSP402 Device Profile for Drives and Motion Control
- /3/ CAN specification ISO 11898

### 4.2 CONVENTIONS & DEFINITIONS

Numbers followed by “h” are hexadecimal. Numbers followed by “b” are binary.  
All other numbers are decimal.

Abbreviations:

Pp	Profile Position Mode
pv	Profile Velocity Mode
hm	Homing Mode
ip	Interpolated Position Mode
csp	Cyclic Synchronous Position Mode
csv	Cyclic Synchronous Velocity Mode
tq	Profile Torque Mode0
ff	Force Feedback Mode
all	Mandatory for all modes
dc	Device Control
pc	Position Control Function

RO read only

WO write only

RW read/write

BEH Brunner Elektronik AG