CANopen-630

SSD DRIVES

CANopen

Product Manual

07-05-03-04-E-V1004.doc

Further descriptions, that relate to this document:

UL: 07-01-08-02 	631 – Product manual
UL: 07-01-05-06 	635 - Product manual
UL: 07-02-08-03 	637 - Product manual
UL: 07-02-09-01 	637+ - Product manual
UL: 07-02-10-01 	637f - Product manual
CiA Draft Standard 201-207	CAL; CAN Application Layer for Industrial Applications
CiA Draft Standard 301	CANopen; CAL-based Communication Profile for Industrial Systems
CiA Draft Standard 402	CANopen Device Profile; Drives and Motion Control

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Made in Germany, 2004

Contents

Thanks for your confidence choosing our product.

These operating instructions present themselves as an overview of the technical data and features.

Please read the operating instructions before operating the product.

If you have any questions, please contact your nearest SSD Drives representative.
Improper application of the product in combination with dangerous voltage can lead to injuries.
In addition, damage can also occur to motors or other products.
Therefore please observe our safety precautions strictly.

Safety precautions

We assume that, as an expert, you are familiar with the relevant safety regulations, especially in accordance with VDE 0100, VDE 0113,VDE 0160, EN 50178, the accident prevention regulations of the employers liability insurance company and the DIN regulations and that you are able to use and apply them.
As well, relevant European Directives must be observed.

Depending on the kind of application, additional regulations e.g. UL, DIN are subject to be observed.
If our products are operated in connection with components from other manufacturers, their operating instructions are also subject to be observed strictly.

1 630 Introduction to CAN

1.1 Target group

This documentation describes the functionality of 630 series drives inside a CAN network.
You should be familiar with the basic functions of the 630 drives and with the setup and diagnosis software EASYRIDER®.
The hard- and software you use with the 630 series CAN interface must comply with the guidelines by the CiA.

1.2 Basic properties of the CAN-bus

In contrast to other fieldbus systems, CAN-bus does not operate in a station-based way but uses a (**object oriented**) content-addressing.

This means that the useful data is seen as objects to which names are assigned. Priorities (**identifiers**) for bus access are given to these message objects in the target system under which they can then be requested or sent, respectively.
This feature offers the advantage that the bus is used exclusively by stations with which a transmission request is queued. Thus the bus is not burdened unnecessarily as, for example, with the polling process.

A further advantage with CAN is the **Multi-Master Capability**. This means that each user on the bus has the same access rights. The access authorization alone controls the users among one another via the priority of the communication objects and their **identifiers** (arbitration). This allows direct communication between the individual users without a time-consuming "detour" over a central master.

A CAN telegramm may contain up to **8 byte of user data**.

1.2.1 Transmission

The maximum bus length is depending on the chosen baud rate:

20kBit/s	approx.	**800 m**
50kBit/s	approx.	**600 m**
125kBit/s	approx.	**500 m**
250kBit/s	approx.	**250 m**
500kBit/s	approx.	**100 m**
800kBit/s	approx.	**50 m**
1MBit/s	max.	**25 m**

The 630 series drives support all the baud rates listed above.

The user organisation **CiA** (**C**AN **i**n **a**utomation) has declared the bus medium according to ISO/DIS 11898 as their standard. This standard is also supported by the 635/637.
A **shielded twisted pair cable** is to be used as the bus cable. (for pin assignment see chapter 3)

1.3 Attaching the 630 series drives to the CAN-bus

Before using the drive on the CAN-bus you should consider the following questions:

A. How many devices(nodes) will be connected to the bus? (also count additional nodes for future extensions)
B. What is the maximum cable length?
C. Which configuration is needed?

The answers to these questions determine the parameters for baud rate, identifier assignment and configuration mode.

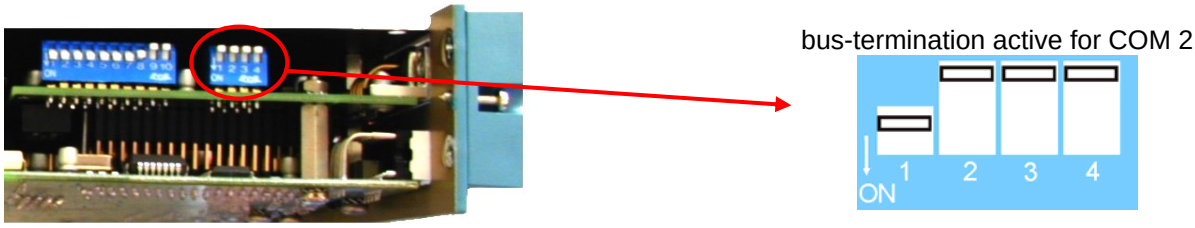
Physical medium

The CAN interface is galvanically isolated. A CAN-transceiver on the 635/637 can be used for coupling onto the bus in accordance with **ISO/DIS 11898**.

Bus termination

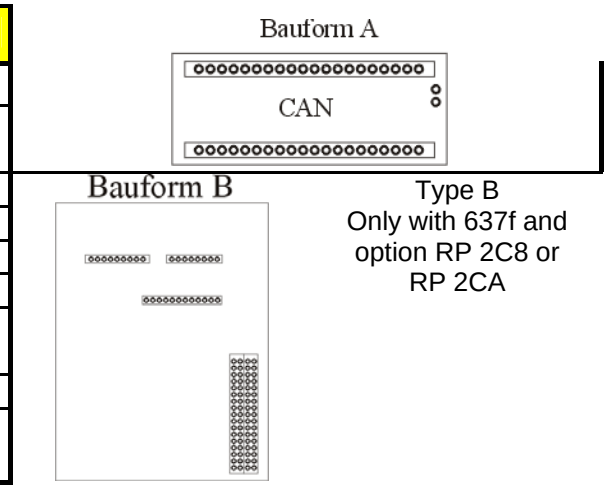
A defined quiescence level on the bus must be guaranteed for communication. It is necessary to use terminal resistors on both ends of the line.
This must be done with special bus plugs with which there is a resistance of approx. 124Ω between CAN_L and CAN_H.
With a 637f and either one of the options RP-2C8 or RP-2Ca you can enable a bus termination resistor by acitvating the DIL-switch 1 for bus-termination.

637f with option RP-2C8 or RP-2CA

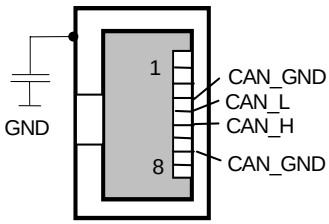
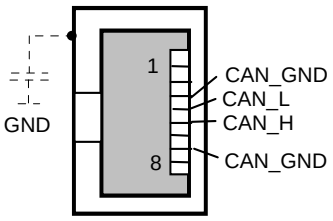


1.3.1 Pin assignment for COM2 - 635/637/637+/637f drive

Pin	Description	Name
1	-	-
2	CAN_L wire (dominant low)	CAN_L
3	Ground	GND
4	-	-
5	-	-
6	Ground	GND
7	CAN_H wire (dominant high)	CAN_H
8	-	-
9	-	-



1.3.2 Pin assignment for X20/21 CAN – 631 drive

Pin	Function	X20	X21
	X20 and X21 are identically and internal switched in parallel with all pins.(X20 = X21) Therfore bus-wiring is easy.	8-pole Modular Jack, screened 	8-pole Modular Jack, screened 
-	internal conn. to GND via capacitor	Case: Shielding	Case: Shielding
1			
2			
3	CAN_GND reference galvanically separated. Coupling-resistor to PE / GND: 1MΩ		
4	CAN_L (dominant low)		
5	CAN_H (dominant high)		
6			
7	(CAN_GND, like Pin 3)		
8			

This Pin-Assignment is related to „CiA Draft Recommendation DR-303, V0.1 / 16.10.98“. The wires on Pins 3/6 and 4/5 should be twisted pairs.

1.4 Configuration modes

Since the CAN-bus functionality of the 630 series drives is constantly advancing different configuration modes had to be realized over the time.

Configuration mode	Properties
0: PC configuration	Addressing is defined through manual input with EASYRIDER. The communication relationships and data contents is statically predefined.
1: PC configuration with node numbers offset	Addressing and node numbers are defined through manual input with EASYRIDER. Data contents is statically predefined.
2: PC configuration + Wait for IBT-communication	Addressing is defined through manual input with EASYRIDER. Data contents is statically predefined. In addition the drive waites for data transfer with the IBT before starting automatic operation mode.
3: CANopen configuration DS301	Addressing is done conforming to the CANopen standard DS301, data contents for PDO1 and PDO2 are statically predefined.
4: CANopen configuration DS402	Addressing and control is done conforming to the CANopen standard DS402 Motion Profil incl. PDO-mapping functions.
5: CANopen configuration DS301+ PDO mapping	Addressing is done conforming to the CANopen standard DS402 Motion Profil incl. PDO-mapping functions. The control of the DS402 State-machine is being ignored. 6040h,6041h control- and statusword are not being evaluated.

1.5 Configuration

Short list of instructions for initializing the 635/637 for CAN bus connection

Initializing the CAN bus connection on the 635/637 can be done with the EASYRIDER software.

- Configuration is done by opening → **Commissioning** → **Fieldbus**

  Here you can adjust the appropriate parameters.
  You must specify the following configuration data:
  - **Configuration mode**
  - **IDENTIFIER or node number (or DIL Switch)**
  - **baud rate (or DIL-Switch)**
  - **reaction on bus-interruption**

- By pressing the Enter key, the initialization data is send to the 630 drive.
- The data has to be saved into the EEPROM bei pressing F7.

Connect the 630 drive with the bus cable.

Open the fieldbus diagnosis in EASYRIDER by chosing „Diagnosis/Fieldbusdiagnosis“ from the menu and check for working communication.

2 CANopen Introduction

2.1 Definitions and abbreviations

CAN	**Controller Area Network**	
CAL	CAN Application Layer	
CMS	CAN Message	A service element in the application layer.
COB	Communication Object	Transport unit within the CAN networt. Data must be transmitted through the CAN network in a COB.
COB-ID	COB-Identifier	Definite allocation of the COB. The identifier defines the priority of the COB within the bus communication.
DBT	Distributer	The DBT supports dynamic assignment of identifiers between one module (DBT master) and another one (DBT slaves).
LMT	Layer Management	A service element in the application layer (CAN reference model). Is necessary to configure parameters in the single layers.
NMT	Network Management	A service element in the application layer (CAN reference model). NMT performs the initialization, configuration and error management within the bus communication.
SDO	Service Data Object	A data element with low priority. Is necessary for configuration of the bus node.
PDO	Process Data Object	A data element with high priority. Is necessary for real-time data transfer.
RTR	Remote Transmission Request	Data request telegram (without data content)

Further the following shortcuts are used in this manual:

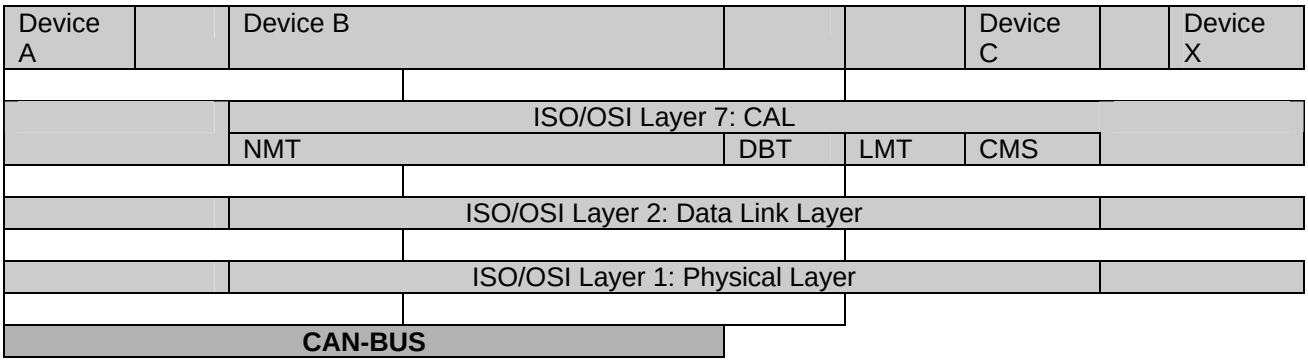
FC	Function code	Determines the kind of message which is trasmitted via bus.
KN	Node number	Definite allocation of the bus node.
LSB	Last Significant Bit/ Byte	Least significant bit/byte
MSB	Most Significant Bit/ Byte	Most significant bit/byte
ro	read only	Utility, resp. parameter can only be read.
rw	read/write	Utility, resp. parameter can be read as well as written.
wo	write only	Utility, resp. parameter can only be written.

Number representation: If not specified otherwise decimals are indicated as digits without suffix (e.g. 1234). Hexadecimal values are identified with a h behind the digits(e.g. 0123h).

2.2 General inforation to CANopen

CANopen is a standard, acquired by the association CiA „CAN in Automation“.

The concept of the CAN communication can be described with the ISO-OSI reference model for interfaces.



The specifications of the definitions and functions of CANopen communication according to this reference model are documented by the CiA in the following manuals:

CiA Draft Standard 201-207	CAL; CAN Application Layer for Industrial Application	This documentation specifies the general management of the network and the transmission of objects.
CiA Draft Standard 301	CANopen; CAL-based Communication Profil for Industrial Systems	This documentation concretizes the definitions according to Draft 201-207 and specifies the structure of the object directory and the access to CANopen devices.
CiA Draft Standard 402	CANopen Devices Profile; Drives and Motion Control	This documentation includes all definitions for drive controllers in a CANopen network.

The supported functions for controllers of 630 series, by these standards according to CAL and CANopen, are described in this manual.

2.3 General structure of data transfer

The data transfer in CAN is made via message telegrams. Basically the telegrams can be divided schematically in COB-ID and 8 following bytes:

COB-ID	8 bytes of user data							
11 Bit	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7

2.4 The COB-ID

The COB-ID (communication object identifier) is the message address of a data packet in a CANopen network.
The valence of the message address determines the priority of the message at concurrent transmission of several stations. The message address with value 0 has highest priority.

The 11 bit of the COB-Identifier are composed as follows:

10	9	8	7	6	5	4	3	2	1	0
function code				node number						

The COB-Identifier comprises the definite allocation of the message object. It is composed of the function code, which takes the different kinds of messages into account; and the node number, which is definite allocated to each device.
The node number will be set via EASYRIDER for Windows software.
The node number is composed of seven bits (1- 127).

2.5 The function codes

The following function codes are available:

(rx) and (tx) are relates to the slave (drive)!

Object	Function code (binary)	Result. COB-ID	hexadecimal	Communication parameter Fixing at index
NMT	0000	0	0h	
SYNC	0001	128	80h	(1005h)
Emergency	0001	129-255	81h-FFh	(1014h)
PDO1 (tx)	0011	385-511	181h-1FFh	1800h, 1A00h
PDO1 (rx)	0100	513-639	201h-27Fh	1400h, 1600h
PDO2 (tx)	0101	641-767	281h-2FFh	1801h, 1A01h
PDO2 (rx)	0110	769-895	301h-37Fh	1401h, 1601h
PDO3 (tx)	0111	897-1023	381h-3FFh	1802h, 1A02h
PDO3 (rx)	1000	1025-1151	401h-47Fh	1402h, 1602h
PDO4 (tx)	1001	1153-1279	481h-4FFh	1803h, 1A03h
PDO4 (rx)	1010	1281-1407	501h-57Fh	1403h, 1603h
SDO (tx)	1011	1049-1535	581h-5FFh	
SDO (rx)	1011	1537-1663	601h-67Fh	
Node guarding	1110	1793-1919	701h-77Fh	(100Eh)

Which objects are used and supported by a device, is fixed in the object library of the device.
This object library for each device is stored in the EDS file (electronical data sheet).
All EDS files for the SSD Drives devices are stored on the installation CD of the EASYRIDER for Windows software or on the website www.SSDDrives.de.

3 630 CANopen SDO message

SDO accesses are always triggered by the master control. At this it can be a matter of both a read request and a write request, which must be acknowledged by the controller.

With the SDO services access (write and read of parameters) to the object library of the controller is possible.
SDO telegrams are structured as follows:

COB-ID	Command	Index		Subindex	Service data			
11Bit	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
		LSB	MSB		LSB			MSB

Note: SDO telegrams always have a telegram length of 8 byte.
Not used data bytes will be transmitted with 0!

The command byte

The command byte includes the request mode of the message telegram.
At this it's distinguished between a set-parameter-telegram (domain download),
a request-telegram (domain upload) and alarm messages (warnings).
Via the set-parameter-telegram parameterization data will be transmitted to the controller.
Via the request-telegram the stored parameterization data can be returned (read back) into the master.
Alarm messages will be returned from the controller to the master, if a transmitted telegram can not be executed.

Command	Function	Telegram mode			Action
22h, 23h, 2Bh,2Fh (*)	domain download	Request master	→	drive	send parameter to drive
60	domain download	Confirmation drive	→	master	parameter adopted
40h	domain upload	Request master	→	drive	read parameter
43h, 4Bh, 4Fh (*)	domain upload expedited	Response drive	→	master	send parameter to master
61h	domain upload normal	Response drive	→	master	parameter length to master
60h (70h)	domain upload segment	Request master	→	drive	read segment parameter
80h	warning	Response drive	→	master	transmission error

(*) The value of the command byte determines the data length of the read parameter!

Command	Data length	Data type
22h, 23h, 43h	4 Byte	Unsigned 32
2B, 4Bh	2 Byte	Unsigned 16
2F, 4F	1 Byte	Unsigned 8

4 Object library

In the object library all parameters and services available, as well as their characteristics, are fixed.

Index	Name	Object code	Data type	Access	PDO mapping
1000h	device type	VAR	Unsigned 32	ro	-
1001h	error register	VAR	Unsigned 8	ro	-
1002h	manufacturer status register	VAR	Unsigned 32	ro	-
1003h	Pre-defined error field	ARRAY	Unsigned 32	ro	-
1004h	number of PDO's supported	ARRAY	Unsigned 32	ro	-
1005h	COB-ID SYNC	VAR	Unsigned 32	rw	-
1006h	communication cycle period	VAR	Unsigned 32	rw	-
1008h	manufacturer device name	VAR	Visible string	ro	-
1009h	manufacturer hardware version	VAR	Visible string	ro	-
100Ah	manufacturer software version	VAR	Visible string	ro	-
100Bh	Node-ID	VAR	Unsigned 32	ro	-
100Ch	Guard time	VAR	Unsigned 16	rw	-
100Dh	life time factor	VAR	Unsigned 8	rw	-
1010h	store parameters	VAR	Unsigned 32	rw	-
1011h	restore parameters	VAR	Unsigned 32	rw	-
1014h	COB-ID EMCY	VAR	Unsigned 32	rw	-
1015h	Inhibit time EMCY	VAR	Unsigned 16	rw	-
1018h	Identity object	RECORD	Identity	ro	-
PDO communication- and mapping parameters					
1400h	receive PDO1 parameter	RECORD	PDO CommPar	rw	-
1401h	receive PDO2 parameter	RECORD	PDO CommPar	rw	-
1402h	receive PDO3 parameter	RECORD	PDO CommPar	rw	-
1403h	receive PDO4 parameter	RECORD	PDO CommPar	rw	-
1600h	receive PDO1 mapping parameter	RECORD	PDO CommPar	rw	-
1601h	receive PDO2 mapping parameter	RECORD	PDO CommPar	rw	-
1602h	receive PDO3 mapping parameter	RECORD	PDO CommPar	rw	-
1603h	receive PDO4 mapping parameter	RECORD	PDO CommPar	rw	-
1800h	transmit PDO1 parameter	RECORD	PDO CommPar	rw	-
1801h	transmit PDO2 parameter	RECORD	PDO CommPar	rw	-
1802h	transmit PDO3 parameter	RECORD	PDO CommPar	rw	-
1803h	transmit PDO4 parameter	RECORD	PDO CommPar	rw	-
1A00h	transmit PDO1 mapping parameter	RECORD	PDO CommPar	rw	-
1A01h	transmit PDO2 mapping parameter	RECORD	PDO CommPar	rw	-
1A02h	transmit PDO3 mapping parameter	RECORD	PDO CommPar	rw	-
1A03h	transmit PDO4 mapping parameter	RECORD	PDO CommPar	rw	-
Manufacturer specific parameters					
2014h	PDO transmit mask	RECORD	Unsigned 32	rw	-
2015h	PDO transmit mask	RECORD	Unsigned 32	rw	-
2016h	PDO transmit mask	RECORD	Unsigned 32	rw	-
2017h	PDO transmit mask	RECORD	Unsigned 32	rw	-
2018h	NMT operational state	VAR	Unsigned 16	rw	-
2019h	REMOTE-->LOCAL STATE	VAR	Unsigned 16	rw	-

Index	Name	Object code	Data type	Access	PDO mapping
4000h	Parameter_00	VAR	Unsigned 32	rw	-
. . .					
4044h	Parameter_44	VAR	Unsigned 32	rw	-

4100h	Variable 0	VAR	Unsigned 32	rw	possible
. . .					
41FFh	Variable 255	VAR	Unsigned 32	rw	possible
4200h	Actual position 2	VAR	Unsigned 32	rw	possible
4201h	Actual position 3	VAR	Unsigned 32	rw	possible

4800h	Checksums	ARRAY	Unsigned 16	ro	possible
4801h	BIAS-Information	ARRAY	Unsinged 32	ro	possible
4802h	Module information	ARRAY	Unsigned 16	ro	possible
4803h	Drive information	ARRAY	Unsigned 16	ro	possible

Index	Name	Object code	Data type	Access	PDO mapping
Device profile parameters					
6040h	controlword	VAR	unsigned 16	rw	possible
6041h	statusword	VAR	unsigned 16	ro	possible
6042h	vl_target_velocity	VAR	integer 16		possible
6043h	vl_velocity_demand	VAR	integer 16		possible
6044h	vl_velocity_efford	VAR	integer 16		possible
6046h	vl_velocity_min_max amount	VAR	unsigned 32		
6048h	vl_velocity_acceleration	VAR	unsigned 32		
6048h	vl_velocity_deceleration	VAR	unsigned 32		
605Ah	quick_stop_option_code	VAR	integer 16		
6060h	modes_of_operation	VAR	integer 8		possible
6061h	modes_of_operation_display	VAR	integer 8		possible
6062h	Position demand value*	VAR	integer 32	ro	
6063h	actual value*	VAR	integer 32	ro	possible
6064h	actual value	VAR	integer 32	ro	possible
6065h	following error window	VAR	unsigned 32	rw	possible
6067h	position window	VAR	unsigned 32	rw	
606Ch	actual velocity	VAR	integer 32	ro	possible
607Ah	target position	VAR	integer 32	ro	possible
607Ch	home offset	VAR	integer 32	rw	possible
607Dh	Position limit	VAR	unsigned 32	rw	possible
6080h	Max speed motor	VAR	unsigned 16	rw	possible
6081h	profile velocity	VAR	unsigned 32	rw	possible
6083h	profile acceleration	VAR	unsigned 32	rw	
6084h	profile deceleration	VAR	unsigned 32	rw	
6085h	quick_stop_deceleration	VAR	unsigned 32	rw	
6086h	motion_profile_type	VAR	integer 16	rw	
6098h	homing method	VAR	integer 8	rw	
6099h	homing speed	VAR	integer 32	rw	
60C0h	interpolation submode select	VAR	integer 16	rw	
60C1h	interpolation data record	RECORD	defined in 60C4h	rw	SUB ID 01 (1.Record) possible
60C2h	interpolation time period	RECORD 2 elements		rw	
60C3	interplation sync definition	ARRAY	unsigned 8	rw	
60FDh	digital inputs	VAR	unsigned 32	rw	
60FEh	digital outputs	VAR	RECORD	rw	
6502h	supported drive modes	VAR	unsigned 32	ro	possible

Objects marked by a * are connected to a factor from the factorgroup (here: factor=1).

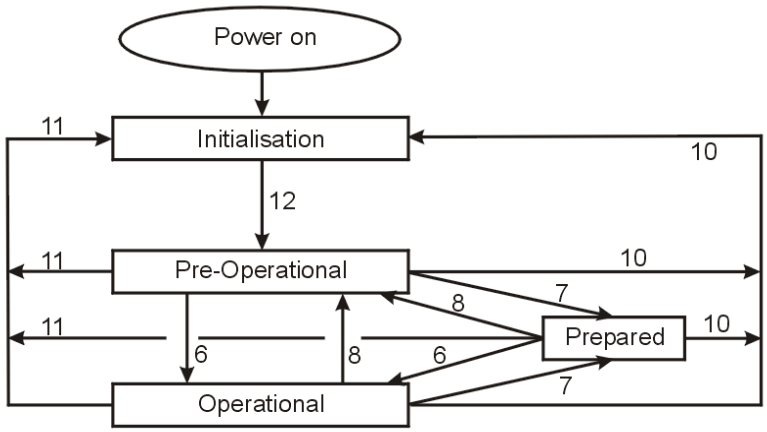
5 CANopen “Error messages with SDO services”

Error code		Description
0601	0000h	Access to the object is not supported (see example)
0602	0000h	Object does not exist in the object list
0604	0041h	Object can not be mapped into the PDO
0604	0042h	Number and length of the mapped objects exceed PDO length
0607	0010h	Message type or message length do not fit the data length of the object
0609	0011h	Sub index does not exist
0609	0030h	Parameter has an invalid value (see example)
0609	0031h	Parameter’s value is too high
0609	0032h	Parameter’s value is too low
0800	0022h	Data can not be written into the device due to the acutal device state (operating mode wrong, PDO not activated or invalid entries)

6 630 Network management according to CANopen DS 301

Precondition for integration of the controller into a CANopen network is a network master, which coordinates the network services (e.g. higher level loop PLC, IPC or host computer).

This master takes over then the NMT (Network Management) services, which enable the configuration, initialization and the error management in a CAN network.
The service element "network management" (NMT) forms the basic premise for operating a CAN network. The task of the NMT is simplified shown by the following state transition diagram.



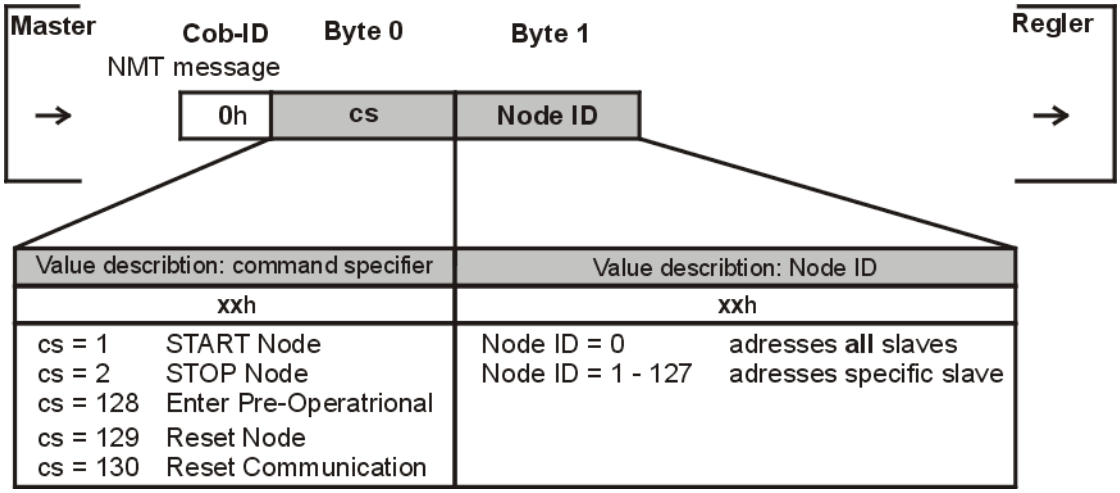
Explanation of the state diagram:
(6) Start_Remote_Node
(7) Stop_Remote_Node
(8) Enter Pre_Operational
(10) Reset_Node
(11) Reset Communication
(12) Initialisation finished- enter Pre-Operational automatically

After power on the controller the CAN interface and the CAN services will be initialized corresponding to the Baud rate and the set node number.

The controller switches then automatically to operating state „Pre-operational“.

In operating state „Pre-operational“ only the SDO services are active!
For performing process data communication (PDO), the controller is to switch to operating state „Operational“ by the net work master (with NMT service „Start remote node“).

Code example:



The respective bus state of the controller is displayed in the EASYRIDER Field bus diagnosis.

7 630 CANopen PDO messages

Process data objects (PDOs) are data packets, which can be transmitted event-controlled in the CAN bus. In contrast to a SDO, for transmission of a PDO there is no handshake provided between sender and receiver.

All devices of the controller series 630 support 4 receive PDOs (PDO1rx – PDO4rx) and 4 transmit PDOs (PDO1tx – PDO4tx).

The fixing of functionality and of data contents of the PDO messages will be set in the object library by the SDO telegrams.

(see following table)

The default settings for the PDOs will be generated with the SDO service 1011h „Restore parameter“ and the SDO service 1010h „Save parameter“.

Modifications of the PDO definitions are permitted in operating state **Pre-operational** only. By writing the parameter „number_of_mapped_objects“ the validity of data will be checked and the function activated. Maximum 8 objects can be defined in a PDO telegram with a maximum length of 8 byte (64 bit).
With the SDO service 1010h „Save parameter“ the last set mapping entries can be stored in the controller power fail-safe.

Activation of the PDOs happens by the NMT command „NMT start node“ at transition to state „**Operational**“.

The controller is configured with the following PDO initial setting:

Receive PDO messages

1. Receive PDO

Index	Subindex	Comment	Default value
1400h	0	number of entries	2
	1	COB-ID used by PDO	200h + Node ID + enable
	2	transmission type	255

1600h	0	number of mapped objects	1
	1	controlword	60400010h
	2-8	optional	0

2. Receive PDO

Index	Subindex	Comment	Default value
1401h	0	number of entries	3
	1	COB-ID used by PDO	300h + Node ID + enable
	2	transmission type	255

1601h	0	number of mapped objects	2
	1	controlword	60400010h
	2	modes_of_operation	60600008h
	3-8	optional	0

3. Receive PDO

Index	Subindex	Comment	Default value
1402h	0	number of entries	3
	1	COB-ID used by PDO	400h + Node ID + disable
	2	transmission type	255

1602h	0	number of mapped objects	2
	1	controlword	60400010h
	2	traget_position	607A0020h
	3-8		0

4. Receive PDO

Index	Subindex	Comment	Default value
1403h	0	number of entries	3
	1	COB-ID used by PDO	500h + Node ID + disable
	2	transmission type	255

1603h	0	number of mapped objects	2
	1	controllword	60400010h
	2	profile velocity	60810020h
	3-8	optional	0

Transmit PDO messages

1. Transmit PDO

Index	Subindex	Comment	Default value
1800h	0	number of entries	5
	1	COB-ID used by PDO	180h + Node ID + enable
	2	transmission type	255
	3	inhibit timer	0
	4	reserved	0
	5	event timer	0

1A00h	0	number of mapped objects	1
	1	statusword	60410010h
	2-8	optional	0

2. Transmit PDO

Index	Subindex	Comment	Default value
1801h	0	number of entries	3
	1	COB-ID used by PDO	280h + Node ID + enable
	2	transmission type	255
	3	inhibit timer	0
	4	reserved	0
	5	event timer	0

1A01h	0	number of mapped objects	2
	1	statusword	60410010h
	2	modes_of_operation_dispay	60610008h
	3-8	optional	0

3. Transmit PDO

Index	Subindex	Comment	Default value
1802h	0	number of entries	5
	1	COB-ID used by PDO	380h + Node ID + disable
	2	transmission type	255
	3	inhibit timer	0
	4	reserved	0
	5	event timer	0

1A02h	0	number of mapped objects	2
	1	statusword	60410010h
	2	position_actual_value	60640020h
	3-8		0

4. Transmit PDO

Index	Subindex	Comment	Default value
1803h	0	number of entries	3
	1	COB-ID used by PDO	480h + Node ID + disable
	2	transmission type	255
	3	inhibit timer	0
	4	reserved	0
	5	event timer	0

1A03h	0	number of mapped objects	2
	1	statusword	60410010h
	2	velocity actual value	606C0020h
	3-8	optional	0

Permissible mapping objects of the controller

Receive PDO mapping objects momentary supported by the controller:

controlword	6040h	0010h	target_velocity	60FFh	0020h
modes_of_operation	6060h	0008h	vl_target_velocity	6042h	0010h
target_position	607Ah	0020h	home_offset	407C	0020h
profile_velocity	6081h	0020h	istpos_2	4200h	0020h
interpolation_data_record	60C1h	0120h	istpos_3	4201h	0020h
			Variable 0 - 255	4100h-41FFH	0020h

Transmit PDO mapping objects momentary supported by the controller:

Statusword	6041h	0010h	digital inputs	60FDh	0020h
modes of operation display	6061h	0008h	digital inputs (low word)	60FDh	0010h
position demand value	6042h	0020h	digital inputs (high word	60FDh	0008h
position actual value (incr.)	6063h	0020h	istpos_2	4200h	0020h
position actual value	6064h	0020h	istpos_3	4201h	0020h
vl velocity demand	6043h	0010h	Variable 0 - 255	4100h-41FFH	0020h
vl velocity effort	6044h	0010h			
velocity actual value	606Ch	0020h			

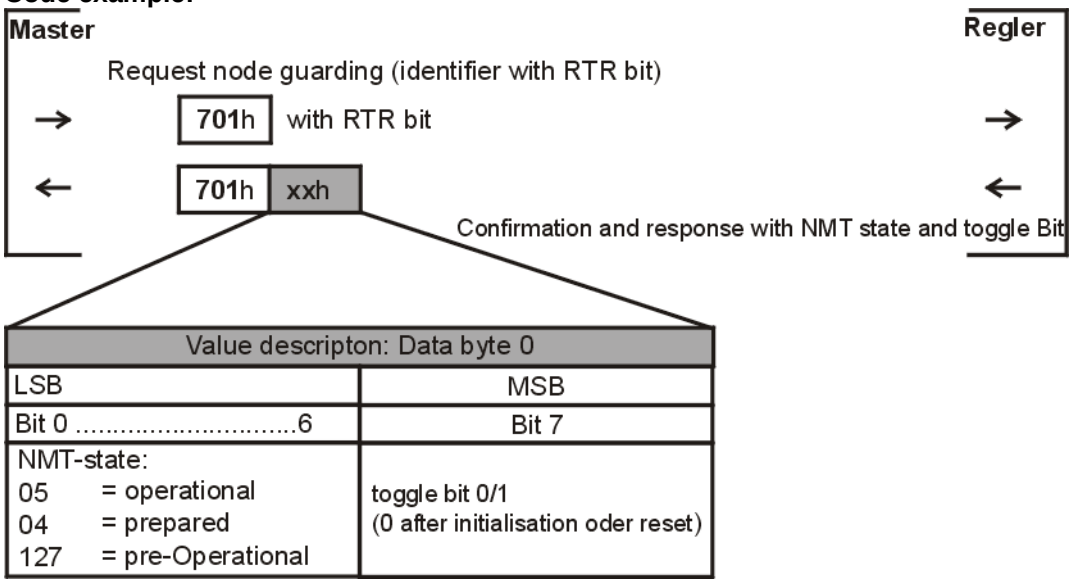
8 630 CANopen Node Guarding

Under employment of the node guard function the bus master can read out the state of the controller with a Remote Transmit Request on the node guarding identifier.

The node monitoring should always be used where the drive is transmitting data via the bus just in irregular intervals (event-controlled). If the controller with other services is in continuous communication with the master, this additional function is not necessary.
After power on the drive the first toggle bit will be always transmitted with 0. By means of the bits 0 - 6 the actual status of the NMT State Machine will always be co-transmitted.

The parameter guard time (Object Index 100Ch) and life time factor (Object Index 100Dh) are not being evaluated by the controller and are always 0 after power on.

Code example:

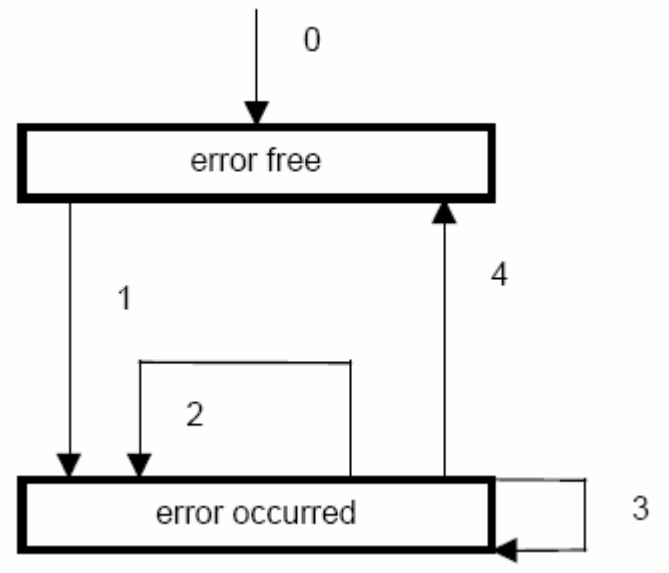


Value descripton: Data byte 0	
LSB	MSB
Bit 0 6	Bit 7
NMT-state: 05 = operational 04 = prepared 127 = pre-Operational	toggle bit 0/1 (0 after initialisation oder reset)

9 EMCY Errorcode

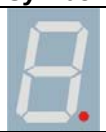
Emergency Object State Diagram

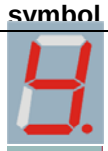
A device may be in one of two emergency states (see figure).
Depending on the transision(1-4) the corresonding emergency telegram is sent.



0. After the initialisation of the drive it enters the „error free“ state if no error has been detected. The message “no error” is being sent.
1. The drive detects an internal error and sets the appropriate error code and the error register in the first three bytes of the emergency telegram. The drive’s state is changing to “error occurred”. An emergency object with the corresponding error code and error register is being sent. The error code is also entered into the array ob object 1003h (pre-defined error field).
2. One error – but not all errors – is cleared. An emergency telegram with error code 0000 (error reset), the still pending errors in ther error register and the manufacturer specific error field is being sent.
3. A new – additional – error occures to the drive. It stays in the “error occurred” state and sends an emergency object with the corresponding error code. The new error code is inserted as first entry of the array of error codes (1003h). The error codes are sorted by the time of appearance – older errors have higher subindices.(refer to object 1003h; max. 8 entries)
4. All errors are cleared. The device changes to the „error free“ state and sends an emergency telegram with the error code „reset error / no error“.

Table 1: Emergency Error Codes 630 drives

Meaning Error group	Error Code (hex)	630 Error register nr. (Obj 1001h)	manuf. specific error field	630 display symbol	supported in drive
Error Reset or No Error 00xx no error	0000h	00h	„Vxxxx“ (ASCCII) xxxx = Firmwareversion i.e. 819d		637f, 631, 635, 637
short circuit/earth leakage 20xx current 22xx Current inside the device	2230h	03h	00h 00h 00h 00h 00h		637f, 631, 635, 637
continuous over current No.1 20xx current 23xx Current, device output side	2311h	03h	00h 00h 00h 00h 00h		637f, 631, 635, 637
continuous over current No.2 20xx current 23xx Current, device output side	2312h	03h	00h 00h 00h 00h 00h		637f, 631, 635, 637
DC link over-voltage 30xx Voltage 32xx Voltage inside the device	3210h	05h	00h 00h 00h 00h 00h		637f, 631, 635, 637
DC link under-voltage 30xx Voltage 32xx Voltage inside the device	3220h	05h	00h 00h 00h 00h 00h		637f, 631, 635, 637
excess temperature device 40xx Temperature 42xx Device Temperature	4210h	09h	00h 00h 00h 00h 00h		637f, 631, 635, 637
excess temperatur drive/motor 40xx Temperature 43xx Drive Temperature	4310h	09h	00h 00h 00h 00h 00h		637f, 631, 635, 637
supply low voltage 50xx Device Hardware 51xx supply	5110h	05h	00h 00h 00h 00h 00h		637f, 635, 637
contact 1 = enable input 50xx Device Hardware 5440 contacts	5441h	81h	00h 00h 00h 00h 00h		637f, 631, 635, 637
contact 2 = X300 missing 50xx Device Hardware 5440 contacts	5442h	81h	00h 00h 00h 00h 00h		637f
contact 3 = RP SBT X290 Pin 3 Safety Stop 50xx Device Hardware 5440 contacts	5443h	81h	00h 00h 00h 00h 00h		637f

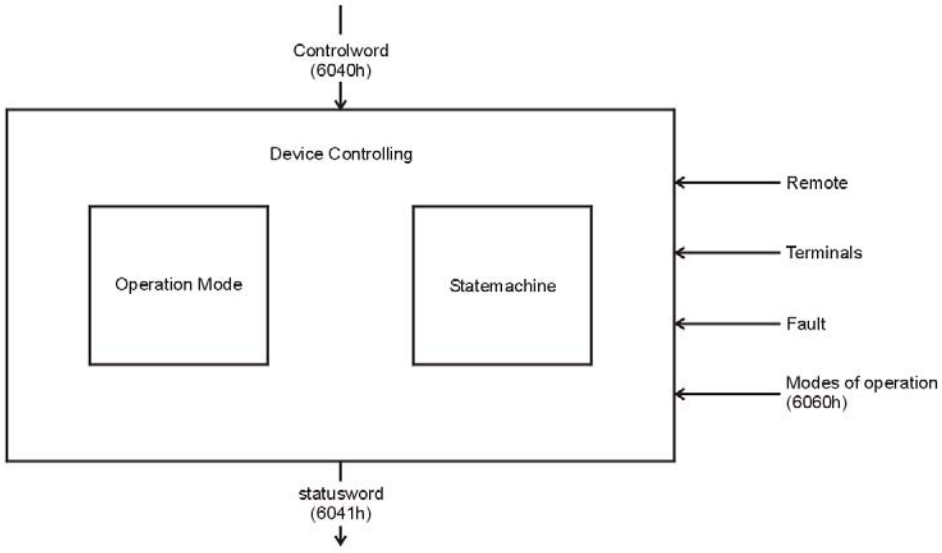
Meaning Error group	Error Code (hex)	630 Error register nr. (Obj 1001h)	manuf. specific error field	630 display symbol	supported in drive
EEPROM 50xx Device Hardware 55xx data storage	5530h	81h	00h 00h 00h 00h 00h		637f, 631, 635, 637
software reset (watchdog) 60xx Device Software	6010h	81h	00h 00h 00h 00h 00h		637f, 631, 635, 637
internal software (X300 code wrong) 60xx Device Software	6100h	81h	00h 00h 00h 00h 00h		637f
user software (BIAS code wrong) 60xx Device Software	6200h	81h	00h 00h 00h 00h 00h		637f, 631, 636, 637 flash
protective circuit brake chopper 70xx Additional Modules 7110 brake chopper	7113h	09h	00h 00h 00h 00h 00h		637f, 631, 635, 637
sensor 70xx Additional Modules	7300h	81h	00h 00h 00h 00h 00h		637f, 631, 635, 637
velocity speed controller 80xx Monitoring	8400h	21h	00h 00h 00h 00h 00h		637f
following error 80xx Monitoring 8600 positioning controller	8611h	21h	00h 00h 00h 00h 00h		637f, 631, 635, 637
reference limit, limt switches 80xx Monitoring 8600 positioning controller	8612h	21h	00h 00h 00h 00h 00h	 right  left  both	637f, 631, 635, 637
sync controller 80xx Monitoring 8600 positioning controller	8700h	21h	00h 00h 00h 00h 00h		637f, 631, 635, 637

See also: **Object 1001h: Error Register**
See also: **Object 1003h: Pre-defined Error Field**

10 CANopen „Device control according to CANopen DS402 "

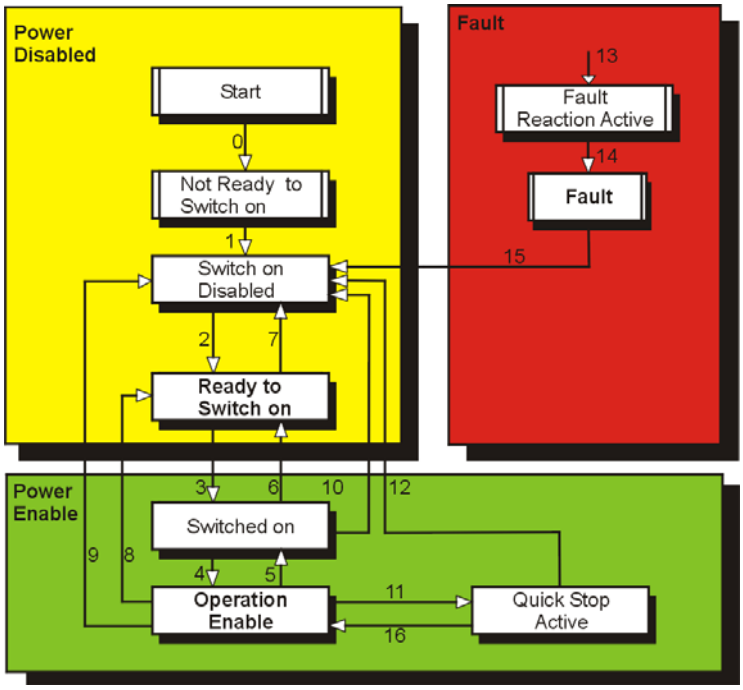
The device control for drive controllers according to CANopen DS 402 standard is described in the State Machine. The State Machine fixes the possible control signals to the controller, the state of the controller and the permissible state changes.
Via the object "controlword" (6040h) the State Machine is being controlled. The actual state of the State Machine can be red out via the object Objekt "statusword" (6041h).

Further effects on the State Machine have the internal error messages, the enable input, local←→ remote commands of the serial interface and the set operation mode.
(Object: 6060h modes of operation)



Note:
After power on the controller is always positioned
in operation mode 1 = Profile Position Mode

10.1 CANopen „State Machine "



10.2 CANopen „States and transitions of the state machine"

State	Meaning	State transitions		cw = controlword sw = statusword bit 15……..……bit0
(Start) **Not Ready to Switch On**	After power on the controller runs its power-up procedure, the power fail-safe values will be loaded as actual values.			cw 0000 0000 0000 0000 sw 0000 0000 0000 0000
		1	The power-up procedure is completed and the CAN communication will be activated.	
		7 9 10 12 15	Disable Voltage or Quick Stop received from **Ready to Switch on** or **Switch on** Disable Voltage from **Enable operation.** Disable Voltage or Quick Stop completed received from **Quick Stop**. Fault Reset (edge) received from **Fault**	cw xxxx xxxx xxxx x00x cw xxxx xxxx xxxx xx0x cw xxxx xxxx 1xxx xxxx
Switch on Disable	Controller checks switch-on conditions: a. Contoller Active Input = 24 V b. Controller is not deactiviert by the serial interface. If the conditions are fullfilled, the remote bit in the statusword will be set and the Shutdown command is being expected.		Bit 9 in statusword „Remote" must be on 1!	sw xxxx xx**0**x x1xx 0000 ↓ sw xxxx xx**1**x x1xx 0000
		2 6 8	Shut down command received from **Switched On** from **Operation Enable**	cw xxxx xxxx xxxx x110 cw xxxx xxxx 1xxx x110
Ready to Switch on	The controller is deactive and is waiting for the Switch On command.			sw xxxx xx1x x01x 0001
		3	Switch on Kommando received	cw xxxx xxxx xxxx x111
Switch On	The controller is deactive and is waiting for the Enable Operation command.			sw xxxx xx1x x01x 0011
		4 16	Enable Operation command received Quick Stop option code dependent	cw xxxx xxxx xxxx 1111
Operation Enable	The controller is activated and is being controlled according to the operating mode			sw xxxx xx1x x01x 0001
		11	Quick Stop command received from **Operation Enable**	cw xxxx xxxx xxxx x01x
Quick Stop	The controller is activated and the Quick Stop function will be executed.			sw xxxx xx1x xx00 0111
	The controller will be deactivated and the fault handling executed.	13 14	Fault occured or Drive active input = 0V (see option Index 2019h)	sw xxxx xx**x**x xx0x 1111
Fault	The controller is deactivated and is waiting (at pending fault) for fault correction resp. Fault Reset edge as CAN command. If the controller has been deactivated via the Active Input only, it will be switched automatically in the operating state **Switch on Disabled** !	15	**Switch on Disable**	sw xxxx xx**x**x xx0x 1111

Verwendung:

See also: Controlword
See also: Statusword

11 630 CANopen DS301 – List of objects

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1000h	CCS		Index		Sub ID	Data			
	r	w							
Device type	43	--	00h	10h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1001h	CCS		Index		Sub ID	Data			
	R	w							
Error register	40	--	01h	10h	0	Unsigned 8	00	00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1002h	CCS		Index		Sub ID	Data			
	r	w							
Manufacturer status register	40	--	02h	10h	0	Unsigned 16 Error-Bit's		Unsigned 16 Status Bit's	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1003h	CCS		Index		Sub ID	Data			
	r	w							
Pre-defined error field	40	2F	03h	10h	0	Unsigned 8	Read: Number of errors (8) Write: 0 = empties the error field		
	40	--			1-8	Unsigned 32 Error fields			
						EMCY Error code		00	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1004h	CCS		Index		Sub ID	Data			
	r	w							
Number of PDO's supported	40	--	04h	10h	0	Unsigned 32 Number of PDO's			
					1	Unsigned 32 number of synchronous PDO's			
					2	Unsigned 32 number of asynchronous PDO's			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1005h	CCS		Index		Sub ID	Data			
	r	w							
COB-ID_Sync message	40	(23)	05h	10h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1006h	CCS		Index		Sub ID	Data			
	r	w							
Communi-cation cycle periode	40	--	06h	10h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1008h	CCS		Index		Sub ID	Data			
	r	w							
Manufacturer device name	40/ 60	--	08h	10h	0	00	00	00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1009h	CCS		Index		Sub ID	Data			
	r	w							
Manufacturer hardware version	40/ 60	--	09h	10h	0	00	00	00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
100Ah	CCS		Index		Sub ID	Data			
	r	w							
Manufacturer software version	40/ 60	--	08h	10h	0	00	00	00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
100Bh	CCS		Index		Sub ID	Data			
	r	w							
Node ID	40	--	0Bh	10h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
100Ch	CCS		Index		Sub ID	Data			
	r	w							
Guard time	40	--	0Ch	10h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
100Dh	CCS		Index		Sub ID	Data			
	r	w							
Life time factor	40	--	0Dh	10h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1010h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entry 1	00	00	00
Store parameter	40		10h	10h	1	Bit 0 1 = device save parameters on command		Bit 1-31 0	
						Unsigned 32			
		23				73h	61h	76h	65h
						„s“	„a“	„v“	„e“

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1011h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entry 1	00	00	00
Restore parameter	40		11h	10h	1	Bit 0 1 = device restore parameters on command		Bit 1-31 0	
						Unsigned 32			
		23				73h	61h	61h	64h
						„l“	„o“	„a“	„d“

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1014h	CCS		Index		Sub ID	Data			
	r	w							
COB-ID Emergency message	40	--	14h	10h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1018h	CCS		Index		Sub ID	Data			
	r	w							
Identity object	40	--	18h	10h	0	Unsigned 8 Number of entries 4	00	00	00
	40	--			1	Unsigned 32 Vendor ID			
	40	--			2	Unsigned 32 Product code			
	40	--			3	Unsigned 32 Revision number			
	40	--			4	Unsigned 32 Serial number			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1400h	CCS		Index		Sub ID	Data			
	r	w							
Receive PDO1 Communi-cation parameter	40	--	00h	14h	0	Unsigned 8 Number of entries 2	00	00	00
	40	23			1	Unsigned 32 COB ID used by PDO			
						Bit 0 - 30			Bit 31
						200h + Node ID			1 = disable
	40	23			2	Unsigned 8 Transmission type			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1401h	CCS		Index		Sub ID	Data			
	r	w							
Receive PDO2 Communi-cation parameter	40	--	01h	14h	0	Unsigned 8 Number of entries 2	00	00	00
	40	23			1	Unsigned 32 COB ID used by PDO			
						Bit 0 - 30			Bit 31
						300h + Node ID			1 = disable
	40	23			2	Unsigned 8 Transmission type			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1402h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entries 2	00	00	00
Receive PDO3 Communi-cation parameter	40	23	02	14h	1	Unsigned 32 COB ID used by PDO			
						Bit 0 - 30			Bit 31
						400h + Node ID			1 = disable
	40	23			2	Unsigned 8 Transmission type			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1403h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entries 2	00	00	00
Recive PDO4 Communi-cation parameter	40	23	03h	14h	1	Unsigned 32 COB ID used by PDO			
						Bit 0 - 30			Bit 31
						500h + Node ID			1 = disable
	40	23			2	Unsigned 8 Transmission type			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1600h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entries 0-8	00	00	00
Recive PDO1 mapping parameter	40	23	00h	16h	1-8	Unsigned 32 PDO mapping information of 1-8th application object to be mapped			
						Length	Sub Index	Index	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1601h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entries 0-8	00	00	00
Recive PDO2 mapping parameter	40	23	01h	16h	1-8	Unsigned 32 PDO mapping information of 1-8th application object to be mapped			
						Length	Sub Index	Index	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1602h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entries 0-8	00	00	00
Recive PDO3 mapping parameter	40	23	02h	16h	1-8	Unsigned 32 PDO mapping information of 1-8th application object to be mapped			
						Length	Sub Index	Index	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1603h	CCS		Index		Sub ID	Data			
	r	w							
	40	--	003	16h	0	Unsigned 8 Number of entries 0-8	00	00	00
Recive PDO4 mapping parameter	40	23			1-8	Unsigned 32 PDO mapping information of 1-8th application object to be mapped			
						Length	Sub Index	Index	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1800h	CCS		Index		Sub ID	Data			
	r	w							
	40	--	00h	18h	0	Unsigned 8 Number of entries 5	00	00	00
	40	23			1	Unsigned 32 COB ID unse by PDO			
						Bit 0 - 30			Bit 31
Transmit PDO1 Communi-cation parameter						180h + Node ID			1 = disable
	40	2F			2	Unsigned 8 Transmission type	00	00	00
	40	2B			3	Unsigned 16 Inhibit time		00	00
	40	2F			4	reserved	00	00	00
	40	2B			5	Unsigned 16 Event timer		00	00

Note: Object 2014h allows to mask event drive PDO1tx information with transmission type 254

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1801h	CCS		Index		Sub ID	Data			
	r	w							
	40	--	01h	18h	0	Unsigned 8 Number of entries 5	00	00	00
	40	23			1	Unsigned 32 COB ID unse by PDO			
						Bit 0 - 30			Bit 31
Transmit PDO2 Communi-cation parameter						280h + Node ID			1 = disable
	40	2F			2	Unsigned 8 Transmission type	00	00	00
	40	2B			3	Unsigned 16 Inhibit time		00	00
	40	2F			4	reserved	00	00	00
	40	2B			5	Unsigned 16 Event timer		00	00

Note: Object 2015h allows to mask event drive PDO2tx information with transmission type 254

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1802h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entries 5	00	00	00
	40	23			1	Unsigned 32 COB ID unse by PDO			
						Bit 0 - 30			Bit 31
Transmit PDO3 Communi-cation parameter						380h + Node ID			1 = disable
	40	2F	02h	18h	2	Unsigned 8 Transmission type	00	00	00
	40	2B			3	Unsigned 16 Inhibit time		00	00
	40	2F			4	reserved	00	00	00
	40	2B			5	Unsigned 16 Event timer		00	00

Note: Object 2016h allows to mask event drive PDO3tx information with transmission type 254

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1803h	CCS		Index		Sub ID	Data			
	r	w							
	40	--			0	Unsigned 8 Number of entries 5	00	00	00
	40	23			1	Unsigned 32 COB ID unse by PDO			
						Bit 0 - 30			Bit 31
Transmit PDO4 Communi-cation parameter						480h + Node ID			1 = disable
	40	2F	03h	18h	2	Unsigned 8 Transmission type	00	00	00
	40	2B			3	Unsigned 16 Inhibit time		00	00
	40	2F			4	reserved	00	00	00
	40	2B			5	Unsigned 16 Event timer		00	00

Note: Object 2017h allows to mask event drive PDO4tx information with transmission type 255

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1A00h	CCS		Index		Sub ID	Data			
	r	w							
Transmit PDO1 mapping parameter	40	--	00h	1Ah	0	Unsigned 8 Number of entries 0-8	00	00	00
	40	23			1-8	Unsigned 32 PDO mapping information of 1-8th application object to be mapped			
						Length	Sub Index	Index	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1A01h	CCS		Index		Sub ID	Data			
	r	w							
Transmit PDO2 mapping parameter	40	--	01h	1Ah	0	Unsigned 8 Number of entries 0-8	00	00	00
	40	23			1-8	Unsigned 32 PDO mapping information of 1-8th application object to be mapped			
						Length	Sub Index	Index	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1A02h	CCS		Index		Sub ID	Data			
	r	w							
Transmit PDO3 mapping parameter	40	--	02h	1Ah	0	Unsigned 8 Number of entries 0-8	00	00	00
	40	23			1-8	Unsigned 32 PDO mapping information of 1-8th application object to be mapped			
						Length	Sub Index	Index	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
1A03h	CCS		Index		Sub ID	Data			
	r	w							
Transmit PDO4 mapping parameter	40	--	03h	1Ah	0	Unsigned 8 Number of entries 0-8	00	00	00
	40	23			1-8	Unsigned 32 PDO mapping information of 1-8th application object to be mapped			
						Length	Sub Index	Index	

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
2014h	CCS		Index		Sub ID	Data			
	r	w							
Transmit PDO1 Mask (manufacturer specific)	40	--	14h	20h	0	Unsigned 8 Number of entries 2	00	00	00
	40	23			1	Unsigned 32 Mask low (Byte 0 – 3) Default value all bits are event driven			
	40	23			2	Unsigned 32 Mask high (Byte 4 – 7) Default value all bits are event driven			

Only valid in transmisstion type 254!! (see object 1800h)

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
2015h	CCS		Index		Sub ID	Data			
	r	w							
Transmit PDO2 Mask (manufacturer specific)	40	--	15h	20h	0	Unsigned 8 Number of entries 2	00	00	00
	40	23			1	Unsigned 32 Mask low (Byte 0 – 3) Default value all bits are event driven			
	40	23			2	Unsigned 32 Mask high (Byte 4 – 7) Default value all bits are event driven			

Only valid in transmisstion type 254!! (see object 1801h)

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
2016h	CCS		Index		Sub ID	Data			
	r	w							
Transmit PDO3 Mask (manufacturer specific)	40	--	16h	20h	0	Unsigned 8 Number of entries 2	00	00	00
	40	23			1	Unsigned 32 Mask low (Byte 0 – 3) Default value all bits are event driven			
	40	23			2	Unsigned 32 Mask high (Byte 4 – 7) Default value all bits are event driven			

Only valid in transmisstion type 254!! (see object 1802h)

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
2017h	CCS		Index		Sub ID	Data			
	r	w							
Transmit PDO4 Mask (manufacturer specific)	40	--	17h	20h	0	Unsigned 8 Number of entries 2	00	00	00
	40	23			1	Unsigned 32 Mask low (Byte 0 – 3) Default value all bits are event driven			
	40	23			2	Unsigned 32 Mask high (Byte 4 – 7) Default value all bits are event driven			

Only valid in transmisstion type 254!! (see object 1803h)

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
2018h	CCS		Index		Sub ID	Data			
	r	w							
NMT operational state (manufacturer specific)	40	2B	18h	20h	0	Unsigned 16 0 = Standard NMT-Mode (**Pre-operational**) 1 = NMT state (**operational** after power on)			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
2019h	CCS		Index		Sub ID	Data			
	r	w							
Remote→ Local State (manufacturer specific)	40	2B	19h	20h	0	Unsigned 16 0 = Remote → local in Switched on disable state 1 = Remote → local in FAULT State			

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Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6040h	CCS		Index		Sub ID	Data			
	r	w							
Controlword	40	2B	40h	60h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6041h	CCS		Index		Sub ID	Data			
	r	w							
Statusword	40	-	41h	60h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6042h	CCS		Index		Sub ID	Data			
	r	w							
vl target velocity	40	2B	42h	60h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6046h	CCS		Index		Sub ID	Data			
	r	w							
vl velocity min max amount	40	--	46h	60h	0	Unsigned 8 Number of entries = 2	00	00	00
	40	23			1	Unsigned 32 vl_velocity_min_amount			
	40	23			2	Unsigned 32 vl_velocity_max_amount			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6048h	CCS		Index		Sub ID	Data			
	r	w							
vl velocity acceleration vl (vl velocity deceleration)	40	--	48h	60h	0	Unsigned 8 Number of entries = 2	00	00	00
	40	23			1	Unsigned 32 delta speed			
	40	2B			2	Unsigned 16 delta time 535s		00	00

Hinweis: Die Funktionen von Beschleunigung und Verzögerung werden im “velocity mode“ symetrisch berechnet!!

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
605A	CCS		Index		Sub ID	Data			
	r	w							
Quick stop option code	40	2B	5Ah	60h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6060h	CCS		Index		Sub ID	Data			
	r	w							
modes of operation	40	2B	60h	60h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6061h	CCS		Index		Sub ID	Data			
	r	w							
modes of operation display	40	2B	61h	60h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6062h	CCS		Index		Sub ID	Data			
	r	w							
Position demad value	40	23	62h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6063h	CCS		Index		Sub ID	Data			
	r	w							
Position actual value*	40	23	63h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6064h	CCS		Index		Sub ID	Data			
	r	w							
Position actual value	40	23	64h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6065h	CCS		Index		Sub ID	Data			
	r	w							
trailing error window	40	23	65h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6067h	CCS		Index		Sub ID	Data			
	r	w							
position window	40	23	67h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
606Ch	CCS		Index		Sub ID	Data			
	ro								
velocity actual value	40		6Ch	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
607Ah	CCS		Index		Sub ID	Data			
	r	w							
target position	43	23	7Ah	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
607Ch	CCS		Index		Sub ID	Data			
	r	w							
home offset	40	23	7Ch	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
607Dh	CCS		Index		Sub ID	Data			
	r	w							
	40	--	7D	60h	0	Unsigned 8 Number of entries = 2	00	00	00
Position limit only 637f	40	23			1	Unsigned 32 Neg. Position limit			
	40	23			2	Unsigned 32 pos. Position limit			

Both values = 0, supervision deactivated.

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
607Fh	CCS		Index		Sub ID	Data			
	r	w							
Max profile velocity	40	23	7Fh	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6080h	CCS		Index		Sub ID	Data			
	r	w							
	40	--	80	60h	0	Unsigned 8 Number of entries = 2	00	00	00
Max motor speed	40	2B			1	Unsigned 16 neg. max motor speed		00	00
	40	2B			2	Unsigned 16 pos. max motor speed		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6081h	CCS		Index		Sub ID	Data			
	r	w							
Profile velocity	40	23	81h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6083h	CCS		Index		Sub ID	Data			
	r	w							
profile acceleration	40	23	83h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6084h	CCS		Index		Sub ID	Data			
	r	w							
profile deceleration	40	23	84h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6085h	CCS		Index		Sub ID	Data			
	r	w							
quick stop deceleration	40	23	85h	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6086h	CCS		Index		Sub ID	Data			
	r	w							
motion profile type	40	2B	86h	60h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6098h	CCS		Index		Sub ID	Data			
	r	w							
homing method	40	2F	98h	60h	0	Unsigned 16 0 = no homing mode -24 ... -1 = 0 ...23 refer to homing method		00	00

The homing modes 0..23 must appear as values -24..-1 in the object.

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6099h	CCS		Index		Sub ID	Data			
	r	w							
Homing speed	40	--	99h	60h	0	Unsigned 8 Number of entries = 2	00	00	00
	40	23			1	Unsigned 32 Homing speed 1			
	40	23			2	Unsigned 32 Homing speed 2 This value is unused with modes -24..-1			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
60C0	CCS		Index		Sub ID	Data			
	r	w							
Interpolation submode select	40	2B	C0	60h	0	Unsigned 16		00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
60C1	CCS		Index		Sub ID	Data			
	r	w							
Interpolation data record	40	--	C1h	60h	0	Unsigned 8 Number of entries = 1	00	00	00
	40	23			1	Unsigned 32 Setpoint			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
60C2	CCS		Index		Sub ID	Data			
	r	w							
Interpolation time period	40	--	C2h	60h	0	Unsigned 8 Number of entries = 2	00	00	00
	40	2F			1	Unsigned 8 Ip time units	00	00	00
	40	2F			2	Unsigned 8 Ip time index	00	00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
60C3	CCS		Index		Sub ID	Data			
	r	w							
Interpolation sync definition	40	--	C3h	60h	0	Unsigned 8 Number of entries = 2	00	00	00
	40	2F			1	Unsigned 8 synchronize on group	00	00	00
	40	2F			2	Unsigned 8 ip sync every n event	00	00	00

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
60FDh	CCS		Index		Sub ID	Data			
	r	w							
Digital inputs 631 635 637f	43	23	FDh	60h	0	Unsigned 32			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
60FEh	CCS		Index		Sub ID	Data			
	r	w							
Digital outputs	40	--	FEh	60h	0	Unsigned 8 Number of entries = 2	00	00	00
	40	23			1	Unsigned 32 Physikal output 631 635/637 637f			
	40	23			2	Unsigned 32 Bit mask 631 635/637/637f			

Objectno.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
6502h	CCS		Index		Sub ID	Data			
	r	w							
supported drive modes	40	--	02h	65h	0	Unsigned 32			

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Object no. 4000h Axis number	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	00	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4001h X40-Mode X40 output resolution	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	01	40h	0	Unsigned 8 X40-Mode	Unsigned 8 X40 output resolution	00	00
	40	2B							

Object no. 4002h 630 operation mode	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	02	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4003h Configuration	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	03	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4004h Delay time for brake	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	04	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4005h "Position reached" low time	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	05	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4006h Ucc Overvoltage	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	06	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4007h Ucc Undervoltage	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	07	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4008h Brake circuit setpoint	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	08	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4009h Brake resistance	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	09	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 400Ah Brake circuit rated power	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	0A	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 400Bh Motor, rated current	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	0B	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 400Ch Motor, number of pole-pairs	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	0C	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 400Dh EMF-Constant	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	0D	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 400Eh Motor, inductance	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	0E	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 400Fh Motor, resistance	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	0F	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4010h Motor, I^2t-monitoring time	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	10	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4011h NTC-Resistance T1	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	11	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4012h NTC-Resistance T2	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	12	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4013h PTC-Resistance	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	13	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4014h Motor, name [1-4]	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	14	40h	0	Unsigned 32			
	40	23							

Object no. 4015h Motor, name [5-8]	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	W	15	40h	0	Unsigned 32			
	40	23							

Object no. 4016h Motor, name [9-12]	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	16	40h	0	Unsigned 32			
	40	23							

Object no. 4017h Motor, name [13-16]	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	17	40h	0	Unsigned 32			
	40	23							

Object no. 4018h Motor, name [17-20]	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	18	40h	0	Unsigned 32			
	40	23							

Object no. 4019h Number of pole-pairs, Encoder	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	19	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 401Ah Phaseshifting at Imax	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	R	w	1A	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 401Bh Motor, max. current	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	1B	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 401Ch Motor, max speed	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	1C	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 401Dh Motor, static current	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	1D	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 401Eh Motor, thermal time constant	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	1E	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 401Fh GGT	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	1F	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4020h Motor, reserved1	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	20	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4021h Drive, limit current	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	21	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4022h P-gain current loop	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	R	w	22	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4023h I-gain current loop	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	23	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4024h P-gain speed loop	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	24	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4025h I-gain speed loop	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	25	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4026h P-gain position loop	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	26	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4027h I-gain position loop	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	27	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4028h V-gain position loop	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	28	40h	0	Unsigned 16		00	00
	4B	2B							

Object no. 4029h Speed	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	29	40h	0	Unsigned 16		00	00
	4B	2B							

Object no. 402A Acceleration	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	2A	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 402Bh Deceleration	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	2B	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 402Ch Position window	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	2C	40h	0	Integer 16		00	00
	40	2B							

Object no. 402Dh Trail window	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	2D	40h	0	Integer 16		00	00
	40	2B							

Object no. 402Eh Trail fault reaction	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	2E	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 402Fh n-Filter	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	2F	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4030h Speed setpoint, 0-window	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	30	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4031h Speed set point, integrator	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	31	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4032h Speed set point, scaling	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	32	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4033h Current set point, scaling	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	33	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4034h 0 offset analog input	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	34	40h	0	Integer 16		00	00
	40	2B							

Object no. 4035h X30 sensor offset	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	35	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4036h ramp filter	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	36	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4037h I/O-Mode E2, E4, E11, E14	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	37	40h	0	Unsigned 32			
	40	23							

Object no. 4038h I/O-Mode E15, E24, E25, A12	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	38	40h	0	Unsigned 32			
	40	23							

Object no. 4039h I/O-Mode A13, A20, A23, res	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	39	40h	0	Unsigned 32			
	40	23							

Object no. 403Ah I/O-Modus reserved	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	3A	40h	0	Unsigned 32			
	40	23							

Object no. 403Bh X40 Input-resolution	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	3B	40h	0	Unsigned 32			
	40	23							

Object no. 403Ch Analog output, scaling MP1 (X10.17)	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	3C	40h	0	Unsigned16		00	00
	40	2B							

Object no. 403Dh Analog output, scaling MP2 (X10.6)	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	3D	40h	0	Unsigned16		00	00
	40	2B							

Object no. 403Eh External current limitation scaling	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	3E	40h	0	Unsigned16		00	00
	40	2B							

Object no. 403Fh Reference-offset	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	3F	40h	0	Unsigned16		00	00
	40	2B							

Object no. 4040h Reference-Latch	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	40	40h	0	Unsigned16		00	00
	40	2B							

Object no. 4041h Rotor position	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	41	40h	0	Unsigned16		00	00
	40	2B							

Object no. 4042h X120 input configuration	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	42	40h	0	Unsigned16		00	00
	40	2B							

Object no. 4043h X120 output configuration	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	43	40h	0	Unsigned 32			
	40	23							

Object no. 4044h SSI-Offset	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	44	40h	0	Unsigned 32			
	40	23							

Object no. 4045h SSI-fault reaction	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	45	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4046h Pole finding mode	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	46	40h	0	Unsigned 16		00	00
	40	2B							

Object no. 4047h Pole finding max. current	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w	47	40h	0	Unsigned 16		00	00
	40	2B							

Objectno. 4048h Shiftfactor speed	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Daten			
	r	w	48	40h	0	Unsigned 8	00	00	00
	40	2F							

Objektnr. 4049h Shiftfactor P-gain	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Daten			
	r	w	49	40h	0	Unsigned 8	00	00	00
	40	2F							

Object no. 4100h - 41FFh Variable 0 . . . Variable 255	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w							
	40	23	00 . . . FF	41h	0	Unsigned 32			

Object no. 4200h Actual pos. 2	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w							
	40	23	00	42h	0	Unsigned 32			

Object no. 4201h Actual pos. 3	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
	CCS		Index		Sub ID	Data			
	r	w							
	40	-	01	42h	0	Unsigned 32			

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
4800h	CCS		Index		Sub ID	Data			
	r	w							
Checksums	40	--	00h	48h	0	Unsigned 8 Number of entries 6	00	00	00
	40	--			1	Unsigned 16 Accumulative checksum, BIAS, profiles, parameter		00	00
	40	--			2	Unsigned 16 Checksum parameter		00	00
	40	--			3	Unsigned 16 Checksum BIAS		00	00
	40	--			4	Unsigned 16 Checksum Profile memory		00	00
	40				5	Unsigned 16 Checksum X300 code		00	00
	40				6	Unsigned 16 Checksum EE2 (reserved)		00	00

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
4801h	CCS		Index		Sub ID	Data			
	r	w							
BIAS Information	40	--	01h	48h	0	Unsigned 8 Number of entries 4	00	00	00
	40	--			1	Unsigned 32 BIAS Statusbits, PLC Statusbits			
	40	--			2	Unsigned 16 BIAS-Block pointer		00	00
	40	--			3	Unsigned 16 PLC-Block pointer		00	00
	40	--			4	Unsigned 16 Mathe-Block pointer		00	00

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
4802h	CCS		Index		Sub ID	Data			
	r	w							
Module-Information	40	--	02h	48h	0	Unsigned 8 Number of entries 4	00	00	00
	40	--			1	Unsigned 16 EX-BUS1(up) Module		00	00
	40	--			2	Unsigned 16 EX-BUS2 (down) Module		00	00
	40	--			3	Unsigned 16 X300-Module		00	00
	40	--			4	Unsigned 16 7-Segment-Display-Nr.		00	00

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
4803h	CCS		Index		Sub ID	Data			
	r	w							
Drive-Information	40	--	03h	48h	0	Unsigned 8 Number of entries 8	00	00	00
	40	--			1	Unsigned 16 I2t-Motor		00	00
	40	--			2	Unsigned 16 I2t-Drive		00	00
	40	--			3	Unsigned 16 Ballast utilisation		00	00
	40	--			4	Unsigned 16 output stage temp.		00	00
	40	--			5	Unsigned 16 Motor temperature		00	00
	40	--			6	Unsigned 16 Ucc-intermediate circuit voltage		00	00
	40	--			7	Unsigned 16 Analog input value X10		00	00
	40	2B			8	Unsigned 16 CAN2 bus-member check (engl.)		00	00

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
4804h	CCS		Index		Sub ID	Data			
	r	w							
CAN-Parameter set	40	--	04h	48h	0	Unsigned 8 Number of entries 7	00	00	00
	40	--			1	Unsigned 8 CAN-node-number	00	00	00
	40				2	Unsigned 8 Bus interruption mode	00	00	00
	40	2B			3	Unsigned 16 Delay		00	00
	40	--			4	Unsigned 8 baud rate	00	00	00
	40	2F			5	Unsigned 8 confi-guration mode	00	00	00
	40	--			6	Unsigned 8 extended identifier	00	00	00
	40	2F			7	Unsigned 8 Send status automatically	00	00	00

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
5000h – 5BFFh	CCS		Index		Sub ID	Data			
BIAS-program-line 0 5000h Part 1	r	w	00	50	0	Unsigned 32			
	40	23				Code	DB1	DB2	DB3
BIAS-program-line 0 5001h Part 2			01	50	0	DB4	DB5	DB6	DB7
. . .			. . .	. . .	. . .	BIAS-command description e. g. BIAS-command „Move Position“			
program-line 1499 5BFEh Part1			FE	5B	0	Code	DB1	DB2	DB3
program-line 1499 5BFFh Part 2			FF	5B	0	DB4	DB5	DB6	DB7

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
5C00h	CCS		Index		Sub ID	Data			
	r	w							
BIAS-program-definitions, general	40	--	00h	5Ch	0	Unsigned 8 Number of entries 25	00	00	00
	40	2B			1	Unsigned 16 BIAS-program start		00	00
	40	2B			2	Unsigned 16 BIAS start Mode		00	00
	40	2B			3	Unsigned 16 PLC start Mode		00	00
	40	2B			4	Unsigned 16 Mathematics start Mode		00	00
	40	23			5	Unsigned 32 BIAS-program name			
						1. Char	2. Char	3. Char	4. Char
					...				
					20	61.Char	62.Char	63. Char	64. Char
	40	23			21	Unsigned 32 BIAS-program date			
						1. Char	2. Char	3. Char	4. Char
					...				
					23	9. Char	10.Char	11.Char	12.Char
	40	23			24	Unsigned 32 BIAS-program version			
						1. Char	2. Char	3. Char	4. Char
	40	23			25	Unsigned 32 BIAS-program version			
						5. Char	6. Char	00	00

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
5C01h	CCS		Index		Sub ID	Data			
	r	w							
EASYRIDER Information	40	--	01h	5Ch	0	Unsigned 8 Number of entries 8	00	00	00
	40	23			1..8	unsigned 32 drive name			

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
5C02h	CCS		Index		Sub ID	Data			
	r	w							
EASYRIDER Information	40	--	02h	5Ch	0	Unsigned 8 Number of entries 9	00	00	00
	40	23			1	Unsigned 32 Number of sprockets drive-sided internal			
	40	23			2	Unsigned 32 Number of sprockets output-sided internal			
	40	23			3	Unsigned 32 Number of sprockets drive-sided external			
	40	23			4	Unsigned 32 Number of sprockets output-sided external			
	40	2B			5	Unsigned 16 Encoder resolution external	00	00	
	40	23			6	Unsigned 32 Units text, internal (Character 1-4)			
	40	23			7	Unsigned 32 Units text, internal (Character 5-7)			00
	40	23			8	Unsigned 32 Units text, external (Character 1-4)			
	40	23			9	Unsigned 32 Units text, external (Character 5-7)			00

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
5C03h	CCS		Index		Sub ID	Data			
	r	w							
EASYRIDER Information	40	--	03h	5Ch	0	Unsigned 8 Number of entries 8	00	00	00
	40	23			1	Unsigned 32 Distance per turn, internal Byte 0-3			
	40	23			2	Unsigned 32 Distance per turn, internal Byte 4-7			
	40	23			3	Unsigned 32 Turn, internal Byte 0-3			
	40	23			4	Unsigned 32 Turn, internal Byte 4-7			
	40	23			5	Unsigned 32 Distance per turn, external Byte 0-3			
	40	23			6	Unsigned 32 Distance per turn, external Byte 4-7			
	40	23			7	Unsigned 32 Turn, external Byte 0-3			
	40	23			8	Unsigned 32 Turn, external Byte 4-7			

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
5C04h	CCS		Index		Sub ID	Data			
	r	w							
EASYRIDER Information	40	--	04h	5Ch	0	Unsigned 8 Number of entries 5	00	00	00
	40	2B			1	Unsigned 16 Identifier: “Parameter “torque“ written“		00	00
	40	23			2	Unsigned 32 Motor, torque Byte 0-3			
	40	23			3	Unsigned 32 Motor, torque Byte 4-7			
	40	23			4	Unsigned 32 Motor, rated moment Byte 0-3			
	40	23			5	Unsigned 32 Motor, rated moment Byte 4-7			

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
5C05h	CCS		Index		Sub ID	Data			
	r	w							
EASYRIDER Information	40	--	05h	5Ch	0	Unsigned 8 Number of entries 4	00	00	00
	40	2B			1	Unsigned 16 Identifier “String written“		00	00
	40	2B			2	Unsigned 16 Encoder resolution		00	00
	40	2B			3	Unsigned 16 Numberof BIAS-Blocks		00	00
	40	23			4	Unsigned 32 Motor inertia * 100			

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
5C10h-5C1F	CCS		Index		Sub ID	Data			
	r	w							
CAM-Profile-definitions Profile 0- 15	40	--	10h	5Ch	0	Unsigned 8 Number of entries	00	00	00
Profile 0	40	2F			1	Unsigned 8 Correct	00	00	00
Profile 0	40	2B			2	Unsigned 8 Max. correction	00	00	00
Profile 0	40	2B			3	Unsigned 16 Number of supporting points		00	00
Profile 0	40	2B			4	Unsigned 16 Sync start address		00	00
Profile 0	40	2B			5	Unsigned 16 Deltamaster		00	00
Profile 0	40	23			6..10	Unsigned 32 Correction value			
Profile 0	40	23			11	Unsigned 32 Master clock			
Profile 0	40	23			12	Unsigned 32 Slave clock			
Profile 0	40	23			13	Unsigned 32 Couple factor			
Profile 0	40	23			14	Unsigned 32 Slave sync distance in incr.			
Profile 0	40	23			15	Unsigned 32 Slave sync inc start			
Profile 0	40	23			16	unsigned 32 slave sync inc stop			
Profile 0	40	2F			17	unsigned 8 Syncmode	00	00	00
Profile 0	40	23			18..20	unsigned 32 reserved			
. . ..			. . .	. . .					
Profile 15	40	2F	1F	5C	17	unsigned 8 Syncmode	00	00	00

Object no.	DB 0		DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7
3000h – 3FFFh	CCS		Index		Sub ID	Data			
	r	w							
Profilememory Supp. point 0 Position	40	23	00	30	0	Position Unsigned 32			
Supp. point 0 IP-Factor			01	30	0	IP-Factor Unsigned 32			
. . .			. . .	. . .	. . .	Profile generation			
Profilememory Supp. point 2047 Position			FE	3F	0	Position Unsigned 32			
Supp. point 2047 IP-Factor			FF	3F	0	IP-Factor Unsigned 32			

14.1 Read unsupported index 1234h

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

Read unsupported index 1234h

→	**601h**	**40h**	**34h**	**12h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**80h**	**34h**	**12h**	**00h**	**00h**	**00h**	**01h**	**06h**	←

Abort and reply with the error code 0601 0000h:
Access to this object is not supported.

14.2 Write an unsupported parameter

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

Write an unsupported parameter

→	**601h**	**2Fh**	**60h**	**60h**	**00h**	**09h**	00h	00h	00h	→
←	**581h**	**80h**	**60h**	**60h**	**00h**	**30h**	**00h**	**09h**	**06h**	←

Abort and reply with the error code 0609 0030h:
Parameter has an invalid value.

14.3 Check device type (read object: 1000h)

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

Check device type (read object 1000h)

→	**601h**	**40h**	**00h**	**10h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**43h**	**00h**	**10h**	**00h**	**92h**	**01h**	**02h**	**00h**	←

Acknowledge and reply with the device type

14.4 Check error register (read object: 1018h)

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

Check error register (read object 1018h)

→	**601h**	**40h**	**18h**	**10h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**4Fh**	**18h**	**10h**	**00h**	**00h**	00h	00h	00h	←

Acknowledge and reply with the error register: The drive is error free.

14.5 Check device status register (read object: 1002h)

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

Check device status register (read object 1002h)

→	**601h**	**40h**	**02h**	**10h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**43h**	**02h**	**10h**	**00h**	**00h**	**00h**	**00h**	**00h**	←

Acknowledge and reply with device status error register
The Drive is active and error free.

14.6 Read Node-ID (read object: 100Bh)

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

Read node ID (read object 100Bh)

→	**601h**	**40h**	**0Bh**	**10h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**43h**	**0Bh**	**10h**	**00h**	**04h**	**00h**	**00h**	**00h**	←

Acknowledge and reply with the node-ID: The drive has node-ID 4

14.7 Initiate segmented upload of manufacturer device name (read object: 1008h) für 631

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

Initiate segmented upload of manufacturer device name (read object: 1008h)

→	**601h**	**40h**	**08h**	**10h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**41h**	**08h**	**10h**	**00h**	**07h**	**00h**	**00h**	**00h**	←

Acknowledge and reply with the length (7 Bytes):

Initiate upload of 7 Bytes of the manufacturer device name

→	**601h**	**60h**	**08h**	**10h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**01h**	**36h**	**33h**	**31h**	**5Fh**	**34h**	**30h**	**32h**	←
			’6’	’3’	’1’	’_’	’4’	’0’	’2’	

Acknowledge and reply with the recognized data block 1“631_402“

14.8 Initialisation of the state machine

Settings : The drive has the node number 1.
The value for the baud rate and all drive parameters are stored in the drive.
The Drive Active Input X10.7 is connected with 24 V DC.

Actions : Power on the drive and send the following commands:

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

1st step: Request **Statusword** from drive (read object 6041h)

→	**601h**	**40h**	**41h**	**60h**	**00h**	00h	00h	00h	00h →
←	**581h**	**4Bh**	**41h**	**60h**	**00h**	**40h**	**02h**	00h	00h ←

Confirmation and return of the Statusword from the contoller 0250h
(Remote bit = 1, Switch on disabled)

2nd step: Send **Shut down** controlword to the drive (write object 6040h)

→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**06h**	**00h**	00h	00h →
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h ←

Confirmation of takeover from drive to master
(Repeat step 1 → if successful: Statusword from drive: 0231h)

3rd step: Send **Switch on** controlword to the drive (write object 6040h)

→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**07h**	**00h**	00h	00h →
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h ←

Confirmation of takeover from drive to master
(Repeat step 1 → if successful: Statusword from drive: 0233h)

4th step: Send **Operation Enable** controlword to the drive (write object 6040h)

→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**0Fh**	**00h**	00h	00h →
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h ←

Confirmation of takeover from drive to master
(Repeat step 1 → if successful: Statusword from drive: 0627h)

14.9 Positionieren über SDO

Settings : The drive is to be move on by 100.000 increments from the actual position with a speed of 1000 min-1 and after attaining the position return by 100.000 increments with a speed of 100 min-1. Steps 1-4 have been successfully executed.

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

5th step: Send speed value 1000 min-1 to the drive (write object 6081h)

→	**601h**	**23h**	**81h**	**60h**	**00h**	**E8h**	**03h**	**00h**	**00h**	→
←	**581h**	**60h**	**81h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

6th step: Send position value 100000 to the drive (write object 607Ah)

→	**601h**	**2Bh**	**7Ah**	**60h**	**00h**	**A0h**	**68h**	**01h**	**00h**	→
←	**581h**	**60h**	**7Ah**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

(Repeat step 1 → Statusword should include the value 0627h → axis stopped)

7th step: Send **new_set_point** and **relative** in the controlword to drive (write object 6040h)

→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**5Fh**	**00h**	00h	00h	→
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

(Repeat step 1 → Statusword should include the value 9227h;
set_point_acknowledge = 1; target reached = 0 → axis moves)

8th step: Reset and send **new_set_point** and **relative** (write object 6040h)

→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**0Fh**	**00h**	00h	00h	→
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

9th step: Send speed value 100 min-1 to the drive (write object 6081h)

→	**601h**	**23h**	**81h**	**60h**	**00h**	**64h**	**00h**	**00h**	**00h**	→
←	**581h**	**60h**	**81h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

10th step: Send position value -100000 to the drive (write object 607Ah)

→	**601h**	**2Bh**	**7Ah**	**60h**	**00h**	**60h**	**79h**	**FEh**	**FFh**	→
←	**581h**	**60h**	**7Ah**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

(Repeat step 1 → Statusword should include the value 062Fh → axis stopped)

11th step: Send **new_set_point** and **relative** in the controlword to drive (write object 6040h)

→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**5Fh**	**00h**	00h	00h	→
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

(Repeat step 1 → Statusword should include the value 9227h;
set_point_acknowledge = 1; target reached = 0 → axis moves)

12th step: Reset **new_set_point** and **relative** in the controlword and send to the drive (write object 6040h)

→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**0Fh**	**00h**	00h	00h	→
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

As a loop it can be continued now with step 5.

14.10 Search for reference (homing) via SDO's

Settings: The telegrams described in 6.1 are executed successfully.
The drive is to be refer to the next zero pulse with a speed of 50 min^{-1} in positive direction (Mode –24, E8h).

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

5th step: Send operating mode **Homing Mode** to the drive (write object 6060h)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**2Fh**	**60h**	**60h**	**00h**	**06h**	**03h**	**00h**	**00h**	→
←	**581h**	**60h**	**60h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

6th step: Check operating mode switchover (read object 6061h)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**40h**	**61h**	**60h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**4Fh**	**61h**	**60h**	**00h**	**06h**	00h	00h	00h	←

Confirmation an return of the operating mode from drive to master

7th step: Send reference speed 50 min^{-1} to the drive (write object 6099h Sub-ID 01)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**23h**	**99h**	**60h**	**01h**	**32h**	**00h**	**00h**	**00h**	→
←	**581h**	**60h**	**99h**	**60h**	**01h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

8th step: Send reference mode, homing method –24 to the drive (write object 6098h)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**2Fh**	**98h**	**60h**	**00h**	**E8h**	00h	00h	00h	→
←	**581h**	**60h**	**98h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

9th step: Send **Homing operation Start** in the controlword to drive (write object 6040h)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**1Fh**	**00h**	00h	00h	→
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

10th step: Request **Statusword** from drive (read object 6041h)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**40h**	**41h**	**60h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**4Bh**	**41h**	**60h**	**00h**	**27h**	**96h**	00h	00h	←

Confirmation and return of the Statusword from drive,
wait till Bit 12 **Homing attained** feeds to 1

11th step: Reset **Homing operation Start** in the controlword and send to the drive (write object 6040h)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**2Bh**	**40h**	**60h**	**00h**	**0Fh**	**00h**	00h	00h	→
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

(Repeat step 1 → Statusword should include the value 9227h;
set_point_acknowledge = 1; target reached = 0 → axis moves)

12th step: Send operating mode **Position Mode** to the drive (write object 6060h)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**2Fh**	**40h**	**60h**	**00h**	**01h**	**00h**	00h	00h	→
←	**581h**	**60h**	**40h**	**60h**	**00h**	00h	00h	00h	00h	←

Confirmation of takeover from drive to master

13th step: Check operating mode switchover (read object 6061h)

	Cob-ID	Command	Index		Sub_ID	Data			
→	**601h**	**40h**	**61h**	**60h**	**00h**	00h	00h	00h	00h	→
←	**581h**	**4Fh**	**61h**	**60h**	**00h**	**01h**	00h	00h	00h	←

Confirmation and return of operating mode from drive to master

14.11 PDO activation and positioning via PDO

Settings: The telegrams described in 6.1 are executed successfully.
The drive is to be move on by 100.000 increments from the actual position with a speed of 1000 min^{-1} and after attaining the position return by 100.000 increments.

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

1st step: Send **PDO1 rx enable** to the drive (write object 1400h, Subindex 1, ID 201h)

→ **601h** **23h** **00h** **14h** **01h** **01h** **02h** **00h** **00h** →

← **581h** **60h** **00h** **14h** **01h** 00h 00h 00h 00h ←

Confirmation of takeover from drive to master

2nd step: Send **PDO1 tx enable** to the drive (write object 1800h, Subindex 1, ID 181h)

→ **601h** **23h** **00h** **18h** **01h** **81h** **01h** **00h** **00h** →

← **581h** **60h** **00h** **18h** **01h** 00h 00h 00h 00h ←

Confirmation and return of operating mode from drive to master

3rd step: Send speed value 1000 min^{-1} to the drive (write object 6081h)

→ **601h** **23h** **81h** **60h** **00h** **E8h** **03h** **00h** **00h** →

← **581h** **60h** **81h** **60h** **00h** 00h 00h 00h 00h ←

Confirmation of takeover from drive to master

4th step: Send position value 100000 to the drive (write object 607Ah)

→ **601h** **23h** **7Ah** **60h** **00h** **A0h** **86h** **01h** **00h** →

← **581h** **60h** **7Ah** **60h** **00h** 00h 00h 00h 00h ←

Confirmation of takeover from drive to master

5th step: Switch on NMT operating mode „**operational**“ for node 1

→ **000h** **01h** **01h** →

eventually check the confirmation of takeover from drive to master by Node guarding

6th step: **Start:** Send **new_set_point** and **relative** controlword (write object 6040h) with PDO

→ **201h** **5Fh** **00h** →

7th step: Receive **PDO tx** Statusword (object 6041h) via PDO , **setpoint acknowledge**

← **181h** **27h** **96h** ←

8th step: Receive **PDO tx** Statusword (object 6041h) via PDO , **target not reached**

← **181h** **27h** **92h** ←

9th step: Receive **PDO tx** Statusword (object 6041h) via PDO , **target reached**

← **181h** **27h** **96h** ←

10th step: **Start:** Reset **new_set_point** in the controlword and send (write object 6040h) with PDO

→ **180h** **4Fh** **00h** →

11th step: Receive **PDO tx** Statusword (object 6041h) via PDO , **setpoint acknowledge**

← **181h** **27h** **06h** ←

12th step: Send position value -100000 to the drive (write object 607Ah)

→ **601h** **40h** **61h** **60h** **00h** **60h** **79h** **FEh** **FFh** →

← **581h** **4Fh** **61h** **60h** **00h** 00h 00h 00h 00h ←

Confirmation of takeover from drive to master

13th step: Start as step 6 etc.

14.12 SYNC PDO initialization and positioning in interpolated position mode via PDO

Settings: After initialization, the drive has to control in Interpolated Position Mode with the SYNC telegram to the position setpoint in the PDO1 rx (interpolation cycle 5 ms).
With the SYNC telegram, status and actual position are to be transmit via PDO1 tx to the master control.

Steps: 1. Initialization of the PDO 1 contents (Mapping of PDO1 tx and PDO1 rx) and activation of the PDO`s in the NMT state Pre-operational !

1.1. – 1.6. PDO1 rx mapping and SYNC mode enable

	Cob-ID	Command	Index		Sub_ID	Data			
	Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)
Master									**Drive**
	1.1st step: PDO1rx Mapping enable (write object 1600h, Subindex 0, number of entries = 0)								
→	**601h**	**2Fh**	**00h**	**16h**	**00h**	**00h**	00h	00h	00h →
←	**581h**	**60h**	**00h**	**16h**	**00h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	1.2nd step: PDO1rx 1.mapped object (write object 1600h, Subindex 1, controlword 6040h)								
→	**601h**	**23h**	**00h**	**16h**	**01h**	**10h**	**00h**	**40h**	**60h** →
←	**581h**	**4Fh**	**00h**	**16h**	**01h**	**06h**	00h	00h	00h ←
	Confirmation and return of operating mode from drive to master								
	1.3rd step: PDO1rx 2.mapped object (write object 1600h, Subindex 2, Ip-data-record 60C1h								
→	**601h**	**23h**	**00h**	**16h**	**02h**	**20h**	**01h**	**C1h**	**60h** →
←	**581h**	**60h**	**00h**	**16h**	**02h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	1.4th step: PDO1rx Mapping entries enable (write object 1600h, Subindex 0, number of entries = 2)								
→	**601h**	**2Fh**	**00h**	**16h**	**00h**	**02h**	00h	00h	00h →
←	**581h**	**60h**	**00h**	**16h**	**00h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	1.5th step: Activate PDO1 rx SYNC transmission (write object 1400h, Subindex 2, mode 1)								
→	**601h**	**2Fh**	**00h**	**14h**	**02h**	**01h**	00h	00h	00h →
←	**581h**	**60h**	**00h**	**14h**	**02h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	1.6th step: Send **PDO1 rx enable** to the drive (write object 1400h, Subindex 1, ID 201h)								
→	**601h**	**23h**	**00h**	**14h**	**01h**	**01h**	**02h**	**00h**	**00h** →
←	**581h**	**60h**	**00h**	**14h**	**01h**	00h	00h	00h	00h ←
	Confirmation and return of the status word from drive to master, wait for bit 12 homeing attained is high								

14.13 SYNC PDO initialization and positioning in interpolated position mode via PDO

1.7 – 1.12 PDO tx mapping und SYNC-Mode enable

	Cob-ID	Command	Index		Sub_ID	Data			
	Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)
Master									**Drive**
	1.7th step: PDO1tx Mapping enable (write object 1A00h, Subindex 0, number of entries = 0)								
→	**601h**	**2Fh**	**00h**	**1Ah**	**00h**	**00h**	00h	00h	00h →
←	**581h**	**60h**	**00h**	**1Ah**	**00h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	1.8th step: PDO1tx 1.mapped object (write object 1A00h, Subindex 1, statusword 6041h)								
→	**601h**	**23h**	**00h**	**1Ah**	**01h**	**10h**	**00h**	**41h**	**60h** →
←	**581h**	**4Fh**	**00h**	**1Ah**	**01h**	**06h**	00h	00h	00h ←
	Confirmation and return of operating mode from drive to master								
	1.9th step: PDO1tx 2.mapped object (write object 1A00h, Subindex 2, real-position 6063h)								
→	**601h**	**23h**	**00h**	**1Ah**	**02h**	**20h**	**00h**	**63h**	**60h** →
←	**581h**	**60h**	**00h**	**1Ah**	**02h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	1.10th step: PDO1tx Mapping entries enable (write object 1600h, Subindex 0, number of entries = 2)								
→	**601h**	**2Fh**	**00h**	**1Ah**	**00h**	**02h**	00h	00h	00h →
←	**581h**	**60h**	**00h**	**1Ah**	**00h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	1.11th step: Activate PDO1 tx SYNC transmission (write object 1800h, Subindex 2, mode 1)								
→	**601h**	**2Fh**	**00h**	**18h**	**02h**	**01h**	00h	00h	00h →
←	**581h**	**60h**	**00h**	**18h**	**02h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	1.12th step: Send **PDO1 tx enable** to the drive (write object 1800h, Subindex 1, ID 181h)								
→	**601h**	**23h**	**00h**	**18h**	**01h**	**01h**	**18h**	**00h**	**00h** →
←	**581h**	**60h**	**00h**	**18h**	**01h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								

2. Initialization of the interpolation time (Object 1006h)

	2.1st step: Send **PDO1 tx enable** to the controller (write object 1006h, 5000 µs = 1388h)								
→	**601h**	**23h**	**06h**	**10h**	**00h**	**88h**	**13h**	**00h**	**00h** →
←	**581h**	**60h**	**06h**	**10h**	**00h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								

14.14 SYNC PDO initialization and positioning in interpolated position mode via PDO

3. Running-up of the State Machine see Chapter 6.1 step 1 – 4

If the State Machine is in „Operation enable“, the operating state Interpolated Position Mode + Operational (NMT, so that PDO’s are running) can be switched on.

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

3.1st step: Send operating mode **Interpolated Position Mode** to the drive (write object 6060h)

→	**601h**	**2Fh**	**60h**	**60h**	**00h**	**07h**	00h	00h	00h →
←	**581h**	**60h**	**60h**	**60h**	**00h**	00h	00h	00h	00h ←

Confirmation of takeover from drive to master

3.2nd step: Check operating mode switchover (read object 6061h)

→	**601h**	**40h**	**61h**	**60h**	**00h**	00h	00h	00h	00h →
←	**581h**	**4Fh**	**61h**	**60h**	**00h**	**07h**	00h	00h	00h ←

Confirmation and return of operating mode from drive to master

3.3rd step: Switch on NMT operating mode „**operational**“ for node 1

→	**000h**	**01h**	**01h** →

eventually check the confirmation of takeover from controller to master by Node guarding

4. SYNC telegram and activation of the Interpolated Position Mode

Cob-ID	Command	Index		Sub_ID	Data			
Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)

Master **Drive**

4.1st step: SYNC telegram cyclically (e.g.: Cycle every 5 ms)

→	**80h** →							
←	**181h**	**27h**	**06h**	**05h**	**00h**	**00h**	**00h** →	

Status and act. value returns from controller via PDO1 tx

every 5ms

4.2nd step: Switch on IP mode in the controlword and send demand value position to the controller via PDO1 rx

→	**200h**	**1F**	**00h**	**05h**	**00h**	**00h**	**00h** →	

4.3rd step: SYNC telegram cyclically (e.g.: Cycle every 5 ms)

→	**80h** →							

14.15 Profile Velocity Mode

Settings: The telegrams described in 6.1 are executed successfully.
The controller is to be turn with 1000 rpm.

Steps: 1. Initialization of the State Machine as in Chapter 6.1

2.1. – 2.3. Loading operating mode and controlling speed

	Cob-ID	Command	Index		Sub_ID	Data			
	Bit 0…10	Byte 0	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3	Byte 4 (LSB)	Byte 5	Byte 6	Byte 7 (MSB)
Master									**Drive**
	2.1st step: Pre-load speed 0 (write object 60FFh, Subindex 0, value = 0)								
→	**601h**	**23h**	**FFh**	**60h**	**00h**	**00h**	**00h**	**00h**	**00h** →
←	**581h**	**60h**	**FFh**	**60h**	**00h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	2.2nd step: Load operating mode 3 (write object 6006h, subindex 0, profile velocity mode=3)								
→	**601h**	**2Fh**	**06h**	**60h**	**00h**	**03h**	00h	00h	00h →
←	**581h**	**60h**	**06h**	**60h**	**00h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								
	2.3rd step: Pre-load speed 1000 (write object 60FFh, Subindex 0, value = 1000)								
→	**601h**	**23h**	**FFh**	**60h**	**00h**	**E8h**	**03h**	**00h**	**00h** →
←	**581h**	**60h**	**FFh**	**60h**	**00h**	00h	00h	00h	00h ←
	Confirmation of takeover from drive to master								

Note: Before switchover in another operating mode, the Object 60FFh must be written with 0 !!

Version	Modification	Chapter	Date	Name	Comment
V0101	Untested edition		19.10.2001	T. Saladin	1. Release with Firmware 631 V 6.14
V0201	Upgrade, Synchmode and IP Position Mode		20.11.2001	T. Saladin	Firmware 6.14b necessary !!
V0301	Example: Synch- and IP Position Mode, Velocity Mode		04.12.2001	T. Saladin	Firmware 6.14b necessary !!
V0401	Additions 635/637/637+ controller		17.12.2001	T.Saladin N.Dreilich	Eurotherm - Format
V0501	Upgrades		15.01.2002	T.Saladin	
V0602	Upgrades PDO3, 4 limit switch, store, restore		23.04.2002	T.Saladin	Firmware 6.15b !!
V0702	Upgrades Index 4000 a. following Chapter 8 Peer to Peer		24.05.2002	T.Saladin	
V0802	Upgrades Index 4000... data take over and value ranges		18.06.2002 10.10.2002	T.Saladin M.Dewald	Firmware 6.15f !! translate
V0904	New manual from the **DOC-LIBRARY**		28.09.2004	ET-Team	Convert from .htm

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