

Ic/A N06x, CANopen

Intelligent Compact drives

Fieldbus manual

V2.00, 12.08



Important information

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or unbraked movements can never be totally excluded without additional safety equipment. For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

See safety section for additional critical instructions.

Not all product variants are available in all countries.

Please consult the current catalogue for information on the availability of product variants.

We reserve the right to make changes during the course of technical developments.

All details provided are technical data and not promised characteristics.

In general, product names must be considered to be trademarks of the respective owners, even if not specifically identified as such.

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Writing conventions and symbols

Work steps If work steps must be carried out in sequence, they are shown as follows:

- Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Important response to this work step
- ▶ Step 2

If a response to a work step is specified, this will inform you that the step has been carried out correctly.

Unless otherwise stated, the individual instruction steps must be carried in the given sequence.

Lists Lists can be sorted alphanumerically or by priority. Lists are structured as follows:

- Point 1
- Point 2
 - Subpoint to 2
 - Subpoint to 2
- Point 3

Making work easier Information on making work easier can be found at this symbol:



*This offers supplementary information on making work easier.
See the chapter on safety for an explanation of the safety instructions.*

Parameters Parameters are shown as follows:

Group.Name Index:Subindex

1 Introduction

1.1 Documentation and literature references

IcIA documentation Installation and the field bus mode of compact drives are described in separate manuals. The manuals can be obtained individually in a bound form in the two languages German and English. (see Chapter ...for order numbers 8 "Accessories and spare parts".)

The device manual introduces you to the compact drives and informs you about all steps required to install the drive. Once you allocate the signals for manual operation you can already begin executing a first function test.

The full scope of the performance of compact drives can, however, only be used in field bus mode. This field bus manual leads you through programming of compact drives and shows you how you can implement the operating modes and functions of the drive.

Supplier catalogues Field bus components, CAN-PHYSICAL MEDIA, DeviceNet/CANopen-The company Turck

Wiring of compact drives *IcIA* in the fieldbus

CAN literature references CAN field bus technology

- Controller Area Network
Basics, protocols, logic arrays, applications Konrad Etschberger,
Carl Hanser Verlag ISBN 3-446-19431-2

CANopen literature references The following standards for CANopen are obtainable from CiA.

- ISO/DIS 11898 , Controller Area Network (CAN) for High Speed Communication; 1993
- EN50325 , Industrial Communications Subsystem based on ISO-11898 for Controller Device Interfaces (CANopen); 2002
- CiA/DS 301, CANopen Application Layer and Communication Profile; V4.02; February 2002
- DSP 402 , Device Profile for Drives and Motion Control; V2.0, July 2002

2 Safety

2.1 Qualification of personnel

Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system. The technicians must be able to detect potential dangers that may be caused by setting parameters, changing parameter values and generally by the mechanical, electrical and electronic equipment.

The technicians must have sufficient technical training, knowledge and experience to recognise and avoid dangers.

The technicians must be familiar with the relevant standards, regulations and safety regulations that must be observed when working on the drive system.

2.2 Intended use

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or unbraked movements can never be totally excluded without additional safety equipment. For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

In the system configuration described the drive systems must be used in industrial applications only and must have a fixed connection only.

In all cases the applicable safety regulations and the specified operating conditions, such as environmental conditions and specified technical data, must be observed.

The drive system must not be commissioned and operated until completion of installation in accordance with the EMC regulations and the specifications in this manual.

To prevent personal injury and damage to property damaged drive systems must not be installed or operated.

Changes and modifications of the drive systems are not permitted and if made all no warranty and liability will be accepted.

The drive system must be operated only with the specified wiring and approved accessories. In general, use only original accessories and spare parts.

The drive systems must not be operated in an environment subject to explosion hazard (ex area).

2.3 Hazard categories

Safety notes and general information are indicated by hazard messages in the manual. In addition there are symbols and instructions affixed to the product that warn of possible hazards and help to operate the product safely.

Depending on the seriousness of the hazard, the messages are divided into three hazard categories.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death, serious injury, or equipment damage.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

2.4 General safety instructions

⚠ DANGER

Motor out of view

When the system is started the drives are generally out of the operator's view and cannot be visually monitored.

- Only start the system if there are no persons in the operating zone of the moving components and the system can be operated safely.

Failure to follow these instructions will result in death or serious injury.

▲ WARNING**Loss of control**

- Observe the accident prevention regulations. (For USA see also NEMA ICS1.1 and NEMA ICS7.1)
- The system manufacturer must take the potential error possibilities of the signals and the critical functions into account to ensure a safe status during and after errors. Some examples are: emergency stop, final position limitation, power failure and restart.
- The assessment of error possibilities must also include unexpected delays and the failure of signals or functions.
- Suitable redundant control paths must be in place for dangerous functions.
- Check that measures taken are effective.

Failure to follow these instructions can result in death or serious injury.

3 Basics

3.1 CAN bus

The CAN bus (CAN:**C**ontroller **A**rea **N**etwork) was originally developed for fast, economical data transmission in automotive engineering. In the meantime the CAN bus is also used in industrial automation technology and has been further developed for communication at fieldbus level.

Features of the CAN bus

The CAN bus is a standardised open bus, through which devices, sensors and actuators from different manufacturers communicate with each other. The features of the CAN bus are

- Multimaster capacity

Every device in the fieldbus can send and receive data independently without being assigned to an "ordering" master function.

- Message-oriented communication

Devices can be linked into an existing network without requiring reconfiguration of the entire system. The address of a new device does not need to be specified on the network.

- Prioritisation of messages

Messages with higher priority are sent first for time-critical applications.

- Residual error probability

Various backup processes in the network reduce the probability of an undetected, faulty data transfer to less than 10^{-11} . In practice, 100%-secure transmission can be assumed.

Transmission technology

In the CAN bus multiple devices are connected via a bus cable. Every network device can send and receive messages. Data between network devices are transmitted serially.

Network devices

Examples of CAN bus devices are

- automation devices, e.g. PLCs
- PCs
- input/output modules
- drive controllers
- analysis devices
- Sensors and actuators

3.2 CANopen technology

3.2.1 CANopen description language

CANopen is a device and manufacturer-independent description language for communication on the CAN bus. CANopen offers a unified base for exchanging commands and data between CAN bus devices.

3.2.2 Communications layers

CANopen uses the CAN bus technology for data communications.

CANopen is based on the ISO-OSI layer model on the data communications basic network service. 3 layers secure data communications in the CAN bus.

- CAN Physical Layer
- CAN Data Link Layer
- CANopen Application Layer

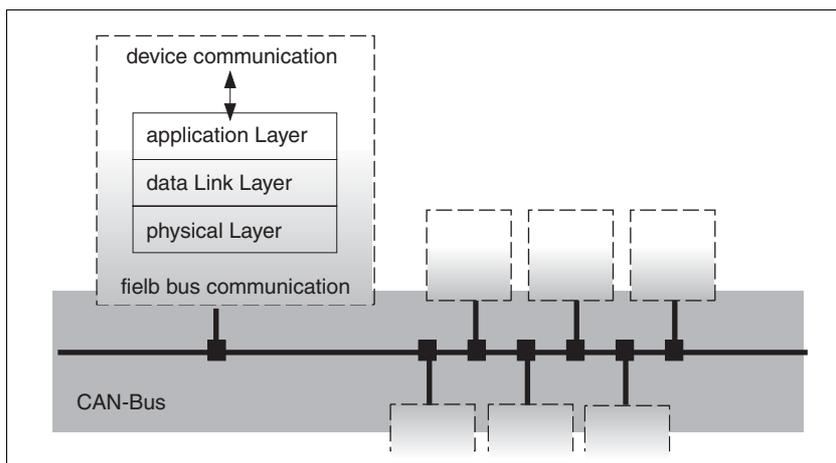


Figure 3.1 CANopen layer model

CAN Physical Layer The physical layer defines the electrical properties of the CAN bus such as plug connectors, cable length and cable properties such as bit-coding and bit-timing.

CAN Data Link Layer The data link layer connects the network devices. It sets the priorities of individual data packets and monitors and corrects errors.

CANopen Application Layer The application layer uses communications objects (COB) to exchange data between the various devices. Communication objects are elementary components for creating a CANopen application.

3.2.3 Objects

All processes under CANopen are executed via objects. Objects carry out different tasks; they act as communications objects for data transport to the fieldbus, control the process of establishing a connection or monitor the network devices. If objects are directly connected to the device (device-specific objects), the device functions can be used and changed with device-specific objects.

Object directory The central controller connection for all objects is the object directory of every network device. Other devices find all objects listed here with which they can establish a connection with the device.

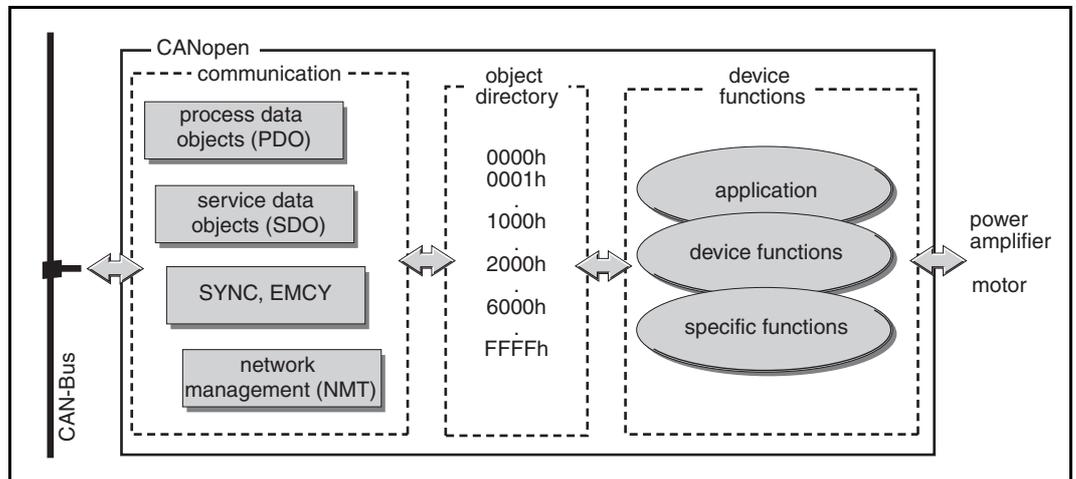


Figure 3.2 Device model with object directory

Objects for describing the data types and executing the communications tasks and device functions under CANopen are registered.

Object index Every object is addressed over a 16-bit index, which is displayed as a four-character hexadecimal number. The objects are pooled together in groups.

Index (hex)	Object groups
0000 _h	reserved
0001 _h -009F _h	Static and complex data types (see CiA DS301 for definitions)
00A0 _h -0FFF _h	reserved
1000 _h -1FFF _h	Communication profile, standardised in DS 301
2000 _h -5FFF _h	Manufacturer-specific device profiles
6000 _h -9FFF _h	Standardised device profiles, e.g. in DSP 402
A000 _h -FFFF _h	reserved

A list of all objects used under CANopen for the device can be found from page 115.

Object group data types The messages that move over the network as bit streams have the same meaning for sender and receiver with the data types. They are agreed via the objects of the data types.

Object groups of the profiles CANopen objects carry out various tasks in field bus operation. Profiles combine the objects in accordance with their prescribed tasks.

3.2.4 CANopen profiles

Standardised profiles Standardised profiles describe objects that can be applied to various devices without additional configuration. The association for CAN in Automation e. V. (CiA) has standardised different profiles. They include:

- the communications profile DS 301

- the device profile DSP 402

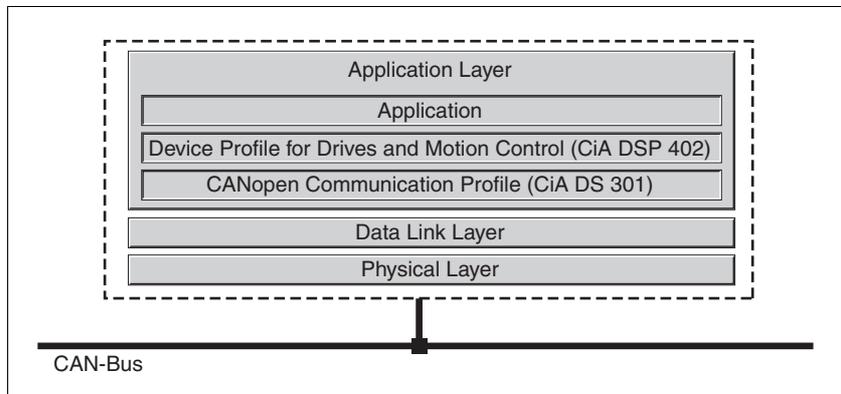


Figure 3.3 CANopen reference model

Both profiles are part of the user layer in the ISO-OSI layers model. Additional services are available from a manufacturer-specific device profiles and applications.

DS301 communications profile

The DS 301 communications profile forms the interface between device profiles and CAN bus. It was specified in 1995 under the name DS 301 and defines unified standards for common data exchange between different device types under CANopen.

The communications profile objects in the device carry out the tasks of data and parameter exchange with other network devices and initialise, control and monitor the device in the network.

Communications profile objects are

- Process data object PDO
- Service data object SDO
- Objects with special functions for synchronisation SYNC and for error reporting and response EMCY
- Objects of network management NMT for initialisation, error monitoring and device status monitoring.

You will find details about the objects of the communication profile from page 22.

DSP 402 device profile

The DSP 402 device profile describes standardised objects for positioning, monitoring and settings of drives. The tasks of the objects are:

- Device control and status monitoring (Device Control)
- Standardised parameter setting
- Switching, verification and execution of operating modes

Manufacturer-specific profiles

The basic functions of a device can be used with device profiles standardised with objects. Only manufacturer-specific device profiles offer the complete range of functions. The objects with which the special functions of a device can be used under CANopen are defined in them.

3.3 Field bus devices in CAN bus

Various field bus devices can be operated in the same field bus segment. CANopen offers a unified base for exchanging commands and data between CAN bus devices.

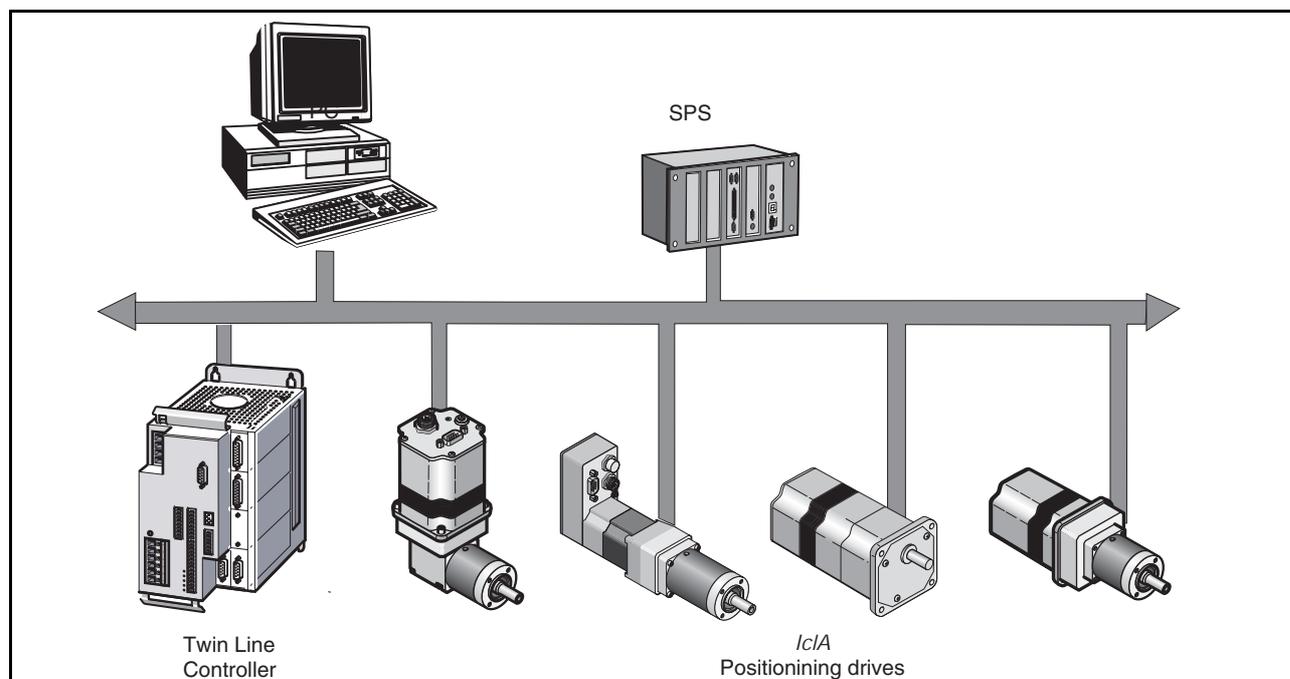


Figure 3.4 Field bus devices from the manufacturer in the network

3.4 Operating modes and functions in field bus operation

The compact drive operates in field bus mode with the following operating modes and functions:

- Position drive control with relative and absolute positioning
- Jogging via signals
- Jogging via a fieldbus (simulated operation in manual mode)
- Homing

The operating functions include

- Ramp functions
- Emergency Stop function
- Monitoring functions.

The following can be achieved over the fieldbus:

- the parameter settings for the positioning controller can be called up and changed,
- the inputs and outputs of the signal interface can be monitored
- the diagnostics and fault monitoring functions can be activated.

3.5 Communications profile

CANopen manages communications between the network devices with object directories and objects. A network device can use process data objects (PDO) and service data objects (SDO) to request the object data from the object directory of another device and, if permissible, write back modified values.

The following can be done with the access to the objects of the network devices

- exchange parameter values
- start movement functions of individual CAN bus devices
- query status information

3.5.1 Object directory

Every CANopen device administers an object directory, in which all objects for communications are listed.

Index, subindex

The objects are addressed in the object directory with a 16-bit long index. One or more 8-bit-long subindex entries to every object point to individual data fields in the object. Index and subindex are shown in hexadecimal characters, recognisable by the attached "h".

Example

The following table shows index and subindex entries with the example of the object `software position limit (607Dh)` for identifying the position of the software limit switch.

Index	Subindex	Name	Meaning
607D _h	00 _h	-	Number of data fields
607D _h	01 _h	min. position limit	Bottom limit value switch
607D _h	02 _h	max. position limit	Top limit value switch

Table 3.1 Example for index and subindex entries

Directory structure

The objects are arranged in the structure of the object directory, sorted according to index values. Table 3.2 shows an overview of the object directory according to the CANopen agreement.

Index range (hex)	Object groups
0000 _h	reserved
0001 _h -001F _h	Static data types
0020 _h -003F _h	Complex data types
0040 _h -005F _h	Manufacturer-specific data types
0060 _h -007F _h	Status data types for the device profiles
0080 _h -009F _h	Complex data types for the device profiles
00A0 _h -0FFF _h	reserved
1000 _h -1FFF _h	Communications profile
2000 _h -5FFF _h	Manufacturer-specific objects ¹⁾
6000 _h -9FFF _h	Standardised device profiles ¹⁾
A000 _h -FFFF _h	reserved

1) supported by the positioning controller

Table 3.2 Object directory according to the CANopen agreement, Overview

Object descriptions in the manual

The objects of the following object groups are described differently for CANopen programming with a positioning controller:

- 1xx_h objects: Communications objects in this chapter
- 2xx_h objects: Manufacturer-specific objects in as far as they are required for the control of the device, in chapter 6 "Operation".
- 6xx_h objects: Standardised objects of the device profile in chapter 6 "Operation"

Standardised objects

Standardised objects form the basis of applying the same applications for the various network devices of a device type. This requires the devices to list the objects in their directory. Standardised objects are defined in the DS 301 communications profile and the DSP 402 device profile.

3.5.2 Communications objects

Overview

The communications objects are standardised with the DS 301 CANopen communications profile. The objects can be classified into four groups according to their tasks.

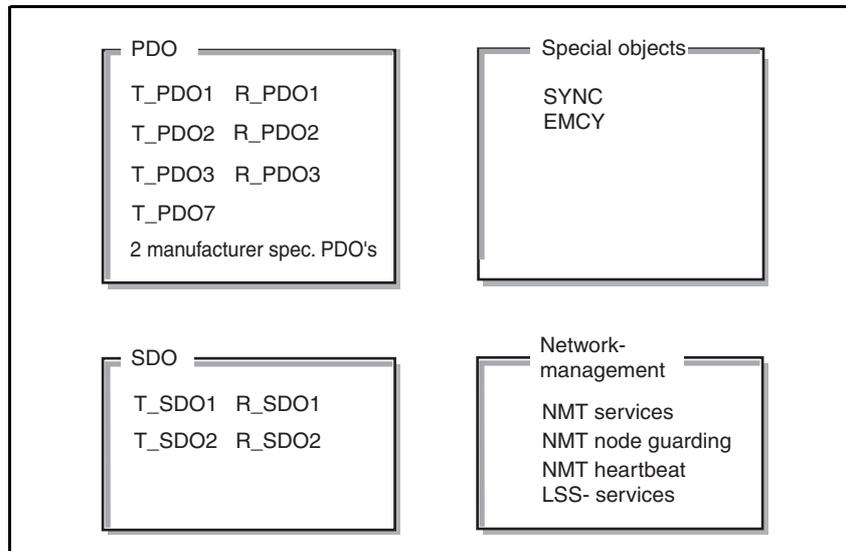


Figure 3.5 The following are considered communications objects from the point of view of the device: T_...:"Transmit", R_...: "Receive"

- PDO (process data object) for real-time transmission of process data
- SDO (service data object) for read and write access to the object directory
- Objects for controlling CAN messages:
 - SYNC object (synchronisation object) for synchronisation of network devices
 - EMCY object (emergency object) for error display of a device or its peripheral.
- Network management services:
 - NMT services for initialisation and network control (NMT: network management)
 - NMT guarding objects for monitoring the network user
 - LSS services (LSS: Layer setting services) with objects for setting the node address and rate of transmission

CAN message Data are exchanged on the CAN bus as CAN messages. A CAN message sends the communications object and a variety of administration and control information to ensure data transmission without loss and errors.

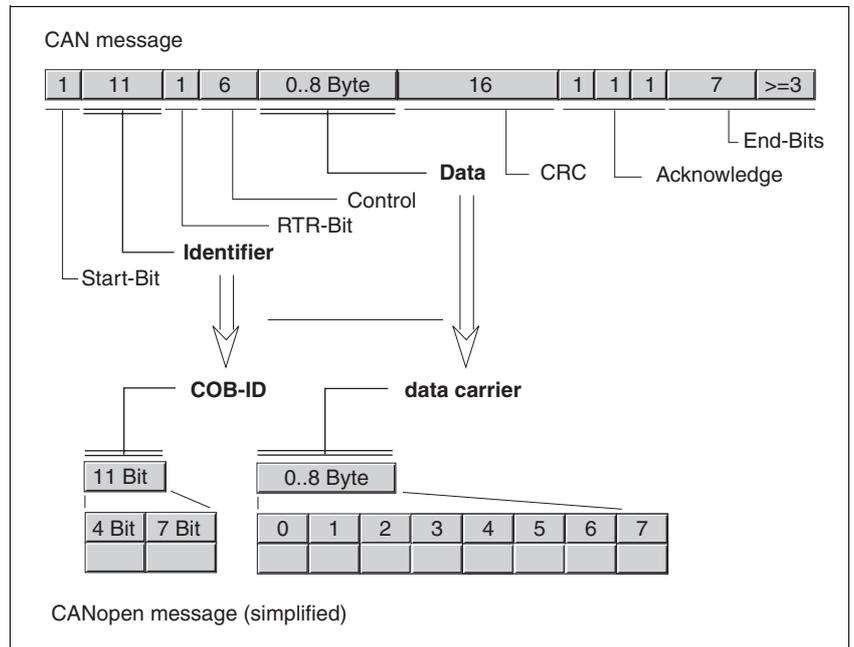


Figure 3.6 CAN message and simplified display of CANopen message

CANopen message

The CAN message can be displayed in simplified form for work with CANopen objects and for data exchange, because most of the bits are used to ensure error-free data transmission. These bits are automatically removed from the received message by the data security layer, the data link layer of the OSI layer model, and added to a message before transmission.

The two bit fields "identifier" and "data" form the simplified CANopen message. The "identifier" corresponds to the "COB ID" and the "data" field to the maximum 8-byte data frame of a CANopen message.

COB-ID

The COB Id (**C**ommunication **O**bject **I**dentifier) has two tasks in the control of communications objects:

- Bus arbitration: specification of transmission priorities
- identification of communications objects

An 11-bit COB identifier as per the CAN 3.0A specification is defined for CAN communications. It comprises two parts:

- Function code, 4 bit size
- Node-ID, 7 bit size.

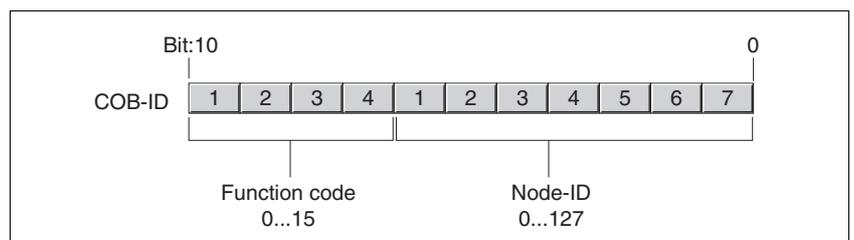


Figure 3.7 COB Id with function code and node address

Function code The function code classifies the communications objects. Because the bits of the function code in the COB Id are significantly higher, the function code simultaneously controls the transmission priorities: Objects with a small function code are sent at high priority. For example, with simultaneous bus access an object with the function code "1" is sent before an object with the function code "3".

Node address Every network device is configured before network operation. It is given a unique, 7-bit-long node address (node-Id) between 1 (01_h) and 127 (7F_h). The device address "0" is reserved for "broadcast" transmissions, which are used to send the messages to all devices simultaneously.

COB IDs of the communications objects The following table shows the COB IDs of all communications objects in the factory setting. The column "Index of object parameters" shows the index of special objects with which the settings of the communications objects can be read or modified by SDO.

The default values for sub-index 1 of the PDO parameter (COB ID for T_PDO7, T_PDO33 und T_PDO34) are all 0x000_h + node ID per default.

Communications object	Function code	Node addressnode-Id [1...127]	COB IDdecimal (hexadecimal)	Index of object parameters
NMT Start/Stop Service	0 0 0 0	0 0 0 0 0 0 0	0 (0 _h)	-
SYNC object	0 0 0 1	0 0 0 0 0 0 0	128 (80 _h)	1005 _h ...1007 _h
EMCY object	0 0 0 1	x x x x x x x	128 (80 _h) + node-Id	1014 _h
T_PDO1	0 0 1 1	x x x x x x x	384 (180 _h) + node-Id	1800 _h
R_PDO1	0 1 0 0	x x x x x x x	512 (200 _h) + node ID	1400 _h
T_PDO2	0 1 0 1	x x x x x x x	640 (280 _h) + node ID	1801 _h
R_PDO2	0 1 1 0	x x x x x x x	768 (300 _h) + node-Id	1401 _h
T_PDO3	0 1 1 1	x x x x x x x	896 (380 _h) + node-Id	1802 _h
R_PDO3	1 0 0 0	x x x x x x x	1024 (400 _h) + node-Id	1402 _h
T_SDO	1 0 1 1	x x x x x x x	1408 (580 _h) + node-Id	1200 _h
R_SDO	1 1 0 0	x x x x x x x	1536 (600 _h) + node ID	1200 _h
NMT error control	1 1 1 0	x x x x x x x	1792 (700 _h) + node-Id	100C _h ..100E _h
LSS services	1 1 1 1	1 1 0 0 1 0 x	2020 (7E4 _h), 2021 (7E5 _h)	
NMT Identify Service ¹⁾	1 1 1 1	1 1 0 0 1 1 0	2022 (7E6 _h)	
DBT Services ¹⁾	1 1 1 1	1 1 0 0 x x x	2023 (7E7 _h), 2024 (7F8 _h)	
NMT Services ¹⁾	1 1 1 1	1 1 0 1 0 0 x	2025 (7E9 _h), 2026 (7EA _h)	

1) not supported by the IcIA compact drive

Table 3.3 COB IDs of all communications objects

Example Selection of a COB-Id

For a device with the node address 5, the COB-Id of the communications object T PDO1 is:

$$384 + \text{node-Id} = 384 (180_{\text{h}}) + 5 = 389 (185_{\text{h}}).$$

Data frame The data frame of the CANopen message can hold up to 8 bytes of data. In addition to the data frame for SDOs and PDOs, special frame types are specified in the CANopen profile:

- Error data frame
- Remote data frame for requesting a message
- LSS protocol frames

The data frames are described with the relevant communications objects.

3.5.3 Communications relationships

CANopen uses three relationships for communications between network devices:

- Master-slave relationship
- Client-server relationship
- Producer-consumer relationship

Master-slave relationship A "master" in the network controls the message traffic. A "slave" only responds when addressed by the master.

The master-slave relationship is used with network management objects to guarantee a controlled network start and to monitor the connection of devices.

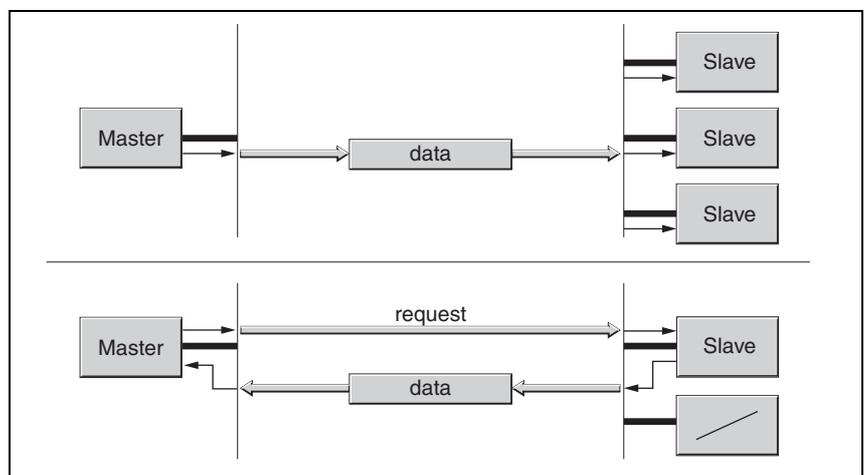


Figure 3.8 Master-slave relationships

Exchange of messages can be executed unconfirmed and confirmed. If the master sends an unconfirmed CAN message, it can be received by multiple or no slaves.

To confirm the message, the master requests a message from a specific slave, which then responds with the desired data.

Client-server relationship A client-server relationship is always established between two devices. The "server" is the device whose object list is used during the data exchange. The "client" addresses and starts the exchange of messages and waits for a response from the server.

A client-server relationship is implemented with SDOs to send configuration data and long messages.

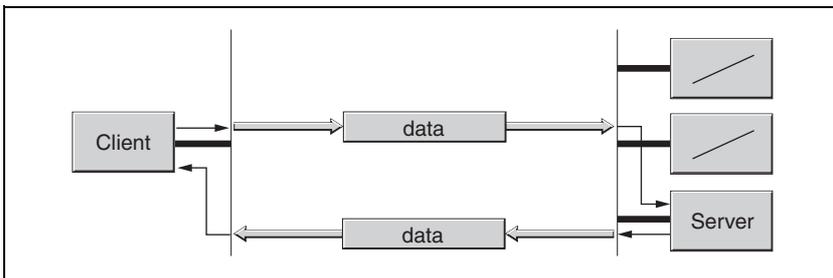


Figure 3.9 Client-server relationship

The client addresses and sends a CAN message to a server. The server analyses the message and sends the answer data as response.

Producer-consumer relationship

The producer-consumer relationship is used for exchanging messages with process data, because this relationship enables fast data exchange without administration data.

A "producer" sends data, a "consumer" receives data.

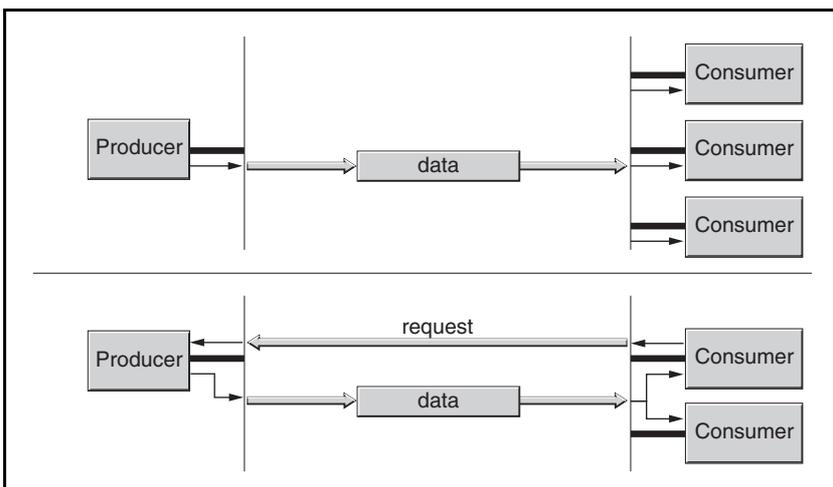


Figure 3.10 Producer-consumer relationships

The producer sends a message that can be received by one or more network devices. The producer does not receive a receipt response. The message transmission can be triggered

- by an internal event, e.g. by the message "Target position reached"
- by the synchronisation object SYNC
- by the request of a consumer.

For details on the function of the producer-consumer relationship and the request of messages see chapter 3.7 "Process data communication" from page 34.

3.6 Service data communication

3.6.1 Overview

Service data objects (SDO: **S**ervice **D**ata **O**bject) can be used to access the entries of an object directory via index and subindex. The values of the objects can be read and - if permissible - also be changed.

Every network device has at least one server SDO to be able to respond to read and write requests from a different device. A client SDO is only required to request SDO messages from the object directory of a different device or to change them there.

The T_SDO of a SDO client can be used to send the request for data exchange and to receive with the R_SDO. The data frame of a SDO is always 8 bytes.

SDOs have a higher COB-Id than PDOs and therefore are sent over the CAN bus at a lower priority.

3.6.2 SDO data exchange

A service data object (SDO) sends parameter data between two devices. The data exchange conforms to the client-server relationship. The server is the device to whose object directory a SDO message refers.

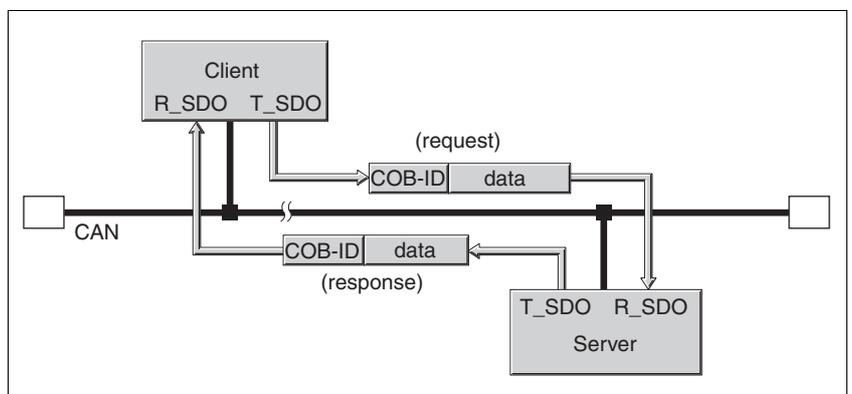


Figure 3.11 SDO message exchange with request and response

Message types

Client-server communications are triggered by the client to send parameter values to the server or to obtain them from the server. In both cases the client starts the communication with a request and receives a response from the server.

3.6.3 SDO message

A SDO message in simplified form consists of the COB-Id and the SDO data frame, in which up to four bytes of data can be sent. Longer data strings are distributed over multiple SDO messages with a special protocol.

The device sends SDOs of up to 4 bytes data length (data). Larger quantities of data such as 8.byte values of the "Visible String 8" data type can be distributed over multiple SDOs and are sent successively in 7-byte blocks.

Example The following diagram shows an example of a SDO message.

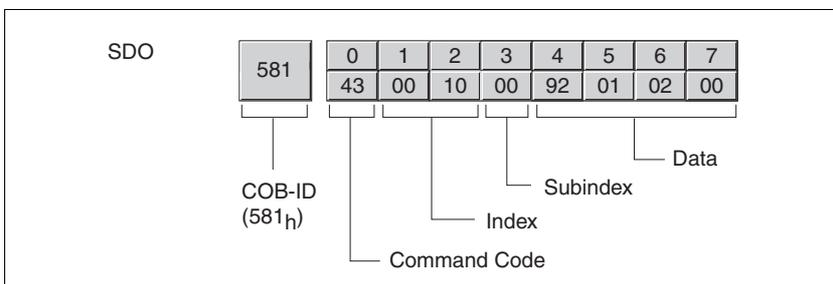


Figure 3.12 SDO message, example

COB ID R_SDO and T_SDO have different COB IDs, compare this to Table 3.3. Settings for the service data object (SDO) can be read via the objects `Server SDO Parameter (1200h and 1201h)`.

Data frame The data frame of an SDO messages consists of:

- Command code in which the SDO message type and the data length of the transmitted value are encrypted
- Index and sub-index, which point to the object whose data are transported with the SDO message. In the case of an error the faulty SDO is specified itself with index and sub-index.
- Data that comprise up to 4 bytes

Evaluation of numeric values Index and data are transmitted left-aligned in Intel format. If the SDO contains numerical values over 1 byte in length, the data must be converted bit-by-bit before and after a transmission.

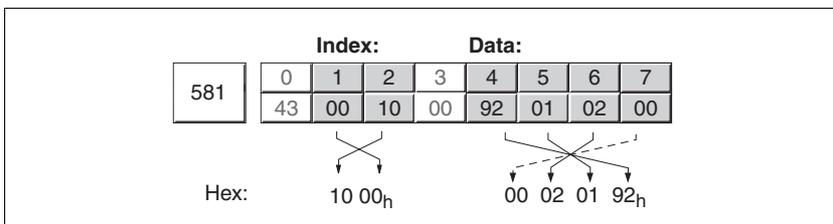


Figure 3.13 Repositioning numeric values greater than 1 byte

3.6.4 Reading and writing data

Write data The client starts a write request by sending index, subindex, data length and value.

The server sends a response indicating whether the data were correctly processed. The response contains the same index and subindex, but no data.

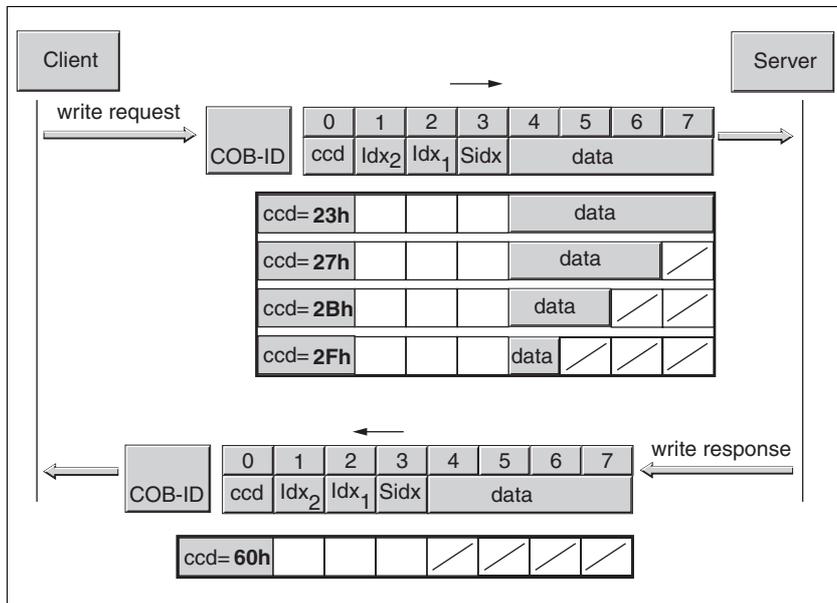


Figure 3.14 Writing parameter values

Unused bytes in the data field are shown with a slash in the graphic. The content is not defined.

ccd-coding

The table below shows the command code for writing parameter values. It depends on the message type and the transmitted data length.

Message type	Data length used				
	4 byte	3 byte	2 byte	1 byte	
write request	23 _h	27 _h	2B _h	2F _h	Send parameters
write response	60 _h	60 _h	60 _h	60 _h	response
error response	80 _h	80 _h	80 _h	80 _h	Error

Table 3.4 Command codes for writing parameter values

Read data

The client starts a read request by sending index and subindex that point to the object or the object value whose value it wants to read out.

The server responds to the query with the desired data. The SDO response contains the same index and subindex. The length of the response data is specified in the command code "ccd".

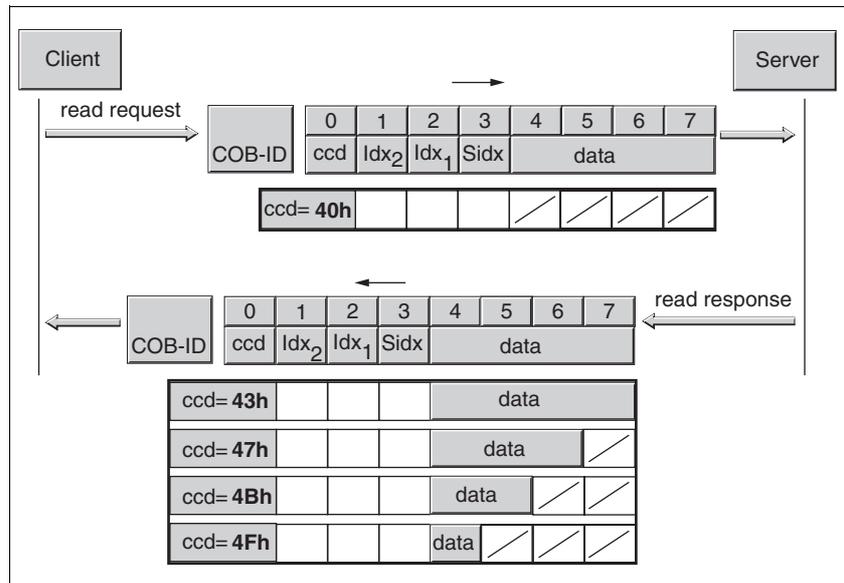


Figure 3.15 Reading parameter value

Unused bytes in the data field are shown with a slash in the graphic. The content is not defined.

ccd-coding

The table below shows the command code for sending a read value. It depends on the message type and the transmitted data length.

Message type	Data length used				
	4 byte	3 byte	2 byte	1 byte	
read request	40 _h	40 _h	40 _h	40 _h	Request read value
read response	43 _h	47 _h	4B _h	4F _h	Return read value
error response	80 _h	80 _h	80 _h	80 _h	Error

Table 3.5 Command code for sending a read value

Error response

If a message could not be evaluated without errors, the server sends an error message. For details on the evaluation of the error message see chapter 7.4 "SDO error message (SDO abort)".

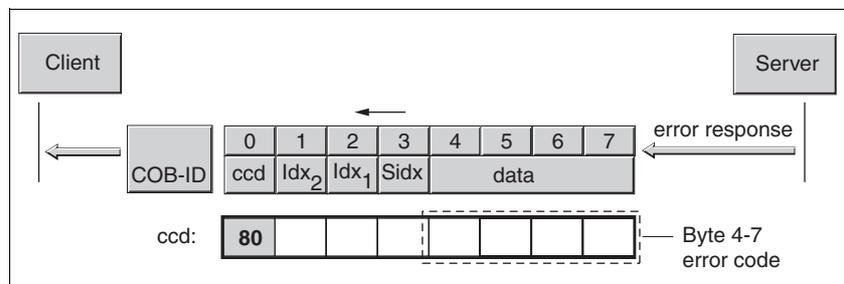


Figure 3.16 Response with error message (error response)

Data lengths > 4 bytes

SDO messages with data lengths of more than 4 bytes, e.g. 8 bytes values of the data type "visible string 8", are sub-divided over a number of telegrams.

The first telegramme it is constructed in exactly the same way as a SDO message £ 4 byte. On further messages the index and sub-index are not transmitted so there is a larger range available for data transmission.

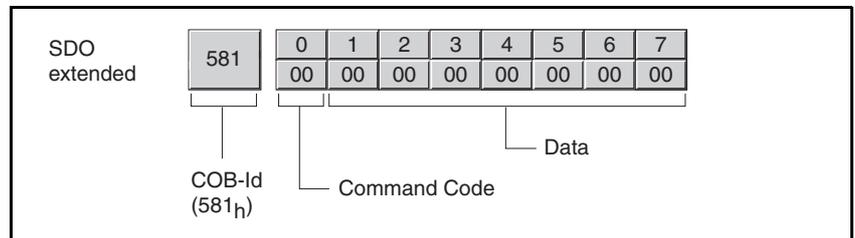


Figure 3.17 Example of a telegramme for an extended SDO message

The first 4 bytes are transmitted in the first SDO message. The remaining bytes are transmitted with further messages in parts of up to a maximum of 7 bytes in length. When transmitting data > 4 bytes, there is no byte by byte conversion of the data, it is simply transmitted continuously in ASCII format.

Data frame extended SDO message

The data frame of an extended SDO messages consists of:

- Command code (command code), in which the SDO message type, a so-called "toggle bit", the data lengths of the transmitted values and a bit which indicates the end of the message, are encrypted.

The value of the toggle bits for every telegramme of an extended SDO message must toggle between 0 and 1; the toggle bit of the first telegramme is 0, that of the second telegramme is 1, that of the third telegramme is again 0, etc.

The bit which shows the end of the complete SDO message always has the value 0 and just for the last telegramme of the SDO message has the value 1.

- Data that comprise up to 7 bytes

3.6.5 Reading data longer than 4 bytes

If values should be transmitted with an SDO message which are larger than 4 bytes then the message must be split into a number of telegrammes. Each telegramme consists of 2 parts:

- Request by the SDO client,
- Validation by the SDO server.

The request by the SDO client contains the control segment "ccd" with the toggle bit and a data segment. The validation telegramme also contains a toggle bit in segment "ccd". In the first telegramme the toggle bit has the value "0" and in the following telegrammes it switches between 1 and 0.

Reading data

The client starts a read request by sending the index and sub-index that point to the object or the object value whose value it wants to read out.

The server confirms the enquiry with transmission of the index, sub-index, data length and the first 4 bytes of the desired data. (At ccd = 41_h, byte 4..7 contain the length of data and at ccd = 40_h byte 4..7 are undefined.) The command code shows that data > 4 bytes was sent during the transmission. The command code of the read response from the server to the first message is 41_h.

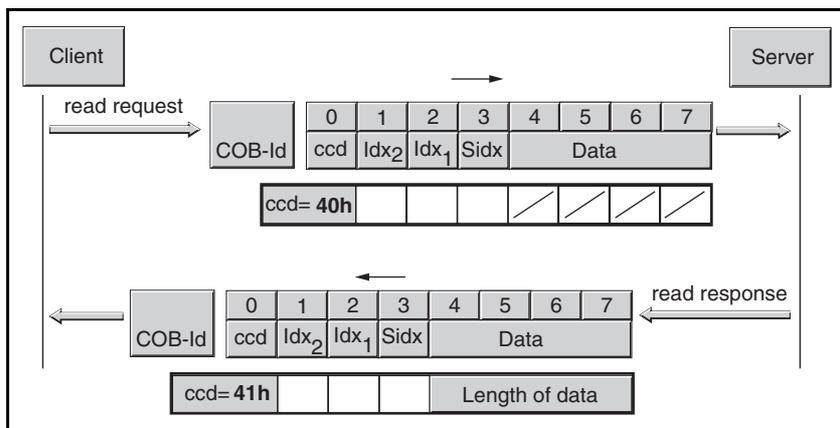


Figure 3.18 Transmitting the first message

In the next telegrams, the remaining data is requested and transmitted in packets of 7 bytes from the server. Further information about the ccd process can be taken from the DS301 of the CiA.

3.7 Process data communication

3.7.1 Overview

Process Data Objects (PDO:Process Data Object) are used for real-time data exchange of process data such as actual and setpoint or operating status of the device. The transmission can be executed very fast, because it is sent without additional administration data and does not require a response from the recipient.

The flexible data length of a PDO message also increases the data throughput. A PDO message can send up to 8 bytes of data. If only 2 bytes are occupied, only 2 data bytes are sent.

The length of a PDO message and the allocation of the data fields is specified by PDO mapping. For more information see chapter 3.7.4 "PDO mapping".

PDO messages can be exchanged between devices that generate or process the process data.

3.7.2 PDO data exchange

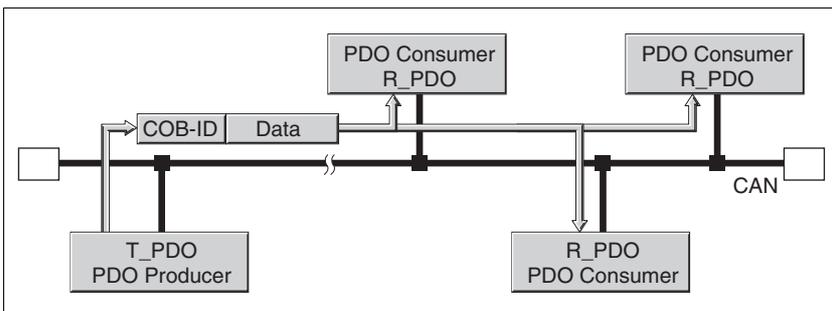


Figure 3.19 PDO data exchange

Data exchange with PDOs conforms to the producer-consumer relationship and can be triggered by three methods

- synchronised
- event-driven, asynchronous
- by request of a consumer, asynchronous

The synchronised data processing is controlled by the SYNC object. Synchronous PDO messages are sent immediately like the standard PDO messages, but are only evaluated on the next SYNC. For example, multiple drives can be started simultaneously by synchronised data exchange.

The device evaluates PDO messages that are called on request or are event-controlled immediately.

The transmission type can be specified separately for every PDO with subindex 02_h (transmission type) of the PDO communications parameter. The objects are shown in Table 3.6.

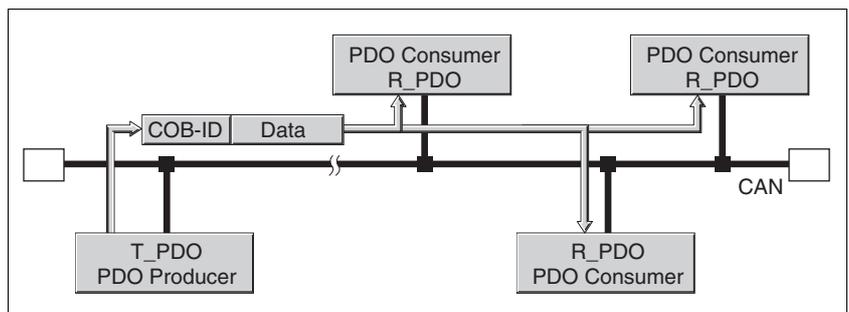


Figure 3.20 PDO data exchange

Data exchange with PDOs conforms to the producer-consumer relationship and can be triggered by three methods

- synchronised
- event-driven, asynchronous
- by request of a consumer, asynchronous

The synchronised data processing is controlled by the SYNC object. Synchronous PDO messages are sent immediately like the standard PDO messages, but are only evaluated on the next SYNC. For example, multiple drives can be started simultaneously by synchronised data exchange.

The device evaluates PDO messages that are called on request or are event-controlled immediately.

The transmission type can be specified separately for every PDO with subindex 02_h (transmission type) of the PDO communications parameter. The objects are shown in Table 3.6.

Request messages

One or more network devices with consumer function can request PDO messages from a producer. The producer is identified by the COB ID of the request and responds with the requested PDO.

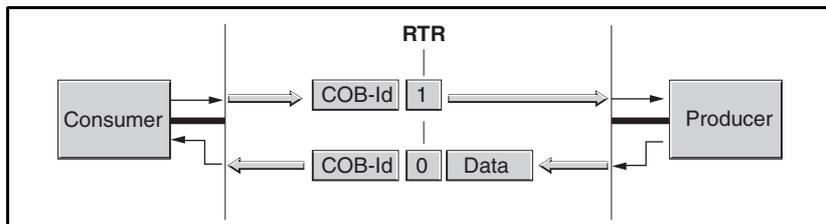


Figure 3.21 Request of a CAN message with RTR=1

The RTR bit of a CAN message is used to detect a request (RTR: **R**emote **T**ransmission **R**equest). The COB ID remains the same for both messages:

RTR=0: transmission of data

RTR=1: request of data.

Setting RTR request

Every PDO can be separately configured concerning whether it should respond to RTR requests. The identifier is enabled or disabled via sub-index 01h, bit 30 for every PDO.

The objects for this are in the Table 3.6 quoted sub-index 02_h, *transmission type* the objects determine the type of transmission. Only if the RTR transmission is enabled for a PDO will the PDO respond to a request via the bit RTR. The sub-index values for using the RTR bits are:

Objects 1800 _h /1801 _h /1802 _h / 1806 _h /1820 _h /1821 _h , sub-index 02 _h , "transmission type"	Description
252	RTR activated, synchronous
253	RTR activated, asynchronous

See the chapter for the relevant object for an overview of all values for the sub-index 0210 "Object directory" h.

The positioning controller cannot request a PDO, but it can respond to the request of a PDO. CANopen uses event-controlled communication. The CiA therefore recommends that CANopen networks are designed as far as possible without using the RTR mechanism.

3.7.3 PDO message

T_PDO, R_PDO A PDO always is available for sending and receiving a PDO message:

- The T_PDO for sending PDO messages (T: Transmit),
- The R_PDO for receiving PDO messages (R: Receive).



The following settings for PDOs correspond to the standard defaults for the device, unless otherwise specified. They can be read and set via objects of the communications profile.

The positioning controller uses 9 PDO's, 3 receiving PDOs and 6 transmitter PDOs.

- PDO 1 and PDO 7 as well as the two manufacturer-specific PDOs are analysed or transmitted with the initial setting "event-controlled".

- PDO 2 and PDO 3 are analysed or transmitted with the initial setting "synchronous to the following SYNC message".
- PDO 1 and PDO 2 are activated according to the initial setting . All other PDOs must be enabled for activation.

Static (not changeable) object mapping applies for all PDOs.

Receive PDOs

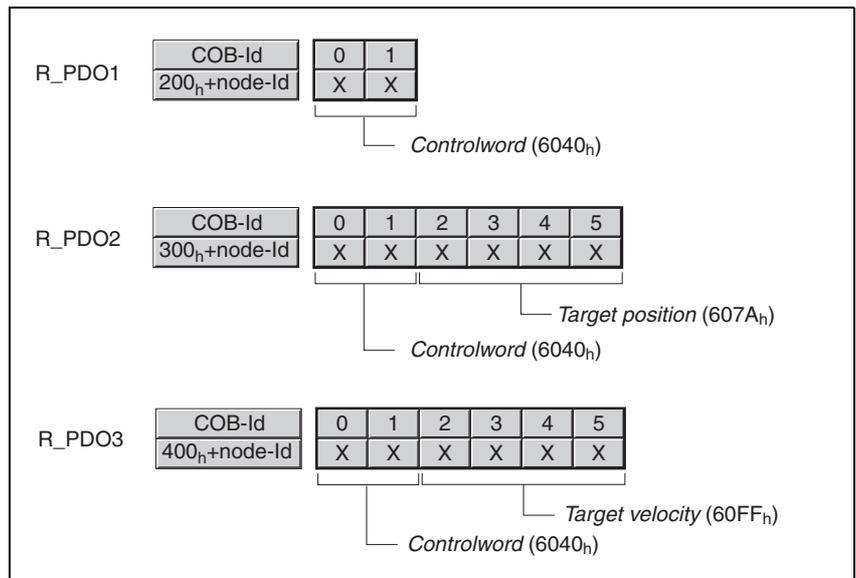


Figure 3.22 Receive PDOs

R_PDO1 In the first receive PDO the control word, object `controlword` (6040_h), of the status machine is represented, which can be used to set the operating status of the device. The communication properties for R_PDO1 are configurable. The PDO mapping is static.

R_PDO1 is analysed asynchronously, i.e. is event-controlled. R_PDO1 is permanently set.

Information about the control word of the status machine can be found in chapter 6.2.1 "CANopen status machine".

R_PDO2 With the second PDO the control word and the target position of a movement command, object `target position` (607A_h), is received for point-to-point positioning in the "profile position mode". The communication properties for R_PDO2 are configurable. The PDO mapping is static.

R_PDO2 is analysed acyclicly and synchronously. R_PDO2 is permanently set.

R_PDO3 In the third receive PDO the control word and the setpoint speed, object `Target velocity` (60FF_h), is mapped for speed mode in the "profile velocity mode". The initial setting for R_PDO3 is synchronous. The communication properties for R_PDO3 are configurable. The PDO mapping is static.

Send PDOs The objects for T_PDO1, T_PDO2, T_PDO3, T_PDO7, as well as for the objects for the manufacturer-specific PDOs, are permanently set (static mapping).

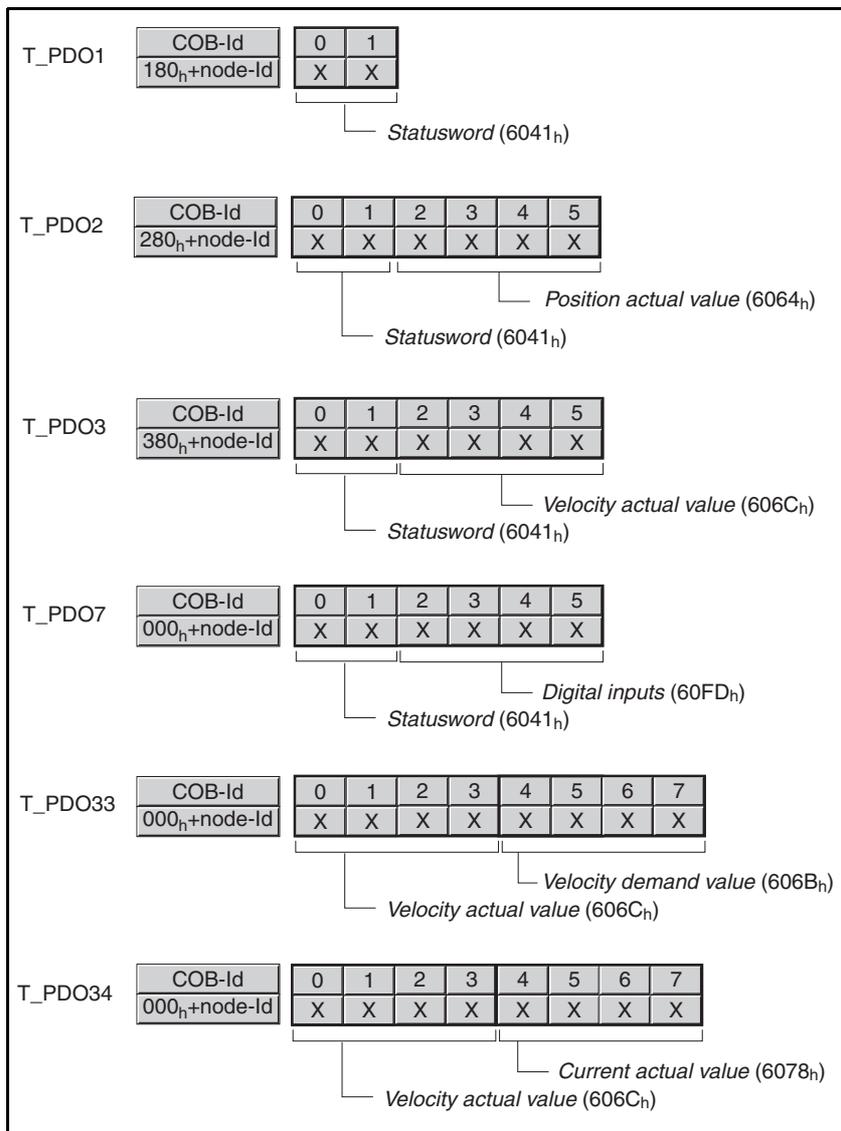


Figure 3.23 Send PDOs

T_PDO1 In the first send PDO the status word, object statusword (6041_h), of the status machine is mapped.

T_PDO1 is sent asynchronously and event-controlled for every change of the status information. No other objects can be mapped with T_PDO1.

Information about the status word of the status machine can be found in chapter 6.2.1 "CANopen status machine".

T_PDO2 In the second send PDO the status word and the current position of the motor, object Position actual value (6064_h), is mapped to monitor point-to-point positioning in the "profile position mode".

T_PDO2 is transmitted synchronously. The T_PDO2 is activated according to the initial setting. The communication properties for T_PDO2 are configurable. The PDO mapping is static.

T_PDO3 In the third send PDO the status word and the current speed, object `Velocity actual value (606Ch)`, is mapped for monitoring the speed mode in "profile velocity mode".

T_PDO3 is transmitted synchronously. The T_PDO3 is not activated according to the initial setting. The communication properties for T_PDO3 are configurable. The PDO mapping is static.

T_PDO7 In the seventh transmitter PDO there is the status word and the status of the digital inputs, object `Digital Inputs (60FDh)` mapped.

R_PDO7 is sent asynchronously and event-driven. The T_PDO7 is not activated according to the initial setting. The communication properties for T_PDO3 are configurable. The PDO mapping is static.

Manufacturer-specific T_PDO33 In the 33rd transmitter PDO the current speed, object `Velocity Actual Value (606Ch)`, and the set speed, object `Velocity Demand Value (606Bh)`, are mapped.

T_PDO33 is transmitted asynchronously according to the adjustable event time. The T_PDO33 is not activated according to the initial setting. The communication properties for T_PDO33 are configurable. The PDO mapping is static.

Manufacturer-specific T_PDO34 In the 34th transmitter PDO the current speed, object `Velocity Actual Value (606Ch)`, and the motor current, object `Current Actual Value(6078h)`, are mapped.

T_PDO34 is transmitted asynchronously according to the adjustable event time. The T_PDO34 is not activated according to the initial setting. The communication properties for T_PDO34 are configurable. The PDO mapping is static.



Before activation of the transmitter PDO T_PDO7, T_PDO33 and T_PDO34, a valid and unique COB ID must be awarded to the PDOs.

PDO settings The settings for PDOs can be read and changed with 8 communications objects:

Object	Description
1st receive PDO parameter (1400 _h)	Settings for R_PDO1
2nd receive PDO parameter (1401 _h)	Settings for R_PDO2
3rd receive PDO parameter (1402 _h)	Settings for R_PDO3
4th receive PDO parameter (1403 _h)	Settings for R_PDO4
1st transmit PDO parameter (1800 _h)	Settings for T_PDO1
2nd transmit PDO parameter (1801 _h)	Settings for T_PDO2
3rd transmit PDO parameter (1802 _h)	Settings for T_PDO3
4th transmit PDO parameter (1803 _h)	Settings for T_PDO4

Table 3.6 Communications objects for PDO

Enable PDO In the default setting of the PDOs R_PDO1 and T_PDO1 as well as R_PDO2 and T_PDO2 are enabled. The other PDOs must be enabled first.

A PDO is enabled with bit 31 (valid bit) in subindex 01_h of that communications object:

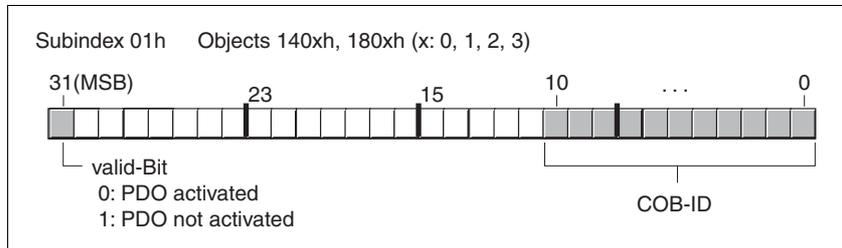


Figure 3.24 Enable PDOs with subindex 01_h, enable bit 31

Example Setting for R_PDO3 in object 1402_h

- subindex 01_h = 8000 04xx_h: R_PDO3 not enabled
- subindex 01_h = 0000 04xx_h: R_PDO3 enabled.

Values for "x" in the example depend on the setting of the COB ID.

PDO time intervals

The time intervals "inhibit time" and "event timer" can be set for every send PDO.

- The time interval "inhibit time" can be used to reduce the load on the CAN bus, which can be the result of continuous transmission of T_PDOs. If an interval time that is not equal to zero is entered, a sent PDO will only be sent again when the interval time expires. The time is set with subindex 03_h.
- The time interval "event timer" triggers an event message periodically. After the interval time has expired the device transmits the event-controlled T_PDO. The time is set with subindex 05_h.

3.7.4 PDO mapping

Up to 8 bytes of data from different areas of the object directory can be sent with a PDO message. The mapping of data in a PDO message is referred to as PDO mapping.

Figure 3.25 shows the data exchange between PDOs and object directory with two examples of objects in T_PDO1 and R_PDO1 of the PDOs.

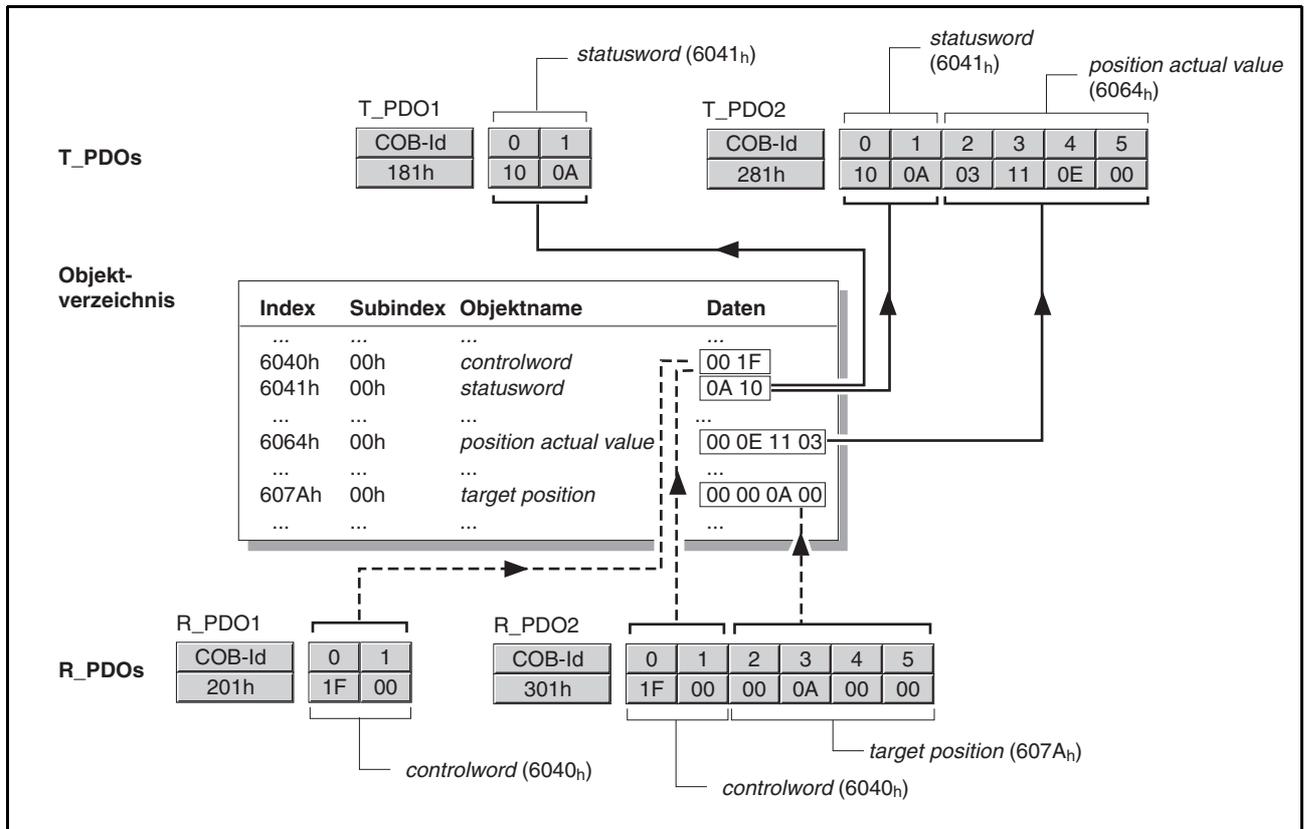


Figure 3.25 PDO mapping, in this case for a device with node address 1

Static PDO mapping

The N065 positioning controller supports static PDO mapping, that is all objects are mapped in the respective PDO according to an established, unchangeable setting.

The settings for PDO mapping are defined in an assigned communications object for every PDO.

Object	Description
1st receive PDO mapping (1600 _h)	PDO mapping for R_PDO1
2nd receive PDO mapping (1601 _h)	PDO mapping for R_PDO2
3rd receive PDO mapping (1602 _h)	PDO mapping for R_PDO3
1st transmit PDO mapping (1A00 _h)	PDO mapping for T_PDO1
2nd transmit PDO mapping (1A01 _h)	PDO mapping for T_PDO2
3rd transmit PDO mapping (1A02 _h)	PDO mapping for T_PDO3
7th transmit PDO mapping (1A03 _h)	PDO mapping for T_PDO7
33rd transmit PDO mapping (1A20 _h)	PDO mapping for T_PDO33
34th transmit PDO mapping (1A21 _h)	PDO mapping for T_PDO34

Table 3.7 Communication objects for PDO mapping

Structure of entries

Up to 8 8-byte values of 8 different objects can be mapped in a PDO. Every communications object for setting the PDO mapping provides 4 sub-index entries. A sub-index entry contains 3 pieces of information on

the object: the index, the sub-index and the number of bits that the object occupies in the PDO.

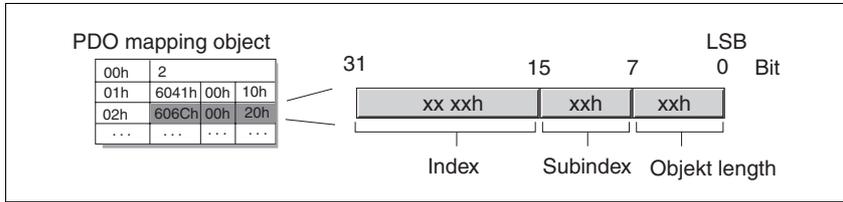


Figure 3.26 Structure of entries for the PDO mapping

The number of valid sub-index entries is contained in sub-index 00_h of the communications object.

3.8 Synchronisation

The synchronisation object SYNC controls the synchronous exchange of messages between network devices for purposes such as the simultaneous start of multiple drives.

The data exchange conforms to the producer-consumer relationship. The SYNC object is sent to all devices by a network device and can be evaluated by all devices that support synchronous PDOs.

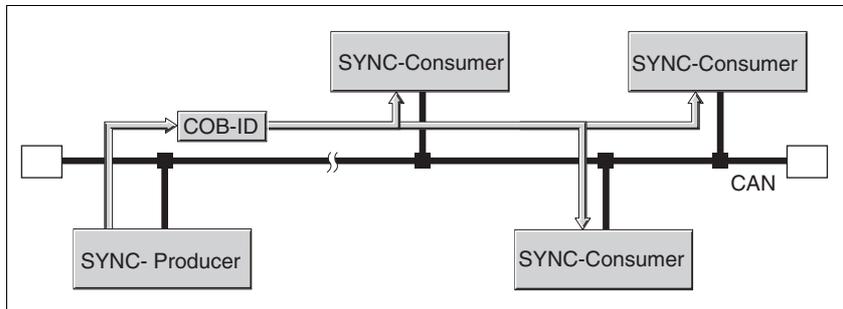


Figure 3.27 SYNC message

Synchronous data transmission

From the point of view of a SYNC receiver, the status data are first sent in a T_PDO and the new control data are received via an R_PDO in one time window. However, the control data are only processed when the next SYNC message is received. The SYNC object itself does not transmit data.

Cyclic and acyclic data transfer

Synchronous exchange of messages can be executed cyclically or acyclically.

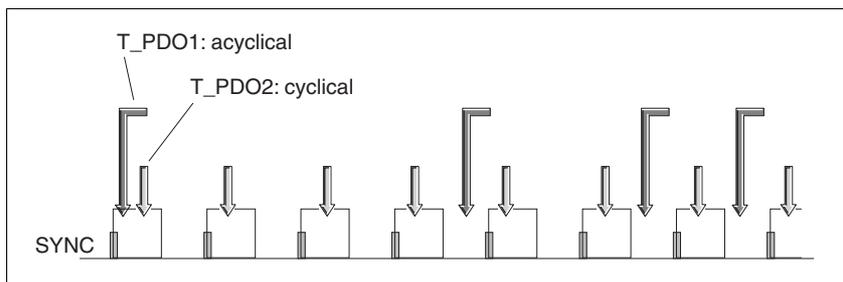


Figure 3.28 Cyclic and acyclic transmission

In cyclic transmission PDO messages are exchanged continuously in a specified cycle, e.g. with every SYNC message.

If a synchronous PDO message is sent acyclically, it can be sent or received at any time, but will only be valid with the next SYNC message.

The cyclic or acyclic behaviour of PDOs is stored in subindex `transmission type (02h)` of the corresponding PDO parameter, e.g. for R_PDO1 in the object 1st receive PDO parameter (1400_h:02_h).

COB-Id, SYNC object

For fast transmission the SYNC object is transmitted unconfirmed and with high priority.

The COB-Id of the SYNC object is set to the value 128 (80_h) by default. The value can be changed after initialising the network with the object COB-ID SYNC Message (1005_h).

"Start" PDO

In the default setting of the PDOs R_PDO2/T_PDO2 and R_PDO3/T_PDO3 are received and transmitted synchronously. Both PDOs are used for starting and monitoring operating modes. The synchronisation allows an operating mode to be started simultaneously on multiple devices and, for example, synchronisation of the feed of a multi-motor portal drive.

3.9 Emergency service

The emergency service reports internal device error over the CAN bus. The error message is sent to all devices with an EMCY object in accordance with the consumer-producer relationship.

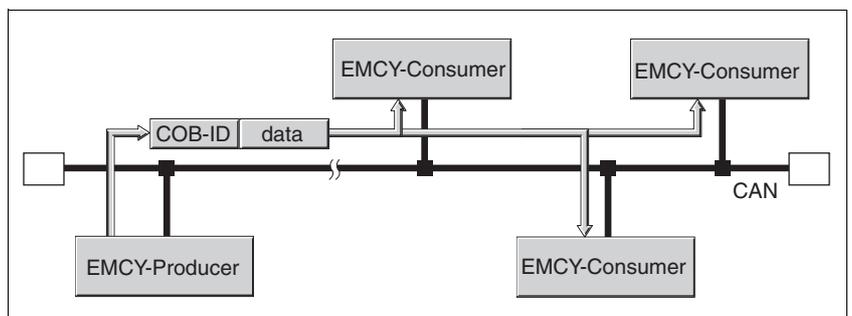


Figure 3.29 Error message via EMCY objects

Boot Up message

The communications profile is implemented according to DS 301, version 4.2. A boot-up message informs all network devices that the device that sent the message is ready for operation in the CAN network.

A boot-up message consists of the COB ID 700_h+Node-Id and one byte data corresponding to the Heartbeat protocol.

3.9.1 Error evaluation and handling

EMCY message

If an internal device error occurs, the device switches to error status according to the CANopen status machine. It sends an EMCY message with error register and error code at the same.

0098 441 113 270, V2.00, 12.08

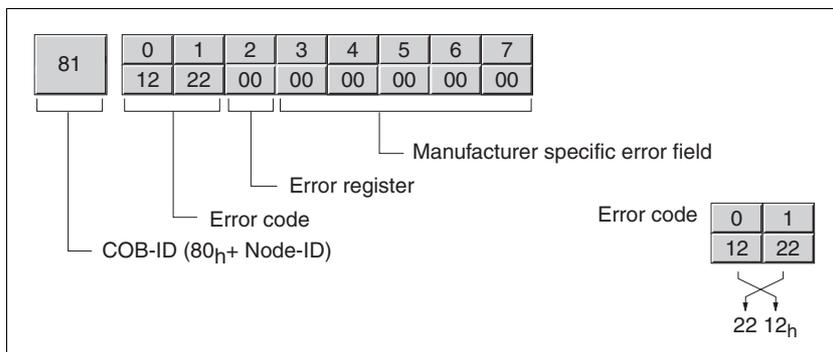


Figure 3.30 EMCY message

- Byte 0, 1 - error code: Error code, value is also stored in the object `Error code (603Fh)`
- Byte 2 - error register: Error register, value is also stored in the object `Error register(1001h)`
- Byte 3-7, manufacturer-specific error field: If the positioning drive is not supported!

COB-ID The COB-Id is calculated from the node address for every device in the network that supports an EMCY object:

$$\text{COB-Id} = \text{function code EMCY object (80_h) + node-Id}$$

The function code of the COB-Id can be changed with the object `COB-ID emergency(1014h)`.

Error register and error code The error register reports the error status of the device in bit-coded form. Bit 0 remains set so long as an error is pending. The remaining bits identify the error type. The precise cause of error can be found with the error code. The error code is sent in Intel format as a 2-byte value and must be reversed by bytes for evaluation.

A list of all error messages and responses by the device and remedies can be found in chapter 7 "Diagnostics and troubleshooting".

Error memory The positioning drive stores the error register in the object `Error register (1001h)` and the last error occurring in the object `Error code (603Fh)`. The last 5 error messages will also be stored at the same time in the sequence in which they occurred in the object `error field (1003h)`. The message about the last error occurring is stored at the memory location sub-index 01_h, while older error messages are at the higher memory location sub-index 02_h to 05_h. All error entries are deleted when switching off the drive or if the sub-index number of errors (00_h) of the object is set to "0".

3.10 Network management services

Network management (NMT) is a component of the CANopen communications profile and is used to initialise the network and start, stop and monitor the network devices in network mode.

NMT services are executed in a master-slave relationship. The NMT master addresses individual NMT slaves through their node address. A message with node address "0" is directed to all NMT slaves simultaneously.

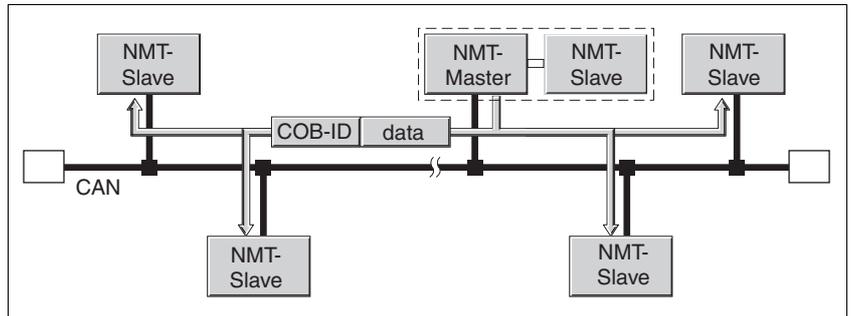


Figure 3.31 NMT services over the master-slave relationship

The device can only take on the function of a NMT slave.

NMT services NMT services can be divided into two groups:

- Services for device control, to initialise devices for CANopen communications and to control the behaviour of devices in network operation
- Services for connection monitoring, to ensure error-free network operation

3.10.1 NMT services for device control

NMT status machine The NMT status machine describes the initialising and status of an NMT slave in mains operation.

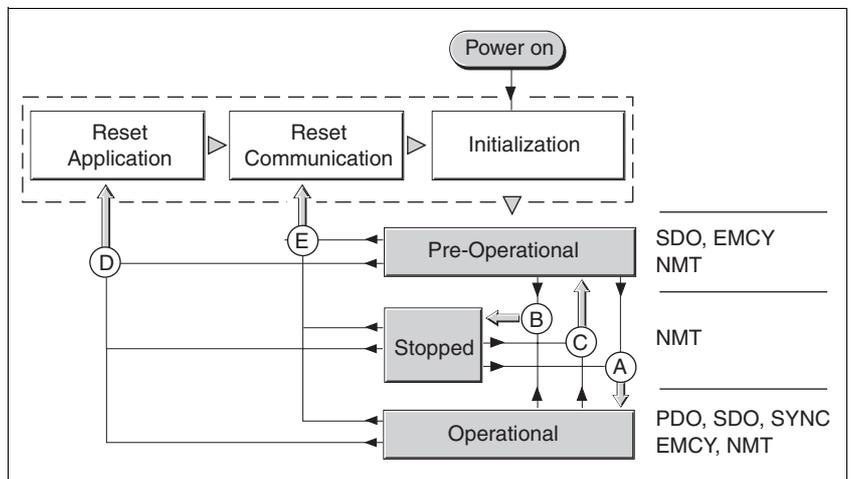


Figure 3.32 NMT status machine and available communications objects

The graphic shows on the right side all communications objects that can be used in the specific network status.

Initialisation An NMT slave automatically runs through an initialisation phase after the supply voltage is switched on (power on) to prepare it for CAN bus operation. After completing initialisation, the slave switches over into the "pre-operational" status and sends a boot-up message (COB-ID 700_h + node-id plus one byte NMT-status (=0)). Now a NMT master can control the operational behaviour of an NMT slave in the network with 5 NMT services, shown in the above graph with the letters A to E.

NMT service	Transition	Description
Start remote node(Start remote node)	A	Switches over into "operational status"Start normal mains operation to all users
Stop remote node(Stop remote node)	B	Switches over into the "status stopped"Stops communication of the users in the network. If connection monitoring is activated, it remains switched on
Enter Pre-Operational(change to the status "pre-operational")	C	Switches to "pre-operational status", all communications objects except for PDOs can be used. The "pre-operational status" can be used for configuration by SDOs: - PDO mapping - start of synchronisation - start of connection monitoring
Reset node(reset nodes)	D	Switch to "reset application status " Load saved data about the device profiles and switch automatically to "pre-operational" via the "reset communication status".
Reset communication (reset communications data)	E	Switch to ""reset communication status". Load stored communication profile data and switch automatically to "pre-operational status".

Non-volatile saved data If the supply voltage is switched on (power on), the device loads the non-volatile saved object data from the EEPROM to the RAM.

NMT message The NMT services for device control are sent as unconfirmed message with the COB-ID = 0. By default they receive top priority on the CAN bus. The data frame of the NMT device service consists of 2 bytes.

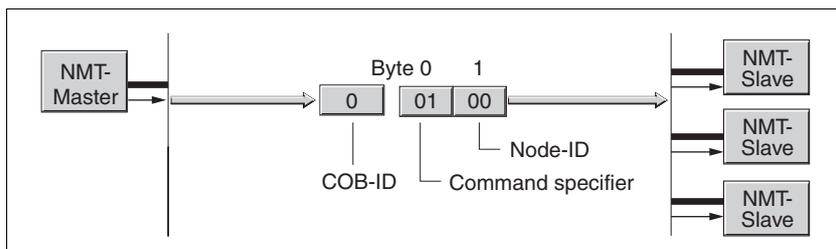


Figure 3.33 NMT message

The first byte, the "command specifier" identifies the NMT service in use.

Command Specifier	NMT service	Transition
1 (01 _h)	Start remote node	A
2 (02 _h)	Stop remote node	B
128 (80 _h)	Enter Pre-Operational	C
129 (81 _h)	Reset node	D
130 (82 _h)	Reset communication	E

The second byte addresses the receiver of a NMT message with a node address between 1 and 127 (7F_h). A message with the node address "0" is directed to all NMT slaves.

3.10.2 services for connection monitoring

Connection monitoring monitors the communications status of network devices, so a response to the failure of a device or an interruption in the network is possible.

Three NMT services for connection monitoring are available:

- "Node guarding" for monitoring the connection of a NMT slave
- "Life guarding" (monitoring for signs of life) for monitoring the connection of a NMT master
- "Heartbeat" for the unconfirmed connection message from network devices.

3.10.2.1 Node/life guarding

COB ID Connection monitoring is executed with the communications object NMT error control (700_h+node-Id). The COB ID for every NMT slave is calculated from the node address:

$$\text{COB ID} = \text{function code NMTerror control (700}_{\text{h}}) + \text{node-Id.}$$

Structure of the NMT message On request of the NMT master the NMT slave responds with one data byte.

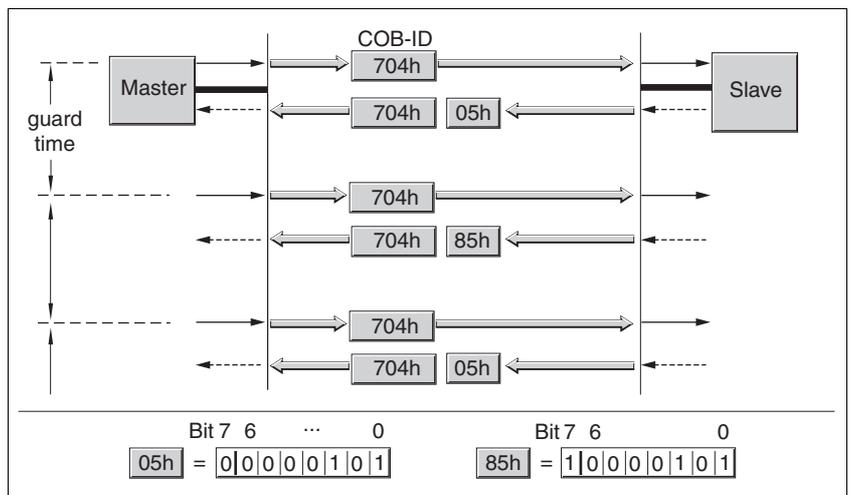


Figure 3.34 Acknowledgement of the NMT slave

Bit 0 to 6 identify the NMT status of the slave:

- 4 (04_h): "Stopped"
- 5 (05_h): "Operational"
- 127 (7F_h): "Pre-Operational"

After every interval "guard-time" bit 7 switches its status between "0" and "1", so the NMT master can detect and ignore a second acknowledgement within the "guard-time" interval time. The first request when starting connection monitoring begins with bit 7 = 0.

Connection monitoring must not be enabled during the initialisation phase of a device. The status of bit 7 is reset as soon as the device runs though the NMT status "Reset communication".

In NMT status "Stopped" the connection monitoring continues to operate.

Connection error The NMT master reports a connection error to the higher level master program if:

- the slave does not acknowledge within the "guard-time" period
- the NMT status of the slave has changed without the initiation of the NMT master.

Figure 3.35 shows an error message after the end of the third cycle because of a missing answer of a NMT slave.

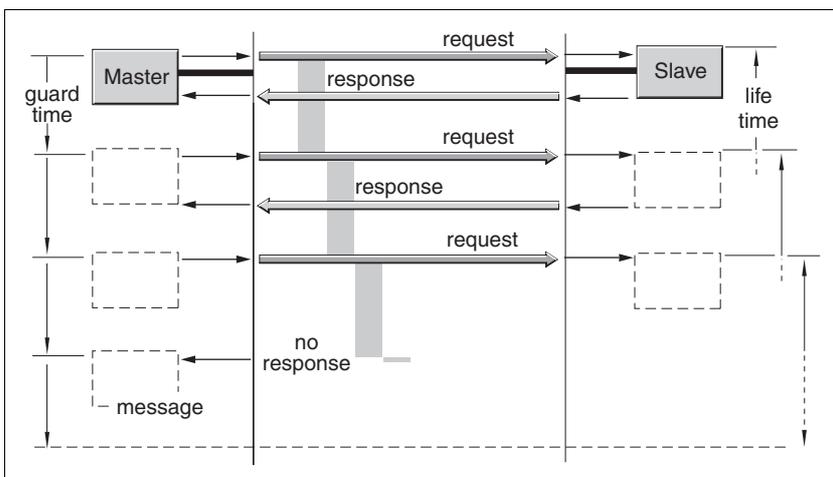


Figure 3.35 "Node guarding" and "Life guarding" with time intervals

3.10.2.2 Heartbeat

The optional heartbeat protocol replaces the node/life guarding protocol. It is recommended for new device versions.

A heartbeat producer transmits a heartbeat message cyclically at the frequency defined in the object `Producer heartbeat time (1017h)`. One or more consumers can receive this message. `Producer heartbeat time (1016h) = 0` disables heartbeat monitoring.

The relationship between producer and consumer can be configured with objects. If a consumer does not receive a signal within the time interval specified in the object `Consumer heartbeat time (1016h)`, it generates an error message (heartbeat event). `Consumer heartbeat time (1016h) = 0` disables the monitoring by a consumer.

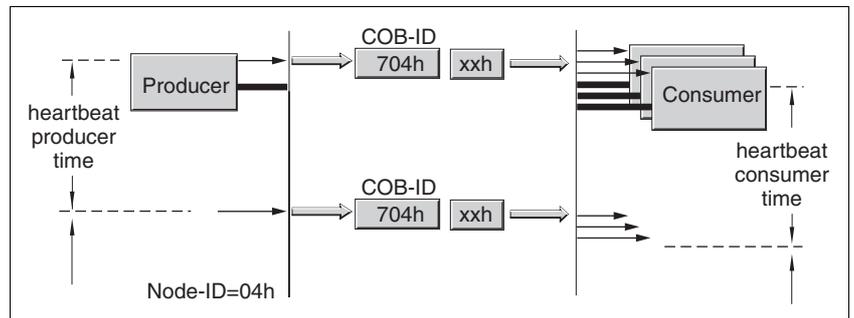


Figure 3.36 "Heartbeat" monitoring

Data byte for NMT status evaluation of the "heartbeat" producer:

- 0 (00_h): "boot-up"
- 4 (04_h): "Stopped"
- 5 (05_h): "Operational"
- 127 (7F_h): "Pre-Operational"

Time intervals

The time intervals are set in 1-ms steps and must not be set smaller for the consumer than for the producer. Whenever the "heartbeat" message is received the time interval of the producer is restarted.

Start of monitoring

"Heartbeat" monitoring starts as soon as the time interval of the producer is greater than zero. If "heartbeat" monitoring is active during the NMT status change to "pre-operational" then "heartbeat" monitoring starts by sending the "boot up message". Information about the "boot-up" message can be found in chapter 3.9 "Emergency service".

Devices can monitor each other by means of the "heartbeat" message. They adopt a consumer and producer function simultaneously.

3.11 Layer Setting Services (services for address and transmission rate setting)



Due to compatibility to existing applications (D065), the LMT-Service according to CiA DS-205 Part 1 and 2 are also still supported.

With LSS services (LSS: Layer Setting Services) the node addresses and rates of transmission of network users can be set over the CAN bus. Devices which support LSS configuration do not need a hardware DIP switch.

LSS services belong to the CAN Application Layer and are described in the "CiA Draft Standard Proposal (DSP) 305 Version 1.1.1".

3.11.1 LSS data transmission

LSS objects

The LSS services operate according to the principle of a master-slave relationship and use two objects for communication.

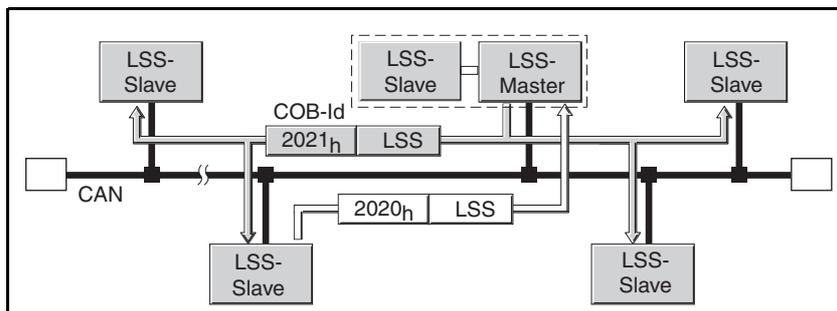


Figure 3.37 LSS Master Slave relationship

The LSS master sends with the LSS master object, COB-ID=2021 (7E5_h) to one or all LSS slaves. If the LSS master sends a message to an LSS slave, the slave answers over the LSS slave object, COB ID = 2020 (7E4_h). LSS messages which are directed to all LSS slaves remain unvalidated.

Attributes of an LSS slave An LSS slave is specified by three attributes:

- LSS address,
- LSS mode,
- LSS class.

An LSS slave is identified by the LSS address. The LSS mode indicates whether the LSS slave operates in a configuration or a normal mains operation. The LSS class informs about the LSS services which an LSS slave supports. The compact drive supports all LSS services required for configuration.

3.11.2 Configuration and operation mode

In order to configure an LSS slave, the slave must be switched out of the operation mode in which it operates according to its foreseen task into configuration mode. Two LSS services serve to arrange the change between operation mode and configuration mode.

- "Switch mode selective" switches an LSS slave from operation mode into configuration mode.
- "Switch mode global" at the same switches all LSS slaves into operation mode or configuration mode, controllable over the parameter "mode".

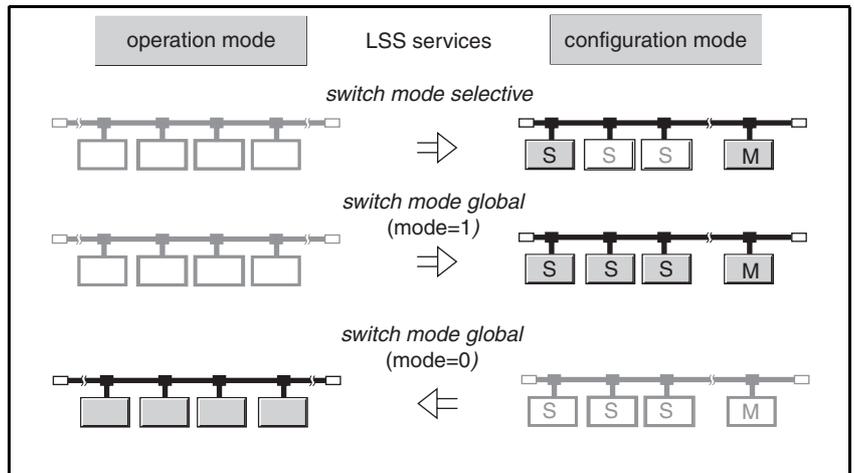


Figure 3.38 LSS services to switch between operation mode and configuration mode

The two LSS services "switch mode selective" and "switch mode global" are activatable in normal mains operation - in operation mode. All other LSS services can only be executed in configuration mode.

Setting configuration mode

Selection of the correct LSS service for a change in the configuration mode is dependent on the LSS services which should be executed in configuration mode.

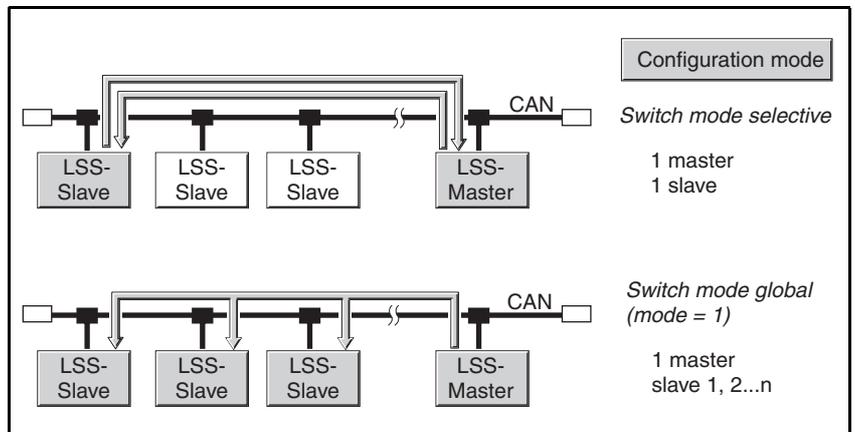


Figure 3.39 LSS services with one or all LSS slaves in configuration mode

LSS services which must validate the LSS slave must only be executed by an LSS slave in configuration mode. These include, for example, the LSS services for setting the node address and rate of transmission. Other LSS services are directed simultaneously to all LSS slaves. The configuration mode with the LSS service "Switch mode global" can be switched on for these services.

3.11.3 LSS services in compact drive

"Command specifier" CS LSS services are identified over the "command specifier" CS. CS is the first byte of the eight byte data frame of a LSS message.

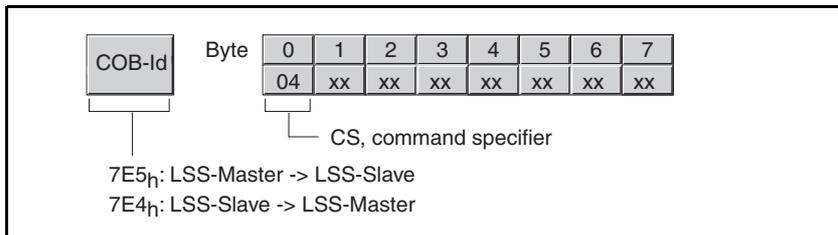


Figure 3.40 LSS message, here the LSS service "Switch mode global"; "xx" are bytes without any significance for service selection

LSS services implemented in the positioning drivecompact drive and their "command specifier" are:

CS	LSS service	Description	Slave
64 (40 _h) 65 (41 _h) 66 (42 _h) 67 (43 _h)	Switch mode selective	Switching of an NMT slave into configuration mode. Addressing the slave over a vendor ID (64), product code (65), revision number (66) and serial number (67).	n
4 (04 _h)	Switch mode global	Switching of all LSS slaves in operation or configuration mode.	n
17 (11 _h)	Configure module id	Assigning an LSS slave a new node address.	1
19 (13 _h)	Configure bit timing parameters	Setting the rate of transmission for an LSS slave.	1
21 (15 _h)	Activate bit timing parameters	Activation of the new baud rate settings	n
23 (17 _h)	Store configuration	Store LSS configuration	1

Table 3.8 LSS services

The table indicates in the column "slave" whether only one LSS slave can operate in configuration mode (1) for the LSS service or all attached slaves (n).

Changing LSS mode

The LSS service "Switch mode global" (CS = 04_h) switches all LSS slaves simultaneously into the configuration mode or the operation mode, depending on the parameter "mode".

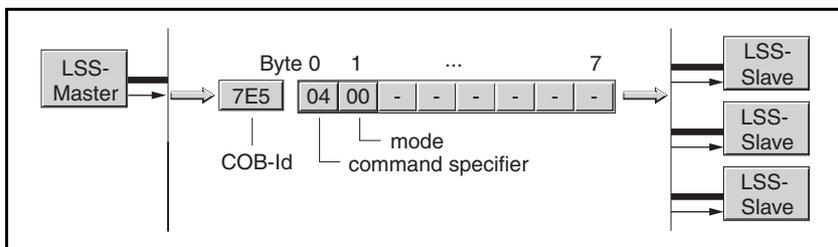


Figure 3.41 LSS service "Switch mode global"

- Byte 0: CS = 04_h
- Byte 1: mode
0: Switch over into operation mode
1: Switch over into configuration mode.

The LSS message is transmitted unvalidated.

LSS address In order to just switch over one LSS slave it is necessary to know the LSS address of the slave. It consists of 4 parts which are stored in a permanent form in the device and which identifies each device in the network uniquely. Every part of the address must be transmitted in the following sequence with its own "command specifier".

- Identifier for the manufacturer, CS = 40_h
- Product code, CS = 41_h
- Revision number, CS = 42_h
- Serial number of the drive, CS = 43_h

The LSS messages are transmitted unvalidated. After receiving the full LSS address the user switches over automatically into configuration mode.

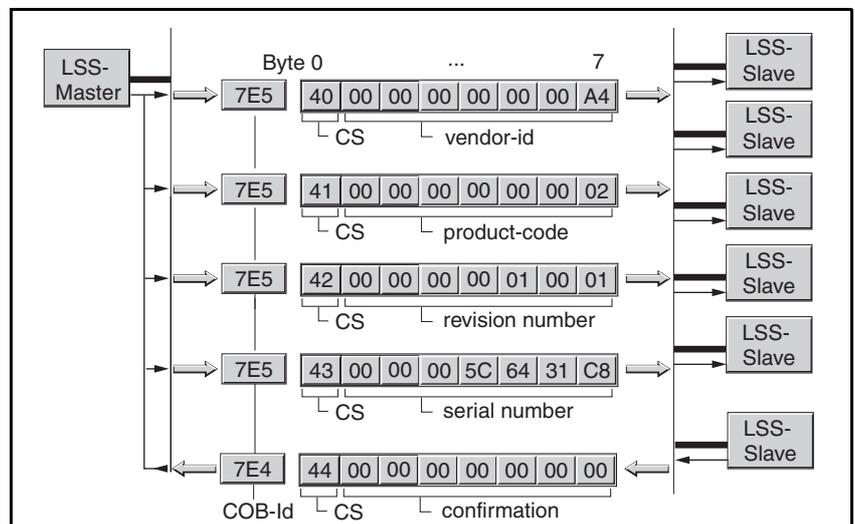


Figure 3.42 LSS service "Switch mode selective" with example data

The above graphic shows:

- Identifier for the manufacturer = A4_h
- Product code = 2 (for IcIA N065)
- Revision number = 00 01 (CANopen Verh.) 00 01 (Software Rel.)
- Serial number of the drive = 1550070216

Switching back into operation mode is achieved using "Switch mode global" (CS=04_h), mode=0.

The serial number can also be read per SDO over the object drive serial number (200F_h) from the device.

3.11.4 Node address

Setting the NMT node address

The NMT node address (node ID) is set using the LSS service "Configure node ID" (CS = 11_h). A value between 1 and 127 (7F_h) is transmitted in the byte "node ID" as a new node address.



The value 255 as node address is permitted with CiA DSP-305. With this value the node address will be deleted (non-configured device); then a CANopen communication (NMT, SDO, PDO, etc.) is no more possible!

The LSS service is transmitted validated and must only be executed with an LSS slave in configuration mode. An example for awarding the node address can be found in chapter 5.2 "Setting the address and the baud rate".

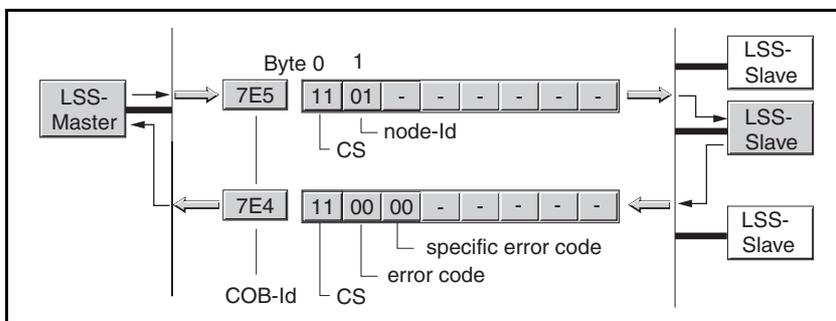


Figure 3.43 LSS service "Configure node ID", here with node ID=01_h

Setting the NMT node address, answering the LSS slave

The LSS slave confirms setting of the new node address or reports an error.

- Byte 0: CS = 11_h
- Byte 1: error code:
0: Message correctly executed
255: Fault arisen
- Byte 2: specific error code
if "error code" = 255: Information about the error message

The node address of "127" is preset for the compact drive when delivered ex works.

Saving settings.

An altered setting is stored remanently using the LSS service "Store configuration" (CS=17_h) and is available whenever the device is switched on.

The LSS service is transmitted validated and must only be executed with an LSS slave in configuration mode.

Only the "command specifier" in the LSS message is entered and transmitted to start the LSS service.

Save setting Answering the LSS slave

- Byte 0: CS = 17_h
- Byte 1: error code
0: Message correctly executed
1: Storing of the values is not supported
255: Fault arisen
- Byte 2: specific error code
Information about the error message, if "error code" = 255.

3.11.5 Transfer rate

Two LSS services are used to set the rate of transmission. The first selects the baud rate but it is not yet activated. The second service ensures that all devices change their baud rate simultaneously so that they can communicate with each other shortly afterwards.

Changing the rate of transmission

The LSS service "Configure bit timing parameters" switches over the baud rate of a device according to a baud rate table. There is at one least one baud rate table stored in a device.

- Byte 0: CS = 13_h
- Byte 1: table selector
Select table for setting the rate of transmission
0: Standardised table 128..255: Manufacturer-specific tables not supported by the compact drive.
- Byte 2: table index
Index entry from the respective table to select a baud rate.

The values in the standard table are:

Table index	Baud rate [Kbaud]	Table index	Baud rate [Kbaud]
0	1000	6	50
1	800	7	20
2	500	8	10
3	250		
4	125		

Table 3.9 Rate of transmission, standard table

Slaves in configuration mode are executed. An example of a setting for the rate of transmission can be found in chapter 5.2 "Setting the address and the baud rate".

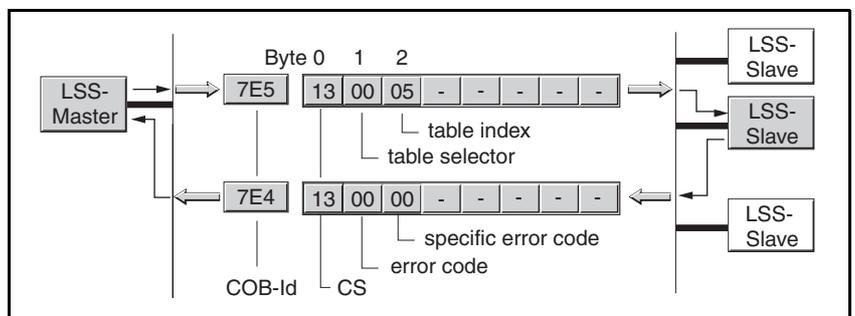


Figure 3.44 LSS service "Configure bit timing parameters"

Changing the rate of transmission
Answering the LSS slave

- Byte 0: CS = 13_h
- Byte 1: error code
0: Message correctly executed
1: Baud rate not supported
255: Fault arisen
- Byte 2: specific error code
Information about the error message, if "error code" = 255.

If no other agreement has been made then a baud rate of 20 kBit/sec. is preset at the time of delivery of the positioning drive.

Saving settings.

The setting is stored remanently using the LSS service "Store configuration" (CS=17_h) and is available whenever the device is switched on.

Activate rate of transmission

If a new rate of transmission has been set using the LSS service "Configure bit timing parameters" (CS = 13_h) then it must also be switched over simultaneously for all network users using the service "Activate bit timing parameters" (CS = 15_h). The rate of transmission can also be activated by switching off and switching on the supply voltage.

By transmitting a wait time, "switch delay" [msec], to all users one ensures that no user transmits at the old baud rate and other users are already receiving at the new baud rate. The LSS message is transmitted unvalidated.

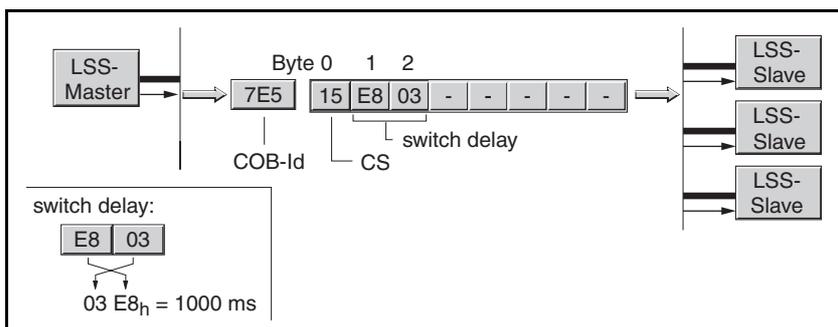


Figure 3.45 LSS service "Activate bit timing parameters" with wait time, "switch delay" [msec]

The wait time is analysed twice: During the first wait time every user remains ready to receive at the old baud rate. If the wait time for one user has expired then it must switch over to the new baud rate. It must not send anymore at the old baud rate. After expiry of the second wait time, transmission and reception by all users is at the new baud rate.

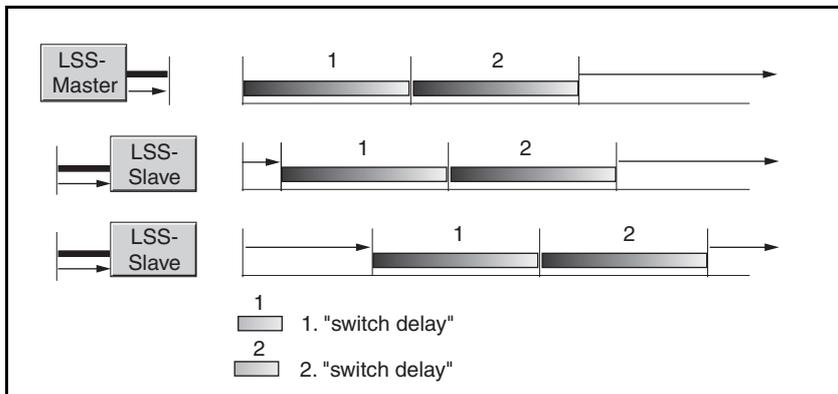


Figure 3.46 Delay of the start of the wait time "switch delay" by a still running transmission made by LSS slaves



In order to avoid a user already transmitting at the new rate of transmission while another is still set at the old baud rate, the wait time "switch delay" should be selected to be so large that all users can complete any running transmission within a time interval and have received the LSS message.

4 Installation

4.1 EMC

EMC requirements must be taken into account when laying and connecting wire cables in an electromagnetic environment.

EMC measures

The following measures are necessary for trouble-free field bus operation. They are in addition to the device-specific EMC measures in the device manual.

EMC measures	Effect
Use cables with braided and foil shields	Deflect interference voltages
Field bus cables can be laid in one conduit with signal wires and analogue wires. Do not lay them with DC and AC cables carrying over 60V.	Avoid mutual interference
Use equipotential bonding conductors in systems with- wide-area installations- different voltage feeds- networking between buildings	Deflect interference currents
Use fine-core bonding conductors	Deflect even high-frequency interference currents

In digital cables, the shields are connected at both ends to protect against interference. Potential differences can result in excessive currents on the shield and must be prevented by equipotential bonding conductor cables. For cables up to 200 metres in length, a cross-section of 16 mm² is sufficient, but for longer cables a cross-section of 20 mm² must be used.

4.2 Unit installation

For information on device installation and connecting the device to the fieldbus see the product manual.

5 Commissioning

5.1 Setting up the device

For installation in the network the device must be mechanically and electrically installed correctly and the device must be successfully commissioned.

Set up the device following the manual. This prepares the device for operation in the network. If the positioning drive is already referenced then you can execute a first manual test run without a field bus connection. Details are described in the device manual. You can only check the reference status of the drive over the fieldbus. An example can be found in chapter 6.4.11 "CANopen example "Homing"".

The CAN bus master node address and rate of transmission are preset for operation of the positioning drive in the CAN bus. A field bus device with LSS master functionality must be integrated in the CAN bus to alter settings.

For programme development under CANopen it is meaningful to use a CAN monitor in order to test, observe and analyse the data which should be exchanged over the CAN bus.

5.2 Setting the address and the baud rate

The node address and rate of transmission are set using LSS services. The following presettings are stored in the compact drive:

- Node address 127
- Rate of transmission 20 kBaud.

The settings can be altered over an LSS master. There are two configuration options available:

- compact drive is the only user in the network: Configuration in LSS mode ""Switch mode global""
- compact drive is integrated into a running mains operation: Configuration in LSS mode ""Switch mode selective""

The LSS address of the compact drive must be known or transmitted via SDO for the second variant.

Information about the LSS services can be found in chapter 3.11 "Layer Setting Services (services for address and transmission rate setting)".

5.2.1 Address and baud rate adjustment in LSS mode "Switch mode global"

- ▶ Switch off all CAN bus users except the LSS master and the compact drive which you wish to configure.

CANopen example "Node address and baud rate"

The COB ID of LSS services are:

- for the LSS master: 2021 (7E5_h),
- for the compact drive as an LSS slave: 2020 (7E4_h).

COB-ID	Data	Description
7E5	04 01 xx xx xx xx xx xx	Change to configuration mode
7E5	11 01 xx xx xx xx xx xx	Allocate new node address 01h
7E4	11 00 00 xx xx xx xx xx	Answer: Message correctly executed
7E5	13 00 04 xx xx xx xx xx	Set new baud rate of 125 kBd
7E4	13 00 00 xx xx xx xx xx	Answer: Message correctly executed
7E5	17 xx xx xx xx xx xx xx	Store configuration
7E4	17 00 00 xx xx xx xx xx	Answer: Message correctly executed
7E5	15 E8 03 xx xx xx xx xx	Activate baud rate switchover, wait about 3 times the "delay time" then ..
7E5	04 00 xx xx xx xx xx xx	Change over to operation mode

The settings for the baud rate are equivalent to those in the standard table, see page 28.

The new baud rate must also be switched on for the NMT master before changing over to operation mode.

5.2.2 Address and baud rate adjustment in LSS mode "Switch mode selective"

The LSS address of the compact drive consists of four parts:

- Manufacturer ID = 0xA4 (00_h 00_h 00_h A4_h),
- Product code = 2 (00_h 00_h 00_h 02_h),
- Revision number = 0101 (00_h 01_h 00_h 01_h),
- Serial number.

Every compact drive has its own serial number which can be determined via SDO over the manufacturer-specific object identity object (Index 1018_h, Sidx 04_h). You will also find the number on the device on the nameplate or a barcode sticker.

CANopen example Request the "serial number"

The example shows request for the serial number of the user with the address 127 (7F_h) by SDO over the object identity object (Index 1018_h, Sidx 04_h).

The COB ID for R_SDO is 600_h+7F_h and that for T_SDO is 580_h+7F_h.

COB-ID	Data	Description
0	80 7F	NMT Service "Pre-operational", node address: 127 (7Fh)
67F	40 18 10 04 00 00 00 00	R_SDO: Requesting the serial number
5FF	43 18 10 04 15 2B 2C BA	T_SDO: Serial number 3123456789 = BA2C2B15 _h

With manufacturer ID, product code, revision number and serial number, the compact drive can now be addressed in order to set the rate of transmission and node address:

CANopen example "Node address" The example shows setting of the node address in the network. The objects of the LSS services are for the LSS master: 2021 (7E5_h) and for the compact drive as an LSS slave: 2020 (7E4_h).

COB-ID	Data	Description
7E5	40 A4 00 00 00 00 00 00	Mode change vendor ID
7E5	41 02 00 00 00 00 00 00	Mode change product code
7E5	42 00 01 00 01 00 00 00	Mode change revision number
7E5	43 BA 2C 2B 15 00 00 00	Mode change serial number (hex)
7E4	44 00 00 00 00 00 00 00	Slave acknowledges with 7E4h: status changed
7E5	11 01 xx xx xx xx xx xx	Assign new node address 01 _h
7E4	11 00 00 xx xx xx xx xx	Answer, message correctly executed
7E5	17 xx xx xx xx xx xx xx	Store configuration
7E4	17 00 00 xx xx xx xx xx	Answer, message correctly executed
7E5	04 00 xx xx xx xx xx xx	Change over to operation mode

5.3 Setting reference values and the direction of rotation

The compact drive can only be driven in reference status. If the drive is not referenced then the reference values must be set in the operating mode homing (homing mode). If the drive is already installed then the set direction of rotation must be taken account of for the test operation.

Preparation for homing If the compact drive is addressed then the drive can be enabled for mains operation over the NMT service "Start remote node". The operating modes can then be changed afterwards over the PDOs. The example in chapter 6.4.11 "CANopen example "Homing"" shows all steps required to prepare the drive for homing.

Perform homing If the drive is not yet coupled to the system mechanics then you can proceed with homing according to the example shown in the chapter 6.4.11 "CANopen example "Homing"". The reference values in the example do lead to valid homing but do not take account of your system constellation.

An example for calculation of suitable referencing values for your system constellation can be found in chapter 5.3 "Setting reference values and the direction of rotation".

Setting the direction of rotation The direction of rotation can be altered using two settings: over the direction of rotation factor and over the position value.

Information about definition and setting of the direction of rotation can be found in chapter 6.7.3.2 "Reversal of direction of rotation".

5.4 Test run

Jog To perform a test run in jogging mode, the jogging mode signals MAN_P and MAN_N must be attached at the signal interface.

Activate the signal MAN_P or MAN_N. The drive turns through a positive turning factor clockwise and if MAN_N is activated then it also turns anticlockwise.

Positioning using CAN bus A test run over CAN bus is performed in the operating mode "Positioning". The example on page 6.4 "Point-to-point mode as "Profile Position mode" to DSP 402" shows all steps required to perform point to point positioning with a referenced drive.

6 Operation

6.1 Operating statuses and operating modes

6.1.1 Overview: Operating status, operating transitions and operating mode

When controlling a positioning drive one differentiates between control of the device by a higher level control unit such as a programmable logic controller) and the internal control of operating functions by the device.

Operating states After switching on the positioning drive and executing a travel command in a operating mode the drive switches between various operating statuses. The operating statuses are selected in such a way that the device can be switched on and off in a controlled manner or can be brought back into operation again after an error event. The operating status and operating transitions are described in the status machine according to the device profile DSP 402, see picture 5.1.

Operating transitions Operating transitions between two operating statuses are performed in 6 ways:

- via a command,
- automatically, e.g. when switching on the device,
- as a reaction to an error event.

Operating modes The positioning drive can work through travel commands in the three different operating modes:

- manual mode over signal inputs MAN_N and MAN_P (standard version),
- manual mode over fieldbus (simulated manual mode),
- manufacturer-specific positioning mode, positioning mode (DSP 402, object group "Profile Position Mode"),
- Speed of rotation mode (DSP 402, object group "Profile Velocity Mode"),
- Homing mode (DSP 402, object group "Homing Mode").

All operating modes can be set over the fieldbus.

If no error has occurred then the drive, after switching on the supply voltage, finds itself in the operating mode manual mode. If no fieldbus is connected then the positioning drive only operates in manual mode and is controlled over the control inputs for manual mode.

The positioning mode can be executed either by means of a definite movement profile according to the CANopen profile DSP 402 or with manufacturer-specific, definable movement profiles. Travel command can be processed in all operating mode (except manual mode) only in operating status "Operation enable".

6.2 Operating states and mode transitions

6.2.1 CANopen status machine

The relationships between the operating statuses and mode transitions of the compact drive are mapped under CANopen in the status machine of DSP 402 for drives.

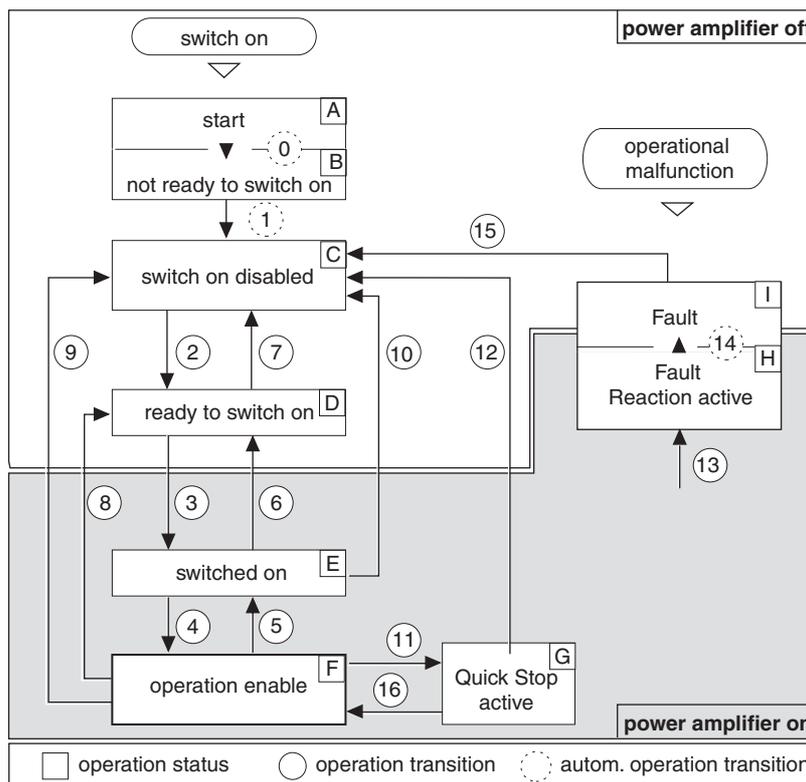


Figure 6.1 Diagram of the status machine

The operating statuses are set by the user by using CANopen object Controlword (6040_h) and monitored with the object Statusword (6041_h). Monitoring and system functions control and influence the operating status inside the device such as temperature and current monitoring. The status machine of DSP 402 refers to the drive system. In contrast to this the NMT status machine for DS 301 describes the operating statuses in network operation.

Operating states

In Figure 6.1 the operating statuses are marked by rectangles 1 to 9 while mode transitions are marked by circles 0 to 16. The table shows the operating statuses of the status machine and their meaning.

Status	Designation	Meaning
A	Start	24 V switched on initialising the device electronics
B	Not ready to switch on	The power amplifier is not ready to switch on
C	Switch on disabled	Switching on the power amplifier is disabled
D	Ready to switch on	The power amplifier is ready to switch on
E	Switched on	Power amplifier is ready to switch on, no operating mode active
F	Operation enable	Device is ready
G	Quick-Stop active	A Quick-Stop is being executed
H	Fault reaction active	Fault recognised, fault response activated if possible
I	Fault	



After being switched on the compact drive remains in operating status A for about 4 seconds for initialisation.

Variations of the compact drive to the status machine according to DSP 402

In order to keep the operating temperature of the compactly built compact drive as low as possible, the operational behaviour deviates in two ways from the illustration of the status machine according to DSP 402:

- The power amplifier is switched off as soon as the motor axis stops. This concerns the statuses "Operation enable" and "Quick-Stop".
- The operating status "Switched on" does not switch on the power amplifier yet. The power amplifier is switched on automatically if a travel command is started and the operating status "Operation enable" is set. The power amplifier is switched off again after the travel command is completed.

These variations to DSP 402 have no relevance for describing the change of state under CANopen. In the compact drive all statuses and change of state are permissible and necessary, as for every other device according to DSP 402.

Operating transitions

Mode transitions via a command are initiated by the object `controlword (6040h)`.

The following table shows the mode transitions which can be initiated via a command. The given numbers of the transitions, the letters of the starting and end statuses refer to the status machine, Figure 5.1

Transition no.	Transition from/to	Command	Response
②	C → D	Shutdown	Status change
③	D → E	Switch on	Change of state; the energy for the DC bus must be available.
④	E → F	Enable Operation	Drive function is enabled; Device switches on the power amplifier automatically for a travel command.
⑤	F → E	Disable operation	End travel command; power amplifier is switched off; dDrive function deactivated.
⑥	E → D	Shutdown	Status change
⑦	D → C	Quick Stop	Status change
⑧	F → D	Shutdown	End travel command; power amplifier is switched off; Drive function deactivated.
⑧	F → C	Disable voltage	End travel command; power amplifier is switched off; Drive function deactivated.
⑩	E → C	Disable voltage	Status change
⑪	F → G	Quick Stop	Execute "Quick Stop" halt; stops any motor movement; Drive stops; power amplifier is switched off.
⑫	G → C	Disable voltage	Status change
⑬	→ H		Error response after a breakdown
⑭	H → I		Transition in status "Fault"
⑮	I → C	Fault Reset	Acknowledge error in order to leave status "Fault".
⑯	G → F	Enable operation	Continue set travel command out of the status "Quick Stop"

Automatic mode transitions

The mode transitions 0 and 1 run after switching on the device, while mode transition 14 runs automatically after an error event.

Error response Mode transitions 13 initiates an as soon as an a monitoring signal reports a breakdown to which the device must react.

In status H "Fault reaction active" the actions of the device are executed which are foreseen for the case of a non-fatal error, for example interruption of the current positioning, deactivation of the power amplifier, gear of an error message. The device then changes into the status "Fault".

An operating error can be indicated by, for example, a temperature sensor. The device breaks off the current travel command, executes an error response, for example a rapid halt with Quick Stop or switching off of the power amplifier, and then changes into the operating status "Fault". Every breakdown is reported on the network by a EMCY message.

In order to leave the operating status "Fault" the cause of the error

- must be removed,
- the bit 7 `Reset fault` from the object `Controlword` of 0 set to 1.

The device must run through the transitions 15, 2, 3 and 4 after removing the error in order to again come into the status "Operation enable".

6.2.2 Changing and monitoring operating statuses

The operating statuses are set by the user by using CANopen object `Controlword` (6040_h) and monitored with the object `Statusword` (6041_h). Monitoring and system functions in the device control and influence the operating states, such as temperature and current monitoring.

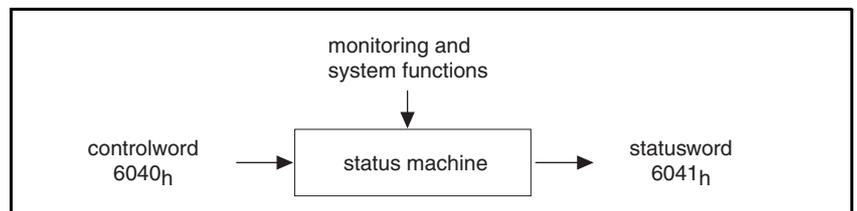


Figure 6.2 Changing and monitoring the operating status

Control word (6040_h) The 16 bit object `Controlword` allows a number of control tasks to be executed:

- Changing between the various operating statuses. Possible statuses and transitions can be found in chapter 5.2 "Setting the address and the baud rate" from page 59. Bits 0 to 3 and bit 7 are relevant for a state change
- Starting and interrupting operating mode specific functions, such as starting a travel command via bit 4. Bits 4 to 6 are used for the operating mode specific settings. Details can be found in chapter 6.2.3 "Setting and monitoring operating modes" and the respective description of the operating modes.
- Stopping the positioning drive during a currently operating movement mode. Bit 8 `HalT` is used to stop the drive. Details can be found in chapter 6.2.3 "Setting and monitoring operating modes".

The following table shows the designations of bits for the control words.

Bit	Significance	Bezeichnung
0	LSB	Switch on
1		Disable voltage (low active)
2		Quick stop (low active)
3		Enable operation
4 - 6		Operation specific
7		Reset fault
8		Halt
9 - 10		reserved
11-15	MSB	Manufacturer specific, not used

Status word (6041_h) The 16 bit object `Statusword` allows you to execute the monitoring functions:

Checking the operating status of the positioning controller. Here it is bits 0 - 3, 5 and 6 which are relevant.

Bit 4 indicates whether the power amplifier is ready to process a travel command.

Bits 7 to 15 are used for monitoring the movement mode and for status monitoring of device specific statuses. Details about monitoring the movement mode can be found in chapter 6.2.3 "Setting and monitoring operating modes" and the respective description of operating modes. The bits for status monitoring of the device are described in chapter 7 "Diagnostics and troubleshooting".

The following table shows the designations of bits for the status words.

Bit	Significance	Designation
0	LSB	Ready to switch on
1		Switched on
2		Operation enabled
3		Fault
4		Voltage disabled
5		Quick stop
6		Switch on disabled
7		Warning
8		Manufacturer specific
9		Remote
10		Target reached
11		Internal limit active
12 - 13		Operation mode specific
14 - 15	MSB	Manufacturer specific

Changing operating statuses The operating statuses are set via the control word with the object `controlword` (6040_h). Bits 0 to 3 and bit 7 are relevant for a state change

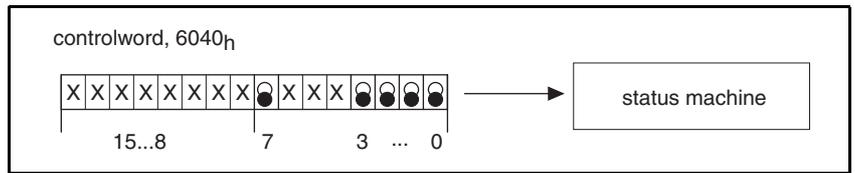


Figure 6.3 Bits in the control word for changing the operating status

Obj. Controlword (6040 _h) Mode transition : Command	Changing to the operating status	Bit 7, Reset Fault	Bit 3, Enable operation	Bit 2, Quick-Stop	Bit 1, Disable voltage	Bit 0, Switch On
② ⑥ Shutdown	<input type="checkbox"/> Ready to switch on	X	X	1	1	0
③ Switch on	<input type="checkbox"/> Switched on	X	X	1	1	1
⑦ ⑧ ⑩ ⑫ Disable voltage	<input type="checkbox"/> Switch on disabled	X	X	X	0	X
⑦ ⑩ Quick Stop	<input type="checkbox"/> Switch on disabled	X	X	0	1	X
⑪ Quick Stop	<input type="checkbox"/> Quick Stop active	X	X	0	1	X
⑤ Disable operation	<input type="checkbox"/> Switched on	X	0	1	1	1
④ ⑯ Enable operation	<input type="checkbox"/> Operation enable	X	1	1	1	1
⑫ Fault reset	<input type="checkbox"/> Switch on disabled	0 -> 1	X	X	X	X

- Operating status according to status machine
- Mode transition according to the status machine

The bit states in the fields marked with an "X" do not have any meaning for the respective state change. Bits 4 to 6 are used for the operating mode specific settings. Details can be found the description of the respective operating modes and further on in the chapter.

In order to obtain rapid access to a change of state the data of the control word is mapped in the first two bytes of PDOs R_PDO1, R_PDO2 and R_PDO3.

Monitoring operating statuses

The operating statuses are, for use of standardised operating modes, monitored over the bits 0 to 3, 5 and 6 of the status word, readable over the object Statusword (6041_h).

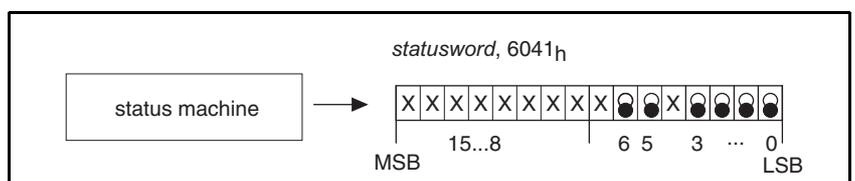


Figure 6.4 Bits in status word for detection of the operating status

Object Statusword (6041 _h)status	Bit 6, Switch on disable	Bit 5, Quick-Stop	Bit 3, Fault	Bit 2, Operation enable	Bit 1, Switch on	Bit 0, Ready to switch on
<input type="checkbox"/> B Not ready to switch on	0	X	0	0	0	0
<input type="checkbox"/> C Switch on disabled	1	X	0	0	0	0
<input type="checkbox"/> D Ready to switch on	0	1	0	0	0	1
<input type="checkbox"/> E Switched on	0	1	0	0	1	1
<input type="checkbox"/> F Operation enable	0	1	0	1	1	1
<input type="checkbox"/> G Quick Stop active	0	0	0	1	1	1
<input type="checkbox"/> H Fault reaction active	0	X	1	1	1	1
<input type="checkbox"/> I Fault	0	X	1	0	0	0

Operating status according to status machine

Bits 4,7-15 Bits 4 and 7 to 15 are used for monitoring the movement mode and for status monitoring of device specific statuses. Details about monitoring the movement mode can be found in the respective description of operating modes. The bits for status monitoring of the device are described in the chapter on handling errors.

In order to obtain rapid access to the operating status, the data of the status word is mapped in the first two bytes of PDOs T_PDO1, T_PDO2 and T_PDO3.

CANopen example "Switching over the operating status" The CANopen programme example shows switching over of operating statuses for a network user with the node address 1.

COB-ID	Data	Meaning
0	01 00	NMT change of state for all network users on "Operational"
181	xx xx	possibly reporting the current status (arbitrary)
201	00 00	R_PDO1: Requesting a change of state to Switch on disabled
181	40 00	T_PDO1: Defined operating status: Switch on disabled
201	06 00	R_PDO1: Requesting a change of state to Ready to switch on
181	21 00	T_PDO1: Data change in status word; Ready to switch on
201	07 00	R_PDO1: Requesting a change of state to Switched on
181	23 00	T_PDO1: Data change in status word: Switched on
201	0F 00	R_PDO1: Requesting a change of state to Operation enable
181	27 00	T_PDO1: Data change in status word: Operation enable

6.2.3 Setting and monitoring operating modes

6.2.3.1 Setting the operating mode

Requirements To start an operating mode the device must be ready to start and correctly initialised.

An operating mode cannot be carried out in parallel with another operating mode. If an operating mode is active, then you can only change to a different operating mode if the current operating mode is completed or is discontinued.

A operating mode ends if the drive stops, e.g. if the target point of a positioning was reached. If a fault occurs during the process which leads to discontinuation of a current operating mode, then, after the cause of the fault has been removed, the traverse operation can be resumed, or you can change to a different operating mode.

Indicating and changing the operating mode

Two parameters are available for displaying and changing the operating modes under CANopen.

- Modes of operation display (6061_h): Show currently set operating mode
- Modes of operation (6060_h): Change operating mode.

Both objects use the same values:

Operating mode	Value	Meaning
Point-to-point mode in "Profile position mode"	1	from page 76
Speed mode in "Profile velocity mode"	3	from page 87
Homing in "Homing mode"	6	from page 90
Manual mode over signal inputs, manufacturer-specific.		from page 74
Manual mode over the fieldbus, manufacturer-specific		from page 75
Positioning mode, manufacturer-specific		from page 80

List of possible operating modes

With the object Supported drive modes (6502_h) you can receive information about all settable operating modes of compact drive.

Configuration mode

Configuration mode is also indicated via the object Supported drive modes (6502_h). It can be set as an alternative to an operating mode but cannot be executed parallel to an operating mode. System and application parameters of the drive are set in configuration mode.

Read out current operating mode

The current operating mode is read out over the object Modes of operation display (6061_h) per SDO.

Change operating mode

The object Modes of operation (6060_h) can be used to change the operating mode over SDOs.

6.2.4 Starting and interrupting travel commands

Travel commands in the operating modes positioning mode, speed mode and homing are started via the fieldbus, and in manual mode via the manual movement signals of the signal interface. Travel data and parameters are exchanged over the field bus interface.

initial conditions In order to execute the set operating mode the following start conditions must be fulfilled:

- Device not in an error condition
- valid homing values in the operating modes manual mode and positioning mode, see chapter 6.4.6 "Homing ranges".

Start operating mode Bits 4 to 6 are assigned operating mode specifically. Over bit 4 in object `Controlword (6040h)` the drive receives the request to start the set operating mode.

Operating mode	Obj. Controlword (6040 _h)	Meaning
Positioning mode	Bit 4: New setpoint	0->1: Start positioning.
	Bit 5: -	not assigned
	Bit 6: Absolute/relative	0: Absolute positioning1: Relative positioning
Homing	Bit 4: Homing operation start	1: Start homing
	Bits 5, 6: -	not assigned
Manual mode over fieldbus	Bit 4:	0->1: Jog in a positive direction
	Bit5:	0->1: Jog in a negative direction

For the operating mode speed mode (Profile velocity mode) bits 4 to 6 are free. Speed mode starts with passing on of the reference value.

Interrupt operating mode Bit 8 of the control word `Controlword (6040h)` can used to interrupt a currently running movement.

Obj. Controlword (6040 _h)	Meaning
Bit 8: halt	0: Execute processing 0->1: Interrupt processing

6.2.5 Monitoring operating mode

The drive reports over bit 8 and bits 10 to 15 in the object `Statusword (6041h)` Status information for the set operating mode.

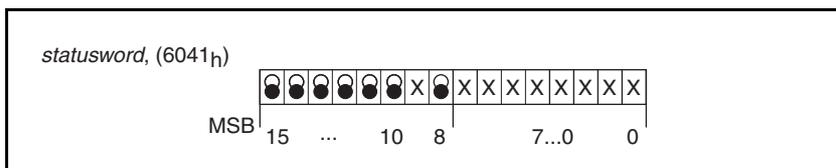


Figure 6.5 Status reports for operating mode

Target position and limit switch

Obj. Statusword (6041 _h)	Meaning
Bit 8: Leave operating range	Only valid if bit 11 = 10: End position switch position W1 passed over 1: End position switch position W0 passed over
Bit 10: target reached	1->0: Start a new positioning movement 0->1: Requested target position reached
Bit 11: internal limit active	0->1: limit switch position W0 or W1 was passed over
Bit 14: Leave movement range	0->1: limit switch position D0 or D1 passed over
Bit 15: Leave safety range	0->1: limit switch position S0 or S1 passed over

The limit positions are explained in section 6.6 "Homing as "Homing mode" to DSP 402" from page 90.

Operating mode dependent status

Bits 12 and 13 are assigned operating mode specifically.

Operating mode	Obj. 6041 _h , status word	Meaning
Positioning mode (Profile Position mode)	Bit 12: setpoint acknowledge	0: Adoption of a new position possible 1: Receive new target position
	Bit 13: -	not assigned
Speed mode (Profile Velocity mode)	Bit 12:	0: motor standstill 1: travel in action
	Bit 13: -	not assigned
Homing	Bit 12: Homing attained	0: Homing not yet executed 1: Homing executed
	Bit 13: Homing error	0: no error 1: Error during homing
Manual mode (manufacturer specific)	Bit 12	Positive direction 0-> 1: start of travel 1-> 0: stop of travel
		Negative direction 0-> 1: start of travel 1-> 0: stop of travel

6.3 Manual mode

6.3.1 Manual mode via signal inputs

Overview In manual mode the compact drive can be moved via the manual drive signals MAN_P and MAN_N of the signal interface either clockwise or anticlockwise. After switching on the supply voltage the positioning drive changes into the operating mode manual mode if in object `Interface Option Type (6510h / Sub 0Ah)"0 = standard interface"` is set.

A jog is only executed within the referenced operating range. A field bus connection is not necessary for manual mode.

Function The compact drive operates in jogging mode or in continuous operation independently of the duration of an applied manual movement signal.

If a manual movement signal is activated shortly then the drive executes a settable number of motor steps (increments) in jogging mode. If the signal is held for longer then the drive changes over to continuous operation. The time for changing from jogging mode to continuous operation is adjustable (release time).

The compact drive waits after switching on of jog for a debounce time of 50 ms before the jog is started.

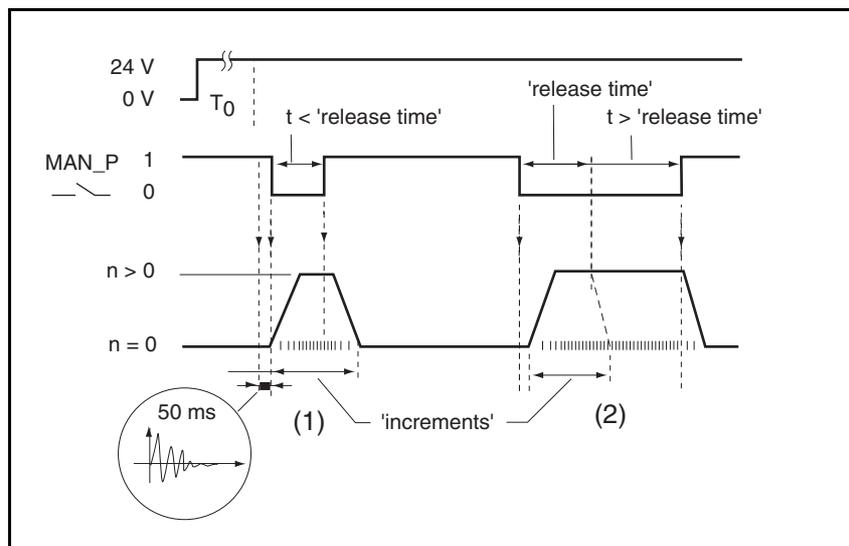


Figure 6.6 Jog mode (1) and continuous operation (2), T_0 : Starting time of the drive after switching on about 6 seconds

Settings Manual mode is parameterised over the object `Manual mode settings (2011h)` and `(2012h)`. Parameters which are adjustable are:

Object 2011 _h , sub-index	Meaning
01h:increments	Number of motor steps for jog mode
02h: velocity	Final speed
03 h: acceleration	Acceleration ramp
04h: deceleration	Deceleration ramp
05h: max current	max. current, operating current limitation
06h: release time	Inching duration for 2011 _h
06h: enable	Activation at 2012 _h

The drive accelerates according to the adjustable ramp value "acceleration", a maximum up to the manual movement speed "velocity". If the signal is deactivated then the drive decelerates with the value of the braking ramp "deceleration" down to a speed of rotation of zero. The maximum torque for jogging can be reduced by means of parameterisable operating current limitation "max current".

The final speed as well as the acceleration and deceleration ramp are limited by the maximum values Max profile velocity (607F_h), Max acceleration (60C5_h) and Max deceleration (60C6_h).

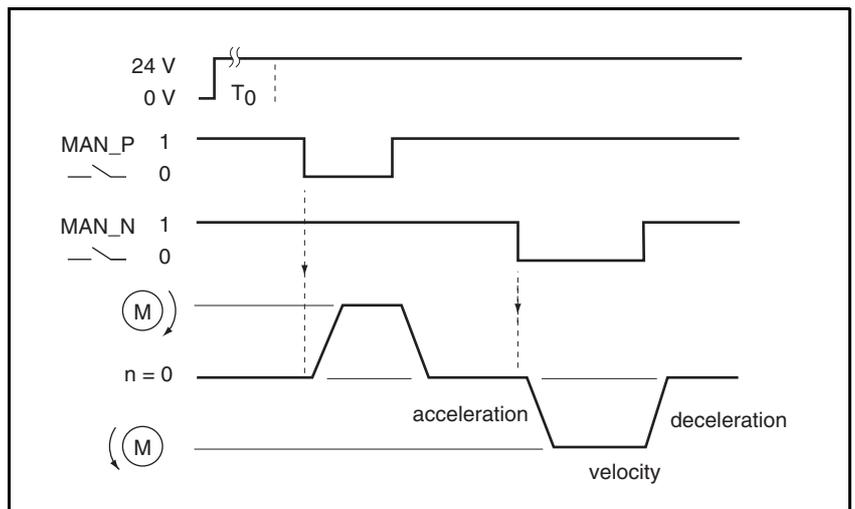


Figure 6.7 Setting values for manual mode

The direction of rotation is specified via control inputs for manual mode. A direction reversal is only possible when the motor is stationary.

6.3.2 Manual mode over fieldbus

Overview In manual mode via fieldbus the compact drive can be moved clockwise or anticlockwise. A field bus connection is for this type is necessary for manual mode.

Manual mode over fieldbus is activated by selecting the operating mode "manual mode via fieldbus". The value -3 (FD_h) should be entered in the object Modes of operation to select and start the last-named operating mode and to set the positioning controller in the status "operational enable".

Settings Manual mode is parameterised over the object Manual mode settings (2011_h) and (2012_h). Parameters which are adjustable are:

Object 2011 _h , sub-index	Meaning
01h: increments	Number of motor steps for jog mode
02h: velocity	Final speed
03h: acceleration	Acceleration ramp
04h: deceleration	Deceleration ramp
05h: max current	max. current, operating current limitation
06h: release time	Inching duration for 2011 _h
06h: enable	Activation at 2012 _h

The drive accelerates according to the adjustable ramp value "acceleration", by a maximum up to the manual movement speed "velocity". If the signal is deactivated then the drive decelerates with the value of the braking ramp "deceleration" down to a speed of rotation of zero. The maximum torque for jogging can be reduced by means of parameterisable operating current limitation "max current".

The final speed as well as the acceleration and deceleration ramp are limited by the maximum values Max profile velocity (607F_h), Max acceleration (60C5_h) and Max deceleration (60C6_h).

Bits 4 and 5 of object 6040_h aid specifying the direction of rotation as well as the start or interruption of a jog. A rising edge for bit 4 triggers a positive direction of travel - while a falling edge of bit 4 stops the currently running jog. Bit 5 activates or stops according to a movement in a negative direction of travel.

A direction reversal can also be requested on a turning motor. The drive decelerates at the value of the braking ramp "deceleration" down to the speed of rotation zero and accelerates at the corresponding set ramp value "acceleration" in the other direction.

The object 6041_h can be used to indicate whether a jog is active or not.

6.4 Point-to-point mode as "Profile Position mode" to DSP 402

6.4.1 Function

In profile position operating mode a movement with an adjustable travel profile is run from a start position to a target position. The value of the target position can be given as either a relative or an absolute position.

A movement profile can be set with values for acceleration and deceleration ramps and final speed.

Relative and absolute positioning,

The new target position is transferred with the object Target position (607A_h). For relative positioning the target position is measured from the current starting position of the drive while for absolute positioning it is measured from the zero position. A reference point must be defined for absolute and relative positioning.

Relative or absolute positioning is set via bit 6 in the control word Controlword (6040_h). Positioning mode can be executed in two operating mode settings:

- Positioning mode with standardised object according to the device profile DSP 402 (Profile Position mode). A movement profile can be set with values for acceleration and deceleration ramps and final speed. The values do not remain permanently stored.
- Positioning mode with manufacturer-specific objects (Manufacturer specific profile)

10 predefined movement profiles can be selected from for positioning. 9 of the 10 movement profiles are adjustable while one movement profile is specified permanently. The values can be permanently stored.

Positionings are executed in both operating modes using linear acceleration and deceleration ramps.

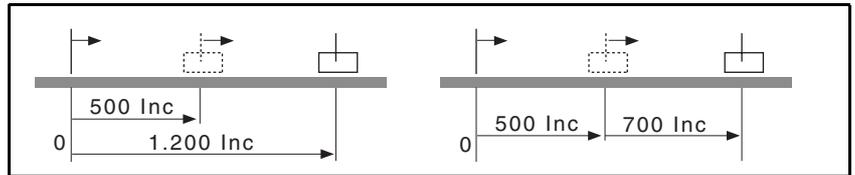


Figure 6.8 Absolute positioning (left) and relative positioning (right)

Target position The target position is passed on in user-defined units (usr) with the object `target position (607Ah)` and can be transmitted in `R_PDO2` for the standard setting together with the control word `controlword (6040h)`.

Current Position The current position can be determined over 2 objects:

- Position actual value (`6063h`) delivers an absolute value in increments (Inc).
- Position actual value (`6064h`) delivers an absolute value in user-defined units. For IcIA N06x only the unit "position increments" is adjustable.

The current position in user-defined units is transmitted in `T_PDO2` for the standard setting as a 4 byte value together with the object `Statusword (6041h)`.

6.4.2 Start positioning

Requirements The operating mode point-to-point mode must be set over the object `Modes of operation (6060h)`, see chapter 6.2.3.1 "Setting the operating mode".

The power amplifier must be switched on. Using control word `Controlword (6040h)` change over must occur into the operating status "Operation enabled", see chapter 6.2.2 "Changing and monitoring operating statuses".

Settings Object values for the target position, movement profile, movement range and scale factors must contain valid values for positioning. See chapter 6.4.3 "Objects and setting values" to set the objects.

Control and checking signals If the operating mode, operating status and positioning values are set then the operating mode can be activated and monitored over the control and status word.

Controlword (6040_h)

Signal	Meaning
Bit 4: new setpoint	0->1: Start positioning or prepare next positioning
Bit 8:halt	0: Execute processing 0->1: Interrupt processing

Statusword (6041_h)

Signal	Meaning
Bit 10:target reached	0: Storing the new target position 1: Stored target position reached

Statusword (6041 _h)	
Signal	Meaning
Bit 12: setpoint acknowledge	0: Adoption of a new position possible 1: New target position reached

Triggering positioning The new target position is transmitted per SDO with the object `Target position` (607A_h) or per R_PDO2, byte 2..5 before positioning. The motor does not move. Starting is achieved over bit 4 `new setpoint` in object `Controlword` (6040_h). With a change from "0" to "1" the drive is signalled that a position was transmitted and a travel command can be started. The drive confirms with bit 12 `setpoint acknowledge = 1`, that the travel command was activated. Bit 4 can be reset again. If a travel command cannot be executed the drive will issue an error message.

The target position is reached just as soon as bit 10, `Target reached`, changes to "1" in the status word. The drive reports the status change automatically over T_PDO1. New data can be processed. For each start of positioning it is possible to set the type of positioning, relative or absolute, anew. The type of positioning is set over bit 6 in object `Controlword` (6040_h). The new target position is mapped in R_PDO2 in bytes 2..5. The drive internally stores all position value relative to the machine zero point.

Positioning finished The target position is reached just as soon as bit 10, `Target reached` changes to "1". The positioning controller reports status changes automatically over the status word of the event-controlled T_PDOs to the network client. For a standard setting this effects T_PDO1, T_PDO2 and T_PDO3.

6.4.3 Objects and setting values

The positioning mode can be set and executed over the standardised objects of CANopen "Profile position mode" according to DSP 402. Manufacturer-specific objects are also available in order to use further freely definable movement profiles for controlling the drive.

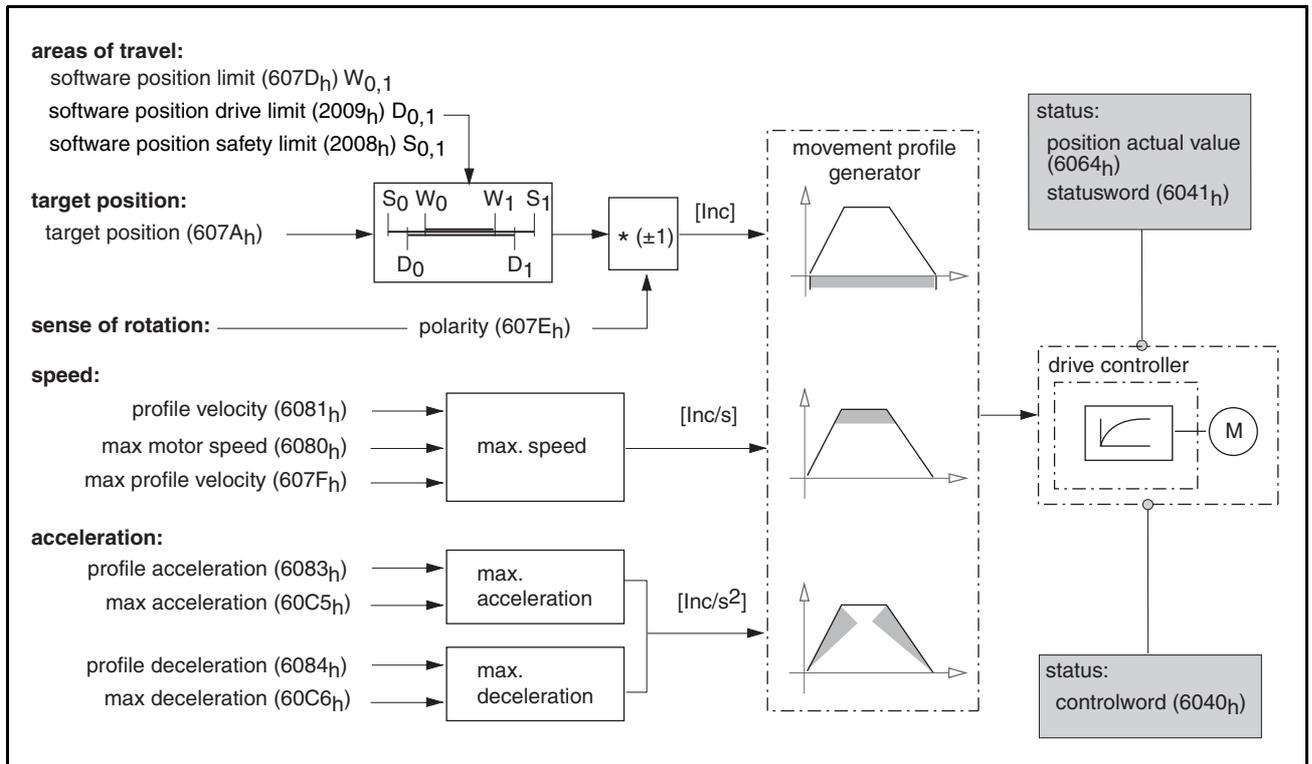


Figure 6.9 Positioning mode "Profile Position mode" and settings

Target position A new position value is transmitted with the object `Target position` (607A_h) or with the R_PDO2, bytes 2..5. The position is specified in motor increments (Inc) and must lie within the defined limits of the operating area. The drive issues an error message if the target position lies outside the limits.

The new target position follows from the position value multiplied by the direction of rotation factor. Details about the direction of rotation factor can be found in the chapter 6.7.3.2 "Reversal of direction of rotation".

Movement range The movement range is limited by the software limit switch. The value of the limit switch is stored for a homing in the objects `Software position limit` (607D_h), `Software position drive limit` (2009_h) and `Software position safety limit` (2008_h).

Movement profiles To achieve positioning the drive moves according to the movement profile defined over the acceleration and deceleration rampe as well as the final speed.

Movement profile with standardised objects With the object `Modes of operation` (6060_h) the standardised positioning mode must be set. The following objects are available for defining the movement profile according to the device profile DSP 402.

Object	Meaning
Profile velocity (6081 _h)	Final speed
Profile acceleration (6083 _h)	Acceleration ramp
Profile deceleration (6084 _h)	Deceleration ramp

The parameters for the movement profile cannot be remanently stored.

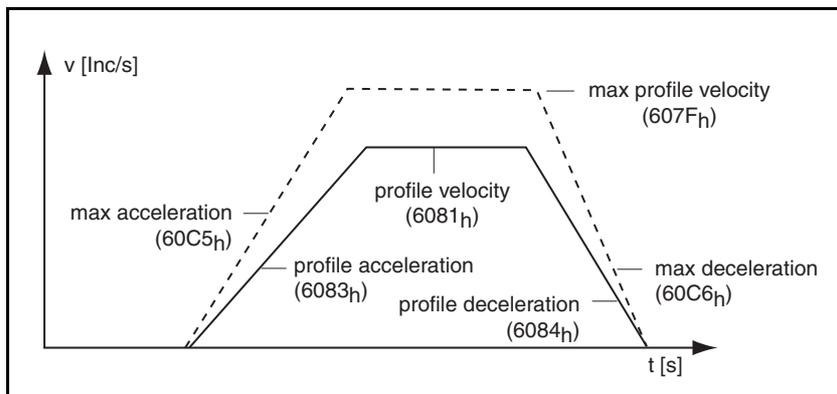


Figure 6.10 Parameters for the movement profile

The profile settings are valid for both directions of movement of the drive.

Maximum values limit the setting options for a movement profile. They are stored in the drive data sheet and cannot be altered. The drive issues an error message if a ramp setting exceeds a maximum value.

Object	Meaning
Max profile velocity (607F _h)	Maximum final speed
Max. motor speed (6080 _h)	Maximum motor speed
Max. acceleration (60C5 _h)	Maximum acceleration ramp
Max. deceleration (60C6 _h)	Maximum deceleration ramp

Movement profile with manufacturer-specific objects

In order to use the 10 preconfigured movement profiles for a positioning the manufacturer-specific positioning mode must be set.

The first of the 10 movement profiles is preset at the works and cannot be altered. It sets the profile speed for the standard nominal speed of the drive.

The acceleration and deceleration ramp as well as the final speed for the other 9 movement profiles can be freely parameterised in configuration mode and stored permanently. The objects for setting the parameter each contain 10 fields for movement profile data.

Object	Meaning
User profile velocity (2004 _h)	Final speed
User acceleration (2005 _h)	Acceleration ramp
User deceleration (2006 _h)	Deceleration ramp
User profile number (2007 _h)	Selecting a movement profile
User profile max current (200A _h)	Torque-generating motor phase current

CANopen example "Positioning with SDO, PDO and SYNC"

The example shows setting of the movement profile parameter by means of SDO, operating status change by means of PDO1 and starting by means of PDO2 and SYNC reception.

COB-ID	Data	Meaning
601	23 83 60 00 D0 07 00 00	T_SDO: Setting the acceleration ramp: 2000 Inc/s/s
581	60 83 60 00 00 00 00 00	R_SDO: OK
601	23 81 60 00 F4 01 00 00	T_SDO: Setting the speed: 500 Inc/s
581	60 81 60 00 00 00 00 00	R_SDO: OK
601	23 84 60 00 E8 03 00 00	T_SDO: Setting the deceleration ramp: 1000 Inc/s/s
581	60 84 60 00 00 00 00 00	R_SDO: OK
0	01 00	NMT protocol; Start Remote Node
181	xx xx	Reporting the current status (arbitrary)
201	06 00	R_PDO1: Requesting a change of state to Ready to switch on
181	21 00	T_PDO1: Data change in status word; Ready to switch on
201	07 00	R_PDO1: Requesting a change of state to Switched on
181	23 00	T_PDO1: Data change in status word, Switched on
201	0F 00	R_PDO1: Requesting a change of state to Operation enable
181	27 00	T_PDO1: Data change in status word; Operation enable
601	2F 60 60 00 01	T_SDO: Switching over into Profile Position mode
581	60 60 60 00 00	R_SDO: OK
301	1F 00 DC 05 00 00	R_PDO2: Byte 0,1: Controlword, byte 2..5: Target position $5DC_h = 1500$ Inc
80		SYNC: SYNC object for starting positioning
181	27 10	T_PDO1: Setpoint acknowledge
201	0F 00	R_PDO1: Bit 4: Resetting new setpoint
181	27 00	T_PDO1: Setpoint acknowledge = 0
181	27 14	T_PDO1: Bit 10, Target reached = 1

Table 6.1 Position capture

6.4.4 Movement ranges

Function Homing defines the permissible traversing range of the compact drives. The traversing range limits are stored as absolute values in the compact drive. The compact drive can only be driven after being homed.

A homed status remains after switching off and switching on the positioning drive again, since the current position value of the drive is stored as the absolute value in the internal position memory.

If the compact drive recognises that the motor shaft was put into a deenergised state then homing is removed and must be executed again.

To conduct homing the drive must be within the permissible operating range so that it can be moved after homing.

6.4.5 Position capture

The drive continuously updates two pieces of information to monitor, prepare and store reproducible position values.

- Rotor position of the motor
- Position counter

The motor operates for devices of the type IcIA N065 internally with a resolution of 12 increments for two pole pair or 24 increments for four pole pair drives. The signals are detected over the Hall sensors. The actual position is also recorded at the same time as an absolute value over a 32 bit position counter.

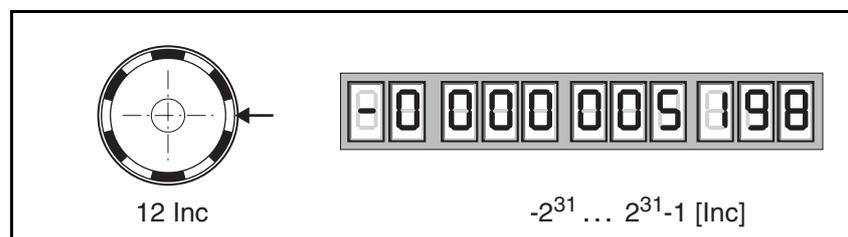


Figure 6.11 Schematic diagram for position detection by IcIA N065

Storing the position data

When switching off the supply voltage, the position counters and rotor position are stored in the remanent data memory. If the motor is still turning then it will be braked beforehand over the permanent magnetic field of the stator.

Monitoring storing data

An internal storage check detects whether the position data can still be stored correctly. If the motor cannot be stopped in time, for example due to an external load, then the monitoring function initiates monitoring re-setting of the reference values during switching on again.

On switching on again the drive compares the current rotor position with the stored one. If the drive recognises that the motor has been misaligned within one revolution by more than one increment then the reference values are deleted. The drive must be homed again. An offset of ± 1 increments is updated in the position memory without deleting the homing.

Quasi-absolute value recognition

The compact drive uses the rotor position for evaluating a valid homing. The resolution of 12 increments for IcIA N065 comes from:

- 3 Hall sensors (H1,2,3) x
- 2 magnetising statuses (N, S) x
- 2 pole pairs (NS, NS).

Recognition of motor misalignment for a switched off supply voltage is 75% for two pole pairs or 87.5% for four pole pairs. A mechanical change in position by exactly 12 or 24 increments per revolution plus a tolerance range per revolution plus a tolerance range of ± 1 increment is not recognised by the quasi-absolute value detection as a mechanical misalignment.

6.4.6 Homing ranges

A valid homing is defined over the limit switch zones which must lie in the possible traversing range of the drive. The limit switches protect drive and plant from being damaged.

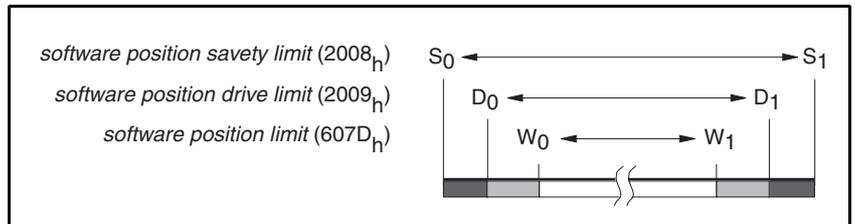


Figure 6.12 Traversing ranges of the drive

Operating range W0 - W1 for positioning mode.

Movement range D0 - D1. From ranges D0 - W0 and D1 - W1 the drive can only be traversed back in the direction of the operating range.

Safety range S0 - S1. From ranges S0 - D0 und S1 - D1 the drive can only be traversed back manually.

CANopen objects

Three CANopen objects are used for setting up the limit switch in which the position values for the upper and low range limits have been entered.

- Limits to the operating range in Software position limit (607D_h)
- Limits to the movement range in Software position drive limit (2009_h)
- Limits to the safety range in Software position safety limit (2008_h)

6.4.7 Homing methods

Homing methods are established with the object Homing method (6098_h). The simplest method here represents homing by assigning a position.

Assigning a position takes place in that a new position value is adopted with the object Position assignment value (200B_h) in the motor control position counter.

Further homing methods which are supported by the drive are described in chapter 6.6 "Homing as "Homing mode" to DSP 402".

6.4.8 Checking homing

Over the CAN bus it is possible to check with the object Manufacturer status register (1002_h) whether the drive has already been homed.

Obj. Manufacturer status register (1002 _h),	Meaning
Bit 24	0: Drive is not referenced 1: Drive referenced

Example "Checking homing" The example shows how the homing status can be checked by SDO. The node address of the compact drives is set to 01_h.

COB-ID	Data	Meaning
601	40 02 10 00 xx xx xx xx	R_SDO: manufacturer status register read
581	43 02 10 00 00 00 00 00	T_SDO: Homing OK? Bit 24=0 =>not homed

6.4.9 Setting the software limit switch

The limit switch positions are specified as position values with the resolution of the motor. The reference points of the application are generally available in length measuring units and must be converted to the internal motor increments.

Conversion factors The following data is needed for conversion of the application positions to the internal increments from the compact drive:

- Gear ratio
- the number of motor increments per revolution

Gear ratio The gear versions are coded by means of the type code. The gear ratio is firmly established for each type of gear and can be determined over the object *Gear ratio* (6091_h). The gear reduction is obtained as the ratio of motor revolutions to drive shaft revolutions; the drive shaft is the shaft coming out of the housing.

Motor increments per revolution The number of motor increments per revolution is obtained from: 3 Hall sensors (H1,2,3) x 2 magnetising statuses x number of pole pairs. For the standard versions of IcIA N065 the motor needs 12 increments per revolution (3 Hall sensors, 2 magnetising statuses, 2 pole pairs).

This multiplied by the gear ratio gives the increments per drive shaft revolution. The ratio can be read out of the motor datasheet over the object *Position encoder resolution* (608F_h). An example: the gear reductions of IcIA N065 standard versions with a spur gear.

Object gear versions as an example for N065 with spur gear	6091 _h Gear reduction [Rev M / Rev W]	608F _h Motor incr./ rev. [IncM / RevW]
IcIA D065 DC024 V-115	3675: 32	44100: 32
IcIA D065 DC024 V-054	490: 9	5880: 9
IcIA D065 DC024 V-038	75: 2	900: 2
IcIA D065 DC024 V-018	160: 9	1920: 9

6.4.10 Example application

Conversion of the application data in increments is illustrated by the following example. The drive moves a slide over a spindle drive. The rotational movement of the spindle is converted in a translation. The range limits of the limit switches must be established so that the slide does not move beyond the permissible traversing range.

A compact drive IcIA D065 DC024 V-038 is used.

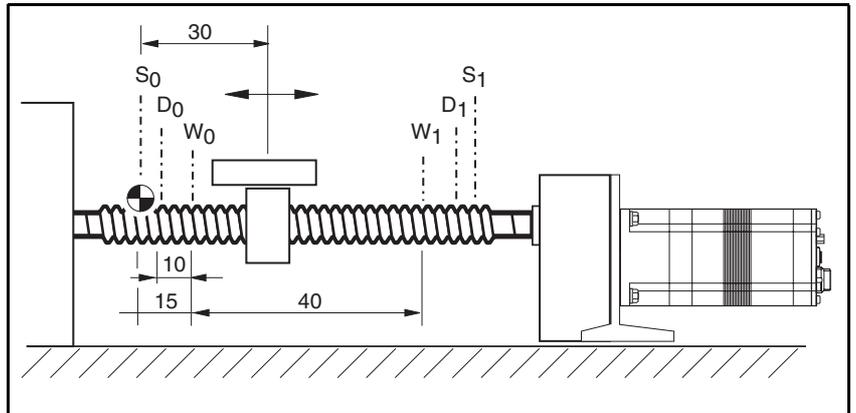


Figure 6.13 Positioning with a spindle drive

Application variables

Operating range W0 - W1	40 mm
Distances from operating range W0 - W1	
- to movement range D0, D1	each 10 mm
- to safety range S0, S1	each 15 mm
Location of the reference point	Position S ₀
Distance from the current position to the reference point	30 mm
Spindle pitch	1 mm/rev.
Gear gear reduction	75: 2
Increments per motor revolution	12 Inc

Step 1 Convert rotational movement into distance increments

$$12 \text{ Inc / motor revolution} * 75/2 = 450 \text{ Inc / spindle revolution}$$

$$450 \text{ Inc / motor revolution} * 1 = 450 \text{ Inc / spindle revolution}$$

Step 2 Distances to neighbouring limit switches

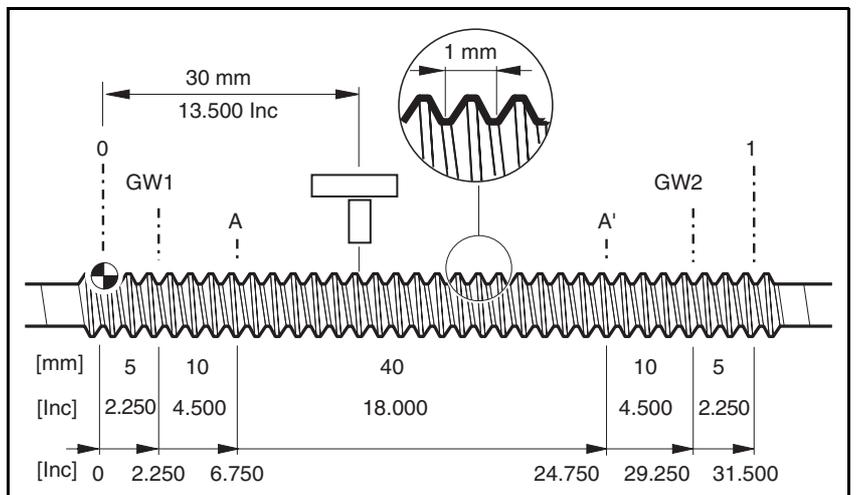


Figure 6.14 Example calculation

Distance $S_0 - D_0$	= 5 mm	=>	5 * 450 Inc	= 2.250 Inc
Distance $D_0 - W_0$	= 10 mm	=>	10 * 450 Inc	= 4,500 Inc
Distance $W_0 - W_1$	= 40 mm	=>	40 * 450 Inc	= 18,000 Inc
Distance $W_1 - D_1$	= 10 mm	=>	10 * 450 Inc	= 4,500 Inc
Distance $D_1 - S_1$	= 5 mm	=>	5 * 450 Inc	= 2.250 Inc

Reference point relative to the current position

Distance S_0 to current position:	30 * 450 Inc	= 13,500 Inc
-------------------------------------	--------------	--------------

Step 3 Calculate limit switch values to reference point S_0

Safety range S_0		0 Inc
Movement range D_0		2.250 Inc
Operating range W_0	2,250 + 4,500 Inc	= 6,750 Inc
Operating range W_1	7,750 + 18,000 Inc	= 24,750 Inc
Movement range D_1	25,750 + 4,500 Inc	= 29,250 Inc
Safety range S_1	30,250 + 2,250 Inc	= 31,500 Inc

Step 4 Enter position values

Object (index)	Position	Subindex	Value [Inc], dec. (hex.)	Software limit switches
Software position limit (607D _h)	min.max.	01 _h 02 _h	6,750 (1A5E _h)24,750 (60AE _h)	Operating range W_0 Operating range W_1
Software position drive limit (2009 _h)	min.max.	01 _h 02 _h	2,250 (8CA _h)29,250 (7242 _h)	Movement range D_0 Movement range D_1
Software position safety limit (2008 _h)	min.max.	01 _h 02 _h	031.500 (7B0C _h)	Safety range S_0 Safety range S_1

6.4.11 CANopen example "Homing"

The following listing shows entry of the homing values. The node address of the compact drives is set to 01_h.

COB-ID	Data	Meaning
601	2F 60 60 00 06	R_SDO: Switching over into Homing Mode
581	60 60 60 00xx	T_SDO: OK
601	23 08 20 02 0C 7B 00 00	R_SDO: max. value for safety range S_1 : 7B0C _h
581	60 08 20 02 xx xx xx xx	T_SDO: OK
601	23 08 20 01 00 00 00 00	R_SDO: min. value for safety range S_0 : 0000 _h
581	60 08 20 01 xx xx xx xx	T_SDO: OK
601	23 09 20 02 42 72 00 00	R_SDO: max. value for movement range D_1 : 7242 _h
581	60 09 20 02 xx xx xx xx	T_SDO: OK
601	23 09 20 01 CA 08 00 00	R_SDO: min. value for movement range D_0 : 8CA _h
581	60 09 20 01 xx xx xx xx	T_SDO: OK

COB-ID	Data	Meaning
601	23 7D 60 02 AE 60 00 00	R_SDO: max. value for operating range W_1 : 60AE _h
581	60 7D 60 02 xx xx xx xx	T_SDO: OK
601	23 7D 60 01 5E 1A 00 00	R_SDO: min. value for operating range W_0 : 1A5E _h
581	60 7D 60 01 xx xx xx xx	T_SDO: OK
601	23 10 10 03 73 61 76 65	R_SDO: Storing application parameters: "save"
581	60 10 10 03 xx xx xx xx	T_SDO: OK
601	2F 98 60 00 FF	R_SDO: Selecting the homing method
581	60 98 60 00xx	T_SDO: OK
601	23 0B 20 00 BC 34 00 00	R_SDO: Set dimensions, actual position up to S_0 : 34BC _h
581	60 0B 20 00 xx xx xx xx	T_SDO: OK
601	2B 40 60 00 1F 00	R_SDO: Homing Operation Start (rising edge, bit 4)
581	60 40 60 00 xx xx	T_SDO: OK

6.5 Speed mode as "Profile Velocity mode" according to DSP 402

6.5.1 Function

In the profile velocity operating mode it is accelerated to an adjustable setpoint speed. A movement profile can be set with values for acceleration and deceleration.

Setpoint speed The set speed is entered via the object *Target velocity* (60FF_h) in user-defined units. The new speed values are adopted by the positioning controller during a currently running travel command together with simultaneous transmission of Controlwords (object 6040_h) and alteration of the mode-specific control information in the same object.

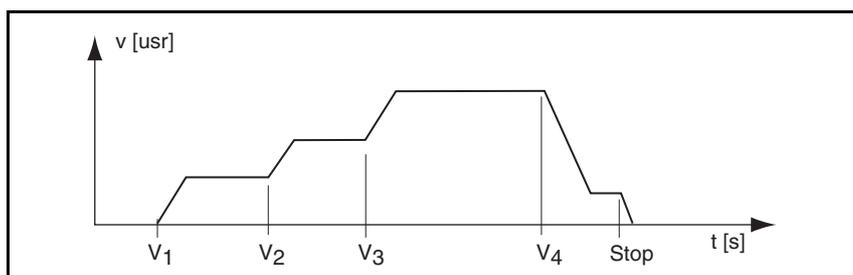


Figure 6.15 Travel commands with speeds v1 to v4

The set speed *Target velocity* (60FF_h) is transmitted for the standard setting of the R_PDO3 together with the control word *Controlword* (6040_h) in R_PDO3.

- Current speed* The current speed can be determined over 2 objects:
- Velocity sensor actual value (6069_h) feeds back the speed value in increments/second [Inc/s].
 - Velocity actual value (606C_h) shows the speed value in user-defined units (usr) for IcIA N06x in increments/second [Inc/s].
- The speed value in object Velocity actual value (606C_h) is transmitted after activation of the T_PDO3 as a 4 byte value together with the object Statusword (6041_h) in T_PDO3.

6.5.2 Starting speed mode

- Requirements* The operating mode profile velocity must be set with the object modes of operation (6060_h). The output stage must be switched on. Using control word controlword (6040_h) it is necessary to switch over into the operating status "Operation enabled".

See chapter 6.2.2 "Changing and monitoring operating statuses".

- Settings* Object values for movement profile and standardisation must contain a valid value for the positioning. See chapter 6.5.3 "Objects and setting values" to set the objects.

- Velocity operation trigger* If operating mode, operating status and object values are set then the operating mode can be started with delivery of a set speed in object Target velocity (60FF_h) and simultaneous writing of Controlword (6040_h) or started over R-PDO3.

- Monitoring speed mode* The Statusword allows the movement mode to be monitored:

Object / signal	Meaning
Status word (6041 _h)	
Bit 10: Target reached :	0: Storing a new set speed 1: Setpoint speed reached
Bit 12: speed	0: Motor moving 1: Motor stopped

6.5.3 Objects and setting values

The speed mode can be set and executed over the standardised objects of CANopen "Profile Velocity mode" according to DSP 402. With manufacturer-specific objects additional functions can be realised.

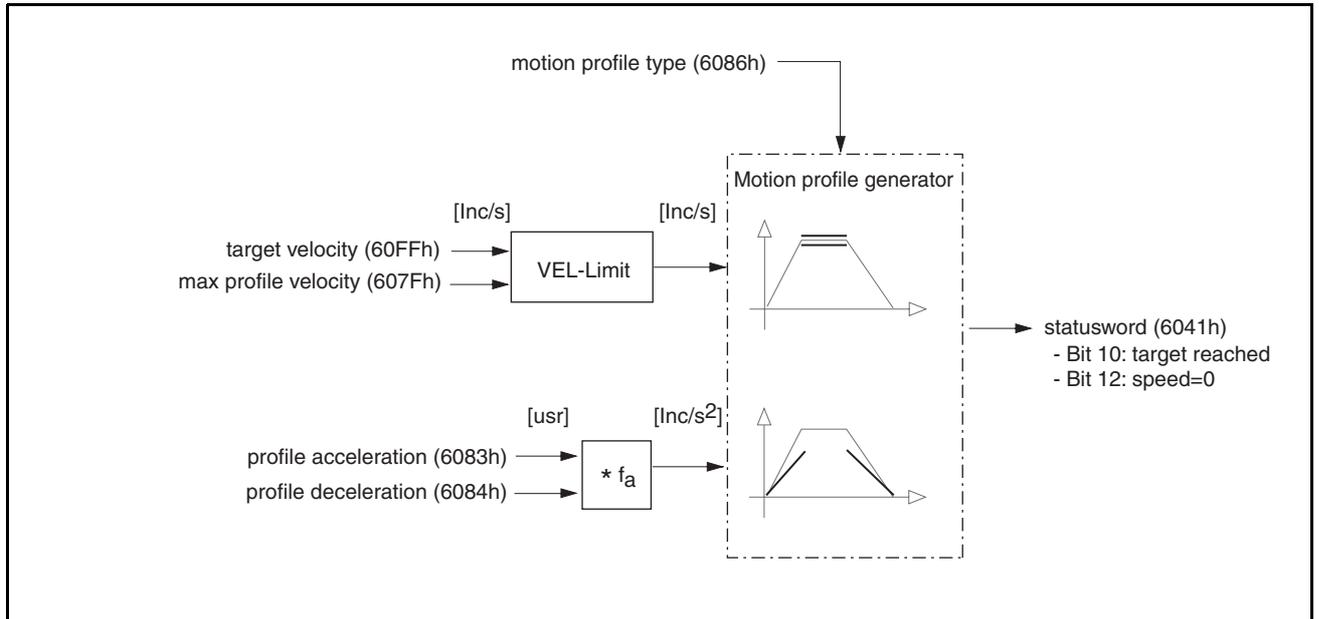


Figure 6.16 Speed mode "Profile Velocity mode"

Setpoint speed The set speed is delivered with the object target velocity (60FF_h) in user-defined units (usr).

Movement profiles The acceleration phase and deceleration phase are defined over a movement profile. The following object from "Profile Position mode" are available:

Object	Meaning
Max profile velocity (607F _h)	Maximum final speed
Profile acceleration (6083 _h)	Acceleration ramp
Profile deceleration (6084 _h)	Deceleration ramp
Quick stop deceleration (6085 _h)	Quick Stop delay (device specific)
Motion profile type (6086 _h)	Ramp form (for IcIA N06x only trapezoid ramps adjustable)

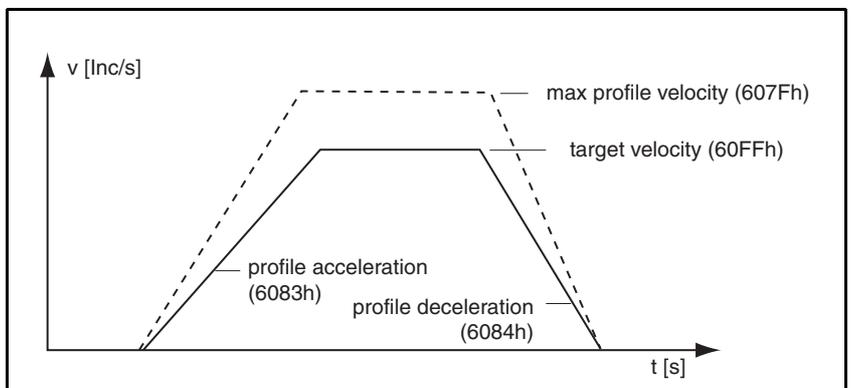


Figure 6.17 Ramp settings

The profile settings are valid for both directions of movement of the drive. The maximum value for the profile speed `Max profile velocity` ($607F_h$) limits the speed value for a movement profile.

Example Speed mode with SDO and PDO

The example shows settings for speed mode by means of SDO and change of operating mode by means of PDO1 and starting by means of PDO3. Node address is 1.

COB-ID	Data	Meaning
601	23 02 14 01 01 04 00 00	R_SDO: Activate R_PDO3, sub-index 01 _h =0000 0401 _h
581	60 02 14 00 00 00 00 00	T_SDO: OK
601	23 02 18 01 81 03 00 00	R_SDO: Activate T_PDO3, sub-index 01 _h =0000 0381 _h
581	60 02 18 00 00 00 00 00	T_SDO: OK
601	23 83 60 00 D0 07 00 00	T_SDO: Setting the acceleration ramp: 2000 Inc/s/s
581	60 83 60 00 00 00 00 00	R_SDO: OK
601	23 84 60 00 E8 03 00 00	T_SDO: Setting the deceleration ramp: 1000 Inc/s/s
581	60 84 60 00 00 00 00 00	R_SDO: OK
0	01 00	NMT protocol; Start Remote Node
181	40 00	T_PDO1: Changing data in statusword
201	06 00	R_PDO1: Request for change of status: SwitchOnDisabled->Ready-toSwitchOn
181	21 00	T_PDO1: Changing data in statusword
201	0F 00	R_PDO1: Request for change of status: ReadytoSwitchOn->OperationEnable
181	27 00	T_PDO1: Changing data in statusword
601	2F 60 60 00 03	T_SDO: Switching over into Profile Velocity mode
581	60 60 60 00 00	R_SDO: OK
401	0F 00 85 00 00 00	R_PDO3: Byte 0,1: controlword, byte 2..5: Target speed 85 _h = 133 rpm

6.6 Homing as "Homing mode" to DSP 402

6.6.1 Function

In referencing mode, an absolute scale reference of the motor position at a defined axis position is established. Referencing is possible by:

- one of 31 selectable reference movements
- dimension setting

The reference movement defines a reference point based on a defined position, for example a limit switch or referencing switch position. Set dimensions establish a reference point relative to the current position of the drive.

The user can use the object `Homing method` (6098_h) to set the respective method for performing a homing.

The following referencing methods are available, according to the attached sensor and use of a drive with interface versions

"sensor" (6510_h/Sub 0A_h):

- Homing to the reference sensor (Home-switch)
- Homing to the positive or negative end position sensor (Limit-switch)
- Homing to the reference sensor with reversing at the limit switch
- Homing to the the next right or left "index pulse"
- Homing to the current position
- Homing by means of position assignment

The user can select from a total of 35 methods.

Object	Meaning
Homing methods (6098 _h)	Selecting the homing method
Homing speed (6099 _h)	Speed for the reference movement in [Inc/s]
Homing acceleration (609A _h)	Acceleration for the reference movement in [Inc/s/s]

Table 6.2 Overview of objects for the operating mode homing

Object	Meaning
Negative limit-switch settings (2013 _h)	Setting the function and polarity of the reference switch LIMN
Positive limit-switch settings (2014 _h)	Setting the function and polarity of the reference switch LIMP
Home-switch settings (2015 _h)	Setting the function and polarity of the reference switch REF

Table 6.3 Overview of further important objects for the operating mode homing

6.6.2 Start homing

Requirements The operating mode homing must be set with the object `modes of operation` (6060_h). Using control word `controlword` (6040_h) it is necessary to switch over into the operating status "Operation enabled".

See chapter 6.2.2 "Changing and monitoring operating statuses".

Settings Object value for the homing methods and the homing speed must contain valid values for the positioning. See chapter 6.6.3 "Objects and setting values" to set the objects.

Control and checking signals If the operating mode, operating status and object values are set then the operating mode can be activated and monitored over the control and status word.

Controlword (6040 _h)	
Signal	Meaning
Bit 4: homing operation start	0: no homing active 0->1: Start homing

Statusword (6041 _h)	
Signal	Meaning
Bit 13: homing error	0: no error for homing 1: Error during homing
Bit 12: homing attained	0: Bit 13=0: Homing not finished yet bit 13=1: Homing faulty 1: Bit 13=0: Homing complete bit 13=1: -

Trigger positioning The positioning is started by setting bit 4 Homing operation start in the control word.

6.6.3 Objects and setting values

Homing methods The referencing method is selected over the object Homing method (6098_h). The following methods are supported:

Method	Meaning
1	Homing to LIMN with index pulse
2	Homing to LIMP with index pulse
3 and 4,	Homing to REF (positive edge) with index pulse
5 and 6,	Homing to REF (negative edge) with index pulse
7 to 14	Homing to REF with index pulse
15 and 16,	reserved
17 to 30	Like methods 1 to 14 but without index pulse
33 and 34,	Homing to the index pulse
35	Set dimensions to the current position (position assignment)

Table 6.4 Homing methods

Homing methods with index pulse For homing methods with index pulse (methods 1-14, 33 and 34) the drive homes to a manufacturer-specific defined reference point (Hall sensor W) of the internal commutation system. There is no possibility from the user point of view of feeding in an externally defined index pulse.

The reproducibility of the location of the reference point can possibly be improved by selecting the homing methods with index pulse.

The effectiveness of homing with index pulse is in all cases dependent on the reproducibility of the switching edges of external end position sensors.

Homing speed The drive moves at a reduced speed during a reference movement. The drive moves up to switching window of an end or reference switch at search speed. Once it finds the switch it then moves at approaching speed up to the switching edge of the switch. Both speed values are stored in the sub-index 01_h und 02_h of the object *homing speeds* (6099_h) in user-defined units.

The acceleration of the reference movement is established by the object *Homing acceleration* (609A_h). If the value is greater than the limit value of the maximum profile acceleration, object *Max acceleration* (60C5_h), limits the drive to the value of the maximum value and issues a SDO error message. Entry of the acceleration value takes place in *Acceleration units*; see object *Acceleration dimension index* (608E_h). For a positioning drive the specification represents an increase in motor increments per second squared.

Reference point shifting The set dimensions with method 35 allow the zero point for absolute positioning to be shifted to the current position of the drive. The zero point is then also, at the same time, the new reference point.

Values for the software limit switch must be corrected here by the difference in value between the previous reference point and the new dimension setting position.

6.7 Functions

6.7.1 Safety function

Hardware Emergency-Stop (ESTOP)

The compact drive activates the integral Emergency-Stop safety function via two redundant operating signal paths over the Emergency-Stop connection, pin 2 of the signal interface or via a fieldbus command.

Details about connection of the external Emergency-Stop signals are described in the device manual. The object `Manufacturer status register (1002h)` reports by means of bit 28 = 1 whether the external Emergency-Stop signal was activated.

Quick Stop

The Emergency-Stop command over the fieldbus triggered by a change in the operating status Quick Stop. Quick Stop over bit 1 and bit 2 in object `controlword (6040h)` activated.

Object	Meaning
Quick stop deceleration (6085 _h)	Quick Stop braking ramp

The drive decelerates according to the adjustable Quick Stop ramp. The object `Manufacturer status register (1002h)` reports via bit 26 = 0 that the drive has stopped.

6.7.2 Monitoring systems

Monitoring and diagnostic functions ensure a secure movement mode for the drive. Operating errors are reported by the drive via the EMCY object.

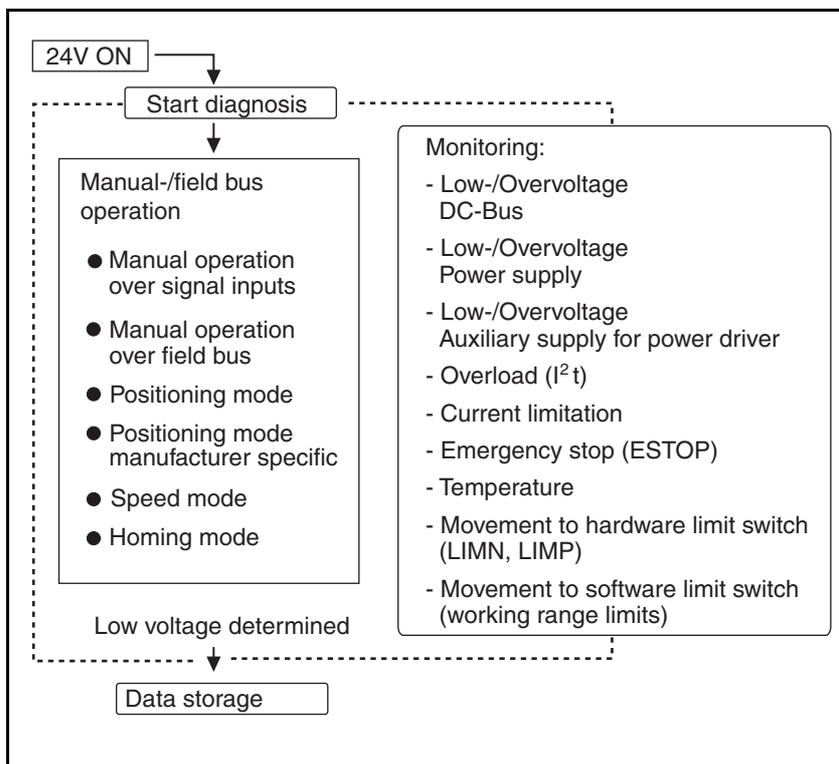


Figure 6.18 Monitoring functions

<i>Start diagnosis</i>	After switching on the supply voltage the drive performs a start diagnosis in which the most important system statuses are checked. These include the memory status (plausibility of the non-volatile position memory as well as the drive parameters), voltage, power amplifier temperature, Hall sensor status and orderly functioning of the hardware Emergency-Stop circuits. The diagnostics takes about five seconds. During performance of the self diagnosis the drive only functions partially and persists in maintaining a stationary condition.
<i>Monitoring while operating</i>	During operation there is continuous monitoring in compact drive of the temperature, motor current, motor voltage, motor speed, commutation status, Emergency Stop (ESTOP) and operating range.
<i>Storing data</i>	On removal of the supply voltage the compact drive stores the current run-time data and the logbook in the configuration memory. Messages related to device monitoring are analysed over the object <code>Manufacturer status register (1002_h)</code> . For more detail, please refer to chapter 7.2 "Error diagnosis over a fieldbus".

6.7.2.1 Temperature monitoring

The power amplifier temperature is monitored during the whole period of operation. If excess temperature occurs then the motor is stopped, the motor system locked and an EMCY message discharged.

Excess temperature of the power amplifier is indicated in object `Manufacturer status register (1002h)` with bit 22 = 1.

The current temperature of the power amplifier can be requested over object `Temperature actual value (200Dh)`.

6.7.2.2 Motor start

If the compact drive is not turning after a start time which can be set over object `60F9h/Sub03h`, after about 1 second, then the power amplifier switches off. The system is ready again.

The drive sends an EMCY message. The object `Manufacturer status register (1002h)`, bit 17 is indicated for a start error.

6.7.2.3 Rotational speed monitoring

After the acceleration phase for starting positioning or after reaching the final motor speed in speed mode the drive switches to constant movement and moves at the actual speed. If the actual speed and nominal speed vary to a degree greater than the limit value then the drive sends an EMCY message. Deviation from nominal speed can be detected over object `Manufacturer status register (1002h)`, bit 18.

The limit value of a speed deviation can be requested and set in object `Velocity window (606Dh)` and `VelocityWindowTime (606Eh)` in object `VelocityControlParameterSet (60F9h/Sub04h)`.

6.7.2.4 Voltage monitoring

DC bus voltage During operation the supply voltage, the DC bus voltage and the auxiliary voltage are monitored continuously. In the case of an undervoltage or overvoltage of $\pm 20\%$ bits 3-7 are set and bit 30 set according to the faulty voltage. There is no EMCY message generated at this time. The motor is not stopped. If the voltage values fall or increase below or above the maximum permissible limit values then the motor is stopped. One of the messages assigned to the respective event will be discharged. A logbook is stored in cases of very serious undervoltage events. The computer is brought into reset status and thus runs through the initialisation phase and self diagnosis.

The error "overvoltage" can only be reset by switching off and switching on the supply voltage again.

6.7.2.5 Current monitoring

The control electronics achieve current monitoring via a current monitor. The current monitor has a motor current detection and current limitation as well as overload recognition. Parameters and status objects are available for parameterising current monitoring.

Parameters for current monitoring The parameters are written in CANopen objects and can be read out of the objects.

Symbol	Parameter	CANopen object	Unit	Access
I_{Nominal}	Nominal motor current	Object 6075h Nominal motor current	mA	ro
$I_{\text{Operation}}$	Adjustable operating current limitation	Object 6073 _h Max current	1/1000 of the nominal motor current	r/w
$I_{\text{Electronic Max}}$	Maximum current of the motor electronics	Object 6510 _h /sub-index 03h	mA	ro
$I_{\text{Motor Max}}$	Maximum motor current	Object 6410 _h /sub-index 0Eh	mA	ro
f_{Start}	Current limitation during the acceleration phase	Object 60F9 _h /sub-index 05h	as a percentage of the operating current	r/w
$K_{\text{Limitation}}$	Event counter limit for maximum current recognition	Object 60F9 _h /sub-index 06h	no dimensions	r/w

Table 6.5 Parameters for current monitoring

$I_{\text{Operation}}$ The parameter operating current allows the operating current to be set for every travel command and thus also the torque to be limited. The operating current is based on the nominal motor current and is limited by the maximum motor current or the maximum current of the motor electronics.

I_{Nominal} The parameter nominal motor current depends on the gear motor version. It is to be found in the electronic data sheet. The nominal motor current must be smaller than the maximum current of the electronics.

Operating current limitation active During every regulating cycle there is a check is made to see whether current limitation was active in the last cycle. If this is the case then the counter increments upwards, otherwise downwards. If this counter reaches the value $K_{\text{limitation}}$ then the bit current limitation in the status register (object `Manufacturer status register 1002h`, bit 18) is set.

If the maximum value of the $K_{\text{limitation}}$ is set then setting of the status flag current limitation is switched off. The current will however be limited.

Overload detection The measured motor phase current is used with the aid of the I^2t method for thermal monitoring of the motor. If the measured current exceeds the permissible continuous motor current (Objekt `6410h`, Subindex `0Dh`) for a period of time defined by the size of the current, then the bit `Continuous motor current exceeded` is set in the status register, object `Manufacturer status register (1002h)`, bit 21, and the applied movement command broken off. The status machine of the drive control branches in the status "Fault reaction active", object `Statusword (6041h)`; the motor is brought to a speed of rotation of 0 and the power output stage is deenergized.

6.7.2.6 Signal monitoring of a limit switch and ESTOP signal

During the movement both limit switches are monitored via the input signals LIM_N und LIM_P (on the sensor versions). If the drive travels to a limit switch, the controller stops the positioning controller. The positioning drive sends an EMCY message "passed over a limit switch".

Object	Meaning
Negative limit-switch settings (2013 _h)	Activation and parameterising the negative limit switch (end position switch in the direction of the lower position values)
Positive limit-switch settings (2014 _h)	Activation and parameterising the positive limit switch (end position switch in the direction of the higher position values)

Table 6.6 Objects for monitoring function for the limit switch

6.7.3 Drive functions

6.7.3.1 Interruption of movement

The drive can be stopped during a movement command over the fieldbus. If bit 8 `Halt` in object `Controlword (6040h)` changes to "1" then the motor is stopped according to the deceleration ramp which was set for the travel command. The movement and position data are retained.

The drive continues an interrupted travel command just as soon as bit 8 is changed again to "0" and bit 6 `new setpoint` is set in the control word.

6.7.3.2 Reversal of direction of rotation

A new target position comes from multiplication of a position value by the current direction of rotation factor.

Direction of rotation factor The direction of rotation factor is set over bit 7 in object `Polarity (607Eh)` and can assume the value +1 or -1.

Object	Meaning
Polarity (607E _h)	Bit7=0: Direction of rotation factor for position = +1 Bit7=1: Direction of rotation factor for position = -1 bit6 = 0: Direction of rotation factor for speed of rotation = +1 Bit6=1: Direction of rotation factor for speed of rotation = -1

Direction of rotation and the direction of rotation factor are defined by viewing the rear side of the gear shaft for movement to higher position values in positioning mode or for positive speed of rotation values in speed mode:

- Factor +1: Direction of rotation clockwise
- Factor - 1: Direction of rotation anticlockwise.

6.7.3.3 Target position reached

On completing positioning there are small differences in the target area between the specified and the actual position which can no longer be compensated for through further motor movements.

In order to report the target position as reached a symmetrical window is defined using object 6067_h. If the drive stops within the window area then the target position is reported as reached. Bit 10 in status word, object statusword (6041_h) and bit 25 in object Manufacturer status register (1002_h) are set.

If T_PDO1 is transmitted event-controlled then the drive sends a PDO message on reaching the target position.

6.7.3.4 Monitoring digital inputs

The signal states of the input signals can be detected over the fieldbus. For example, this enables the start of a manual movement to be monitored by the fieldbus via the interface signals.

The object Digital inputs (60FD_h) analyses the status of the following digital inputs:

Bit	Signal	Meaning
0	LIM_N	Sensor signal in a negative direction of movement (only sensor versions)
1	LIM_P	Sensor signal for positive direction of movement (only sensor versions)
2	REF	Reference signal (only sensor versions)
16	MAN_N	Manual signal for negative direction of movement (standard versions)
17	MAN_P	Manual signal for positive direction of movement (standard versions)
22	ABS_1	Hall sensor signal 1 for absolute track (drive dehoming)
23	ABS_2	Hall sensor signal 2 for absolute track (drive dehoming)
24	HALL_U	Signal for Hall sensor U (commutation track)
25	HALL_V	Signal for Hall sensor U (commutation track)
26	HALL_W	Signal for Hall sensor U (commutation track)
27	ESTOP	Hardware Emergency Stop signal

6.7.3.5 Logbook

2 electronic log-books record data from the currently running movement mode. Data which is recorded includes:

- Switching on time of the drive,
- Total operating time of the drive,
- Number of positionings,

When switching off the drive voltage the compact drive uses the voltage of the internal charging capacitor in order to transfer the travel data into the first logbook. The logbook can be read out over the object `Drive log-book (200Eh)`.

The data, also that in the second logbook, is stored every 8 hours of total operating time. If the drive cannot write the run-time data in time in the first logbook then the first logbook will be reconstructed using data from the second book.

6.7.4 Memory areas of the compact drive

The compact drive manages a number of separate memory areas in order to save operating software, system data and application data. The memory areas are checked when starting the drive. The drive sends an EMCY message if there is an error present. The object `Manufacturer status register (1002h)` indicates the error with bit 13.

Application memory

The application memory stores all data for CAN and CANopen use of the drive. They include:

- Identification parameters such as serial number, date of manufacture and device identification,
- CAN interface data such as node address and rate of transmission,
- CANopen communication parameters,
- CANopen application parameters,
- CANopen manufacturer-specific parameters,
- logbook and run-time data.

The application memory is designed as a network fail safe data memory. All parameter values are stored with a factory setting in the positioning drive.

Changing application parameters

In order to adapt to the application and network operation, parameters which are enabled for writing access can be altered and stored over the object `Store parameters (1010h)`. They are then available immediately for the next switching on of the drive.

The signature "save" must be issued to avoid unintentional data storage.

CANopen example "data storage" ASCII coded produces "save": 65_h 76_h 61_h 73_h

COB-ID	Data	Meaning
601	23 10 10 03 73 61 76 65	R_SDO: Storing application parameters
581	60 10 10 03 xx xx xx xx	T_SDO: OK

If a faulty signature was issued then the save command is not executed. T_SDO then delivers an error message as an answer, recognisable with the value 80_h in byte 1 of the SDO answer.

Load factory setting The parameter values of the factory setting can be restored with the object `Restore default parameters (1011h)`. Just as in the case of the save command a signature must be issued here to avoid unintentional write actions, the word "load". ASCII coded this produces "load" 6C_h 6F_h 61_h 64_h.

6.7.5 ramp function

The ramp function allows the profile acceleration, profile deceleration and profile speed of the positioning drive to be set.

The IcIA N06x only supports trapezoid profile curves. The ramp gradient shows the motor's change of speed, and the trapezoid form the acceleration over time.

Object	Meaning
Profile velocity (6081 _h)	Speed of travel of the drive after completing the acceleration phase.
Profile acceleration (6083 _h)	Acceleration of the drive after starting positioning.
Profile deceleration (6084 _h)	Delay of the drive in order to reach the target position.

7 Diagnostics and troubleshooting

7.1 field bus communication error diagnosis

Field-mode must be functioning to be able to evaluate operational and error messages. The compact drive can only exchange messages over the fieldbus.

Connections to field-bus mode

If the drive cannot be addressed over the field bus, first check the connections. compact drivecompact drive contains the technical data on the device and information on network and device installation. Check the following:

- 24V power supply
- Power connections to the device
- Fieldbus cable and wiring
- Network connection to the device

Function test on the fieldbus

If the compact drive is connected up correctly then test field bus operation. This requires installation of a CAN monitor that displays CAN messages. Acknowledgement of the drive is captured by a boot-up message:

- ▶ Switch the drive power supply off and on again.
- ▶ Observe the network messages shortly after switching on the device. The compact drive sends a 1-byte long boot-up message after bus initialisation: 1792 (700_h)+node ID.
- ▶ With the node address factory setting to "127" (7F_h), the boot-up message "2047" (77F_h) is sent over the bus. The drive can then be put into operation via LSS and NMT services.

If no boot-up message is received on the network after switching on the drive, first check whether the baud rate of the CAN monitor matches the set baud rate in the network.



If network operation cannot be started, the network function of the device must be checked by your local representative. Contact your local representative.

Baud rate and address

If a connection to a device cannot be made, check the baud rate and node address.

- The baud rate of all network devices must be set to the same value
- The node address of every device must be between 1 and 127 and must be different for each device

Baud rate and node address for the compact drive can be set over LSS services, see page 51.

The default baud rate is 20 kBit. The default address lies at 127.

7.2 Error diagnosis over a fieldbus

7.2.1 Message objects

Inform a number of objects about the operation and error status of the compact drive:

- Object `Statusword (6041h)`
operating statuses which are reported over the status word are described in the CANopen manual in the chapter "Operating statuses and operating modes".
- Object `EMCY(80h+ node-Id)`
error message of a user with error status and fault code; see CANopen manual, chapter "Emergency service".
- Object `Manufacturer status register (1002h)`
Operation and error status of device components; this is where the manufacturer-specific messages about the compact drive are stored. The object remains set after a error status until a new positioning order is executed or the original source of the malfunction is removed. Detailed information about this can be obtained from the following 7.2.2 "Messages: on the device status" chapter.
- Object `Error register (1001h)`
shows the error status of a device in bit-coded form. The exact cause of error must be determined with the error code table. Bit 0 is set as soon as an error occurs.

Bit	Message	Description
0	generic error	An error has occurred
1	current	The parameterised range limits of the maximum motor current or the I2t monitoring were exceeded
2	voltage	Detection of an overvoltage or undervoltage for the internal auxiliary voltage (12V), supply voltage or DC bus voltage
3	temperature	The maximum permissible limit temperature was exceeded (internal measurement)
4	communication error	Error in the network communication
5	device profile-specific	Error during execution of the command according to device profile (e.g. block movement)
6	reserved	reserved
7	manufacturer-specific	Manufacturer-dependent error message (e.g. external torque)

- Object `Error code(603Fh)`
The error code is analysed by the object error code(603F_h), an object of the device profile DSP 402 and is issued as a 4-digit hexadecimal number. The error code shows the cause of the last movement interruption. The meaning of the error code can also be found in the CANopen manual in the section on error diagnosis and troubleshooting.
- Object `Predefined error field (1003h)`
Error memory contains the last five occurring errors as an error code in chronological order.

- Devices use the special SDO ABORT error message to report the failed message exchange via SDO (abort)

Validates transmitted LSS services "Transmitting acknowledgment information" or an error code. The meaning of the feedback message to each LSS service is described in the CANopen manual, chapter "Basics".

7.2.2 Messages: on the device status

The 32 bit object "Manufacturer status register" (1002_h) of the engine operating programme is the central register of engine interface.

Bits 24 - 31 inform about the operating status of the engine control.

Bits 0 - 22 inform about the error status of the various monitoring functions.

Error occurring can be analysed over the bits 0 - 23 in a detailed manner.

Operation and error messages indicate the drive bitcoded.

For error analysis and handling purposes one differentiates between reversible and fatal errors as well as note messages.

Warning (Warn) A Warning (object 1002_h/Bit30) indicates that the drive is in a critical but not yet operation-endangering condition (value = 1). The exact origin of the problem is stored in bits 23 to 0 of the status register (object 1002_h).

The warning bit and the bit(s) which indicate the origin of the problem remain until a new travel command is discharged, that is possible origins of problems can also be called up after completing a travel command.

Reversible error (Rev) If the drive detects a reversible error, it sends an EMCY message over the fieldbus and stops the current movement operation. After the error has been corrected, the error message must be acknowledge via bit 7, `Reset fault` in the control word `Controlword` (6040_h).

In the event of a reversible error bit 7 in the object `Statusword` (6041_h) and bit 30 in the object `manufacturer status register` (1002_h) are set.

Fatal error (fatal) A fatal error occurs when the internal device test detects hardware or software errors. The motor controller is blocked; the block can only be reset by switching the drive off and on again.

The drive sends an EMCY message.

Message The entry "Info" in the column "Type of message" indicates that a note was issued without interruption of the currently running movement mode.

The following table shows the bit values of the object `Manufacturer status register` (1002_h).

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
0	Configuration error drive parameter	Reading/writing error or plausibility error when copying drive parameters (control parameter, communications parameter, application parameter or identification parameter) from the configuration memory (EEPROM).	Warning	Check user settings for plausibility and correct or go back to the factory setting. Bit 30 = 1!	No
			Fatal	There is an EEPROM memory error; the drive must be replaced and sent back to the manufacturer Bit 31 = 1!	Yes / EMCY code 6310 _h
1	Configuration error in drive data	Reading/writing error or plausibility error when copying drive data from the configuration memory (EEPROM).	Fatal	There is an EEPROM error in the memory area of the drive and motor data. The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / EMCY code 6310 _h
2	Self test error in Enable input circuit	Error during testing of the Enable hardware during the self test phase (occurs with every switching on of the power supply)	Fatal	Possible defect in the Enable hardware. The drive must be replaced and sent back to the manufacturer Bit 31 = 1! CAUTION: If the drive is turned during the initialisation and self test phase then this will result in an Enable self-test error!	Yes / EMCY code 5000 _h
3	Auxiliary voltage undervoltage (12VDC)	Going below the tolerance limit (10VDC) or going below the switch off limit (8.5VDC).	Warn/Rev	1) Going below the tolerance limit 10VDC: Bit3 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1! 2) Going below the switch off limit 8.5VDC: Bit3 in object 1002 _h is set. The drive stores all run-time data and is put into initialisation status for a self-reset. Bit 31 = 1! Measure: In both cases check stability of the central power supply! If the error occurs again or is not removed after initialisation then the drive must be replaced and sent back to the manufacturer.	1) No 2) Yes / 5110 _h
4	DC bus overvoltage	Exceeding the tolerance limit (24VDC +20%) or the maximum switch off limit (about 39VDC)	Warn/Rev	1. Exceeding the tolerance limit of 24VDC +20%: Bit4 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1! Exceeding the switch off limit of 39VDC: Bit4 in object 1002 _h is set. The drive stores all run-time data and is put into initialisation status for a self-reset. Bit 31 = 1! Measure: In both cases check stability of the central power supply! If the error occurs again or is not removed after initialisation then the drive must be replaced and sent back to the manufacturer.	1) No 2) Yes / 3210 _h

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
5	DC bus undervoltage	Going below the tolerance limit (24VDC -20%) or the switch off limit (15VDC) of the DC bus voltage	Warn/Rev	<p>1) Going below the tolerance limit of 24VDC -20%) Bit5 in object 1002_h is set. The full drive function continues to be accessible. Bit 30 = 1!</p> <p>2) Going below the switch off threshold of 15VDC: Bit5 in object 1002_h is set. The drive stores all run-time data and is put into initialisation status for a self-reset. Bit 31 = 1!</p> <p>Measure: In both cases check stability of the central power supply! If the error occurs again or is not removed after initialisation then the drive must be replaced and sent back to the manufacturer.</p>	1) No 2) Yes / 3220 _h
6	Supply voltage overvoltage	Exceeding the tolerance limit of the supply voltage 24VDC +20%	Warning	Exceeding the tolerance limit of 24VDC +20%: Bit6 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1!	No
7	Supply voltage undervoltage	Going below the tolerance limit (24VDC -20%) or the switch off limit (12VDC) of the supply voltage	Warn/Rev	<p>1 Going below the tolerance limit of 24VDC -20%) Bit7 in object 1002_h is set. The full drive function continues to be accessible. Bit 30 = 1!</p> <p>2. Going below the switch off threshold of 12VDC: Bit7 in object 1002_h is set. The drive stores all run-time data and is put into initialisation status for a self-reset. Bit 31 = 1!</p> <p>Measure: In both cases check stability of the central power supply! If the error occurs again or is not removed after initialisation then the drive must be replaced and sent back to the manufacturer.</p>	1) No 2) Yes / 3120 _h
8	Oscillator watchdog	An excessively high variation of the oscillator frequency or the oscillator does not reach the specified frequency.	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x6000
9	Watchdog timer reset	Reset of the microcontroller by the watchdog timer	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x6000
10	Class B hardware trap	Error message from an internal software monitoring function	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x6000
11	Class B hardware trap	Error message from an internal hardware monitoring function	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x6000
12	not assigned				
13	EEPROM error (storing run-time data)	Error in reading the run-time data previously stored in the EEPROM (logbook)	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x5530

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
14	ROM error (programme memory)	Not implemented on the IcIA N065			
15	RAM error (data memory)	Not implemented on the IcIA N065			
16	An unexpected Hall sensor combination	An undefinable Hall sensor combination occurs or a sequence occurs during the commutation sequence a number of times	Fatal	The drive must be replaced and sent back to the manufacturer. Bit 31 = 1!	Yes / 0x7122
17	Start up error on the motor	No Hall sensor signals after the start up phase, an excessively high start up torque, drive blocked	Warning	Reduce load, increase operating current or peak current, increase value of the acceleration ramp Bit 30 = 1!	Yes / 0x71AA
18	Deviation in rpm	An excessively high start up torque	Warning	Reduce load, increase operating current or peak current, increase value of the acceleration ramp, choose a low speed of rotation Bit 30 = 1!	Yes / 0x71BB
19	Current limiting	The motor current is limited by the parameterised maximum current (lowest maximum value from the motor or electronic parameters).	Warning	Reduce load Bit 30 = 1!	Yes / 0x2222
20	Block movement	Movement onto an obstacle leads to a drop in speed of rotation or stopping and to an over-current.	Rev	Remove the cause of the blockage (obstacle, dead stop, ...). In field bus operation: Perform FaultReset (Bit7/object 6040 _h). In manual mode: Remove power supply, remove the cause of the blockage, switch on again. Bit 31 = 1!	Yes / 0x7121
21	Overload (I ² t)	The measured motor current is above the permissible continuous engine current (calculation with the aid of the I ² t method, thermal motor monitoring)	Rev	Reduce load or increase operating current. The drive executes a rapid stop. Bit 31 = 1!	Yes / 0x2221
22	Excessively high temperature of the power electronics	Exceeding the parameterised temperature limit values	Warn/Rev	1. Exceeding the temperature warning threshold of 80°C: Bit22 in object 1002 _h is set. The full drive function continues to be accessible. Bit 30 = 1! 2. Exceeding the temperature switch off threshold of 90°C: Bit22 in object 1002 _h is set. The drive is stopped. Bit 31 = 1! Measure: The drive can be moved again when it has cooled down to below the temperature warning threshold.	1) No 2) Yes / 0x4310

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
23	External torque	The drive is pulled out of its rest condition by an external torque. Activation of the message takes place depending on the presettings in object "Position window", 6067h.	Warn/Rev	Checking of the mechanical system. Bit 30 = 1!	Yes / 0xFF29
24	Drive referenced	1: Drive is referenced, which means that the commutation pattern and the co-recorded position concur.	----	No measure necessary.	Yes / 0xFF22
		0: The drive is not referenced! Cause: The drive was moved while not under power (effect of an external force). Bit 31= Bit 30, both are 0!		The drive must be newly referenced over the fieldbus (position adjustment).	
25	Move to position	1: The drive has reached the target position window after executing the travel command	Info	No measure necessary.	
26	Motor turns	1: Motor turns itself (Hall sensor signals change) 0: Motor stationary (Hall sensor signals static)	Info	No measure necessary.	
27	not assigned				
28	reserved				
29	Standstill demand by Enable signal	1: Enable signal = low (Standstill) - a drive stop was demanded. Neither Bit31 nor Bit30 are set!	----	If an emergency situation arose! In field bus mode: -Apply hardware Enable signal at potential of the supply voltage. -Execute "Reset fault" (Bit7/object 6040 _h). In manual mode without use of a fieldbus: -Remove supply voltage. -Apply hardware Enable signal on the potential of the supply voltage. -Apply supply voltage again. Bit30/Bit31 = 0!	Yes / 0xFF01
		0: Enable signal = high (Ready-for-operation) - The drive can be moved.			
30	WARNING/note	Drive is in a critical but not an operation-endangering condition. The drive functionality is still available in full for the moment. The cause of the WARNING can be taken from the status information about the object 1002 _h .	Info	The WARNING cannot be reset in a targetted manner. Bit30 is reset as soon as the event causing the WARNING has been removed and a movement of the drive could be executed without a renewed WARNING.	

Bit	Designation	Possible cause for the message	Type of message	Remedy	EMCY message
31	Error/malfunction	Error or malfunction in a monitoring function of the motor operating programme. The cause of the WARNING can be taken from the status information about the object 1002 _h .	Info	The possible source of the error can be determined by evaluation of bits 0-29 from object 1002 _h . If it is a reversible error (Rev), then the original source of error must be removed. The command "Reset fault" (change Bit7 in control word/object 6040 _h von 0 ->1) resets the drive into operating mode.	

Table 7.1 Messages about the device status

7.3 Error code table

The error code is evaluated with the object `Error code (603Fh)`, an object of the DSP 402 device profile, and output as a four-character hexadecimal number. The error code shows the cause of the last interruption of movement.

Code	Name	Meaning
0000 _h	no error	no error
1000 _h	generic error	General error coding
2221 _h	motor overload	Overload
2222 _h	motor current limitation	Current limiting
3110 _h	mains overvoltage	Overvoltage of supply voltage
3120 _h	mains undervoltage	Undervoltage of supply voltage
3210 _h	DC bus overvoltage	Overvoltage of motor DC link
3220 _h	DC bus undervoltage	Undervoltage of motor DC link
4310 _h	excess temperature drive	Overtemperature of power electronics
5000 _h	device hardware	Hardware self-test error (Enable circuit in this case)
5110 _h	supply low voltage	Undervoltage of auxiliary voltage VDD
5510 _h	data storage RAM	Data memory self-test error
5530 _h	data storage EEPROM	Configuration memory self-test error
6000 _h	device software	Microcontroller, internal process or hardware fault
6010 _h	software reset (watchdog)	Software reset by Watchdog timer (timeout in software processing)
6310 _h	loss of parameters	Parameter loss in non-volatile configuration data memory (motor/electronics parameter, identification parameter, application parameter, control parameter and communications parameter)
7121 _h	motor blocked	Block movement
7122 _h	motor error or commutation	Hall error
71AA _h	Motor start failed	Motor starting error
71BB _h	Motor rpm failed	Motor speed deviation
8110 _h	Queue Overrun	Overrun of CAN message buffer. Potential cause of error: loss of communications connection.
8210 _h	PDO not processed	PDO could not be sent. Potential cause of error: receipt of PDO message with errors.
FF00 _h	device specific	Additional drive/motor error

Code	Name	Meaning
FF01 _h	emergency stop	Hardware Enable signal = low - drive was stopped
FF02 _h	guarding signal	Safe Standstill active
FF03 _h	negative limit switch	Negative limit position sensor overrun
FF04 _h	positive limit switch	Positive limit position sensor overrun
FF10 _h	general application	Application: general error
FF11 _h	illegal mode application	Application: Invalid operating mode
FF12 _h	illegal parameter application	Application: invalid parameter value
FF13 _h	position value application	Application: invalid position value
FF14 _h	usrerr poslim	Application: invalid position memory
FF15 _h	communication (NMT)	Communication error at NMT
FF20 _h	general drive controller	Motor controller: general error
FF21 _h	power drive enabled	Motor controller: controller not ready
FF22 _h	no reference	Motor controller: drive not referenced
FF23 _h	drive moves	Motor controller: drive not at standstill
FF24 _h	illegal mode drive controller	Motor controller: invalid operating mode
FF25 _h	illegal parameter drive controller	Motor controller: invalid parameter value
FF26 _h	parameter too low	Motor controller: parameter value too small
FF27 _h	parameter too high	Motor controller: parameter value too large
FF28 _h	position not accepted	Motor controller: position not accepted/processed
FF29 _h	external force	External force effect
FF2A _h	Position overrun error	Drive has not reached target position because of external force application
FF2B _h	Velocity exceeded	Drive was accelerated over the maximum permissible speed of rotation by external force application
FF30 _h	illegal homing method	Illegal homing method
FF33 _h	negative limit switch active	Drive in negative limit position sensor
FF34 _h	positive limit switch active	Drive in positive limit position sensor
FF35 _h	negative limit switch disabled	Negative limit position sensor not enabled
FF36 _h	positive limit switch disabled	Positive limit position sensor not enabled
FF37 _h	home switch disabled	Homing sensor not enabled
FF83 _h	drive at target position	Drive stopped at setpoint

Table 7.2 Error codes

7.4 SDO error message (SDO abort)

An SDO error message is output as a response to an error in a SDO transmission. The cause of the error is shown in `Error code`, byte 4 to byte 7.

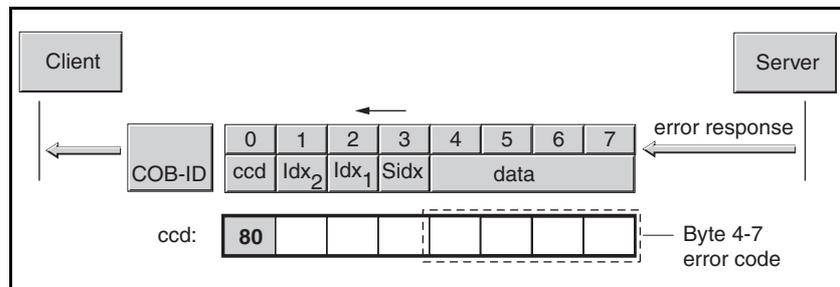


Figure 7.1 SDO error message as answer to a SDO message

The table below shows all error messages that may occur with the positioning controller during data exchange.

Error code	Description
0503 0000 _h	Inverse bit not inverted
0601 0000 _h	No access to object possible
0602 0000 _h	Object does not exist in object directory
0604 0041 _h	Object does not support PDO mapping
0604 0043 _h	Parameters are not compatible
0604 0047 _h	Device detects internal incompatibility
0606 0000 _h	Hardware error, access denied
0607 0010 _h	Data type and parameter length do not match
0607 0012 _h	Data type does not match, parameter too long
0607 0013 _h	Data type does not match, parameter too short
0609 0011 _h	Sub-index not supported
0609 0030 _h	Value range of parameter too large (relevant only for write access)
0609 0031 _h	Parameter values too great
0609 0032 _h	Parameter values too small
0800 0000 _h	General error
0800 0021 _h	Device control is executed locally, data cannot be uploaded or saved.
0800 0022 _h	Device status prevent uploading and saving data.

The byte sequence must be exchanged before evaluating according to the Intel format.

Example Intel format for error code

Error code 0607 0013_h is transmitted as 1300 0706_h byte 7: 06_h, byte 6: 07_h, byte 5: 00_h, byte 4: 13_h

8 Accessories and spare parts

8.1 IcIA connection accessories

Accessory components for signal interface

Designation

sub-D socket, 9-pin, IP65, type designation: F09S-K701

Watertight hood, type designation: FWH1 E

The following company supplies accessory parts for the signal interface:

FCT electronic GmbH Schatzbogen 13D-81829 Munich

Telephone: +49 (0) 89 420004-0 Fax: +49 (0) 89 420004-10

Internet <http://www.fct-electronic.de>

Accessory components for the field bus connection

Designation

eurofast ® circular connector, female connector, type designation: RKC*

eurofast ® circular connector, connector, type designation: RSC*

T-piece, type designation: VB2-FKM FKM FSM 57

Cable, shielded, twisted pair, surge impedance 120 ohm type designation: cable 578

Terminating resistor, 120 ohm, type designation: RSE57-TR2

The following company supplies connection accessories for the fieldbus:

Hans Turck GmbH & Co. KG Witzlebenstraße 7D-45472 Mülheim an der Ruhr

Tel.: +49 (0) 208 - 4952 -0 Fax: +49 (0) 208 - 4952-264

Internet <http://www.turck.come-mail>, turckmh@mail.turck-globe.de

8.2 Ic/A documentation

Designation	Order no.
Device manual, printed, format DIN A4- German (D)- English (GB)- French (F)- Italian (I)	5960 0100 0065960 0100 0075960 010 0 0085960 0100 00 9
CANopen manual, printed, format DIN A4- German (D)- English (GB)- French (F)- Italian (I)	5960 0100 0105960 0100 0115960 010 0 0125960 0100 01 3
CD-ROM with all manuals in all languages in pdf format,	5960 0100 014

9 Service, maintenance and disposal

⚠ CAUTION

Destruction of unit components and loss of control!

Excessive currents can be created at the signal connections if the negative connection to the controller supply voltage is interrupted.

- Do not interrupt the negative connection between power supply unit and load with a fuse or switch
- Check for correct connection before switching on.
- Never connect the controller supply voltage or change its wiring while there is supply voltage present.

Failure to follow these instructions can result in injury or equipment damage.

9.1 Service address

Please contact your local dealer if you have any questions or problems. Your dealer will be happy to give you the name of a customer service outlet in your area.

10 Object directory

10.1 Legend for object description

Name	Example of an object description	
Idx	Code	DT
1111 _h	VAR	I32
<hr/>		
Idx	=	Index
<hr/>		
Code	=	Object code (Object code)
VAR	=	Variable; simple value, which is for example of type Integer8, Unsigned32 or Visible String .
ARR	=	Array; Data field, where every entry is of the same data type.
REC	=	Record; Data field, where entries are a combination of simple data types.
<hr/>		
DT	=	Data type (Data type)
I8	=	Integer8 = -128..+127
I16	=	Integer16 = -32768 .. +32767
I32	=	Integer32 = -2147483648 .. +2147483647
PCo	=	PDO CommPar
PMp	=	PDO Mapping
U8	=	Unsigned8 = 0..255
U16	=	Unsigned16 = 0..65535
U32	=	Unsigned32 = 0..4294967295
UD	=	User Defined
VS	=	Visible String

10.2 Legend for values description

Description		Example of a values description						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	ro	-	U32	1	-	-	

Sdx	=	Sub-index
DT	=	Data type (Data type) see "Legend for object description: DT = data type"
AC	=	Access (Access)
ro	=	read-only
rw	=	read-write
wo	=	write-only
MP	=	PDO-Mapping
-	=	no
Yes	=	Yes
VR	=	Value range (Value Range) see "Legend for object description": DT = date type"
DF	=	Default value (DeFault value)
Acl	=	Accessible
-	=	No access
AM	=	All operating modes (All Operating modes)
const	=	Constant (constant)
CM	=	Configuration mode
HM	=	Homing mode
PM	=	Production mode(password protected)
SV	=	Storable (save, storable)
-	=	No
Yes	=	Yes
Auto	=	Automatic (automatic)

10.3 Overview of the objects

10.3.1 Overview of the object group 1000_h

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
1000 _h		Device type	VAR	U32	ro	–	–	127
1001 _h		Error Register	VAR	U8	ro	–	–	127
1002 _h		Manufacturer status register	VAR	U32	ro	–	Auto	128
1003 _h		Predefined error field	ARR	U32				132
	00 _h	Number of errors		U8	rw	–	–	
	01 _h	Standard error field		U32	ro	–	–	
	02 _h	Standard error field		U32	ro	–	–	
	03 _h	Standard error field		U32	ro	–	–	
	04 _h	Standard error field		U32	ro	–	–	
	05 _h	Standard error field		U32	ro	–	–	
1005 _h		COB-Id SYNC message	VAR	U32	rw	–	Yes	134
1008 _h		Manufacturer device name	VAR	VS	const	–	–	134
1009 _h		Manufacturer hardware version	VAR	VS	const	–	–	135
100A _h		Manufacturer software version	VAR	VS	const	–	–	135
100C _h		Guard time	VAR	U16	rw	–	Yes	135
100D _h		Life time factor	VAR	U8	rw	–	Yes	136
1010 _h		Store parameter	ARR	U32				137
	00 _h	Largest supported sub-index		U8	ro	–	–	
	01 _h	Save all parameters		U32	rw	–	–	
	02 _h	Save communication parameters		U32	rw	–	–	
	03 _h	Save application parameters		U32	rw	–	–	
1011 _h		Restore default parameters	ARR	U32				138
	00 _h	Largest supported sub-index		U8	ro	–	–	
	01 _h	Restore all default parameters		U32	rw	–	–	
	02 _h	Restore communication default parameters		U32	rw	–	–	
	03 _h	Restore application parameters		U32	rw	–	–	
1014 _h		COB-ID emergency message	VAR	U32	rw	–	Yes	139
1015 _h		Inhibit time EMCY	VAR	U16	rw	–	Yes	140
1016 _h		Consumer Heartbeat time	ARR	U32				141
	00 _h	Number of elements		U8	ro	–	–	
	01 _h	Consumer Heartbeat time		U32	rw	–	–	
1017 _h		Producer Heartbeat time	VAR	U16	rw	–	Yes	141
1018 _h		Identity object	REC	Identity				142
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Vendor id		U32	ro	–	–	
	02 _h	Product code		U32	ro	–	–	
	03 _h	Revision number		U32	ro	–	–	

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
	04 _h	Serial number		U32	ro	–	–	
1020 _h		Verify configuration	ARR	U32				144
	00 _h	Number of supported entries		U8	ro	–	–	
	01 _h	Configuration date		U32	rw	–	Yes	
	02 _h	Configuration time		U32	rw	–	Yes	
1200 _h		Server SDO parameter	REC	SDO-P				145
	00 _h	Number of elements		U8	ro	–	–	
	01 _h	COB-ID Client -> Server (rx)		U32	ro	–	–	
	02 _h	COB-ID Server -> Client (tx)		U32	ro	–	–	
1201 _h		Server SDO parameter	REC	SDO-P				146
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID Client -> Server (rx)		U32	rw	–	–	
	02 _h	COB-ID Server -> Client (tx)		U32	rw	–	–	
	03 _h	Node-ID of the SDO client		U8	rw	–	–	
1400 _h		1st receive PDO parameter	REC	PCo				147
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	Yes	
	02 _h	Transmission type		U8	rw	–	Yes	
1401 _h		2nd receive PDO parameter	REC	PCo				149
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	Yes	
	02 _h	Transmission type		U8	rw	–	Yes	
1402 _h		3rd receive PDO parameter	REC	PCo				150
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	Yes	
	02 _h	Transmission type		U8	rw	–	Yes	
1600 _h		1st receive PDO mapping	REC	PMp				152
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
1601 _h		2nd receive PDO mapping	REC	PMp				152
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
	02 _h	2nd mapped object		U32	ro	–	–	
1602 _h		3rd receive PDO mapping	REC	PMp				153
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
	02 _h	2nd mapped object		U32	ro	–	–	
1800 _h		1st transmit PDO parameter	REC	PCo				154
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	Yes	

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
	02 _h	Transmission type		U8	rw	–	Yes	
	03 _h	Inhibit time		U16	rw	–	Yes	
	05 _h	Event timer		U16	rw	–	Yes	
1801 _h		2nd transmit PDO parameter	REC	PCo				156
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	Yes	
	02 _h	Transmission type		U8	rw	–	Yes	
	03 _h	Inhibit time		U16	rw	–	Yes	
	05 _h	Event timer		U16	rw	–	Yes	
1802 _h		3rd transmit PDO parameter	REC	PCo				158
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	Yes	
	02 _h	Transmission type		U8	rw	–	Yes	
	03 _h	Inhibit time		U16	rw	–	Yes	
	05 _h	Event timer		U16	rw	–	Yes	
1806 _h		7th transmit PDO parameter	REC	PCo				159
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	Yes	
	02 _h	Transmission type		U8	rw	–	Yes	
	03 _h	Inhibit time		U16	rw	–	Yes	
	05 _h	Event timer		U16	rw	–	Yes	
1820 _h		Manufacturer specific transmit PDO parameter	REC	PCo				161
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	–	
	02 _h	Transmission type		U8	rw	–	–	
	03 _h	Inhibit time		U16	rw	–	–	
	05 _h	Event timer		U16	rw	–	–	
1821 _h		Manufacturer specific transmit PDO parameter	REC	PCo				163
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	COB-ID used by PDO		U32	rw	–	–	
	02 _h	Transmission type		U8	rw	–	–	
	03 _h	Inhibit time		U16	rw	–	–	
	05 _h	Event timer		U16	rw	–	–	
1A00 _h		1st transmit PDO mapping	REC	PMp				165
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
1A01 _h		2nd transmit PDO mapping	REC	PMp				165
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
	02 _h	2nd mapped object		U32	ro	–	–	

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
1A02 _h		3rd transmit PDO mapping	REC	PMp				166
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
	02 _h	2nd mapped object		U32	ro	–	–	
1A06 _h		7th transmit PDO mapping	REC	PMp				167
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
	02 _h	2nd mapped object		U32	ro	–	–	
1A20 _h		Manufacturer specific transmit PDO mapping	REC	PMp				168
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
	02 _h	2nd mapped object		U32	ro	–	–	
1A21 _h		Manufacturer specific transmit PDO mapping	REC	PMp				169
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	1st mapped object		U32	ro	–	–	
	02 _h	2nd mapped object		U32	ro	–	–	

10.3.2 Overview of object group 2000_h

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
2000 _h		Drive hardware version	VAR	VS	rw	–	Yes	170
2001 _h		Motor hardware version	VAR	VS	rw	–	Yes	170
2002 _h		Motor operating software version	VAR	VS	ro	–	–	171
2003 _h		Application software version	VAR	VS	ro	–	–	171
2004 _h		User profile velocity	ARR	U32				171
	00 _h	Number of elements		U32	ro	–	–	
	01 _h	User profile velocity 1		U32	rw	–	Yes	
	02 _h	User profile velocity 2		U32	rw	–	Yes	
	03 _h	User profile velocity 3		U32	rw	–	Yes	
	04 _h	User profile velocity 4		U32	rw	–	Yes	
	05 _h	User profile velocity 5		U32	rw	–	Yes	
	06 _h	User profile velocity 6		U32	rw	–	Yes	
	07 _h	User profile velocity 7		U32	rw	–	Yes	
	08 _h	User profile velocity 8		U32	rw	–	Yes	
	09 _h	User profile velocity 9		U32	rw	–	Yes	
	0A _h	User profile velocity 10		U32	rw	–	Yes	
2005 _h		User profile acceleration	ARR	U32				172
	00 _h	Number of elements		U32	ro	–	–	
	01 _h	User profile acceleration 1		U32	rw	–	Yes	
	02 _h	User profile acceleration 2		U32	rw	–	Yes	
	03 _h	User profile acceleration 3		U32	rw	–	Yes	
	04 _h	User profile acceleration 4		U32	rw	–	Yes	
	05 _h	User profile acceleration 5		U32	rw	–	Yes	
	06 _h	User profile acceleration 6		U32	rw	–	Yes	
	07 _h	User profile acceleration 7		U32	rw	–	Yes	
	08 _h	User profile acceleration 8		U32	rw	–	Yes	
	09 _h	User profile acceleration 9		U32	rw	–	Yes	
	0A _h	User profile acceleration 10		U32	rw	–	Yes	
2006 _h		User profile deceleration	ARR	U32				173
	00 _h	Number of elements		U32	ro	–	–	
	01 _h	User profile deceleration 1		U32	rw	–	Yes	
	02 _h	User profile deceleration 2		U32	rw	–	Yes	
	03 _h	User profile deceleration 3		U32	rw	–	Yes	
	04 _h	User profile deceleration 4		U32	rw	–	Yes	
	05 _h	User profile deceleration 5		U32	rw	–	Yes	
	06 _h	User profile deceleration 6		U32	rw	–	Yes	
	07 _h	User profile deceleration 7		U32	rw	–	Yes	
	08 _h	User profile deceleration 8		U32	rw	–	Yes	
	09 _h	User profile deceleration 9		U32	rw	–	Yes	

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
	0A _h	User profile deceleration 10		U32	rw	–	Yes	
2007 _h		User profile number	VAR	U8	rw	–	–	174
2008 _h		Software position safety limit	ARR	I32				174
	00 _h	Number of elements		I32	ro	–	–	
	01 _h	Min position limit		I32	rw	–	Yes	
	02 _h	Max position limit		I32	rw	–	Yes	
2009 _h		Software position drive limit	ARR	I32				175
	00 _h	Number of elements		I32	ro	–	–	
	01 _h	Min position limit		I32	rw	–	Yes	
	02 _h	Max position limit		I32	rw	–	Yes	
200A _h		User profile max current	ARR	U16				176
	00 _h	Number of elements		U16	ro	–	–	
	01 _h	User profile max current 1		U16	rw	–	Yes	
	02 _h	User profile max current 2		U16	rw	–	Yes	
	03 _h	User profile max current 3		U16	rw	–	Yes	
	04 _h	User profile max current 4		U16	rw	–	Yes	
	05 _h	User profile max current 5		U16	rw	–	Yes	
	06 _h	User profile max current 6		U16	rw	–	Yes	
	07 _h	User profile max current 7		U16	rw	–	Yes	
	08 _h	User profile max current 8		U16	rw	–	Yes	
	09 _h	User profile max current 9		U16	rw	–	Yes	
	0A _h	User profile max current 10		U16	rw	–	Yes	
200B _h		Position assignment value	VAR	I32	wo	–	–	177
200C _h		Current peak value	VAR	I16	wo	–	–	177
200D _h		Temperature actual value	VAR	I16	wo	–	–	177
200E _h		Drive log book	REC	UD				178
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Total power-on time		U32	rw	–	Auto	
	02 _h	Total turn-on time		U32	rw	–	Auto	
	03 _h	Number of positionings		U32	rw	–	Auto	
	04 _h	Number of reference loss		U16	rw	–	Auto	
	05 _h	Number of log book loss		U16	rw	–	Auto	
200F _h		Drive serial-number	VAR	VS	rw	–	Yes	179
2011 _h		Manual mode settings	REC	UD				179
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Increments		I32	rw	–	Yes	
	02 _h	Velocity		U32	rw	–	Yes	
	03 _h	Acceleration		U32	rw	–	Yes	
	04 _h	Deceleration		U32	rw	–	Yes	
	05 _h	Max current		U16	rw	–	Yes	

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
	06 _h	Release time		U16	rw	–	Yes	
2012 _h		Negative manual-switch settings	REC	UD				182
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Increments		I32	rw	–	Yes	
	02 _h	Velocity		U32	rw	–	Yes	
	03 _h	Acceleration		U32	rw	–	Yes	
	04 _h	Deceleration		U32	rw	–	Yes	
	05 _h	Max current		U16	rw	–	Yes	
	06 _h	Enabled		U16	rw	–	Yes	
2013 _h		Negative limit-switch settings	REC	UD				184
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Switch enabled		I8	rw	–	Yes	
	02 _h	Switch trigger polarity		I8	rw	–	Yes	
	03 _h	Switch overrun option code		I16	rw	–	Yes	
2014 _h		Positive limit-switch settings	REC	UD				186
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Switch enabled		I8	rw	–	Yes	
	02 _h	Switch trigger polarity		I8	rw	–	Yes	
	03 _h	Switch overrun option code		I16	rw	–	Yes	
2015 _h		Home-switch settings	REC	UD				188
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Switch enabled		I8	rw	–	Yes	
	02 _h	Switch trigger polarity		I8	rw	–	Yes	
	03 _h	Switch overrun option code		I16	rw	–	Yes	
2100 _h		Device identification	REC	UD				189
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Device name		VS	rw	–	Yes	
	02 _h	Device ident.-no.		VS	rw	–	Yes	
	03 _h	Motor ident.-no.		VS	rw	–	Yes	
	04 _h	Motor manufacturer		VS	rw	–	Yes	
	05 _h	Electronic ident.-no.		VS	rw	–	Yes	
	06 _h	Electronic manufacturer		VS	rw	–	Yes	
	07 _h	LSS vendor-id.		U32	rw	–	Yes	
	08 _h	LSS product code		U32	rw	–	Yes	
	09 _h	LSS revision number		U32	rw	–	Yes	
	0A _h	LSS serial number		U32	rw	–	Yes	
	0B _h	LMT manufacturer name		VS	rw	–	Yes	
	0C _h	LMT product name		VS	rw	–	Yes	
	0D _h	Software version		VS	ro	–	Yes	
	0E _h	Date of production		Date	rw	–	Yes	

10.3.3 Overview of object group 6000_h

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
6007 _h		Abort connection option code	VAR	I16	rw	–	Yes	193
603F _h		Error code	VAR	U16	ro	–	–	194
6040 _h		Controlword	VAR	U16	rww	Yes	–	194
6041 _h		Statusword	VAR	U16	ro	Yes	–	196
605A _h		Quick stop option code	VAR	I16	rw	–	Yes	197
605B _h		Shutdown option code	VAR	I16	rw	–	Yes	199
605C _h		Disable operation option code	VAR	I16	rw	–	Yes	199
605D _h		Halt option code	VAR	I16	rw	–	Yes	200
605E _h		Fault reaction option code	VAR	I16	rw	–	Yes	201
6060 _h		Modes of operation	VAR	I8	wo	–	–	202
6061 _h		Modes of operation display	VAR	I8	ro	–	–	204
6063 _h		Position actual value*	VAR	I32	ro	–	–	205
6064 _h		Position actual value	VAR	I32	ro	Yes	–	205
6067 _h		Position window	VAR	U32	rw	–	Yes	206
6069 _h		Velocity sensor actual value	VAR	I32	ro	–	–	207
606B _h		Velocity demand value	VAR	I32	ro	Yes	–	207
606C _h		Velocity actual value	VAR	I32	ro	Yes	–	208
606D _h		Velocity window	VAR	U16	rw	–	Yes	208
606E _h		Velocity window time	VAR	U16	rw	–	Yes	209
6073 _h		Max current	VAR	U16	rw	–	–	210
6075 _h		Motor rated current	VAR	U32	rw	–	–	211
6078 _h		Current actual value	VAR	I16	ro	–	–	211
6079 _h		DC link circuit voltage	VAR	U32	ro	–	–	212
607A _h		Target position	VAR	I32	rww	Yes	–	213
607D _h		Software position limit	ARR	I32				213
	00 _h	Number of elements		I32	ro	–	–	
	01 _h	Min position limit		I32	rw	–	Yes	
	02 _h	Max position limit		I32	rw	–	Yes	
607E _h		Polarity	VAR	U8	rw	–	Yes	215
607F _h		Max profile velocity	VAR	U32	rw	–	–	215
6080 _h		Max motor speed	VAR	U16	rw	–	–	216
6081 _h		Profile velocity	VAR	U32	rw	–	Yes	216
6083 _h		Profile acceleration	VAR	U32	rw	–	Yes	217
6084 _h		Profile deceleration	VAR	U32	rw	–	Yes	217
6085 _h		Quick stop deceleration	VAR	U32	rw	–	–	218
6086 _h		Motion profile type	VAR	I16	rw	–	–	218
6089 _h		Position notation index	VAR	I8	rw	–	–	219
608A _h		Position dimension index	VAR	U8	rw	–	–	219
608B _h		Velocity notation index	VAR	I8	rw	–	–	220

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
608C _h		Velocity dimension index	VAR	U8	rw	–	–	220
608D _h		Acceleration notation index	VAR	I8	rw	–	–	221
608E _h		Acceleration dimension index	VAR	U8	rw	–	–	221
608F _h		Position encoder resolution	ARR	U32				222
	00 _h	Number of elements		U32	ro	–	–	
	01 _h	Encoder increments		U32	rw	–	–	
	02 _h	Motor revolutions		U32	rw	–	–	
6091 _h		Gear ratio	ARR	U32				223
	00 _h	Number of elements		U32	ro	–	–	
	01 _h	Motor revolutions		U32	rw	–	–	
	02 _h	Shaft revolutions		U32	rw	–	–	
6098 _h		Homing method	VAR	I8	rw	–	–	223
6099 _h		Homing speeds	ARR	U32				226
	00 _h	Number of elements		U32	ro	–	–	
	01 _h	Speed during search for switch		U32	rw	–	Yes	
	02 _h	Speed during search for zero		U32	rw	–	Yes	
609A _h		Homing acceleration	VAR	U32	rw	–	Yes	227
60C5 _h		Max acceleration	VAR	U32	rw	–	–	228
60C6 _h		Max deceleration	VAR	U32	rw	–	–	228
60F9 _h		Velocity control parameter set	REC	UD				228
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	V: gain		U16	rw	–	Yes	
	02 _h	Ti: integration time constant		U16	rw	–	Yes	
	03 _h	Start-up timeout		U16	rw	–	Yes	
	04 _h	Constant drive delay		U8	rw	–	Yes	
	05 _h	Acceleration current factor		U8	rw	–	Yes	
	06 _h	Max current events		U16	rw	–	Yes	
	07 _h	Block deceleration		U16	rw	–	Yes	
	08 _h	Reserved		U16	rw	–	Yes	
	09 _h	Kp cmd		U16	rw	–	Yes	
60FB _h		Position control parameter set	REC	UD				232
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Holding torque time		U16	rw	–	Yes	
	02 _h	Holding torque current		U16	rw	–	Yes	
60FD _h		Digital inputs	VAR	U32	ro	Yes	–	232
60FF _h		Target velocity	VAR	I32	rww	Yes	–	233
6402 _h		Motor type	VAR	U16	rw	–	–	234
6404 _h		Motor manufacturer	VAR	VS	rw	–	–	235
6406 _h		Motor calibration date	VAR	Date	rw	–	Yes	235
6410 _h		Motor data	REC	UD				235

Idx	Sdx	Name/meaning	Code	DT	AC	MP	SV	Page
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Max speed		U16	rw	–	Yes	
	02 _h	Nominal speed		U16	rw	–	Yes	
	03 _h	Nominal motor current		U16	rw	–	Yes	
	04 _h	Motor torque constant		U16	rw	–	Yes	
	05 _h	Gear shaft revolutions		U32	rw	–	Yes	
	06 _h	Gear motor revolutions		U32	rw	–	Yes	
	07 _h	Gear stages		U16	rw	–	Yes	
	08 _h	Gear efficiency		U16	rw	–	Yes	
	09 _h	Nominal gear torque		U16	rw	–	Yes	
	0A _h	Gear detent torque		U16	rw	–	Yes	
	0B _h	Pole pairs		U8	rw	–	Yes	
	0C _h	Encoder resolution		U16	rw	–	Yes	
	0D _h	Continuous motor current		U16	rw	–	Yes	
	0E _h	Max motor current		U16	rw	–	Yes	
	0F _h	Max overload time		U16	rw	–	Yes	
	10 _h	Rotor inertia		U16	rw	–	Yes	
	11 _h	Terminal resistance		U16	rw	–	Yes	
	12 _h	Terminal inductivity		U16	rw	–	Yes	
	13 _h	Generator voltage constant		U16	rw	–	Yes	
	14 _h	GV 5th harmonic content		I16	rw	–	Yes	
	15 _h	GV 7th harmonic content		I16	rw	–	Yes	
6502 _h		Supported drive modes	VAR	U32	ro	–	–	240
6504 _h		Drive manufacturer	VAR	VS	rw	–	–	241
6510 _h		Drive data	REC	UD				241
	00 _h	Number of entries		U8	ro	–	–	
	01 _h	Max drive current		U16	rw	–	Yes	
	02 _h	Excess temperature		U8	rw	–	Yes	
	03 _h	Temperature threshold		U8	rw	–	Yes	
	04 _h	Min ramp acceleration		U16	rw	–	Yes	
	05 _h	Min ramp deceleration		U16	rw	–	Yes	
	06 _h	Hall sensors		U8	rw	–	Yes	
	07 _h	Reserved		U8	rw	–	–	
	08 _h	Reserved		U16	rw	–	–	
	09 _h	Reserved		U16	rw	–	–	
	0A _h	Interface option type		I8	rw	–	Yes	

10.4 Detailed description of the objects

The following are all objects of the drive control IcIA N06x sorted and described in detail according to their index.

10.4.1 1000_h Device type

The object shows the implemented device profile and the device type.

Object description

Name	Device type		
Idx	Code	DT	
1000 _h	VAR	U32	

Values description

Description	Device type							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	ro	–	U32	0002 0192 _h	–	–	

Bit coding, sub-index 00_h

Bit	Access	Value	Description
31..24	ro	00 _h	Manufacturer-specific (not used)
23..16	ro	02 _h	Drive type (Bit17=1: Servo drive
15..0	ro	0192 _h	Device profile DS-402 (192 _h)

Device profile

The device profile CiA DSP-402 “Drives and Motion Control” (version 2.0, July 2002) is used for the drive control IcIA®.

10.4.2 1001_h Error register

The object shows the error status of the device.

Object description

Name	Error Register		
Idx	Code	DT	
1001 _h	VAR	U8	

Values description

Description	Error Register							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	–	U8	–	–	–	

Bit coding, sub-index 00_h

Bit	Access	Value	Meaning, if Bit = 1
0	ro	x	General error
1	ro	x	Current
2	ro	x	Voltage
3	ro	x	Temperature
4	ro	x	Communication error
5	ro	x	Specific device profile

Bit	Access	Value	Meaning, if Bit = 1
6	ro	0	reserved
7	ro	x	Manufacturer-specific

A set bit shows an error message. If sub-index 00_h=0, then there is no error present.

Error evaluation Detailed troubleshooting can be determined over the object `Error code` (603F_h). The object `Predefined error field` (1003_h) shows the error history of the drive.

Emergency-Messages Errors are signalled by a Emergency-Message the moment they occur. See table in chapter 7.2.2 "Messages: on the device status" and chapter 7.3 "Error code table".

10.4.3 1002_h Manufacturer Status Register

The object shows the operating and error status in bit-coded form. The meaning of the bit status is established manufacturer-specific. Operating statuses can be requested via the object `Statusword` (6041_h) of the status machine.

Object description

Name	Manufacturer status register		
Idx	Code	DT	
1002 _h	VAR	U32	

Values description

Description	Manufacturer status register							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	ro	-	U32	-	-	Auto	

Bit coding, sub-index 00_h

Bit	Access	Value	Meaning, if Bit = 1
31	ro	x	Error/malfunction (Malfunction)
30	ro	x	WARNING, note, (Warning)
29	ro	x	Hardware Emergency Stop (Emergency-stop active)
28	ro	x	Guarding signal active (Guarding signal active) (IcIA N06x: new bit)
27	ro	x	Motor control enabled (IcIA N06x: out of date, obsolete)
26	ro	x	Motor turns (Motor turning)
25	ro	x	Moved into position (Position approached)
24	ro	x	Drive referenced (Drive referenced)
23	ro	x	External torque (External torque) (IcIA N06x: new bit)
22	ro	x	Excessively high temperature of power amplifier- Power amplifier excess temperature

Bit	Access	Value	Meaning, if Bit = 1
21	ro	x	Continuous motor current limit value exceeded (Continuous motor current exceeded) (IcIA N06x: meaning changed, meaning changed)
20	ro	x	Block movement (Block movement)
19	ro	x	Current limiting (Current limitation)
18	ro	x	Deviation from speed (Speed variation)
17	ro	x	Start up fault, motor does not turn (Start-up error/ motor not turning)
16	ro	x	Hall sensor error (Unexpected hall sensor combination)
15	ro	0	RAM error (RAM error) (IcIA N06x: out of date, obsolete)
14	ro	0	ROM error (ROM error) (IcIA N06x: out of date, obsolete)
13	ro	x	Error in configuration memory (EEPROM error) (non-reversible, non-reversible)
12	ro	0	Internal system error (Internal system error) (IcIA N06x: out of date, obsolete)
11	ro	x	Class A hardware-trap (non-reversible, non-reversible)
10	ro	x	Class B hardware-trap (non-reversible, non-reversible)
9	ro	x	Watchdog-timer reset (non-reversible, non-reversible)
8	ro	x	Oscillator watchdog (non-reversible, non-reversible)
7	ro	x	Supply voltage undervoltage (Power supply under-voltage)
6	ro	x	Supply voltage overvoltage (Power supply over-voltage)
5	ro	x	DC bus undervoltage (DC link under-voltage)
4	ro	x	DC bus overvoltage (DC link over-voltage)
3	ro	x	Auxiliary undervoltage (Power amplifier low-voltage)
2	ro	x	Error in Emergency Stop circuit (Emergency-stop circuit error) (non-reversible, non-reversible)
1	ro	x	Read error drive data (Configuration data loss)
0	ro	x	Read error drive parameter (Configuration parameter loss)

Bit 31 Malfunction

The bit `Malfunction` (error/malfunction) shows that an error or a malfunction of an internal monitoring function of motor operating programme was detected (value = 1). The exact origin of the error is stored in bits 23 up to 0 of `Statusregisters`.

The `Fehlerflag` can be reset through access from outside, either over a higher-level field bus control or through removal and re-application of the supply voltage.

Bit 30 Warning

The bit `warning` (WARNING/note) shows that the drive is in a critical but not yet operation-endangering condition (value = 1). The exact origin of the error is stored in the bits 23 up to 0 of `Statusregisters`.

The flag `Warnung/Hinweis` and the bit(s) which indicate the origin of the problem remain until a new travel command is discharged, that is possible origins of problems can also be called up after completing a travel command.

Bit 29 Emergency-stop active

The bit `Emergency-stop active` (hardware Emergency Stop) is set if the Emergency Stop signal is applied to the input EMERGENCY STOP (value = 1).

The Emergency Stop flag can only be reset after withdrawal of the Emergency Stop signal and through access from outside, either over a higher-level field bus control or through removal and re-application of the supply voltage.

Bit 28 Guarding signal active

t.b.d.

Bit 26 Motor turning

The bit `Motor turning` (motor turns) shows that the motor is turning (value = 1).

Bit 25 Position approached

The bit `Position approached` (moved to position) shows that the drive has securely come to a stop at the target position after an executed travel command within the established symmetrical range (value = 1).

Bit 24 Drive referenced

The bit `Drive referenced` (drive referenced) shows that the position counter shows a valid value and the drive can be driven in positioning mode (value = 1).

Bit 23 External Torque

The bit `External torque` (external torque) is set if the drive while stationary is pulled out of the established symmetrical range around the actual position by an external torque.

Bit 22 Power amplifier excess temperature

The bit `Power amplifier excess temperature` (power amplifier overtemperature) is set when there is an excessively high temperature at the power amplifier (value = 1).

Bit 21 Continuous motor current exceeded

The measured motor current is used with the aid of the I^2t method for thermal monitoring of the motor. If the measured current exceeds the permissible continuous motor current for a time defined according to the

size of the current, then bit `Continuous motor current exceeded` in the status register will be set and the applied movement command is interrupted.

Bit 20 Block movement

The bit `Block movement` (block movement) is set (value = 1) if the drive is blocked during movement of the drive.

Bit 19 Current limitation

The bit `Current limitation` (current limitation) is set (value = 1) if the measured motor phase current reaches the set maximum motor phase current, that is the drive moves within the current limitation.

Bit 18 Speed variation

The bit `Speed variation` (deviation from rotational speed) is set (value = 1) if the measured speed of rotation deviates from the prescribed speed of rotation during movement of the drive.

Bit 17 Motor start-up error

The bit `Motor start-up error` (start error) is set (value = 1) if the drive does not start for a discharged movement command.

Bit 16 Unexpected hall sensor combination

The bit `Unexpected hall sensor combination` (Hall sensor error) is set (value = 1) if during a drive movement a faulty switching sequence of the Hall sensors is recognized.

Bit 13 EEPROM error

The bit `EEPROM error` (error in configuration memory) is set (value = 1) if after loss of Power-fail data the logbook cannot be restored from the configuration memory (EEPROM). The error bit is non-reversible which means that it cannot be reset even by switching off and switching on the supply voltage.

Bit 11 Class A hardware-trap

The bit `Class A hardware-trap` is set for malfunctioning of a On-Chip component of the microcontroller (value = 1). The error bit is non-reversible which means that it cannot be reset even by switching off and switching on the supply voltage.

Bit 10 Class B hardware-trap

The bit `Class B hardware-trap` is set for malfunctioning of the address/data bus of the microcontroller (value = 1). The error bit is non-reversible which means that it cannot be reset even by switching off and switching on the supply voltage.

Bit 9 Watchdog-timer reset

The bit `Watchdog-timer reset` is set for a reset of the system by the watchdog timer of the microcontroller (value = 1). The error bit is non-reversible which means that it cannot be reset even by switching off and switching on the supply voltage.

Bit 8 Oscillator watchdog

The bit `Oscillator watchdog` is set for malfunctioning of the oscillator (value = 1). The error bit is non-reversible which means that it cannot be reset even by switching off and switching on the supply voltage.

Bit 7 Power supply under-voltage

The bit `Power supply under-voltage` (supply voltage undervoltage) is set for an undervoltage of the supply voltage (value = 1).

Bit 6 Power supply over-voltage

The bit `Power supply over-voltage` (supply voltage overvoltage) is set for an overvoltage of the supply voltage (value = 1).

Bit 5 DC link under-voltage

The bit `DC link under-voltage` (DC bus voltage undervoltage) is set for an undervoltage of the DC bus voltage (value = 1).

Bit 4 DC link over-voltage

The bit `DC link over-voltage` (DC bus voltage overvoltage) is set for an overvoltage of the DC bus voltage (value = 1).

Bit 3 Power amplifier low-voltage

The bit `Power amplifier low-voltage` (auxiliary voltage undervoltage) is set for an undervoltage of the auxiliary voltage (value = 1).

Bit 2 Emergency-stop circuit error

The bit `Emergency-stop circuit error` (error in the Emergency Stop circuit) is set for a malfunction of the Emergency Stop circuit or the circuits for the signals 'Safe standstill' during the self test (value = 1). The error bit is non-reversible which means that it cannot be reset even by switching off and switching on the supply voltage.

Bit 1 Configuration data loss

The bit `Configuration data loss` (read error of drive data) is set (value = 1) if the drive data cannot be read out of the configuration memory. The drive cannot be operated without correct drive data.

Bit 0 Configuration parameter loss

The bit `Configuration parameter loss` (read error of drive parameter) is set (value = 1) if the drive parameter cannot be read out of the configuration memory. The factory settings for the parameter are loaded in such cases.

Diagnostics and troubleshooting

See table in chapter 7.2.2 "Messages: on the device status" and chapter 7.3 "Error code table".

10.4.4 1003_h Predefined error field

The object saves the latest error messages that were shown as an EMCY message.

- The entry under sub-index 00_h contains the number of saved error messages.

- The current error message is stored under sub-index 01_h, older messages are moved to high sub-index entries.
- Writing a '0' to sub-index 00_h resets the error list.

Object description

Name	Predefined error field	
Idx	Code	DT
1003 _h	ARR	U32

Values description

Description	Number of errors						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	rw	-	0..5	0	AM	-

Meaning	Standard error field						
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	ro	-	U32	0	-	-

Meaning	Standard error field						
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	ro	-	U32	0	-	-

Meaning	Standard error field						
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U32	ro	-	U32	0	-	-

Meaning	Standard error field						
Sdx	DT	AC	MP	VR	DF	Acl	SV
04 _h	U32	ro	-	U32	0	-	-

Meaning	Standard error field						
Sdx	DT	AC	MP	VR	DF	Acl	SV
05 _h	U32	ro	-	U32	0	-	-

Bit coding, sub-index 01_h

Bit	Meaning
31..16	Additional information (not used)
15..0	Error code, see object Error code (603F _h)

The compact drive stores the last five error messages. The error list is deleted by switching off the drive.

Emergency-Messages

The compact drive sends 8-byte large error telegrams (emergency message) over the object. The low value word (bit 15..0) of an entry in the error list *Predefined error field* corresponds to the first two bytes of a *Emergency-Message*; see object COB-ID *emergency message* (1014_h) and error table (*Emergency-Codes*).

Diagnostics and troubleshooting See table in chapter 7.2.2 "Messages: on the device status" and chapter 7.3 "Error code table".

10.4.5 1005_h COB-Id SYNC message

The object makes known the COB ID of the SYNC object and establishes whether a device sends SYNC-messages.

Object description

Name	COB-Id SYNC message		
Idx	Code	DT	
1005 _h	VAR	U32	

Values description

Meaning	COB-Id SYNC message							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	rw	-	U32	0000 0080 _h	AM	Yes	

Bit coding, sub-index 00_h

Bit	Access	Value	Meaning
31	ro	0 _b	not relevant
30	ro	0 _b	0: Device cannot send SYNC messages 1: Device can send SYNC messages
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, if bit 29 = 1.
10-0	rw	80 _h	Bit 10..0 of the COB ID

Synchronisation

To achieve synchronisation a device in the network must send SYNC objects the ".SYNC-Producer The compact drive can only receive SYNC messages, which means it is a "SYNC-Consumer".

Set COB ID

The COB ID can be altered in an NMT status "pre-operational".

Store COB ID

The COB ID can be persistently stored with the object Store parameters (1010_h), sub-index=02_h.

10.4.6 1008_h Manufacturer device name

The object shows the device designation from the manufacturer.

Object description

Name	Manufacturer device name		
Idx	Code	DT	
1008 _h	VAR	VS	

Values description

Meaning	Manufacturer device name							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	VS	const	-	VS	-	-	-	

Sub-index 00_h

'IcIA N065'	IcIA N065 DC024 Sxxx CANopen
-------------	------------------------------

... [To Be Continued]

The object `Device information (2100h)` contains further information about the device.

10.4.7 1009_h Manufacturer hardware version

The object shows the material number of the drive.

Object description

Name	Manufacturer hardware version						
Idx	Code	DT					
1009 _h	VAR	VS					

Values description

Meaning	Manufacturer hardware version								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	VS	const	–	VS	–	–	–	–	

The object `Device information (2100h)` contains further information about device.

10.4.8 100A_h Manufacturer software version

The object shows the version number of the firmware.

Object description

Name	Manufacturer software version						
Idx	Code	DT					
100A _h	VAR	VS					

Values description

Meaning	Manufacturer software version								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	VS	const	–	VS	–	–	–	–	

The object `Device information (2100h)` contains further information about device.

10.4.9 100C_h Guard time

The cycle time for connection monitoring of a NMT-Slaves is set by means of the object. A NMT-Master cyclically queries over the Node-Guardingprotocol the node condition of the device and waits for a validation (Node-Guarding).

Object description

Name	Guard time						
Idx	Code	DT					
100C _h	VAR	U16					

Values description

Meaning		Guard time					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U16	rw	-	U16	0	AM	Yes

The cycle time `Guard time` is given in milliseconds. The value "0" deactivates connection monitoring.

"Guard time"Secure

The cycle time `Guard time` can be altered in the NMT "pre-operational" status. In the compact drive the altered setting can be persistently stored with the object `Store parameters (1010h)`, sub-index=02_h.

Node-Guarding

Node-GuardingA checks NMT-Master the communication connection to the network users (NMT-Slaves) over the protocol. The NMT-Slaves check from their side whether the Node-Guarding occurs by the action of NMT-Master (Life-Guarding); see object `Life time factor (100Dh)`.

Node-GuardingProtocol

[CROSS REFERENCE]

10.4.10 100D_h Life time factor

Life timeThe time interval for connection monitoring of a NMT-Masters is set by means of the object. A NMT-Slave expects to receive the node status query from the NMT-Master (Life-Guarding) within this time period.

Object description

Name		Life time factor		
Idx	Code	DT		
100D _h	VAR	U8		

Values description

Meaning		Life time factor					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	rw	-	U8	0	AM	Yes

The time interval "Life time" comes from the cycle time `Guard time (100Ch)` multiplied by the factor `Life time factor`:

$$\text{life time} = \text{guard time} * \text{life time factor}$$

The value "0" deactivates connection monitoring.

Secure 'Life time factor'

The time interval can be altered in the NMT "pre-operational" status. In the compact drive the altered setting can be persistently stored with the object `Store parameters (1010h)`, sub-index=02_h.

Life-guarding

Node-GuardingA checks NMT-Master the communication connection to the network users (NMT-Slaves) over the protocol. The NMT-Slaves check from their side whether the Node-Guarding occurs by the action of NMT-Master (Life-Guarding);

Life-guarding event

The reaction of the drive to a loss of connection to the NMT-Master (Life-Guarding Event) can be queried and set over the object `Abort connection option code (6007h)`.

10.4.11 1010_h Store Parameter

The object allows storing of alterable parameters in a persistent memory in the device. The saved data is available after switching on the device again. Reading access to the object informs about the memory functions of the device.

Selection of the respective sub-index allows parameter ranges for writing or reading access to be specified:

- Sub-index 01_h: All storable parameters
- Sub-index 02_h: Communication parameter
- Sub-index 03_h: Application parameter

The column "SV" in the "values description" to each object entry informs about whether the respective object entry can be stored.

Object description

Name	Store parameter	
Idx	Code	DT
1010 _h	ARR	U32

Values description

Meaning	Largest supported sub-index						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	U8	3	-	-

Meaning	Save all parameters						
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	-	AM	-

Meaning	Save communication parameters						
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	rw	-	U32	-	AM	-

Meaning	Save application parameters						
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U32	rw	-	U32	-	AM	-

Bit-coding, sub-index 01_h..03_h

Write Access

The signature "save" must be passed on for saving data in order to avoid unintentional storage of data.

Bit	ASCII	HEX value
31..24	e	65 _h
23..16	V	76 _h

Bit	ASCII	HEX value
15..8	a	61 _h
7..0	s	73 _h

Read Access

During reading access the compact drive returns the value 1 to every sub-index: The device stores parameters or parameter ranges on request

Store parameters By writing the signature "save" on a sub-index, the respective parameter values will be adopted in the configuration memory and are available after every new switching on of the device (Power-On Defaults).

Power-On defaults The Power-On Defaults are the initial object values which are loaded after switching on the device. They can be adjusted to the concrete application requirements and written in the non-volatile configuration memory.

10.4.12 1011_h Restore Default Parameters

During writing access the object resets all parameters or certain parameter ranges to the prescribed settings. During reading access to the object a check is made to see whether the prescribed values can be set.

Selection of the respective sub-indexes allows parameter ranges for writing or reading access to be specified:

- Sub-index 01_h: All storable parameters
- Sub-index 02_h: Communication parameter
- Sub-index 03_h: Application parameter

Object description

Name	Restore default parameters								
Idx	Code	DT						Acl	SV
1011 _h	ARR	U32						-	-

Values description

Meaning	Largest supported sub-index								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	U8	ro	-	U8	3	-	-		

Meaning	Restore all default parameters								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
01 _h	U32	rw	-	U32	-	AM	-		

Meaning	Restore communication default parameters								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
02 _h	U32	rw	-	U32	-	AM	-		

Meaning	Restore application parameters							
---------	--------------------------------	--	--	--	--	--	--	--

Sdx	DT	AC	MP	VR	DF	ACL	SV
03 _h	U32	rw	-	U32	-	AM	-

Bit-coding, sub-index 01_h..03_h

Write Access

The signature "load" must be passed on for saving data in order to avoid unintentional storage of data.

Bit	ASCII	HEX value
31..24	d	64 _h
23..16	a	61 _h
15..8	O	6F _h
7..0	l	6C _h

The loadable object values are described in the section concerning object Store parameters (1010_h).

Read Access

During reading access the compact drive returns the value "1" to every sub-index:

1: The device can restore the default parameters.

Restore default parameters

Through writing the signature "load" at a sub-index, the factory setting or delivery values (Factory settings) for the respective parameters are restored. In order to ensure that the data is available as current parameter values the NMT service "Reset node" must be executed after loading the data. The data can then be persistently stored over the object Store parameters (1010_h). It is available again as Power-On Defaults after switching on the device.

Factory settings

All devices are parameterised with default values during manufacture: factory setting or delivery values, for example the regulating parameter in object Control parameter set (2010_h). Access can be obtained to the factory setting (Factory settings) by having Objekt Modes of operation (6060_h) set with sub-index 00_h=80_h, before loading the application parameter of the configuration mode.

NMT command "Reset node"

[CROSS REFERENCE]

10.4.13 1014_h COB-ID-Emergency message

The object shows the COB ID of the Emergencyobject "EMCY" .

Object description

Name	COB-ID emergency message		
Idx	Code	DT	
1014 _h	VAR	U32	

Values description

Meaning	COB-ID emergency message						
Sdx	DT	AC	MP	VR	DF	ACL	SV
00 _h	U32	rw	-	U32	\$NODEID+ 0000 0080 _h	AM	Yes

Bit coding, sub-index 00_h

Bit	Access	Value	Meaning
31	rw	0 _b	0:EMCY exists / is valid 1: EMCY does not exist / is not valid
30	ro	0 _b	reserved, always 0
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	rw	0001 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Set COB ID The COB ID can be altered in an NMT "pre-operational" status.

Store COB ID The COB ID can be persistently stored with the object `Store parameters` (1010_h), sub-index=02_h.

Emergency-Message A Emergency-Message consists of 8 bytes and has the following construction:

Byte	Meaning
0-1	Emergency error code
2	Error register, see object 1001 _h
3-7	Manufacturer-specific error field (not used)

The error code of a Emergency-Message (byte 0 and 1) is entered in the device's error list; see object `Pre-defined error field` (1003_h).

EmergencyError code See error table (Emergency-Codes).

10.4.14 1015_h Inhibit time EMCY

The minimum time interval Inhibit time for transmitting Emergency-Messages is set by means of the object.

Object description

Name	Inhibit time EMCY						
Idx	Code	DT					
1015 _h	VAR	U16					

Values description

Meaning		Inhibit time EMCY						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U16	rw	-	U16	0	AM	Yes	

The parameter value `Inhibit time` is given in just a few 100 microseconds. The value "0" means that this object cannot be used.

"Inhibit time" The "Inhibit time" serves to prevent the situation where by continuing to transmit a high priority message, here the Emergency-Message, the bus for the low priority message is blocked (starvation).

"Inhibit time"Secure The time interval `Inhibit time` can be altered in the NMT status "pre-operational". in the compact drive the altered setting can be persistently stored with the object `Store parameters` (1010_h), sub-index=02_h.

Emergency object See object COB-ID emergency message (1014_h).

10.4.15 1016_h Consumer Heartbeat Time

The node number (Node-Id) and the monitoring time (Heartbeat time) of network users are established by means of the object which is being monitored by the drive control over the Heartbeat protocol.

Object description

Name	Consumer Heartbeat time	
Idx	Code	DT
1016 _h	ARR	U32

Values description

Meaning	Number of elements						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	1..127	1	-	-

Meaning	Consumer Heartbeat time						
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	0	AM	-

Bit coding, sub-index 01_h

Bit	Access	Data type	Meaning
31..24	ro	Unsigned8	reserved
23..16	rw	Unsigned8	Node-Id(1-127)
15..0	rw	Unsigned16	Heartbeat time (in ms)

The value "0" for the Heartbeat time means that monitoring of the respective user is deactivated.

Sub-index 01_h

Heartbeat Monitoring

A device sends its status cyclically by means of the Heartbeat protocol; see object `Producer heartbeat time` (1017_h). The "heart beat" of selected devices can be monitored by the drive control. If the heart beat is not there then an event is triggered (Abort connection). The reaction of the drive to such an event can be queried and set over the object `Abort connection option code` (6007_h).

Heartbeat Protocol

The IcIA N06x can monitor exactly one other node over the Heartbeat protocol.

10.4.16 1017_h Producer Heartbeat Time

The cycle time Heartbeat time for the Heartbeat protocol is set by means of the object `wird`; quasi the "heart beat" of the device.

Object description

Name	Producer Heartbeat time	
Idx	Code	DT
1017 _h	VAR	U16

Values description

Meaning		Producer Heartbeat time					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U16	rw	-	U16	0	AM	Yes

The cycle time Heartbeat time is given in milliseconds. The value '0' means that the Heartbeat protocol is deactivated.

"Heartbeat time "Secure

The cycle time Heartbeat time can be altered in the NMT status "pre-operational". in the compact drive the altered setting can be persistently stored with the object `Store parameters (1010h)`, sub-index=02_h.

Heartbeat

A device sends its status cyclically by means of the Heartbeat protocol. In contrast to the Node-Guarding protocol, the device sends the "heart beat" autonomously and not based on a request from a master; see object `Guard time (100Ch)`.

Heartbeat Protocol

[CROSS REFERENCE]

10.4.17 1018_h Identity Object

The object shows the LSS address of the device. The LSS address is used to set the node address and the baud rate via LSS services (Layer Setting Services) and consists of:

- Vendor ID
- Product code
- Revision number
- Serial number

Object description

Name	Identity object						
Idx	Code	DT					
1018 _h	REC	Identity					

Values description

Meaning		Number of entries					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	1..4	4	-	-

Meaning		Vendor id					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	ro	-	U32	-	-	-

Meaning		Product code					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	ro	-	U32	-	-	-

Meaning		Revision number					
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U32	ro	-	U32	-	-	-

Meaning		Serial number					
Sdx	DT	AC	MP	VR	DF	Acl	SV
04 _h	U32	ro	-	U32	-	-	-

The object `Device information` (2100_h) contains further information about device.

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31..24	ro	00 _h	Unique number for each department / manufacturer
23..16	ro	00 _h	(reserved)
15..0	ro	00A4 _h	Unique manufacturer number allocated by CiA

Bit coding, sub-index 02_h

Bit	Access	Value	Meaning
31-0	ro	XXXX _h	Unique number for identification of a certain device version

Bit coding, sub-index 03_h

Bit	Access	Value	Meaning
31..16	ro	0001 _h	upper revision number, counted up for every CANopen change.
15..0	ro	0001 _h	lower revision number, counted up for every functional change.

Bit coding, sub-index 04_h

Bit	Access	Value	Meaning
31-0	ro	XXXX _h	Unique serial number for identification of a certain device

Values description, sub-index 02_h

Bit	Meaning
0	Twin Line
1	IcIA D065, IcIA D042, IcIA IFx
2	IcIA N065
...	To Be Continued

LSS address The sub-indices 01_h to 04_h of the objects provide unique identification of the device: the "LSS address". The LSS address serves to set the node number (Node-Id) and the baud rate (Bit-Timing) via LSS services (Layer Setting Services).

Sub-index 01_h

Vendor id

The Vendor-ID is assigned by the CAN user organisation CiA (CAN in Automation). The drive manufacturer has been assigned the Vendor-ID '164' (000000A4_h).

Sub-index 02_h

Product code

The product code serves to differentiate between product versions.

Sub-index 03_h

Revision number

The revision number corresponds to the version number of the EDS file.

Sub-index 04_h **Serial number**

The serial number uniquely identifies a device of a product version. The serial number for the device can be found on the rating plate.

10.4.18 1020_h Verify configuration

The object shows a time stamp for the last persistent storage of the boot-up configuration (Power-On Defaults).

Object description

Name	Verify configuration						
Idx	Code	DT					
1020 _h	ARR	U32					

Values description

Meaning	Number of supported entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	U8	2	-	-

Meaning	Configuration date						
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	-	AM	Yes

Meaning	Configuration time						
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	rw	-	U32	-	AM	Yes

Verification of the boot-up configuration data

A configuration tool or a CANopen manager uses this object in order to verify the configuration data (Power-On Defaults) after resetting the device.

After configuration of the device the time stamp in this object and in DCF (Device Configuration File) are set to the same value and the configuration data is stored in the non-volatile memory by the command "Store all parameters" (object `Store all parameters (1010h)`, sub-index=01_h). If another command changes a configuration date over SDO writing access, then the device resets the time stamp (value = 0).

After resetting of the device the configuration tool only needs to compare the object value (time stamp) with the time stamp in DCF in order to decide whether renewed configuration of the device must be executed.

Device Configuration File

[CROSS REFERENCE]

CANopen Manager

[CROSS REFERENCE]

Sub-index 01_h

Configuration date

Configuration date: Number of days after the 1st January 1984.

Sub-index 02_h **Configuration time**

Configuration time: Number of milliseconds after midnight.

10.4.19 1200_h Server SDO parameter

The COB IDs for the default SDO are awarded by the object.

An SDO server is the user to whose object register the index and sub-index of an SDO message refer. There is one COB ID established for data transfer from Client to Server (Request/Indication) and one from Server to Client (Response/Confirmation). The data transfer is always initiated and controlled by SDO-Client.

Object description

Name	Server SDO parameter		
Idx	Code	DT	
1200 _h	REC	SDO parameter	

Values description

Meaning	Number of elements							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	2	-	-	

Meaning	COB-ID Client -> Server (rx)							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	ro	-	U32	\$NODEID+600 _h	-	-	

Meaning	COB-ID Server -> Client (tx)							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U32	ro	-	U32	\$NODEID+580 _h	-	-	

Bit coding, sub-index 01_h

Bit	Access	Value	Description
31	ro	0 _b	0: SDO exists / is valid 1: SDO does not exist / is not valid
30	ro	0 _b	reserved
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	ro	1100 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, sub-index 02_h

Bit	Access	Value	Meaning
31	ro	0 _b	0: SDO exists / is valid 1: SDO does not exist / is not valid
30	ro	0 _b	reserved
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)

Bit	Access	Value	Meaning
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	ro	1011 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Default SDO The default SDO cannot be altered.

10.4.20 1201_h Server SDO parameter

The COB IDs for the second SDO channel are awarded by the object.

Object description

Name	Server SDO parameter		
Idx	Code	DT	
1201 _h	REC	SDO parameter	

Values description

Meaning	Number of entries							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	3	-	-	

Meaning	COB ID client -> server (rx)							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	rw	-	U32	-	AM	-	

Meaning	COB ID server -> client (tx)							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U32	rw	-	U32	-	AM	-	

Meaning	Node-ID of the SDO client							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
03 _h	U8	rw	-	1..127	-	AM	-	

Bit coding, sub-index 01_h

Bit	Access	Value	Description
31	rw	1 _b	0: SDO exists / is valid 1: SDO does not exist / is not valid
30	ro	0 _b	reserved
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COD ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10-0	rw	00 _h	Bit 10..0 of the COB ID

Bit coding, sub-index 02_h

Bit	Access	Value	Meaning
31	rw	1 _b	0: SDO exists / is valid 1: SDO does not exist / is not valid
30	ro	0 _b	reserved
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10-0	rw	00 _h	Bit 10..0 of the COB ID

COB ID, sub-index 01_h und 02_h

The COB IDs are invalid at the system start (Power-On/Reset), see sub-index 01_h and sub-index 02_h, Bit 31.

Second SDO channel

The second SDO channel serves dynamic establishment of SDO connections according to CiA DSP-302 (Framework for CANopen Managers and Programmable CANopen Devices).

By default only the default SDO, see objekt `Server SDO parameter (1200h)`, active. The second SDO channel must be configured over a SDO Manager.

10.4.21 1400_h 1st receive PDO parameter

The communication parameters of the first Receive-PDOs (R_PDO1) are set over the object.

Object description

Name	1st receive PDO parameter	
Idx	Code	DT
1400 _h	REC	PCo

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	2	-	-	

Meaning		COB-ID used by PDO						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	rw	-	U32	\$NODEID + 0000 0200 _h	AM	Yes	

Meaning		Transmission type						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U8	rw	-	U8	255	AM	Yes	

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31	rw	0 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	ro	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible

Bit	Access	Value	Meaning
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COD ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	rw	0100 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, sub-index 02_h

0	Synchronous: RxPDO is triggered by the following SYNC
1..240	Synchronous: corresponds to the value 0
241..251	(reserved)
252	(not permitted for recipient PDOs)
253	(not permitted for receive PDOs)
254	Asynchronous: corresponds to the value 255
255	Asynchronous: RxPDO is triggered immediately

R_PDO1 The Receive-PDO R_PDO1 is allocated to the status machine for drives (Statemachine) according to the device profile CiA DSP-402. The control word is mapped in the R_PDO1 (`controlword`) of the status machine.

The control word in receive PDO R_PDO1 allows the cross-over of operational states of the status machine to be controlled. The R_PDO1 serves to bring the status machine into the status "Operation Enabled" or to command interruption of movement or interruption of movement for a currently running movement of the drive.

PDO-Mapping See object 1st receive PDO mapping parameter (1600_h).

Transmission Type The Receive-PDO R_PDO1 is processed asynchronously by the drive controller. It combines with the Transmit-PDO T_PDO1, in which the status word (`statusword`) of the status machine is mapped, a type of hand-shake protocol (acknowledgement mode) between the master controller and the drive controller.

Processing of PDOs Receive PDOs are only processed in NMT status "operational". Alteration of the transmission method of the R_PDO1 is not recommended since the function of the status machine is no longer achievable.

Altering settings The settings of the R_PDO1 can be altered in NMT status "pre-operational".

Saving settings. The current settings of the R_PDO1 can be persistently stored using the object `Store parameters` (1010_h), sub-index=02_h.

PDO, Process Data Object [CROSS REFERENCE]

NMT, Network Management [CROSS REFERENCE]

10.4.22 1401_h 2nd receive PDO parameter

The communication parameters of the second Receive-PDOs (R_PDO2) are set by means of the object.

Object description

Name	2nd receive PDO parameter		
Idx	Code	DT	
1401 _h	REC	PCo	

Values description

Meaning	Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	U8	2	-	-

Meaning	COB-ID used by PDO						
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	\$NODEID + 0000 0300 _h	AM	Yes

Meaning	Transmission type						
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U8	rw	-	U8	0	AM	Yes

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31	rw	0 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	ro	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COD ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	rw	0110 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, sub-index 02_h

0	Synchronous: RxPDO is triggered by the following SYNC
1..240	Synchronous: corresponds to the value 0
241..251	(reserved)
252	(not permitted for receive PDOs)
253	(not permitted for receive PDOs)
254	Asynchronous: corresponds to the value 255
255	Asynchronous: RxPDO is triggered immediately

R_PDO2 The Receive-PDO R_PDO2 is allocated to the operating mode Profile Position mode (positioning operation) according to the device profile CiA DSP-402. The control word is mapped in the R_PDO2 (controlword)

of the status machine and the target position (`target position`) of the drive movement.

Positioning is started by the control word in Receive-PDO `R_PDO2`. The transferred position is adopted as the absolute or relative target position of the drive movement. A drive movement in positioning mode can only be executed from in the status "Operation Enabled" of the status machine.

- PDO-Mapping* See object 2nd receive PDO mapping parameter (`1601h`).
- Transmission Type* The Receive-PDO `R_PDO2` is processed synchronously as standard by the drive controller. It combines with the Transmit-PDO `T_PDO1`, in which the status word (`statusword`) of the status machine is mapped, a type of hand-shake protocol (acknowledgement mode) between the master controller and the drive controller.
- Processing of PDOs* Receive PDOs are only processed in NMT status "operational". In order to achieve a synchronous start of a number of drive, the synchronous type of transmission (`transmission type = 0`) is set. Data from the `R_PDO2` are only then processed after receiving the next SYNC object.
- Altering settings* The settings of the `R_PDO2` can be altered in NMT status "pre-operational".
- Saving settings.* The current settings of the `R_PDO2` can be persistently stored using the object `Store parameters (1010h)`, sub-index=02_h.
- PDO, Process Data Object* [CROSS REFERENCE]
- NMT, Network Management* [CROSS REFERENCE]

10.4.23 1402_h 3rd receive PDO parameter

The communication parameters of the third Receive-PDOs (`R_PDO3`) are set over the object.

Object description

Name	3rd receive PDO parameter							
Idx	Code	DT						
1402 _h	REC	PCo						

Values description

Meaning	Number of entries								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	U8	ro	-	U8	2	-	-		

Meaning	COB-ID used by PDO								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
01 _h	U32	rw	-	U32	\$NODEID + 8000 0400 _h	AM	Yes		

Meaning	Transmission type								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
02 _h	U8	rw	-	U8	0	AM	Yes		

Bit coding, Sub-index 01_h

Bit	Access	Value	Meaning
31	rw	1 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	ro	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COD ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	rw	1000 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, Sub-index 02_h

0	Synchronous: RxPDO is triggered by the following SYNC		
1..240	Synchronous: corresponds to the value 0		
241..251	(reserved)		
252	(not permitted for receive PDOs)		
253	(not permitted for receive PDOs)		
254	Asynchronous: corresponds to the value 255		
255	Asynchronous: RxPDO is triggered immediately		

R_PDO3 The receive PDO R_PDO3 is allocated to the operating mode Profile Velocity mode (speed mode) according to the device profile CiA DSP-402 . The control word is mapped in the R_PDO3 (*controlword*) of the status machine and the set speed (*target velocity*) of the drive movement.

The control word in Receive-PDO R_PDO3 allows a drive movement to be started in a positive or counterclockwise sense of rotation. A drive movement in speed mode can only be executed from in the status "Operation Enabled" of the status machine.

PDO-Mapping See Objekt 3rd receive PDO mapping parameter (1602_h).

COB ID R_PDO3 The COB ID of the R_PDO3 is invalid at system start (Power-On/Reset), see sub-index 01_h, bit 31.

Transmission Type The receive-PDO R_PDO3 is processed synchronously as standard by the drive controller. It combines with the transmit PDO T_PDO1, in which the status word (*statusword*) of the status machine is mapped, a type of hand-shake protocol (acknowledgement mode) between the master controller and the drive controller.

Processing of PDOs Receive PDOs are only processed in NMT status "operational". In order to achieve a synchronous start of a number of drive, the synchronous type of transmission (Transmission Type = 0) is set. Data from the R_PDO3 are only then processed after receiving the next SYNC object.

Altering settings The settings of the R_PDO3 can be altered in NMT status "pre-operational".

Saving settings. The current settings of the R_PDO1 can be persistently stored using Store parameters (1010_h), sub-index=02_h.

PDO, Process Data Object [CROSS REFERENCE]

NMT, Network Management [CROSS REFERENCE]

10.4.24 1600_h 1st receive PDO mapping

The object shows which objects are mapped in R_PDO1 and transmitted with the PDO. When reading the object Sub-index 00_h the number of mapped objects is given.

Object description

Name	1st receive PDO mapping		
Idx	Code	DT	
1600 _h	REC	PMp	

Values description

Meaning	Number of entries							
Sdx	DT	AC	MP	VR	DF	AcI	SV	
00 _h	U8	ro	-	U8	1	-	-	

Meaning	1st mapped object							
Sdx	DT	AC	MP	VR	DF	AcI	SV	
01 _h	U32	ro	-	U32	6040 0010 _h	-	-	

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31..16	ro	6040 _h	Index
15-8	ro	00 _h	Sub-index
7-0	ro	16	Object length in bits

Settings

The compact drive only supports static PDO mapping. Therefore the PDO assignment is not changeable The following assignment is firmly set for the R_PDO1:

- PDO mapping:
Object Controlword (6040_h) in byte 0 and 1.
- PDO parameter:
See Objekt 1st receive PDO parameter (1400_h).

10.4.25 1601_h 2nd receive PDO mapping

The object shows which objects are mapped in R_PDO2 and transmitted with the PDO. When reading the object Sub-index 00_h the number of mapped objects is given.

Object description

Name	2nd receive PDO mapping		
Idx	Code	DT	
1601 _h	REC	PMp	

Values description

Meaning	Number of entries							
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Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	–	U8	2	–	–

Meaning 1st mapped object

Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	ro	–	U32	6040 0010 _h	–	–

Meaning 2nd mapped object

Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	ro	–	U32	607A 0020 _h	–	–

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31..16	ro	6040 _h	Index
15-8	ro	00 _h	Sub-index
7-0	ro	16	Object length in bits

Bit coding, Sub-index 02_h

Bit	Access	Value	Description
31..16	ro	607A _h	Index
15-8	ro	00 _h	Sub-index
7-0	ro	32	Object length in bits

PDO mapping The compact drive only supports static PDO-Mapping. Therefore the PDO assignment is not changeable. The following assignment is firmly set for the R_PDO2:

- Object Controlword (6040_h) in byte 0 and 1.
- Object Target position (607A_h) in bytes 2 to 5.

PDO parameter See object 2nd receive PDO parameter (1401_h).

10.4.26 1602_h 3rd receive PDO mapping

The object shows which objects are mapped in R_PDO3 and transmitted with the PDO. When reading the object sub-index 00_h the number of mapped objects is given.

Object description

Name	3rd receive PDO mapping	
Idx	Code	DT
1602 _h	REC	PMp

Values description

Meaning	Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	–	U8	2	–	–

Meaning 1st mapped object

Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	ro	-	U32	6040 0010 _h	-	-

Meaning 2nd mapped object

Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	ro	-	U32	60FF 0020 _h	-	-

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31..16	ro	6040 _h	Index
15-8	ro	00 _h	Sub-index
7-0	ro	16	Object length in bits

Bit coding, sub-index 02_h

Bit	Access	Value	Meaning
31..16	ro	60FF _h	Index
15-8	ro	00 _h	Sub-index
7-0	ro	32	Object length in bits

PDO-Mapping

The compact drive only supports static PDO-Mapping. Therefore the PDO assignment is not changeable. The following assignment is firmly set for the R_PDO3:

- Object Controlword (6040_h) in byte 0 and 1.
- Object Target velocity (60FF_h) in bytes 2 to 5.

PDO parameter

See object 3rd receive PDO parameter (1402_h).

10.4.27 1800_h 1st transmit PDO parameter

The communication parameters of the first Transmit-PDOs (T_PDO1) are set by means of the object.

Object description

Name	1st transmit PDO parameter						
Idx	Code	DT					
1800 _h	REC	PCo					

Values description

Meaning	Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	U8	5	-	-

Meaning	COB-ID used by PDO						
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	\$NODEID + 0000 0180 _h	AM	Yes

Meaning	Transmission type						
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Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U8	rw	-	U8	255	AM	Yes
Meaning		Inhibit time					
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U16	rw	-	U16	0	AM	Yes
Meaning		Event timer					
Sdx	DT	AC	MP	VR	DF	Acl	SV
05 _h	U16	rw	-	U16	0	AM	Yes

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31	rw	0 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	rw	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	rw	0011 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, sub-index 02_h

0	Synchronous: acyclic, data are updated by the previous SYNC
1..240	Synchronous: cyclic, data are updated by the previous SYNC
241..251	(reserved)
252	Synchronous: on request, data are updated by the previous SYNC
253	Asynchronous: on request, data are updated immediately
254	Asynchronous: corresponds to the value 255
255	Asynchronous: event-controlled, data are deleted immediately

T_PDO1 The Transmit-PDO T_PDO1 is allocated to the status machine for drives (Statemachine) according to the device profile CiA DSP-402. The control word is mapped in the T_PDO1 (*statusword*) of the status machine.

This status word in Transmit-PDO TPDO1 is used for reporting the cross-over of operational states of the status machine. Operational states are called up by the control word (*controlword*) of the status machine or by local events.

PDO-Mapping See Objekt 1st transmit PDO mapping parameter (1A00_h).

Transmission Type The Transmit-PDO T_PDO1 is transferred event-controlled (asynchronously) from the drive controller. It combines with the Receive-PDOs, in which the status word (*controlword*) of the status machine is mapped, a type of hand-shake protocol (acknowledgement mode) between the master controller and the drive controller.

<i>Inhibit Time</i>	The parameter <code>Inhibit time</code> is used to establish the time (in steps of 100 microseconds), which must be the minimum time between transmitting two consecutively sent Transmit-PDOs <code>T_PDO1</code> .
<i>Event Timer</i>	The parameter <code>Event timer</code> is used to set a cycle time (in milliseconds) for the time-controlled transmission of Transmit-PDOs <code>T_PDO1</code> . The transmission type <code>Transmission Type</code> must be configured beforehand via sub-index <code>02_h</code> to the value 254 or 255.
<i>Processing of PDOs</i>	Transmit-PDOs are only processed in NMT status "operational". Alteration of the transmission method of the <code>T_PDO1</code> is not recommended since the function of the status machine is no longer obtainable.
<i>Altering settings</i>	The settings of the <code>T_PDO1</code> can be altered in NMT status "pre-operational".
<i>Saving settings.</i>	The current settings of the <code>T_PDO1</code> can be persistently stored using <code>Store parameters (1010_h)</code> , sub-index= <code>02_h</code> .
<i>PDO, Process Data Object</i>	[CROSS REFERENCE]
<i>NMT, Network Management</i>	[CROSS REFERENCE]

10.4.28 1801_h 2nd transmit PDO parameter

The communication parameters of the second Transmit-PDOs (`T_PDO2`) are set by means of the object.

Object description

Name	2nd transmit PDO parameter							
Idx	Code	DT						
1801 _h	REC	PCo						

Values description

Meaning	Number of entries								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	U8	ro	-	U8	5	-	-		

Meaning	COB-ID used by PDO								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
01 _h	U32	rw	-	U32	\$NODEID + 0000 0280 _h	AM	Yes		

Meaning	Transmission type								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
02 _h	U8	rw	-	U8	0	AM	Yes		

Meaning	Inhibit time								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
03 _h	U16	rw	-	U16	0	AM	Yes		

Meaning	Event timer								
Sdx	DT	AC	MP	VR	DF	Acl	SV		

05_h U16 rw – U16 0 AM Yes

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31	rw	0 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	rw	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	rw	0101 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, sub-index 02_h

0	Synchronous: acyclic, data are updated by the previous SYNC
1..240	Synchronous: cyclic, data are updated by the previous SYNC
241..251	(reserved)
252	Synchronous: on request, data are updated by the previous SYNC
253	Asynchronous: on request, data are updated immediately
254	Asynchronous: corresponds to the value 255
255	Asynchronous: event-controlled, data are deleted immediately

T_PDO2 In the T_PDO2 the control word (`Controlword`) of the status machine and the current position (`Position actual value`) of the drive are mapped.

PDO-Mapping see object 2nd transmit PDO mapping parameter (1A01_h).

Transmission Type The Transmit-PDO T_PDO2 is transmitted asynchronously as standard by the drive controller (value = 0).

Inhibit Time The parameter `Inhibit time` is used to establish the time (in steps of 100 microseconds), which must be the minimum time between transmitting two consecutively sent Transmit-PDOs T_PDO2.

Event Timer The parameter `Event timer` is used to set a cycle time (in milliseconds) for the time-controlled transmission of Transmit-PDOs T_PDO2. The transmission type `Transmission Type` must be configured beforehand via sub-index 02_h to the value 254 or 255.

Processing of PDOs Transmit-PDOs are only transmitted in NMT status "operational". Setting of the event-controlled transmission (`Transmission Type` = 255) for the T_PDO2 is not recommended since during movement of the drive each change of position is evaluated as an event and transmitted.

Altering settings The settings of the T_PDO2 can be altered in NMT status "pre-operational".

Saving settings. The current settings of the T_PDO2 can be persistently stored using the object `Store parameters` (1010_h), sub-index=02_h.

PDO, Process Data Object [CROSS REFERENCE]

NMT, Network Management [CROSS REFERENCE]

10.4.29 1802_h 3rd transmit PDO parameter

The communication parameters of the third Transmit-PDOs (T_PDO3) are set by means of the object.

Object description

Name	3rd transmit PDO parameter		
Idx	Code	DT	
1802 _h	REC	PCo	

Values description

Meaning	Number of entries							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	–	U8	5	–	–	

Meaning	COB-ID used by PDO							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	rw	–	U32	\$NODEID + 8000 0380 _h	AM	Yes	

Meaning	Transmission type							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U8	rw	–	U8	0	AM	Yes	

Meaning	Inhibit time							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
03 _h	U16	rw	–	U16	0	AM	Yes	

Meaning	Event timer							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
05 _h	U16	rw	–	U16	0	AM	Yes	

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31	rw	1 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	rw	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COD ID (CAN 2.0B)
28..1 1	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1

Bit	Access	Value	Meaning
10..7	rw	0111 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, sub-index 02_h

0	Synchronous: acyclic, data are updated by the previous SYNC		
1..240	Synchronous: cyclic, data are updated by the previous SYNC		
241..251	(reserved)		
252	Synchronous: on request, data are updated by the previous SYNC		
253	Asynchronous: on request, data are updated immediately		
254	Asynchronous: corresponds to the value 255		
255	Asynchronous: event-controlled, data are deleted immediately		

T_PDO3 In the T_PDO3 the control word (*Statusword*) of the status machine and the current speed (*Velocity actual value*) of the drive are mapped.

PDO-Mapping see object 3rd transmit PDO mapping parameter (1A02_h).

COB ID T_PDO3 The COB ID of the T_PDO3 is invalid at system start(Power-On/Reset), see sub-index 01_h, bit 31.

Transmission Type The Transmit-PDO T_PDO3 is transmitted asynchronously as standard by the drive controller (value = 0).

Inhibit Time The parameter *Inhibit time* is used to establish the time (in steps of 100 microseconds), which must be the minimum time between transmitting two consecutively sent Transmit-PDOs T_PDO3.

Event Timer The parameter *Event timer* is used to set a cycle time (in milliseconds) for the time-controlled transmission of the transmit PDOs T_PDO3. The transmission type *Transmission Type* must be configured beforehand via sub-index 02_h to the value 254 or 255.

Processing of PDOs Transmit-PDOs are only transmitted in NMT status "operational". Setting of the event-controlled transmission (*Transmission Type* = 255) for the T_PDO3 is not recommended since during movement of the drive each change of position is evaluated as an event and transmitted.

Altering settings The settings of the T_PDO3 can be altered in NMT status "pre-operational".

Saving settings. The current settings of the T_PDO3 can be persistently stored using the object *Store parameters* (1010_h), sub-index=02_h.

PDO, Process Data Object [CROSS REFERENCE]

NMT, Network Management [CROSS REFERENCE]

10.4.30 1806_h 7th transmit PDO parameter

The communication parameters of the seventh Transmit-PDOs (T_PDO7) are set by means of the object.

Object description

Name	7th transmit PDO parameter		
Idx	Code	DT	

1806_h REC PCo

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	5	-	-	

Meaning		COB-ID used by PDO						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	rw	-	U32	\$NODEID + 8000 0000 _h	AM	Yes	

Meaning		Transmission type						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U8	rw	-	U8	255	AM	Yes	

Meaning		Inhibit time						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
03 _h	U16	rw	-	U16	0	AM	Yes	

Meaning		Event timer						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
05 _h	U16	rw	-	U16	0	AM	Yes	

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31	rw	0 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	ro	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COD ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	ro	0000 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, Sub-index 02_h

0	Synchronous: acyclic, data are updated by the previous SYNC
1..240	Synchronous: cyclic, data are updated by the previous SYNC
241..251	(reserved)
252	Synchronous: on request, data are updated by the previous SYNC
253	Asynchronous: on request, data are updated immediately

	254	Asynchronous: corresponds to the value 255
	255	Asynchronous: event-controlled, data are deleted immediately
<i>T_PDO7</i>		In the Transmit-PDO T_PDO7 the status word (<i>Statusword</i>) of the status machine and the status of the digital input signals (<i>Digital inputs</i>) for the drive controller are mapped.
<i>PDO-Mapping</i>		See object 7th transmit PDO mapping parameter (1A06 _h).
<i>COB ID T_PDO7</i>		The COB ID of the T_PDO7 is not configured and invalid at system start (Power-On/Reset), see sub-index 01 _h , bit 31.
<i>Transmission Type</i>		The transmit PDO T_PDO7 is transmitted event-controlled (asynchronously) by the drive controller (value = 255). Every strength change of the digital input signals is evaluated as an event.
<i>Inhibit Time</i>		The parameter <i>Inhibit time</i> is used to establish the time (in steps of 100 microseconds), which must be the minimum time between transmitting two consecutively sent Transmit-PDOs T_PDO7.
<i>Event Timer</i>		The parameter <i>Event timer</i> is used to set a cycle time (in milliseconds) for the time-controlled transmission of Transmit-PDOs T_PDO7. The transmission type <i>Transmission Type</i> must be configured beforehand via sub-index 02 _h to the value 254 or 255.
<i>Processing of PDOs</i>		Transmit-PDOs are only transmitted in NMT status "operational".
<i>Altering settings</i>		The settings of the T_PDO7 can be altered in NMT status "pre-operational".
<i>Saving settings.</i>		The current settings of the T_PDO7 can be persistently stored using the object <i>Store parameters</i> (1010 _h), sub-index=02 _h .
<i>PDO, Process Data Object</i>		[CROSS REFERENCE]
<i>NMT, Network Management</i>		[CROSS REFERENCE]

10.4.31 1820_h Manufacturer specific transmit PDO parameter

The object 1820_h is used to set communication parameters of the manufacturer-specific Transmit-PDOs.

Object description

Name	Manufacturer specific transmit PDO parameter						
Idx	Code	DT					
1820 _h	REC	PCo					

Values description

Meaning	Number of entries						
Sdx	DT	AC	MP	VR	DF	ACL	SV
00 _h	U8	ro	-	U8	5	-	-
Meaning	COB-ID used by PDO						
Sdx	DT	AC	MP	VR	DF	ACL	SV
01 _h	U32	rw	-	U32	\$NODEID + 8000 0000 _h	AM	-

Meaning		Transmission type					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U8	rw	–	U8	254	AM	–

Meaning		Inhibit time					
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U16	rw	–	U16	0	AM	–

Meaning		Event timer					
Sdx	DT	AC	MP	VR	DF	Acl	SV
05 _h	U16	rw	–	U16	0	AM	–

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31	rw	0 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	rw	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	rw	0000 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, Sub-index 02_h

0	Synchronous: acyclic, data are updated by the previous SYNC
1..240	Synchronous: cyclic, data are updated by the previous SYNC
241..251	(reserved)
252	Synchronous: on request, data are updated by the previous SYNC
253	Asynchronous: on request, data are updated immediately
254	Asynchronous: corresponds to the value 255
255	Asynchronous: event-controlled, data are deleted immediately

Manufacturer-specific T_PDO

The manufacturer-specific Transmit-PDO serves to optimise control parameters. In the PDO the current actual value and reference value of the speed regulator are mapped.

The input and output size of the control algorithm can be cyclically queried over the SYNC object (1005_h) or transmitted time controlled by the drive controller.

PDO-Mapping

See object Manufacturer specific transmit PDO mapping parameter (1A20_h).

COB ID T_PDO33

The COB ID of the manufacturer-specific PDO is not configured and invalid at system start (Power-On/Reset), see sub-index 01_h, bit 31.

Transmission Type

The manufacturer-specific Transmit-PDO is transmitted time-controlled as standard (with 30 Hertz) by the drive controller (value = 254).

<i>Inhibit Time</i>	The parameter <i>Inhibit time</i> is used to establish the time (in steps of 100 microseconds), which must be the minimum time between transmitting two consecutively sent Transmit-PDOs T_PDO33.
<i>Event Timer</i>	The parameter <i>Event timer</i> is used to set a cycle time (in milliseconds) for the time-controlled transmission of the transmit PDOs T_PDO3. The transmission type <i>Transmission Type</i> must be configured beforehand via sub-index 02 _h to the value 254 or 255.
<i>Processing of PDOs</i>	Transmit PDOs are only transmitted in NMT status "operational". Setting of the event-controlled transmission (<i>Transmission Type</i> = 255) is not recommended since every change of the actual value or reference value of the speed of rotation is evaluated as an event and transmitted.
<i>Altering settings</i>	The settings of the manufacturer-specific transmit PDO can be altered in the NMT status "pre-operational". The settings cannot be persistentlt stored.
<i>PDO, Process Data Object</i>	[CROSS REFERENCE]
<i>NMT, Network Management</i>	[CROSS REFERENCE]

10.4.32 1821_h Manufacturer specific transmit PDO parameter

The object 1821_h is used to set communication parameters of the manufacturer-specific Transmit-PDOs.

Object description

Name Manufacturer specific transmit PDO parameter		
Idx	Code	DT
1821 _h	REC	PCo

Values description

Description Number of entries							
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	U8	5	-	-

Description COB-ID used by PDO							
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	\$NODEID + 8000 0000 _h	AM	-

Description Transmission type							
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U8	rw	-	U8	254	AM	-

Description Inhibit time							
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U16	rw	-	U16	0	AM	-

Description Event timer							
Sdx	DT	AC	MP	VR	DF	Acl	SV

05_h U16 rw - U16 0 AM -

Bit coding, Sub-index 01_h

Bit	Access	Value	Description
31	rw	1 _b	0: PDO exists / is valid 1: PDO does not exist / is not valid
30	rw	0 _b	0: RTR on this PDO permissible 1: No RTR on this PDO permissible
29	ro	0 _b	0: 11-bit COB ID (CAN 2.0A) 1: 29-bit COB ID (CAN 2.0B)
28..11	ro	00 _h	Bit 28..11 of the 29-bit COB ID, of Bit 29 = 1
10..7	rw	0000 _b	Function code of the COB ID
6..0	ro	XX _h	Node address of the COB ID

Bit coding, Sub-index 02_h

0			Synchronous: acyclic, data are updated by the previous SYNC
1..240			Synchronous: cyclic, data are updated by the previous SYNC
241..251			(reserved)
252			Synchronous: on request, data are updated by the previous SYNC
253			Asynchronous: on request, data are updated immediately
254			Asynchronous: corresponds to the value 255
255			Asynchronous: event-controlled, data are deleted immediately

Manufacturer-specific T_PDO

The manufacturer-specific Transmit-PDO serves to detect the speed of rotation/motor current characteristic curve. The current speed of rotation and measured motor phase current are mapped in the PDO.

The PDO can be cyclically queried over the SYNC object (1005_h) or transmitted time controlled by the drive controller.

PDO-Mapping

see object `Manufacturer specific transmit PDO mapping parameter (1A21h)`.

COB ID T_PDO34

The COB ID of the manufacturer-specific PDO is not configured and invalid at system start (Power-On/Reset), see sub-index 01_h, bit 31.

Transmission Type

The manufacturer-specific Transmit-PDO is transmitted time-controlled as standard (with 30 Hertz) by the drive controller (value = 254).

Inhibit Time

The parameter `Inhibit time` is used to establish the time (in steps of 100 microseconds), which must be the minimum time between transmitting two consecutively sent Transmit-PDOs T_PDO34.

Event Timer

The parameter `Event timer` is used to set a cycle time (in milliseconds) for the time-controlled transmission of Transmit-PDOs T_PDO34. The transmission type `Transmission Type` must be configured beforehand via sub-index 02_h to the value 254 or 255.

Processing of PDOs

Transmit PDOs are only transmitted in NMT status "operational". Setting of the event-controlled transmission (`Transmission Type = 255`) is not

recommended since every change of the speed of rotation or the motor phase current is evaluated as an event and transmitted.

Altering settings The settings of the manufacturer-specific Transmit-PDO can be altered in the NMT status "pre-operational".

The settings cannot be persistentlt stored.

PDO, Process Data Object [CROSS REFERENCE]

NMT, Network Management [CROSS REFERENCE]

10.4.33 1A00_h 1st transmit PDO mapping

The object shows which objects are mapped in T_PDO1 and transmitted with the PDO. When reading the object Sub-index 00_h the number of mapped objects is given.

Object description

Name	1st transmit PDO mapping						
Idx	Code	DT					
1A00h	REC	PMp					

Values description

Description	Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	U8	1	-	-

Description	1st mapped object						
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	ro	-	U32	6041 0010 _h	-	-

Bit coding, Sub-index 01_h

Bit	Access	Value	Description
31..16	ro	6041 _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	16	Object length in bits

PDO-Mapping The compact drive only supports static PDO-Mapping. Therefore the PDO assignment is not changeable. The following assignment is firmly set for the T_PDO1:

- Object Statusword (6041_h) in bytes 0 and 1.

PDO parameter see object 1st transmit PDO parameter (1800_h).

10.4.34 1A01_h 2nd transmit PDO mapping

The object shows which objects are mapped in T_PDO2 and transmitted with the PDO. When reading the object Sub-index 00_h the number of mapped objects is given.

Object description

Name	2nd transmit PDO mapping		
Idx	Code	DT	

1A01_h REC PMp

Values description

Description		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	2	-	-	

Description		1st mapped object						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	ro	-	U32	6041 0010 _h	-	-	

Description		2nd mapped object						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U32	ro	-	U32	6064 0020 _h	-	-	

Bit coding, Sub-index 01_h

Bit	Access	Value	Description
31..16	ro	6041 _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	16	Object length in bits

Bit coding, Sub-index 02_h

Bit	Access	Value	Description
31..16	ro	6064 _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	32	Object length in bits

PDO-Mapping

The compact drive only supports static PDO-Mapping. Therefore the PDO assignment is not changeable. The following assignment is permanently set for the T_PDO2:

- Object Statusword (6041_h) in byte 0 and 1.
- Object Position actual value (6064_h) in bytes 2 to 5.

PDO parameter

see object 2nd transmit PDO parameter (1801_h).

10.4.35 1A02_h 3rd transmit PDO mapping

The object shows which objects are mapped in T_PDO3 and transmitted with the PDO. When reading the object Sub-index 00_h the number of mapped objects is given.

Object description

Name	3rd transmit PDO mapping	
Idx	Code	DT
1A02 _h	REC	PMp

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	2	-	-	

Meaning		1st mapped object						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	ro	-	U32	6041 0010 _h	-	-	

Meaning		2nd mapped object						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U32	ro	-	U32	606C 0020 _h	-	-	

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31..16	ro	6041 _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	16	Object length in bits

Bit coding, Sub-index 02_h

Bit	Access	Value	Meaning
31..16	ro	606C _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	32	Object length in bits

PDO-Mapping

The compact drive only supports static PDO-Mapping. Therefore the PDO assignment is not changeable. The following assignment is firmly set for the T_PDO3:

- Object Statusword (6041_h) in byte 0 and 1.
- Object Position actual value (606C_h) in bytes 2 to 5.

PDO parameter

see object 3rd transmit PDO parameter (1802_h).

10.4.36 1A06_h 7th transmit PDO mapping

The object shows which objects are mapped in T_PDO7 and transmitted with the PDO. When reading the object Sub-index 00_h the number of mapped objects is given.

Object description

Name	7th transmit PDO mapping						
Idx	Code	DT					
1A06h	REC	PMp					

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	2	-	-	

Meaning	1st mapped object							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	ro	–	U32	6041 0010 _h	–	–	

Meaning	2nd mapped object							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U32	ro	–	U32	60FD 0020 _h	–	–	

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31..16	ro	6041 _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	16	Object length in bits

Bit coding, sub-index 02_h

Bit	Access	Value	Meaning
31..16	ro	60FD _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	32	Object length in bits

PDO-Mapping The compact drive only supports static PDO-Mapping. Therefore the PDO assignment is not changeable. The following assignment is firmly set for the T_PDO7:

- Object Statusword (6041_h) in byte 0 and 1.
- Object Digital inputs (60FD_h) in bytes 2 to 5.

PDO parameter see object 7th transmit PDO parameter (1806_h).

10.4.37 1A20_h Manufacturer specific transmit PDO mapping

The object shows which objects are mapped in manufacturer-specific transmit PDOs and transmitted with the PDO. When reading the object Sub-index 00_h the number of mapped objects is given.

Object description

Name	Manufacturer specific transmit PDO mapping		
Idx	Code	DT	
1A20h	REC	PMp	

Values description

Meaning	Number of entries							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	–	U8	2	–	–	

Meaning	1st mapped object							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U32	ro	–	U32	606C 0020 _h	–	–	

Meaning		2nd mapped object					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	ro	–	U32	606B 0020 _h	–	–

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31..16	ro	606C _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	32	Object length in bits

Bit coding, sub-index 02_h

Bit	Access	Value	Meaning
31..16	ro	606B _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	32	Object length in bits

PDO-Mapping

The compact drive only supports static PDO-Mapping. Therefore the PDO assignment is not changeable. The following assignment is firmly set for the R_PDO33:

- Object Velocity actual value (606C_h) in bytes 0 to 3.
- Object Velocity demand value (606B_h) in bytes 4 to 7.

PDO parameter

see object Manufacturer specific transmit PDO parameter (1820_h).

10.4.38 1A21_h Manufacturer specific transmit PDO mapping

The object shows which objects are mapped in manufacturer-specific transmit PDOs and transmitted with the PDO. When reading the object sub-index 00_h the number of mapped objects is given.

Object description

Name	Manufacturer specific transmit PDO mapping	
Idx	Code	DT
1A21 _h	REC	PMp

Values description

Meaning		Number of entries					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	–	U8	2	–	–

Meaning		1st mapped object					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	ro	–	U32	606C 0020 _h	–	–

Meaning		2nd mapped object					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	ro	–	U32	6078 0010 _h	–	–

Bit coding, sub-index 01_h

Bit	Access	Value	Meaning
31..16	ro	606C _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	32	Object length in bits

Bit coding, Sub-index 02_h

Bit	Access	Value	Meaning
31..16	ro	6078 _h	Index
15..8	ro	00 _h	Sub-index
7..0	ro	16	Object length in bits

PDO-Mapping The compact drive only supports static PDO-Mapping. Therefore the PDO assignment is not changeable. The following assignment is firmly set for the R_PDO34:

- Object Velocity actual value (606C_h) in bytes 0 to 3.
- Object Current actual value (6078_h) in bytes 4 to 7.

PDO parameter See Objekt Manufacturer specific transmit PDO parameter (1821_h).

10.4.39 2000_h Drive hardware version

The object indicates information about the device electronics.

Object description

Name	Drive hardware version		
Idx	Code	DT	
2000 _h	VAR	VS	

Values description

Meaning		Drive hardware version							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	VS	rw	-	VS	-	PM	Yes	AV-CP	

The object Device information (2100_h) contains further information about the device.

10.4.40 2001_h Motor hardware version

The object indicates information about the motor mechanics.

Object description

Name	Motor hardware version		
Idx	Code	DT	
2001 _h	VAR	VS	

Values description

Meaning		Motor hardware version							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	VS	rw	-	VS	-	PM	Yes	AV-CP	

The object `Device information (2100h)` contains further information about the device.

10.4.41 2002_h Motor operating software version

The object indicates information about the software for the engine operating programme.

Object description

Name	Motor operating software version							
Idx	Code	DT						
2002 _h	VAR	VS						

Values description

Meaning	Motor operating software version							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	VS	ro	-	VS	-	-	-	AV-CP

The object `Device information (2100h)` contains further information about the device.

10.4.42 2003_h Application software version

The object indicates information about the application software.

Object description

Name	Application software version							
Idx	Code	DT						
2003 _h	VAR	VS						

Values description

Meaning	Application software version							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	VS	ro	-	VS	-	-	-	AV-CP

The object `Device information (2100h)` contains further information about the device.

10.4.43 2004_h User profile velocity

The object establishes the speed values for ten preconfigured movement profiles. A movement profile is selected using the object `User profile number (2007h)`. The value of this movement profile is adopted into the manufacturer-specific positioning mode as a profile speed in the object `Profile velocity (6081h)`.

The object value must not be greater than the maximum profile speed, established over the object `Max profile velocity (607Fh)`.

Object description

Name	User profile velocity							
Idx	Code	DT						
2004 _h	ARR	U32						

Values description

Meaning		Number of elements							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	U32	ro	-	U32	10	-	-		

Meaning		User profile velocity 1							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
01 _h	U32	rw	-	U32	-	PM	Yes		

Meaning		User profile velocity 2..10							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
02h..0A _h	U32	rw	-	U32	-	CM	Yes		

Sub-index 01_h - 0A_h Entry of the ten speed parameters takes place in acceleration units; see object `Velocity dimension index (608Ch)`. For a compact drive the specification represents motor increments per second.

Setting values Sub-index 01_h contains movement profile values which are designed for a nominal load and nominal speed and cannot be altered. The other nine movement profile values can be set in configuration mode. The configuration mode is selected using the object `Modes of operation (6060h)`, sub-index 00_h=80_h.

Store values The settings of the object can be stored in a compact drive using the object `Store parameters (1010h)`, sub-index=03_h.

10.4.44 2005_h User profile acceleration

The object establishes the acceleration values for ten preconfigured movement profiles. A movement profile is selected using the object `User profile number (2007h)`. The value of this movement profile is adopted into the manufacturer-specific positioning mode as a profile acceleration in the object `Profile acceleration (6083h)`.

The object value must not be greater than the maximum profile acceleration, established over the object `Max profile acceleration (60C5h)`.

Object description

Name	User profile acceleration	
Idx	Code	DT
2005 _h	ARR	U32

Values description

Meaning		Number of elements							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	U32	ro	-	U32	10	-	-		

Meaning		User profile acceleration 1							
Sdx	DT	AC	MP	VR	DF	Acl	SV		

01 _h	U32	rw	-	U32	-	PM	Yes
Meaning		User profile acceleration 2..10					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h ..0A _h	U32	rw	-	U32	-	CM	Yes

Sub-index 01_h - 0A_h Entry of the ten acceleration parameters takes place in acceleration units; see object *Acceleration dimension index* (608E_h). For a compact drive the specification represents an increase in motor increments per second squared.

Setting values Sub-index 01_h contains movement profile values which are designed for a nominal load and nominal speed and cannot be altered. The other nine movement profile values can be set in configuration mode. The configuration mode is selected using the object *Modes of operation* (6060_h), sub-index 00_h=80_h.

Store values The settings of the object can be stored in a compact drive using the object *Store parameters* (1010_h), sub-index=03_h.

10.4.45 2006_h User profile deceleration

The object establishes the deceleration values for ten preconfigured movement profiles. A movement profile is selected using the object *User profile number* (2007_h). The value of this movement profile is adopted into the manufacturer-specific positioning mode as a profile deceleration in the object *Profile deceleration* (6084_h).

The object value must not be greater than the maximum profile deceleration, established over the object *Max profile deceleration* (60C6_h).

Object description

Name	User profile deceleration						
Idx	Code	DT					
2006 _h	ARR	U32					

Values description

Meaning		Number of elements					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U32	ro	-	U32	10	-	-

Meaning		User profile deceleration 1					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	-	PM	Yes

Meaning		User profile deceleration 2..10					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h ..0A _h	U32	rw	-	U32	-	CM	Yes

Sub-index 01_h - 0A_h Entry of the ten deceleration parameters takes place in acceleration units; see object Acceleration dimension index (608E_h). For a compact drive the specification represents an increase in motor increments per second squared.

Setting values Sub-index 01_h contains movement profile values which are designed for a nominal load and nominal speed and cannot be altered. The other nine movement profile values can be set in configuration mode. The configuration mode is selected using the object Modes of operation (6060_h), sub-index 00_h=80_h.

Store values The settings of the object can be stored in a compact drive using the object Store parameters (1010_h), sub-index=03_h.

10.4.46 2007_h User profile number

The object can be used in manufacturer-specific positioning mode to select one of the ten preconfigured movement profiles. The profile values are set with the objects User profile velocity (2004_h), User profile acceleration (2005_h), User profile deceleration (2006_h) and User profile max current (200A_h).

Object description

Name	User profile number		
Idx	Code	DT	
2007 _h	VAR	U8	

Values description

Meaning		User profile number						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	rw	-	1..10	1	AM	-	

10.4.47 2008_h Software position safety limit

Das Objekt speichert die Endschalterwerte für den Sicherheitsbereich S0 bis S1. Überfährt der Kompaktantrieb die Bereichsgrenze S0 oder S1, muss er manuell in den Fahr- oder Arbeitsbereich zurückgesetzt werden.

Object description

Name	Software position safety limit		
Idx	Code	DT	
2008 _h	ARR	I32	

Values description

Meaning		Number of elements						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I32	ro	-	I32	2	-	-	

Meaning		Min position limit						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	I32	rw	-	I32	-	HM	Yes	

Meaning		Max position limit					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	I32	rw	-	I32	-	HM	Yes

Sub-index 01_h, 02_h Entry for the software limit switch takes place in Position units; see object `Position dimension index (608Ah)`. For a compact drive it represents entry of the specification in motor increments.

Store values The values of the object are set in the operating mode homing and can be stored in the compact drive with the object `Store parameters (1010h)`, sub-index=03_h.

Three limit switch pairs must be set for valid homing:

- The operating range over object `Software position limit (607Dh)`
- the movement range over object `Software position drive limit (2009h)`
- the safety range over object `Software position safety limit (2008h)`.

10.4.48 2009_h Software position drive limit

Das Objekt speichert die Endschalterwerte für den Fahrbereich D0 bis D1. Die Werte können in der Betriebsart Referenzierung eingestellt werden. If the compact drive drives over the range limit D0 or D1 then it can be driven back into the operating range.

Object description

Name			Software position drive limit
Idx	Code	DT	
2009 _h	ARR	I32	

Values description

Meaning		Number of elements					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	I32	ro	-	I32	2	-	-

Meaning		Min position limit					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	I32	rw	-	I32	-	HM	Yes

Meaning		Max position limit					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	I32	rw	-	I32	-	HM	Yes

Sub-index 01_h, 02_h Entry for the software limit switch takes place in Position units; see object `Position dimension index (608Ah)`. For a compact drive it represents entry of the specification in motor increments.

Store values The values of the object are set in the operating mode homing and can be stored in the compact drive with the object `Store parameters` (1010_h), sub-index=03_h.

Three limit switch pairs must be set for valid homing:

- The operating range over object `Software position limit` (607D_h)
- the movement range over object `Software position drive limit` (2009_h)
- the safety range over Objekt `Software position safety limit` (2008_h).

10.4.49 200A_h User profile max current

The object establishes the maximum permissible torque-creating motor phase current for ten preconfigured movement profiles. A movement profile is selected using the object `User profile number` (2007_h). The value of this movement profile is adopted into the manufacturer-specific positioning mode as a current limit value in the object `Max current` (6073_h).

The specification takes place as a per thousand value based on the measuring current of the (gear) motor (6075_h) used. The entry is limited by the smaller of the object values `Max motor current` (6410_h), sub-index 0E_h and `Max drive current` (6510_h), sub-index 01_h.

Object description

Name	User profile max current						
Idx	Code	DT					
200A _h	ARR	U16					

Values description

Meaning		Number of elements					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U16	ro	-	U16	10	-	-

Meaning		User profile max current 1					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U16	rw	-	U16	-	PM	Yes

Meaning		User profile max current 2..10					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02h..0A _h	U16	rw	-	U16	-	CM	Yes

Current limiting

The current limitation of the device electronics in the manufacturer-specific positioning mode is set by the object; see object `Max current` (6073_h).

Motor phase current

The current motor phase current is shown by the object `Current actual value` (6078_h).

Setting values

Sub-index 01_h contains movement profile values which are designed for a nominal load and nominal speed and cannot be altered. The other nine

movement profile values can be set in configuration mode. The configuration mode is selected using the object `Modes of operation` (`6060h`), sub-index `00h=80h`.

Store values The settings of the object can be stored in a compact drive using the object `Store parameters` (`1010h`), sub-index=`03h`.

10.4.50 200B_h Position assignment value

The object initialises the position memory of the compact drive with the delivered position value. The operating mode homing must be set and activated and the delivered position value must lie within the operating range W0 to W1. The operating range is established with the object `Software position limit` (`607Dh`).

Object description

Name			Position assignment value				
Idx	Code	DT					
200B _h	VAR	I32					

Values description

Meaning		Position assignment value						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I32	wo	-	I32	-	AM	-	

Sub-index 01_h Entry for the position value takes place in Position units; see object `Position dimension index` (`608Ah`). For a compact drive it represents entry of the specification in motor increments.

10.4.51 200C_h Current peak value

The object indicates the maximum measured current per drive movement which can also be called up after ending the drive movement.

The value wird shown as a per thousand value based on the measuring current of the (gear) motor used. The measuring current can be determined over the object `Motor rated current` (`6075h`).

Object description

Name			Current peak value				
Idx	Code	DT					
200C _h	VAR	I16					

Values description

Meaning		Current peak value						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I16	ro	-	I16	-	-	-	

Motor phase current The current motor phase current during a drive movement is shown by the object `Current actual value` (`6078h`).

10.4.52 200D_h Temperature actual value

The object indicates the current temperature of the power output stage.

Object description

Name	Temperature actual value	
Idx	Code	DT
200D _h	VAR	I16

Values description

Meaning		Temperature actual value						
Sdx	DT	AC	MP	VR	DF	ACL	SV	
00 _h	I16	ro	-	I16	-	-	-	

Temperature detection

The temperature of the power output stage is detected and analysed by the controller firmware during the whole period of operation. The power amplifier temperature is read in with a 10 bit resolution and the measurement value filtered.

The temperature measurement value is output in degrees Celsius between -20°C and +125°C. Temperature limits values for the power output stage can be determined over the object Drive data (6510_h), sub-index 02_h und 03_h.

Event 'excess temperature'

In the case of excess temperature of the power output stage the bit Power amplifier excess temperature in the status register, object Manufacturer status register (1002_h), bit 22 is set. The status machine of the drive control branches into the status "Fault reaction active", object Statusword (6041_h); the motor is brought to a speed of rotation of 0 and the power output stage is deenergized.

If the power amplifier temperature falls below an established reset threshold (Temperature threshold) then the drive control can be reset over a higher-level field bus control or over removal and re-application of the supply voltage.

10.4.53 200E_h Drive log book

The object stores the logbook data of the compact drive. The logbook is constantly being updated during the period of operation and is saved in the configuration memory when the compact drive is switched off. The following data are stored:

- Switching on time of the drive
- Total operating time of the drive
- Number of positionings

Object description

Name	Drive log book	
Idx	Code	DT
200E _h	REC	UD

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	ACL	SV	
00 _h	U8	ro	-	U8	5	-	-	

Meaning		Total power-on time					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	-	PM	Auto

Meaning		Total turn-on time					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	rw	-	U32	-	PM	Auto

Meaning		Number of positionings					
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U32	rw	-	U32	-	PM	Auto

Meaning		Number of reference loss					
Sdx	DT	AC	MP	VR	DF	Acl	SV
04 _h	U16	rw	-	U16	-	PM	Auto

Meaning		Number of log book loss					
Sdx	DT	AC	MP	VR	DF	Acl	SV
05 _h	U16	rw	-	U16	-	PM	Auto

10.4.54 200F_h Drive serial-number

The object indicates the serial number of the compact drive which is on the device nameplate.

Object description

Name			Drive serial-number				
Idx	Code	DT					
200F _h	VAR	VS					

Values description

Meaning		Drive serial-number					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	VS	rw	-	VS	-	PM	Yes AV-CP

The object `Device information (2100h)` contains further information about the device.

Serial number

The serial number uniquely identifies a device of a device version. The serial number for the device can be found on the nameplate. It is possible that the printed serial number has zeros at the beginning to bring it up to 14 characters.

10.4.55 2011_h Manual mode settings

The object can be used to set the travel parameters for manual operation. They include:

- Number of motor steps for manual operation
- Final speed
- Acceleration ramp
- Deceleration ramp
- Current limiting
- Inching duration

Object description

Name Manual mode settings

Idx	Code	DT
2011 _h	REC	UD

Values description

Meaning Number of entries

Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	U8	6	-	-

Meaning Increments

Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	I32	rw	-	0..	-	CM	Yes

Meaning Velocity

Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	rw	-	U32	-	CM	Yes

Meaning Acceleration

Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U32	rw	-	U32	-	CM	Yes

Meaning Deceleration

Sdx	DT	AC	MP	VR	DF	Acl	SV
04 _h	U32	rw	-	U32	-	CM	Yes

Meaning Max current

Sdx	DT	AC	MP	VR	DF	Acl	SV
05 _h	U16	rw	-	U16	-	CM	Yes

Meaning Release time

Sdx	DT	AC	MP	VR	DF	Acl	SV
06 _h	U16	rw	-	U16	-	CM	Yes

Settings

The parameters for manual operation can be set in configuration mode (object 6060_h, Subindex 00_h=80_h) and stored in the compact drive with the object Store parameters (1010_h), sub-index=03_h.

	The settings are valid both for clockwise rotation as well as counter-clockwise rotation, see also object <code>Negative-manual switch settings</code> (2012 _h).
<i>Manual inputs</i>	The signals for manual operation can be to the drive controller at input MAN-N and MAN-P. Dies ist nur bei Option "Standardinterface" möglich, Objekt <code>Drive data</code> (6510 _h), Subindex <code>Interface option type</code> 0A _h =0. Die Signalzustände können über das Objekt <code>Digital inputs</code> (60FD _h), Bit 16 und Bit 17 ausgelesen werden.
<i>Manual operating modes</i>	[CROSS REFERENCE]
<i>Sub-index 01_h</i>	<p>Increments</p> <p>The parameter <code>Increments</code> (number of step) is used to set the number of motor steps to be moved in increments which are moved for the control mode "jogging in manual operating modes. Value 0 deactivates the control mode "Jogging".</p>
<i>Sub-index 02_h</i>	<p>Velocity</p> <p>The parameter <code>Velocity</code> (speed) is used to set the speed of travel for manual operating modes. The specification is in speed units; for the drive control in increments per second. The parameter value is limited by the object <code>Max profile velocity</code> (607F_h).</p>
<i>Sub-index 03_h</i>	<p>Acceleration</p> <p>The parameter <code>Acceleration</code> (acceleration) is used to set the acceleration ramp for manual operating modes. The specification is in acceleration units; for the drive control as ramp gradient in increments per second squared. The parameter value is limited by the object <code>Max acceleration</code> (60C5_h).</p>
<i>Sub-index 04_h</i>	<p>Deceleration</p> <p>The parameter <code>Deceleration</code> (deceleration) is used to set the deceleration ramp for manual operating modes. The specification is in acceleration units; for the drive control as ramp gradient in increments per second squared. The parameter value is limited by the object <code>Max deceleration</code> (60C6_h).</p>
<i>Sub-index 05_h</i>	<p>Max current</p> <p>The parameter <code>Max current</code> (maximum permissible torque-producing motor phase current) is used to set the current limit for manual operating mode relative to the measuring current of the (gear) motor used in per thousand units. See also object <code>Max current</code> (6073_h) and object <code>Current actual value</code> (6078_h).</p>
<i>Sub-index 06_h</i>	<p>Release time</p> <p>The parameter <code>Release time</code> (maximum signal period for jogging) is used to set the maximum signal period in milliseconds for the control mode "jogging" in manual operating modes. If the input signal is applied for longer than the maximum signal period for jogging then the motor goes into control mode "Start/stop". This proceeds until the input signal is removed. The value 65535 deactivates the control mode "Start/stop".</p>

10.4.56 2012_h Negative manual-switch settings

The object is used to set the operating parameters for counterclockwise rotation (counterclockwise sense of rotation) in manual operating modes. They include:

- Number of motor steps
- Speed
- Acceleration
- Deceleration
- Current limiting
- Validity bit

If the validity bit is set then for anticlockwise rotation in manual operating modes the parameters from this object are applied and for clockwise rotation the parameters from the object `Manual mode settings (2011h)`. If this is not set then the parameters from the object `Manual mode settings (2011h)` will be applied for both counterclockwise rotation and clockwise rotation.

Object description

Name	Negative manual-switch settings	
Idx	Code	DT
2012 _h	REC	UD

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	6	-	-	

Meaning		Increments						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	I32	rw	-	0..	-	CP	Yes	

Meaning		Velocity						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U32	rw	-	U32	-	CP	Yes	

Meaning		Acceleration						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
03 _h	U32	rw	-	U32	-	CP	Yes	

Meaning		Deceleration						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
04 _h	U32	rw	-	U32	-	CP	Yes	

Meaning		Max current					
Sdx	DT	AC	MP	VR	DF	Acl	SV
05 _h	U16	rw	-	U16	-	CP	Yes

Meaning		Enabled					
Sdx	DT	AC	MP	VR	DF	Acl	SV
06 _h	U16	rw	-	U16	-	CP	Yes

Manual inputs The signals for manual operation can be fed to the input MAN-N and MAN-P of the drive controller. Dies ist nur bei Option "Standardinterface" möglich, Objekt `Drive data (6510h)`, Subindex `Interface option type 0Ah=0`. Die Signalzustände können über das Objekt `Digital inputs (60FDh)`, Bit 16 und Bit 17 ausgelesen werden.

Manual operating modes [CROSS REFERENCE]

Sub-index 01_h **Increments**

The parameter `Increments` (number of steps) is used to set the number of motor steps to be moved in increments which are moved for the control mode "jogging" in manual operating modes. Value 0 deactivates the control mode "Jogging".

Sub-index 02_h **Velocity**

The parameter `Velocity` (speed) is used to set the speed of travel for manual operating modes. The specification is in speed units; for the drive control in increments per second. The parameter value is limited by the object `Max profile velocity (607Fh)`.

Sub-index 03_h **Acceleration**

The parameter `Acceleration` (acceleration) is used to set the acceleration ramp for manual operating modes. The specification is in acceleration units; for the drive control as ramp gradient in increments per second squared. The parameter value is limited by the object `Max acceleration (60C5h)`.

Sub-index 04_h **Deceleration**

The parameter `Deceleration` (deceleration) is used to set the deceleration ramp for manual operating modes. The specification is in acceleration units; for the drive control as ramp gradient in increments per second squared. The parameter value is limited by the object `Max deceleration (60C6h)`.

Sub-index 05_h **Max current**

The parameter `Max current` (maximum permissible torque-producing motor phase current) is used to set the current limit for manual operating mode relative to the measuring current of the (gear) motor used in per thousand units. See also object `Max current (6073h)` and object `Current actual value (6078h)`.

Sub-index 06_h **Enabled**

If the parameter `Enabled` (validity bit) of a value is not 0, then for counterclockwise rotation in manual operating modes the parameters from object `Negative manual-switch settings (2012h)` will be applied and for clockwise rotation the parameters from object `Manual mode settings (2011h)`. If this is not set the parameters from object `Manual mode settings (2011h)` will be used both for counterclockwise rotation and for clockwise rotation.

10.4.57 2013_h Negative limit-switch settings

The object allows the polarity and function of the monitoring input LIM-N to be set.

Object description

Name	Negative limit-switch settings							
Idx	Code	DT						
2013 _h	REC	UD						

Values description

Meaning		Number of entries							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	U8	ro	-	U8	3	-	-		

Meaning		Switch enabled							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
01 _h	I8	rw	-	0..1	-	CP	Yes		

Meaning		Switch trigger polarity							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
02 _h	I8	rw	-	0..1	-	CP	Yes		

Meaning		Switch overrun option code							
Sdx	DT	AC	MP	VR	DF	Acl	SV		
03 _h	I16	rw	-	I16	-	CP	Yes		

Sub-index 01_h

0	End position sensor switched off (disabled)
1	End position sensor switched on (enabled)

Sub-index 02_h

0	End position sensor is "active low"
1	End position sensor is "active high"

<i>Sub-index 03_h</i>	0	no action
	1	Fault, malfunction
	2	Device control command "disable voltage"
	3	Device control command "quick stop"
	4	Device control command "stop"
	5..32767	(reserved)
	-32768...-1	(reserved)
<i>Negative end position sensor</i>	The signal from a limit switch from the application can be fed to the monitoring input LIM-N of the drive controller.	
<i>Positive end position sensor</i>	See object Positive limit-switch settings (2014 _h).	
<i>Reference sensor</i>	See object Home-switch settings (2015 _h).	
<i>Monitoring inputs</i>	The monitoring inputs are only available for option "Sensorinterface", object Drive data (6510 _h) sub-index Interface option type 0A _h =1. The signal state of the monitoring signals can be read out over the object Digital inputs (60FD _h) bit 0-2.	
<i>Sub-index 01_h</i>	Switch enabled	The parameter is used to switch on and switch off the monitoring input LIM-N for the negative end position sensor. The value 0 means that the monitoring input is deactivated; Value 1 means that the monitoring input is enabled. The monitoring input is deactivated as standard (value=0).
<i>Sub-index 02_h</i>	Switch trigger polarity	The parameter indicates the signal level of the monitoring input LIM-N. The monitoring input is "low active", that is fail safe against broken connections (value=0). The setting cannot be changed.
<i>Sub-index 03_h</i>	Switch overrun option code	The parameter establishes the reaction of the drive to driving over the negative end position sensor (Negative limit-switch).
<i>Reaction 'No action'</i>	Driving over the negative end position sensor is not analysed as an error. The drive control remains in its current status and the drive movement is brought to completion.	
<i>Response "Malfunction"</i>	Driving over the negative end position sensor is analysed as a grave error. The status machine of the drive control branches into the status "Fault reaction active", object Statusword (6041 _h); the drive movement is interrupted for a very short time. The reaction of the drive to a grave error can be set with object Fault reaction option code (605E _h).	
<i>Response "Disable voltage"</i>	Driving over the negative end position sensor is not analysed as an error event. The status machine of the drive control branches into the status "Switch on disabled", object Statusword (6041 _h); a started drive movement is interrupted in that the power amplifier is switched to be deenergized.	

- Response "Quick stop"* Driving over the negative end position sensor triggers an event. The status machine of the drive control branches into the status "Quick stop active", object `Statusword (6041h)`; the drive movement is interrupted. The reaction of the drive to a rapid stop can be set with the object `Quick stop option code (605Ah)`.
- Response "Stop"* Driving over the negative end position sensor triggers an event. The drive movement is interrupted; the status machine of the drive control remains in status "Operation enabled", object `Statusword (6041h)`. The drive can be moved out of the final position in the opposite direction of rotation. The reaction of the drive to an interruption of movement can be set in the object `Stop option code (605Dh)`.
- Acknowledgment* For parameter value 1 (malfunction) the error status can only be reset after triggering of the sensor signal.

For parameter value 2 (Disable voltage), 3 (Quick stop) or 4 (Stop) the negative sense of rotation is locked after switching off the sensor. After acknowledging the error event for a negative end position sensor the drive can be moved through clockwise rotation out of the final position.

10.4.58 2014_h Positive limit-switch settings

The object allows the polarity and function of the monitoring input LIM-P to be set.

Object description

Name	Positive limit-switch settings		
Idx	Code	DT	
2014 _h	REC	UD	

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	3	-	-	

Meaning		Switch enabled						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	I8	rw	-	0..1	-	CP	Yes	

Meaning		Switch trigger polarity						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	I8	rw	-	0..1	-	CP	Yes	

Meaning		Switch overrun option code						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
03 _h	I16	rw	-	I16	-	CP	Yes	

Sub-index 01_h

0	End position sensor switched off (disabled)
1	End position sensor switched on (enabled)

<i>Sub-index 02_h</i>	0	End position sensor is "active low"
	1	End position sensor is "active high"
<i>Sub-index 03_h</i>	0	no action
	1	Fault, malfunction
	2	Device control command "disable voltage"
	3	Device control command "quick stop"
	4	Device control command "stop"
	5..32767	(reserved)
	-32768..-1	(reserved)

Positive end position sensor The signal from an end position sensor from the application can be fed to the monitoring input LIM-P of the drive controller.

Negative end position sensor See object Negative limit-switch settings (2013_h).

Reference sensor See object Home-switch settings (2015_h).

Monitoring inputs The monitoring inputs are only available for option "sensor interface", object Drive data (6510_h), sub-index Interface option type 0A_h=1.

The signal state of the monitoring signals can be read out over the object Digital inputs (60FD_h), bit 0-2.

Sub-index 01_h **Switch enabled**

The parameter is used to switch and switch off the monitoring input LIM-P for the positive end position sensor.

The value 0 means that the monitoring input is deactivated; Value 1 means that the monitoring input is enabled. The monitoring input is deactivated as standard (value=0).

Sub-index 02_h **Switch trigger polarity**

The parameter indicates the signal level of the monitoring input LIM-P. The monitoring input is "low active", that is fail safe against broken connections (value=0). The setting cannot be changed.

Sub-index 03_h **Switch overrun option code**

The parameter establishes the reaction of the drive to driving over the positive end position sensor (Positive limit-switch).

Response "No Action" Driving over the positive end position sensor is not analysed as an error. The drive control remains in its current status and the drive movement is brought to completion.

Response "Malfunction" Driving over the positive end position sensor is analysed as a grave error. The status machine of the drive control branches into the status "Fault reaction active", object Statusword (6041_h); the drive movement is interrupted for a very short time. The reaction of the drive to a grave error can be set with object Fault reaction option code (605E_h).

Response "Disable voltage" Driving over the positive end position sensor is not analysed as an error event. The status machine of the drive control branches into the status "Switch on disabled", object Statusword (6041_h); a started drive

movement is interrupted in that the power amplifier is switched to be deenergized.

Response "Quick stop" Driving over the positive end position sensor is triggered as an event. The status machine of the drive control branches into the status "Quick stop active", object *Statusword* (6041_h); the drive movement is interrupted. The reaction of the drive to a rapid stop can be set with the object *Quick stop option code* (605A_h).

Response "Stop" Driving over the positive end position sensor is triggered as an event. The drive movement is interrupted; the status machine of the drive control remains in status "Operation enabled", object *Statusword* (6041_h). The drive can be moved out of the final position in the opposite direction of rotation. The reaction of the drive to an interruption of movement can be set in the object *Stop option code* (605D_h).

Acknowledgment For parameter value 1 (malfunction) the error status can only be reset after triggering of the sensor signal.

For parameter value 2 (disable voltage), 3 (Quick Stop) or 4 (Stop) the positive sense of rotation is locked after switching of the sensor. After acknowledging the error event for a positive end position sensor, the drive can be moved through anticlockwise rotation out of the final position.

10.4.59 2015_h Home-switch settings

The object allows the polarity and function of the monitoring input REF to be set.

Object description

Name	Home-switch settings		
Idx	Code	DT	
2015 _h	REC	UD	

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	3	-	-	

Meaning		Switch enabled						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	I8	rw	-	0..1	-	CP	Yes	

Meaning		Switch trigger polarity						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	I8	rw	-	0..1	-	CP	Yes	

Meaning		Switch overrun option code						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
03 _h	I16	rw	-	0..0	-	CP	Yes	

Sub-index 01_h

0	Reference sensor is switched off (disabled)						
---	---	--	--	--	--	--	--

	1	Reference sensor is switched on (enabled)
<i>Sub-index 02_h</i>	0	Reference sensor is "active low"
	1	Reference sensor is "active high"
<i>Sub-index 03_h</i>	0	no action
	1..32767	(reserved)
	-32768..-1	(reserved)
<i>Reference sensor</i>		The signal from a reference sensor from the application can be fed to the monitoring input REF of the drive controller. The reference sensor is used to establish the mechanical zero point. All logical positions are relative to the machine zero point. In order to establish the logical position "0", a reference movement to the reference sensor can be executed in the operating mode "homing" (Homing mode).
<i>Negative end position sensor</i>		See object Negative limit-switch settings (2013 _h).
<i>Positive end position sensor</i>		See object Positive limit-switch settings (2014 _h).
<i>Monitoring inputs</i>		The monitoring inputs are only available for option "sensor interface", object Drive data (6510 _h), sub-index Interface option type 0A _h =1. The signal state of the monitoring signals can be read out over the object Digital inputs (60FD _h) bit 0-2.
<i>Sub-index 01_h</i>		Switch enabled The parameter is used to switch and switch off the monitoring input REF for the reference sensor. The value 0 means that the monitoring input is deactivated; Value 1 means that the monitoring input is enabled. The monitoring input is deactivated as standard (value=0).
<i>Sub-index 02_h</i>		Switch trigger polarity The parameter is used to set the signal level of the monitoring input REF. The value 0 means reaction at a low signal level; Value 1 reaction at a high signal level. The monitoring input is "high active" (value=1) as standard.
<i>Subindex 03_h</i>		Switch overrun option code The setting of the parameter cannot be changed.

10.4.60 2100_h Device identification

Object description The object indicates information about the drive.

Name	Device identification	
Idx	Code	DT
2100 _h	REC	UD

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	14	-	-	

Meaning		Device name						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	VS	rw	-	VS	-	PM	Yes	

Meaning		Device ident.-no.						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	VS	rw	-	VS	-	PM	Yes	

Meaning		Motor ident.-no.						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
03 _h	VS	rw	-	VS	-	PM	Yes	

Meaning		Motor manufacturer						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
04 _h	VS	rw	-	VS	-	PM	Yes	

Meaning		Electronic ident.-no.						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
05 _h	VS	rw	-	VS	-	PM	Yes	

Meaning		Electronic manufacturer						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
06 _h	VS	rw	-	VS	-	PM	Yes	

Meaning		LSS vendor-id.						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
07 _h	U32	rw	-	U32	-	PM	Yes	

Meaning		LSS product code						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
08 _h	U32	rw	-	U32	-	PM	Yes	

Meaning		LSS revision number						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
09 _h	U32	rw	-	U32	-	PM	Yes	

Meaning		LSS serial number					
Sdx	DT	AC	MP	VR	DF	Acl	SV
0Ah	U32	rw	-	U32	-	PM	Yes

Meaning		LMT manufacturer name					
Sdx	DT	AC	MP	VR	DF	Acl	SV
0B _h	VS	rw	-	VS	-	PM	Yes

Meaning		LMT product name					
Sdx	DT	AC	MP	VR	DF	Acl	SV
0C _h	VS	rw	-	VS	-	PM	Yes

Meaning		Software version					
Sdx	DT	AC	MP	VR	DF	Acl	SV
0Dh	VS	ro	-	VS	-	-	Yes

Meaning		Date of production					
Sdx	DT	AC	MP	VR	DF	Acl	SV
0E _h	Date	rw	-	Date	-	PM	Yes

Sub-index 01_h

"IcIA N065" IcIA N065 DC024 Sxxx CANopen			
[To Be Continued]			

Sub-index 07_h

Bit	Access	Value	Meaning
31..24	rw	00 _h	Unique number for each department of the manufacturer
23..16	rw	00 _h	(reserved)
15..0	rw	00A4 _h	Unique manufacturer number allocated by CiA

Sub-index 08_h

0	TwinLine		
1	IcIA D065, IcIA D042, IcIA IFx		
2	IcIA N065		
...	[To Be Continued]		

Sub-index 09_h

Bit	Access	Value	Meaning
31..16	ro	0001 _h	upper revision number, counted up for every CANopen change.
15..0	ro	0001 _h	lower revision number, counted up for every functional change.

*Sub-index 01_h***Device name**

- The parameter indicates the device designation. See also object `Manufacturer device name (1008h)`.
- Sub-index 02_h* **Device ident.-no.**
- The parameter indicates the material number of the drive. See also object `Manufacturer hardware version (1009h)`.
- Sub-index 03_h* **Motor ident.-no.**
- The parameter indicates the material number of the (gear) motor. See also object `Motor hardware version (2001h)`.
- Sub-index 04_h* **Motor manufacturer**
- The parameter indicates the manufacturer of the (gear) motor. See also object `Motor manufacturer (6404h)`.
- Sub-index 05_h* **Electronic ident.-no.**
- The parameter indicates the material number of the electronic assembly. See also object `Drive hardware version (2000h)`.
- Sub-index 06_h* **Electronic manufacturer**
- The parameter indicates the manufacturer of the electronic assembly. See also object `Drive manufacturer (6504h)`.
- Sub-index 07_h* **LSS vendor-id.**
- The parameter indicates the Vendor-Id. device manufacturer. The vendor ID is part of the LSS address; see object `Identity (1018h)`, sub-index 01_h.
- Sub-index 08_h* **LSS product code**
- The parameter indicates the product code of the device. The product code is part of the LSS address; see object `Identity (1018h)`, sub-index 02_h.
- Sub-index 09_h* **LSS revision number**
- The parameter indicates the revision number of the device. The revision number is part of the LSS address; see object `Identity (1018h)`, sub-index 03_h.
- Sub-index 0A_h* **LSS serial number**
- The parameter indicates the serial number of the device. The serial number is part of the LSS address; see object `Identity (1018h)`, sub-index 04_h.
- See also object `Drive serial-number (200Fh)`.
- Sub-index 0B_h* **LMT manufacturer name**
- The parameter indicates the name of the manufacturer of the device. The name of the manufacturer is part of the LMT address; the character string consists of exactly seven alpha-numerical characters.
- Sub-index 0C_h* **LMT product name**
- The parameter indicates the product name of the device. The product name is part of the LMT address; the character string consists of exactly seven alpha-numerical characters.

Sub-index 0D_h **Software version**

The parameter indicates the version number of the application firmware. See also object `Manufacturer software version (100Ah)`.

Sub-index 0E_h **Date of production**

The parameter indicates the date of manufacturer of the drive.

10.4.61 6007_h Abort connection option code

The object `Abort connection option code` is used to set the reaction of the drive to a loss of connection to NMT-Master (Life-Guarding Event).

Object description

Name	Abort connection option code		
Idx	Code	DT	
6007 _h	VAR	I16	

Values description

Meaning	Abort connection option code							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I16	rw	-	I16	-	CP	Yes	

Sub-index 00_h

0	no action
1	Fault, malfunction
2	Device control command "disable voltage"
3	Device control command "quick stop"
4 ... 32767	(reserved)
-32768 ... -2	Manufacturer-specific (not used)
-1	Slowing down of the quick-stop ramp and changing to jog (manufacturer-specific)

Response "No Action"

The Life-Guarding Event is not analysed as an error. The drive control remains in its current status; an orderly started drive movement is completed.

Response "Malfunction"

The Life-Guarding Event is analysed as a grave error. The status machine of the drive control branches into the status "Fault reaction active", object `Statusword (6041h)`; the drive movement is interrupted for a very short time. The reaction of the drive to a grave error can be set with object `Fault reaction option code (605Eh)`.

Response "Disable voltage"

The Life-Guarding Event is analysed as an error event. The status machine of the drive control branches into the status "Switch on disabled", object `Statusword (6041h)`; a started drive movement is interrupted in that the power amplifier is switched to be deenergized.

Response "Quick stop"

The Life-Guarding Event is analysed as an error event. The Statemachine of the drive control branches into the status "Quick stop active", object `Statusword (6041h)`; the drive movement is interrupted. The reaction of the drive to a rapid stop can be set with the object `Quick stop option code (605Ah)`.

Manufacturer-specific reaction The compact drive breaks off its currently active positioning in that it brings the speed of rotation to "0" using the rapid stop ramp. The drive control sends the Emergency-Message `0FF15h` and changes over after the motor stopped to manual operation.

Der Wechsel in den Manuellbetrieb wird nur bei Option "Standardinterface" ausgeführt, Objekt `Drive data (6510h)`, Subindex `Interface option type 0Ah=0`. Bei den anderen Interface-Varianten bleibt die Antriebssteuerung in der eingestellten Betriebsart; see `object Modes of operation (6060h)`.

Save value The current setting can be persistently stored with the object `Store parameters (1010h)`, sub-index `02h`.

Life-Guarding Event The Life-Guarding Event is triggered if checking of the communication connection (Life-Guarding) by the NMT-Master over the Node-Guarding protocol does not occur. The time interval Life time for the Life-Guarding is set by the cycle time `Guard time (100Ch)` multiplied by the factor `Life time factor (100Dh)`. If the value Life Time is not the same "0" then the Life-Guarding is activated.

As an alternative to the Node-Guarding protocol the Heartbeat protocol can be used according to the communication profile CiA DS-301 (Version 4.0x) for connection monitoring; see `object Consumer heartbeat time (1016h)`.

Node-Guarding Protocol [CROSS REFERENCE]

Heartbeat Protocol [CROSS REFERENCE]

10.4.62 603F_h Error code

The object indicates the error code of the last error. The value represents the lower 16 bit in object `Pre-defined error field (1003h)`.

Object description

Name		Error code		
Idx	Code	DT		
603F _h	VAR	U16		

Values description

Meaning		Error code						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U16	ro	-	U16	0	-	-	

Diagnostics and troubleshooting [CROSS-REFERENCES]

10.4.63 6040_h Controlword

The object represents the control word of the device. The `Controlword` allows a number of control tasks to be executed:

- Changing between the various operating statuses. The possible statuses and changeovers can be found under the index keyword "status machine". Bits 0 to 3 and bit 7 are relevant for a state change

- Starting and interrupting operating mode specific function, such as starting a travel command over bit 4. Bits 4 to 6 are used for the operating mode specific settings. Details can be found under the keywords "operating mode, starting" and "operating mode, monitoring" and with the description of the respective operating modes in the chapters "manual operation" and "positioning".
- Stopping the compact drive during operating movement mode. Bit 8 "Halt" is used to stop the drive. Details can be found under the keywords "operating mode, starting" and "operating mode, monitoring".

The control word is mapped in the first two bytes of R_PDOs.

Object description

Name	Controlword	
Idx	Code	DT
6040 _h	VAR	U16

Values description

Meaning	Controlword						
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U16	rww	Yes	U16	-	AM	-

Sub-index 00_h

Bit	Designation	Meaning
11..15		(not used)
9, 10		(reserved)
8	Halt	Stop motor
7	Reset fault	Reset error
4..6	-	Depending on the operating mode, see under
3	Enable operation	Execution mode
2	Quick stop	Braking on the Quick Stop ramp
1	Disable voltage	Switching off the voltage
0	Switch on	Switching on -> ready

The meaning of bit 4 and bit 6 is dependent on the currently set operating mode. Bit 5 is free.

Operating mode	Bit 4	Bit 5	Bit 6
Positioning (Profile Position mode)	New nominal variable, 0-> 1: Start position	-	Positioning 0: absolute 1: relative
Start/stop mode (Profile Velocity mode)	-	-	-
Homing (Homing mode)	0->1: Start homing	-	-
Jog over the fieldbus (manufacturer-specific)	Positive direction 0-> 1: Starting the movement 1-> 0: Halting the movement	Negative direction 0-> 1: Starting the movement 1-> 0: Halting the movement	-

Operating mode	Bit 4	Bit 5	Bit 6
Jog via input signals (manufacturer-specific)	-	-	-

The bit statuses, procedure for changing the operating statuses and the status machine can be found under "CANopen status machine", "operating status, changing and monitoring", "operating modes, setting and monitoring", "manual operation" and "positioning".

Operating modes see object Modes of operation (6060_h).

10.4.64 6041_h Statusword

The object describes the current operating status of the device. The Statusword allows you to execute the following monitoring functions:

- Checking the operating status of the positioning controller. Here it is bits 0 - 3, 5 and 6 which are relevant.
- Bit 4 indicates whether the power amplifier is ready to process a travel command.
- Bits 7 to 15 are used for monitoring the movement mode and for status monitoring of device specific statuses. Details of monitoring the movement mode can be found under the key words "operating mode, starting" and "operating mode, monitoring" and with the description of the respective operating modes in the chapters "manual operation" and "positioning". The bits for status monitoring of the device are described in chapter "Diagnostics and troubleshooting".

The status word is mapped in the first two bytes of T_PDOs.

Object description

Name	Statusword	
Idx	Code	DT
6041 _h	VAR	U16

Values description

Meaning	Statusword							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U16	ro	Yes	U16	-	-	-	-

Sub-index 00_h

15	Out of security area	The safe area was left0->1: limit switch position S0 or S1 passed over
14	Out of drive area	Movement range was left0->1: limit switch position D0 or D1 passed over
12..13	-	Operating mode dependent meaning, see under
11	Internal limit active	The working area was left0->1: limit switch position W0 or W1 was passed over
10	Target reached	Target position reached1->0: Pass on new target position or target speed0->1: Target position reached (reference value = actual value) or motor standstill after Stop request
9	Remote	0: local operation, SDOs continue to be possible 1: Field bus mode

8	Right out of drive area	Only valid if bit 11 = 1- 0: End position switch position W1 passed over- 1: End position switch position W0 passed over
7	Warning	Warning
6	Switch on disabled	not ready
5	Quick Stop	Quick Stop active
4	Voltage disabled	Voltage switched off
3	Fault	Fault arisen
2	Operation enabled	Operating mode activated
1	Switched on	ready
0	Ready to switch on	ready to switch on

The meaning of bit 12 and 13 is is dependent on the currently set operating mode.

Operating mode	Bit 12	Bit 13
Positioning (Profile Position mode)	Adoption of nominal variables 0: Adoption of a new position possible 1: Receive new target position	-
Start/stop mode (Profile Velocity mode)	Rotational speed 0: Motor moving 1: Motor stationary	-
Homing (Homing mode)	Reference without error 0: Homing not executed yet 1: Homing executed	Homing error0: no error1: Error during homing
Jog (manufacturer-specific)	Positive direction 0-> 1: Starting the movement 1-> 0: Halting the movement	Negative direction 0-> 1: Starting the movement 1-> 0: Halting the movement

The bit statuses, procedure for changing the operating statuses and the status machine can be found under "CANopen status machine", "operating status, changing and monitoring", "operating modes, setting and monitoring", "manual operation" and "positioning".

Operating modes see object Modes of operation (6060_h).

10.4.65 605A_h Quick stop option code

The object is used to set the reaction of the drive to a "Quick Stop" command (interruption of movement). The status machine of the drive control branches due to this command into the status "Quick Stop active", see object Controlword (6040_h).

Object description

Name	Quick stop option code
Idx	Code DT

605A_h VAR I16

Values description

Meaning		Quick stop option code					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	I16	rw	-	I16	-	CP	Yes

Sub-index 00_h

0	Disable drive function
1	Slow down on slow down ramp
2	Slow down on quick stop ramp
3	Slow down on the current limit (not used)
4	Slow down on the voltage limit (not used)
5	Slow down on slow down ramp and stay in Quick-Stop
6	Slow down on quick stop ramp and stay in Quick-Stop
7	Slow down on the current limit and stay in Quick-Stop (not used)
8	Slow down on the voltage limit and stay in Quick-Stop (not used)
9..32767	(reserved)
-32768..-1	Manufacturer-specific (not used)

Response "Disable drive function" For parameter value 0 (Disable drive function) the power amplifier is switched to be deenergized for a short time for a "Quick Stop" command which means that the motor runs on freely.

Response "Slow down on slow down ramp" For parameter value 1 (Slow down on slow down ramp) the motor is brought to the rotational speed 0 based on the normal deceleration ramp, object Profile deceleration (6084_h).

Response "Slow down on quick stop ramp" For parameter value 2 (Slow down on quick stop ramp) the motor is brought to the rotational speed 0 based on the rapid stop ramp, object Quick stop deceleration (6085_h).

Response "Slow down on slow down ramp and stay in Quick-Stop" For parameter value 5 (Slow down on slow down ramp and stay in Quick-Stop) the motor is brought to the rotational speed 0 based on the normal deceleration ramp, object Profile deceleration (6084_h). The drive controller can then be brought back into the status "Operation Enabled" by the command "Enable Operation", object Statusword (6041_h).

Response "Slow down on quick stop ramp and stay in Quick-Stop" For parameter value 6 (Slow down on quick stop ramp and stay in Quick-Stop) the motor is brought to the rotational speed 0 based on the rapid stop ramp, object Quick stop deceleration (6085_h). The drive controller can then be brought back into the status "Operation Enabled" by the command "Enable Operation", object Statusword (6041_h).

Save value / default value The current setting can be persistently stored with the object Store parameters (1010_h), sub-index=02_h.

The default value is 6 (Slow down on quick stop ramp and stay in Quick-Stop).

10.4.66 605B_h Shutdown option code

The object is used to set the reaction of the drive to a "Shutdown" command. The status machine of the drive control branches due to this command into the status "Ready to Switch On", see object `Controlword` (6040_h).

Object description

Name	Shutdown option code		
Idx	Code	DT	
605B _h	VAR	I16	

Values description

Meaning	Shutdown option code							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I16	rw	-	I16	-	CP	Yes	

Sub-index 00_h

0	Disable drive function
1	Slow down on slow down ramp disable of the drive function
2..32767	(reserved)
-32768..-1	Manufacturer-specific (not used)

Response "Disable drive function"

For parameter value 0 ("Disable drive function") the power amplifier is switched to be deenergized for a short time for a "Shutdown" command which means that the motor runs on freely.

Response "Slow down with slow down ramp disable of the drive function"

For parameter value 1 (Slow down on slow down ramp disable of the drive function) the motor is brought to the rotational speed 0 based on the normal deceleration ramp, object `Profile deceleration` (6084_h) and then the power amplifier is switched to be deenergized.

Save value / default value

The current setting can be persistently stored with the object `Store parameters` (1010_h), sub-index=02_h.

The default value is 1 (Slow down on slow down ramp disable of the drive function).

10.4.67 605C_h Disable operation option code

The object is used to set the reaction of the drive to a "Disable Operation" command. The status machine of the drive control branches due to this command into the status "Switched On", see object `Controlword` (6040_h).

Object description

Name	Disable operation option code		
Idx	Code	DT	
605C _h	VAR	I16	

Values description

Meaning	Disable operation option code							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I16	rw	-	I16	-	CP	Yes	

Sub-index 00 _h	
0	Disable drive function
1	Slow down on slow down ramp and then disabling of the drive function
2..32767	(reserved)
-32768..-1	Manufacturer-specific (not used)

Response "Disable drive function" For parameter value 0 (Disable drive function) the power amplifier is switched to be deenergized for a short time for a "Disable Operation" command which means that the motor runs on freely.

Response "Slow down with slow down ramp and then disabling of the drive function" For parameter value 1 (Slow down on slow down ramp and then disabling of the drive function) the motor is brought to the rotational speed 0 based on the normal deceleration ramp, object Profile deceleration (6084_h) and then the power amplifier is switched to be deenergized.

Save value / default value The current setting can be persistently stored with the object Store parameters (1010_h), sub-index=02_h.
The default value is 1 (Slow down on slow down ramp and then disabling of the drive function).

10.4.68 605D_h Halt option code

The object is used to set the reaction of the drive to a "Halt" command (interruption of movement). The status machine of the drive control remains through this command in the status "Operation Enabled". If the halt bit is reset then the interrupted travel command is continued; see object Controlword (6040_h), Bit 8.

Object description

Name	Halt option code		
Idx	Code	DT	
605D _h	VAR	I16	

Values description

Meaning		Halt option code						
Sdx	DT	AC	MP	VR	DF	ACL	SV	
00 _h	I16	rw	-	I16	-	CP	Yes	

Sub-index 00 _h	
0	Disable drive, motor is free to rotate
1	Slow down on slow down ramp
2	Slow down on quick stop ramp
3	Slow down on the current limit (not used)
4	Slow down on the voltage limit (not used)
5..32767	(reserved)
-32768..-1	Manufacturer-specific (not used)

Response "Disable drive, Motor is free to rotate" For parameter value 0 (Disable drive function) the power amplifier is switched to be deenergized for a short time for a "Halt" command which means that the motor runs on freely.

- Response "Slow down on slow down ramp"* For parameter value 1 (Slow down on slow down ramp) the motor is brought to the rotational speed 0 based on the normal deceleration ramp, object `Profile deceleration (6084h)`.
- Response "Slow down on quick stop ramp"* For parameter value 2 (Slow down on quick stop ramp) the motor is brought to the rotational speed 0 based on the rapid stop ramp, object `Quick stop deceleration (6085h)`.
- Save value / default value* The current setting can be persistently stored with the object `Store parameters (1010h)`, sub-index=02_h.
The default value is 1 (Slow down on slow down ramp).

10.4.69 605E_h Fault reaction option code

The object is used to set the reaction of the drive to a error event in the application. The status machine of the drive control branches into the status "Fault reaction active", see object `Controlword (6040h)`.

Object description

Name	Fault reaction option code		
Idx	Code	DT	
605E _h	VAR	I16	

Values description

Meaning	Fault reaction option code						
Sdx	DT	AC	MP	VR	DF	ACL	SV
00 _h	I16	rw	-	I16	-	CP	Yes

Sub-index 00_h

0	Disable drive, motor is free to rotate
1	Slow down on slow down ramp
2	Slow down on quick stop ramp
3	Slow down on the current limit (not used)
4	Slow down on the voltage limit (not used)
5..32767	(reserved)
-32768..-1	Manufacturer-specific (not used)

- Response "Disable drive, Motor is free to rotate"* For parameter value 0 (Disable drive function) the power amplifier is switched to be deenergized for a short time which means that the motor runs on freely.
- Response "Slow down on slow down ramp"* For parameter value 1 (Slow down on slow down ramp) the motor is brought to the rotational speed 0 based on the normal deceleration ramp, object `Profile deceleration (6084h)`.
- Response "Slow down on quick stop ramp"* For parameter value 2 (Slow down on quick stop ramp) the motor is brought to the rotational speed 0 based on the rapid stop ramp, object `Quick stop deceleration (6085h)`.
- Error events* The reaction of the drive to error events from the application is adjustable. Thus certain error events can be analysed as grave errors for which the drive must be shut-down and the status machine branches into the status "Fault".
The following events can be configured as an error function: t.b.d.



The reaction of the motor operating programme to a local error event, such as excess temperature, loss of voltage and so on, is permanently established and is no longer influenced by the object *Fault reaction option code*.

Save value The current setting can be persistently stored with the object *Store parameters* (1010_h), sub-index=02_h.

10.4.70 6060_h Modes of operation

The operating mode of the drive control is set by the object. The compact drive IcIA N06x supports the following operating modes according to the version:

- Profile Position mode (Positioning according to CiA DSP-402)
- Profile Velocity mode (Speed mode according to CiA DSP-402)
- Homing Mode (Homing of the drive according to CiA DSP-402)
- Positioning with the preset movement profile (1 of 10)
- Manual Mode (Manual operation over signal inputs)
- Manual operation over the fieldbus
- Configuration mode (Commissioning mode)

Object description

Name	Modes of operation		
Idx	Code	DT	
6060 _h	VAR	I8	

Values description

Meaning		Modes of operation						
Sdx	DT	AC	MP	VR	DF	ACL	SV	
00 _h	I8	wo	-	I8	-	AM	-	

Sub-index 00_h

Value	Meaning
1	Profile position mode
3	Profile velocity mode
6	Homing mode
-1 (0FF _h)	Manual mode (manufacturer-specific)
-2 (0FE _h)	Manufacturer-specific profile position operation
-3 (0FD _h)	Manufacturer-specific simulated manual operation
-128 (80 _h)	Configuration mode (manufacturer-specific)

Profile Position mode

In the operating mode Profile Position mode (value 1) the positioning commands are processed over the fieldbus. The reference value of a positioning command is the target position of the drive movement: Object *Target position* (607A_h). The target position is mapped together with the control word of the status machine (*controlword*) in the Receive-PDO R_PDO2; see object 2nd receive PDO mapping parameter (1601_h)

Preset movement profile

In manufacturer-specific positioning mode (value -2) the movement profile parameter speed, acceleration and deceleration is selected over the object `User profile number (2007h)`. Ten preconfigured movement profiles can be stored in the drive control configuration memory.

Profile Velocity mode

In the operating mode Profile Velocity mode (value 3) the movement commands are processed over the fieldbus. The reference value of a movement command is the set speed of the drive movement: Object `Target velocity (60FFh)`. The set speed is mapped together with the control word of the status machine (`Controlword`) in the Receive-PDO `R_PDO3`; see object 3rd receive PDO mapping parameter (`1602h`).

Homing Mode

In the operating mode homing (Homing Mode, value 6) the position memory of the positioning system is initialised. Homing takes place either through value assignment or through a reference movement.

Value assignment

The compact drive supports the manufacturer-specific method through value assignment (Homing method = -1). The allocated position is adopted as the actual position over bit 4 in control word of the status machine (`controlword`) in the object `Position actual value (6064h)`, see also object `Position assignment value (200Bh)`.

Reference movement

For the product version with the option "sensor interface", object `Drive data (6510h)`, sub-index `Interface option type 0Ah=1`, no reference movement for determining the machine zero point can be executed. The following homing methods are available, according to the connected sensor:

- to the reference sensor (Home-switch)
- to an end position sensor (Limit-switch)
- to the reference sensor with reversing at the end position sensor

The reference movement is controlled over the control word of the status machine (`controlword`). The referencing method is selected over the object `Homing method (6098h)`.

Manual Mode

In the operating mode Manual Mode (value -1) positionings are started over the signal inputs MAN-L and MAN-R. Depending on the period of the applied signal the drive control operates in the control mode "jogging" or "Start/stop".

The operating mode Manual Mode can only be selected for the option "standard interface"; see object `Drive data (6510h)`, sub-index `Interface option type 0Ah=0`.

Manual inputs

The signals for manual operation can be sent to the drive controller at input MAN-N and MAN-P. The signal states can be read out over the object `Digital inputs (60FDh)`, bit 16 and bit 17.

Simulated manual operation

In manual operation over the fieldbus (value -3) the drive movement is controlled over the object `Controlword (6040h)`. There is a bit in this operating mode for every direction of rotation

- Bit 4: Drive movement by clockwise rotation
- Bit 5: Drive movement by anticlockwise rotation

A positive flank transition (0 -> 1) starts the drive movement in the respective direction of rotation; a negative flank transition (1 -> 0) interrupts it.

<i>Configuration mode</i>	The commissioning parameter is set in configuration mode (value -128).
<i>Supported operating modes</i>	Operating modes which are supported by the drive control are shown in object <code>Supported drive modes (6502_h)</code> .
<i>Current operating mode</i>	The current operating mode indicates the object <code>Modes of operation display (6061_h)</code> . The operating mode can be changed as soon as the drive is stationary. In configuration mode (value -128) it can only change out of NMT status "pre-operational".
<i>Initial operating mode</i>	After switching on the supply voltage and after an NMT change of state via "Reset node" the compact drive changes for the option "standard interface" (object <code>Drive data (6510_h)</code> , sub-index <code>Interface option type 0A_h=0</code> , in manual operation (value -1). For the other interface versions the compact drive changes in the operating mode "profile position mode" (value 1).
<i>Access model</i>	Certain application parameters are allocated to individual operating modes and can only be altered in the respective operating mode. The column "Acl" (Accessible) in the section ""Values description"" to every object entry informs about the operating mode the corresponding object entry can be altered in. Any attempt to gain writing access to the object entry in any other than the given operating mode will lead to an SDO error message (08000022 _h = Data cannot be transferred or stored to the application because of the present device state).

10.4.71 6061_h Modes of operation display

The object indicates the currently set operating mode.

Object description

Name		
Modes of operation display		
Idx	Code	DT
6061 _h	VAR	I8

Values description

Meaning								
Modes of operation display								
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I8	ro	-	I8	-	-	-	-

Sub-index 00_h

Value	Meaning
1	Profile position mode
3	Profile velocity mode
6	Homing mode
-1 (0FF _h)	Manual mode (manufacturer-specific)
-2 (0FE _h)	Manufacturer-specific profile position operation
-3 (0FD _h)	Manufacturer-specific simulated manual operation
-128 (80 _h)	Configuration mode (manufacturer-specific)
-127 (7F _h)	Production mode, password protected (manufacturer-specific)

The current operating mode is altered by means of the object `Modes of operation` (6060_h).

10.4.72 6063_h Position actual value*

The object indicates the current position of the drive in internal units.

Object description

Name	Position actual value*		
Idx	Code	DT	
6063 _h	VAR	I32	

Values description

Meaning		Position actual value int						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I32	ro	-	I32	-	-	-	

The specification of the position value is in increments.

Position resolution

The resolution of position detection is shown by the object `Position encoder resolution` (608F_h).

10.4.73 6064_h Position actual value

The object indicates the current position of the drive.

Object description

Name	Position actual value		
Idx	Code	DT	
6064 _h	VAR	I32	

Values description

Meaning		Position actual value						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I32	ro	Yes	I32	-	-	-	

Sub-index 00_h

Specification of the position value takes place in Position units; see object `Position dimension index` (608A_h). For a compact drive it represents entry of the specification in motor increments.

- Position resolution* The resolution of position detection is shown by the object `Position encoder resolution (608Fh)`.
- Event: "Position reached" in positioning mode* If the drive during positioning stops within a tolerance window, object `Position window (6067h)`, of the setpoint, object `Target position (607Ah)` then bit `Target reached` in status word, object `Statusword (6041h)`, bit 10, as well as bit `Position approached` in the status register, object `Manufacturer status register (1002h)`, bit 25, is set.

The position regulator seeks independently of the size of the tolerance window to exactly approach the setpoint. It is only after motor standstill that a check is made to see whether the position reached, object `Position actual value (6064h)`, is within the tolerance window for positioning.
- Event: "External torque"* If the drive in a stationary condition is pulled out of the tolerance window for positioning by an external force, object `Position window (6067h)`, bit `External torque` in the status register, object `Manufacturer status register (1002h)`, bit 23, is set and the `Emergency-Message 0FF29h` is sent.
- PDO-Mapping* The compact drive transmits the current position using bytes 2..5 of the `Transmit-PDO T_PDO2`; see object `2nd transmit PDO mapping parameter (1A01h)`.

A target position is transferred in positioning mode (`Profile Position mode`) with the object `Target position (607Ah)`.

10.4.74 6067_h Position window

The object (tolerance window for the target position) describes a symmetrical range in which the setpoint, object `Target position (607Ah)` is taken as reached and the bit `Target reached` in the status word, object `Statusword (6041h)`, bit 10) as well as the bit `Position approached` in the status register, object `Manufacturer status register (1002h)`, bit 25 is set.

The position regulator seeks independently of the size of the tolerance window to exactly approach the setpoint. It is only after motor standstill that a check is made to see whether the position reached, object `Position actual value (6064h)`, is within the tolerance window for positioning.

Object description

Name			Position window		
Idx	Code	DT			
6067 _h	VAR	U32			

Values description

Meaning		Position window					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U32	rw	-	U32	-	CM	Yes

Sub-index 00_h

Specification of the position window takes place in `Position units`; see object `Position dimension index (608Ah)`. For a compact drive it represents entry of the specification in motor increments.

<i>Position capture</i>	The resolution of position detection is shown by the object <code>Position encoder resolution (608F_h)</code> . The current position of the drive can be read out with the object <code>Position actual value (6064_h)</code> .
<i>Save value</i>	The object value can be set in configuration mode (object <code>6060_h</code> , sub-index <code>00_h=80_h</code>) and stored with the object <code>Store parameters (1010_h)</code> , sub-index= <code>03_h</code> , in the compact drive.
<i>Factory setting</i>	The factory setting can be accessed through loading the application parameter in configuration mode. Details about restoring the factory setting are described for the communication object <code>Restore default parameters (1011_h)</code> .
<i>IcIA D065</i>	Object Control parameter set (<code>2010_h</code>), parameter <code>Position window (sub-index 05_h)</code> .

10.4.75 6069_h Velocity sensor actual value

The object indicates the current speed from the rpm sensor.

Object description

Name	Velocity sensor actual value		
Idx	Code	DT	
6069 _h	VAR	I32	

Values description

Meaning	Velocity sensor actual value								
Sdx	DT	AC	MP	VR	DF	ACL	SV		
00 _h	I32	ro	-	I32	-	-	-	-	-

Specification of the speed value takes place in increments per second.

10.4.76 606B_h Velocity demand value

The object indicates the current reference value of the rotational speed regulating circuit and is updated in the regulation cycle.

Object description

Name	Velocity demand value		
Idx	Code	DT	
606B _h	VAR	I32	

Values description

Meaning	Velocity demand value								
Sdx	DT	AC	MP	VR	DF	ACL	SV		
00 _h	I32	ro	Yes	I32	-	-	-	-	-

Sub-index 01_h Specification of the rotational speed value is in velocity units; see object `Velocity dimension index (608Ch)`. For a compact drive the specification represents motor increments per second.

PDO-Mapping The object is mapped in bytes 4..7 of the manufacturer-specific transmit PDO `T_PDO33`; see object `Manufacturer specific transmit PDO mapping parameter (1A20h)`.

10.4.77 606C_h Velocity actual value

The object indicates the current speed of the drive.

Object description

Name	Velocity actual value		
Idx	Code	DT	
606C _h	VAR	I32	

Values description

Meaning		Velocity actual value						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I32	ro	Yes	I32	-	-	-	

Sub-index 01_h

Specification of the speed value takes place in Velocity units; see object Velocity dimension index (608C_h). For a compact drive it represents entry in motor increments in seconds.

Event: "Motor stop" in speed mode

If the drive comes to a stop after a Stop command in speed mode (Profile Velocity mode) the bit Speed=0 in the status word, object Statusword (6041_h), bit 12 is set.

Event: "Start up error"

If the motor does not start within the time window rotational speed monitoring motor start, object Start-up timeout (60F9_h), sub-index=03_h, the bit Motor start-up error in the status register, object Manufacturer status register (1002_h), bit 17 is set. In case of a start up error the drive control sends the Emergency-Message 7120_h.

Event: "Deviation from speed of rotation"

The error bit Speed variation in the status register, object Manufacturer status register (1002_h), bit 18, is set if the speed of rotation during a drive movement goes outside the set speed of rotation window, object Velocity window (606D_h) and object Velocity window time (606E_h). In case of deviation from speed of rotation, the drive control sends the emergency message 7120_h.

Event: "Block movement"

If the reduction in speed of rotation exceeds within a time window (10ms) the given deceleration value for block movement, object Block deceleration (60F9_h), sub-index=07_h, with an overcurrent occurring at the same time then bit Block movement in the status register, object Manufacturer status register (1002_h), bit 20, is set and the drive stops immediately. In case of a block movement the drive control sends the Emergency-Message 7121_h.

PDO-Mapping

The compact drive transmits the current speed using bytes 2..5 of the Transmit-PDO T_PDO3; see object 3rd transmit PDO mapping parameter (1A02_h).

A set speed is transferred in speed mode (Profile Velocity mode) with the object Target velocity (60FF_h).

10.4.78 606D_h Velocity window

The object describes the symmetrical range around the specified speed of rotation in transient response status in which the specified speed of rotation is considered as reached.

The specified speed of rotation is set in the operating mode "Profile position mode" by the object `Profile velocity` (6081_h) and in the operating mode "Profile velocity mode" by the object `Target velocity` (60FF_h).

Object description

Name	Velocity window		
Idx	Code	DT	
606D _h	VAR	U16	

Values description

Meaning		Velocity window					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U16	rw	-	U16	-	CM	Yes

Sub-index 01_h

Specification of the speed of rotation window takes place in Velocity units; see object `Velocity dimension index` (608C_h). For a compact drive it represents entry in motor increments per second.

Rotational speed monitoring

see object `Velocity window time` (606E_h).

Save value

The object value can be set in configuration mode (object 6060_h, sub-index 00_h=80_h) and stored with the object `Store parameters` (1010_h), sub-index=03_h, in the compact drive.

Factory setting

The factory setting can be accessed through loading the application parameter in configuration mode. Details about restoring the factory setting are described for the communication object `Restore default parameters` (1011_h).

IcIA D065

ObjectControl parameter set (2010_h), parameter `Rpm window` (sub-index 06_h).

10.4.79 606E_h Velocity window time

The object indicates the time during which the speed of rotation must remain within the speed of rotation window, object `Velocity window` (606D_h) before in speed of rotation mode the bit `Target reached` in status word, object `Statusword` (6041_h), bit 10 is set. This time span must be completed on leaving the speed of rotation window so that bit `Target reached` is reset or the error bit "Speed variation" is set in the status register, object `Manufacturer status register` (1002_h), bit 18.

The error bit `Speed variation` is also set in positioning mode if the speed of rotation lies outside the speed of rotation window after expiry of the time window.

Object description

Name	Velocity window time		
Idx	Code	DT	
606E _h	VAR	U16	

Values description

Meaning		Velocity window time					
Sdx	DT	AC	MP	VR	DF	Acl	SV

00_h U16 rw - U16 - CM Yes

- Specification of the time window takes place in milliseconds.
- Rotational speed monitoring* The time window is realised by an event counter which is incremented in every regulating cycle if the speed of rotation is within the speed of rotation window (object 606D_h) and is deactivated otherwise. If the counter reaches the upper limit value defined by the parameter `Velocity window time` the bit `Target reached` in the status word, object `Statusword` (6041_h), bit 10 is set. If the counter reaches zero again then the bit is reset and the error bit "Speed variation" set in the status register, object `Manufacturer status register` (1002_h), bit 18.
- Save value* The object value can be set in configuration mode (object 6060_h, sub-index 00_h=80_h) and stored with the object `Store parameters` (1010_h), sub-index=03_h, in the compact drive.
- Factory setting* The factory setting can be accessed through loading the application parameter in configuration mode. Details about restoring the factory setting are described for the communication object `Restore default parameters` (1011_h).
- IcIA D065* Object `Control parameter set` (2010_h), parameter `Rpm deviation events` (sub-index 07_h).

10.4.80 6073_h Max current

The object indicates the maximum permissible torque-generating motor phase current.

The specification takes place as a per thousand value based on the measuring current of the (gear) motor (6075_h) used.

Object description

Name	Max current	
Idx	Code	DT
6073 _h	VAR	U16

Values description

Meaning		Max current						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U16	rw	-	U16	-	AM	-	

- Current limiting* The current limitation by the device electronics is set by the object. If the actual current is limited by this value then the bit `Current limitation` in the status register, object `Manufacturer status register` (1002_h), bit 19 is set; see object `Current actual value` (6078_h).
- Motor phase current* The current motor phase current is shown by the object `Current actual value` (6078_h).
- Start up current limitation* During the acceleration phase current limitation can be increased compared to the set value using the parameter `Acceleration current factor` (object 60F9_h, sub-index 05_h). The current is set to the set value after the acceleration phase and after expiry of the time `Constant drive delay` (object 60F9_h, sub-index 04_h).

Limit value The entry for the maximum permissible current is limited by the smaller of the object values `Max motor current (6410h)`, sub-index 0E_h and `Max drive current (6510h)`, sub-index 01_h

10.4.81 6075_h Motor rated current

The object indicates the measuring current of the (gear) motor being used in milliamperes.

Object description

Name	Motor rated current		
Idx	Code	DT	
6075 _h	VAR	U32	

Values description

Meaning		Motor rated current						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	rw	-	U32	-	-	-	

The object value represents specification of the measuring current in the electronic data sheet of the (gear) motor, object `Motor data (6410h)`, sub-index 03_h.

The object value cannot be altered.

10.4.82 6078_h Current actual value

The object can be used to read out the currently measured motor phase current.

The value is given as a per thousand value based on the measuring current of the (gear) motor (6075_h) used.

Object description

Name	Current actual value		
Idx	Code	DT	
6078 _h	VAR	I16	

Values description

Meaning		Current actual value						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I16	ro	-	I16	-	-	-	

Current measurement

The motor phase current is detected and analysed over the current monitor by the controller firmware during the whole period of operation. The current monitor is read in with a 10 bit resolution and filtered.

Event: "Current limitation"

If the measured motor phase current reaches, the current limit value, object `Max current (6073h)` during the acceleration multiplied with object `60F9h`, sub-index 05_h: `Acceleration current factor`), then the bit `Current limitation` in the status register, object `Manufacturer status register (1002h)`, bit 19 is set, which means that the motor is driven with the current limitation.

Event: "I²t-overload current" The measured motor phase current is used with the aid of the I²t method for thermal monitoring of the motor. If the measured current exceeds the permissible continuous motor current (object 6410_h, sub-index 0D_h) for a period of time defined by the size of the current, then the bit Continuous motor current exceeded is set in the status register, object Manufacturer status register (1002_h), bit 21, and the applied movement command broken off. The status machine of the drive control branches into the status "Fault reaction active", object Statusword (6041_h); the motor is brought to a speed of rotation of 0 and the power output stage is deenergized.

Stores motor phase current The drive stores the maximum measured motor phase current for the current drive movement. This can be called up also after ending the drive movement; see object Overcurrent average value (200C_h).

10.4.83 6079_h DC link circuit voltage

The object indicates the current voltage on the motor DC bus in millivolts. The nominal voltage of the compact drive is 24VDC (±20%).

Object description

Name	DC link circuit voltage		
Idx	Code	DT	
6079 _h	VAR	U32	

Values description

Meaning	DC link circuit voltage							
Sdx	DT	AC	MP	VR	DF	AcI	SV	
00 _h	U32	ro	-	U32	-	-	-	

DC bus voltage The DC bus voltage is detected and analysed by the controller firmware for the whole period of operation. The measurement value is read in with a 10 bit resolution and filtered.

Event: "Overvoltage" If the measured DC bus voltage exceeds the upper tolerance value of the nominal voltage then the bit DC Link Over-voltage in the status register, object Manufacturer status register (1002_h), bit 4 is set; the drive control continues to remain ready.

If the measured DC bus voltage reaches the maximum value for the DC bus then the drive movement is interrupted for a short while the power amplifier is switched to become deenergized; The status machine of the drive control branches into the status "Fault Reaction active", object Statusword (6041_h).

Event "Undervoltage" If the measured DC bus voltage goes below the lower tolerance value of the nominal voltage then the bit DC Link Under-voltage in the status register, object Manufacturer status register (1002_h), bit 5 is set; the drive control continues to remain ready.

Event"Power-Fail Safe" If the supply voltage (Power-Fail) fails and thus also the DC bus voltage then the drive will be brought to a speed of rotation of 0 as soon as possible and the bit Mains under-voltage in the status register, object Manufacturer status register (1002_h), bit 7 set.

The current position of the drive, object `Position actual value` (6064_h) and of the logbook, object `Drive log-book`(200E_h), are written to the non-volatile configuration memory.

10.4.84 607A_h Target position

The object indicates a new position value which will be approached using the set values of the movement profile. The position value is set for the positioning mode according to DSP 402 and for the manufacturer-specific positioning mode.

Object description

Name	Target position		
Idx	Code	DT	
607A _h	VAR	I32	

Values description

Meaning		Target position						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I32	rww	Yes	I32	-	AM	-	

Sub-index 01_h

Specification of the position value takes place in Position units; see object `Position dimension index` (608A_h). For a compact drive it represents entry of the specification in motor increments.

PDO-Mapping

The position value is mapped in bytes 2..5 of the Receive-PDO R_PDO2; see object `2nd receive PDO mapping parameter` (1601_h).

Target position

Positioning is started by bit `New setpoint` in the control word of the status machine: Object `Controlword` (6040_h), bit 4. The position value is interpreted dependent on bit 6 of the control word as an absolute or relative position.

Positioning can only be executed from in the status "Operation Enabled" if the positioning mode is activated.

Plausibility checking

With transfer over of the start command for positioning, the drive checks whether the given target position is within the reference operating range W0 to W1. The drive will stop if this is not the case and reports EMCY error code FF22_h: Invalid position value

The operating range W0 - W1 is established over the object `Software position limit` (607D_h).

10.4.85 607D_h Software position limit

The object indicates the absolute limit switch positions for the operating range W0-W1. The drive can be operated between these limits. The limit switch positions refer to the point which was established by homing as a zero point.

Object description

Name	Software position limit		
Idx	Code	DT	
607D _h	ARR	I32	

Values description

Meaning		Number of elements					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	I32	ro	-	I32	2	-	-

Meaning		Min position limit					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	I32	rw	-	I32	-	HM	Yes

Meaning		Max position limit					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	I32	rw	-	I32	-	HM	Yes

Sub-index 01_h, 02_h Entry for the software limit switch takes place in Position units; see object Position dimension index (608A_h). For a compact drive it represents entry of the specification in motor increments.

limit switch ranges The compact drive knows three limit switch ranges which must be defined before operation through homing. The homing is started as an operating mode. The type of homing is given via the object Homing method (6098_h). The limit switch ranges to be defined are :

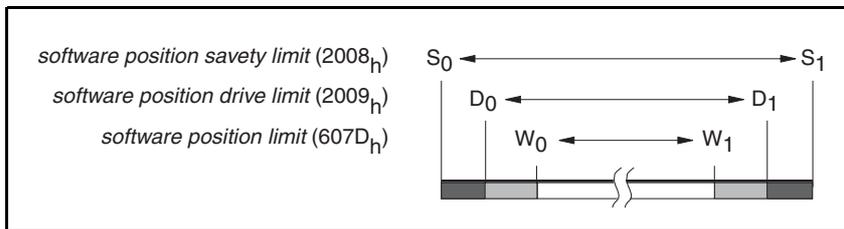


Figure 10.1 Limit switch ranges and objects

- Operating range W0-W1 in which positions can be approached.
- Movement range D0-D1, settable using object Software position drive limit (2009_h). If the drive leaves the operating range then it can be moved out of the movement range by jogging or moved back into the operating range by a positioning command.
- The safety range S0-S1, settable using object Software position safety limit (2008_h). If the current position is outside the movement range D0-D1, then the drive must be moved back mechanically into the operating range.

The operating range W0-W1, limited by the detent torque of the motor, on both sides must be set at least one increment smaller than the movement range D0-D1.

Deactivate limit switch The software limit switches be deactivated in that they are set on both sides to the respective maximum value:

- Min position limit = -2147483648
- Max position limit = +2147483647

Setting and storing values The values of the object are set in the operating mode homing and can be stored in the compact drive with the object Store parameters (1010_h), sub-index=03_h.

Acknowledgment information A total of the limit switch pairs must be set. The drive checks after every entry whether the values are valid. If, for example, two limit switch ranges overlap after the first entry then the drive issues the SDO error message 06040043_h. On setting the last limit switch the drive does, however, issue a positive feedback message.

10.4.86 607E_h Polarity

The object indicates the direction of rotation factor with which the direction of rotation of the motor can be reversed. Change in the direction of rotation factor is only possible in the operating mode homing (Homing mode) for the compact drive.

Object description

Name	Polarity
Idx	Code DT
607E _h	VAR U8

Values description

Meaning	Polarity
Sdx DT	AC MP VR DF AcI SV
00 _h U8	rw - U8 - HM Yes

Sub-index 07_h

Bit	Access	Value	Meaning
7	rw	0 _b	Position polarity:0 = multiplied by 11 = multiplied by -1
6	rw	0 _b	Velocity polarity:0 = multiplied by 11 = multiplied by -1
5..0	ro	00 _h	(reserved)

Direction of rotation

The direction of rotation of the compact drive is defined by a look at the rear side of the driven shaft. If the shaft turns clockwise the position values of the position memory increases with a positive direction of rotation factor to reach higher values.

Save value

The direction of rotation factor can be stored with the object `Store parameters (1010h)`, sub-index=03_h, in the compact drive.

10.4.87 607F_h Max profile velocity

The object indicates the maximum permissible speed of travel of the drive.

Object description

Name	Max profile velocity
Idx	Code DT
607F _h	VAR U32

Values description

Meaning	Max profile velocity
Sdx DT	AC MP VR DF AcI SV

00_h U32 rw - U32 - - -

Sub-index 01_h Specification of the speed value takes place in Velocity units; see object Velocity dimension index (608C_h). For a compact drive it represents entry in motor increments in seconds.

Maximum speed of travel The default value for the maximum speed of travel represents the maximum achievable speed of rotation of the motor shaft; Objekt Max motor speed (6080_h) und Objekt 6410_h, Subindex 01_h. Die maximal zulässige Fahrgeschwindigkeit kann nicht eingestellt werden.

10.4.88 6080_h Max motor speed

The object indicates the maximum achievable speed of rotation of the motor shaft in revolutions per minute.

Object description

Name	Max motor speed						
Idx	Code	DT					
6080 _h	VAR	U16					

Values description

Meaning	Max motor speed						
Sdx	DT	AC	MP	VR	DF	AcI	SV
00 _h	U16	rw	-	U16	-	-	-

The object value represents the specification in the electronic data sheet of the drive control; Objekt Max speed (6410_h), Subindex 01_h. Die maximal erreichbare Drehzahl kann nicht eingestellt werden.

10.4.89 6081_h Profile velocity

The object indicates the speed of travel of the drive after completing the acceleration phase. The value should not exceed the following limit values:

- Maximum speed, object Max profile velocity (607F_h)
- Maximum motor speed, object Max motor speed (6080_h)

Object description

Name	Profile velocity						
Idx	Code	DT					
6081 _h	VAR	U32					

Values description

Meaning	Profile velocity						
Sdx	DT	AC	MP	VR	DF	AcI	SV
00 _h	U32	rw	-	U32	-	AM	Yes

Sub-index 00_h Specification of the speed value takes place in Velocity units; see object Velocity dimension index (608C_h). For a compact drive it represents entry in motor increments in seconds.

Default value For option "standard interface", object Drive data (6510_h), sub-index Interface option type 0A_h=0, the drive changes after switching on automatically into manual operation (default operating mode). The default value represents the settings for the manual movement speed, see object Manuell mode settings (2011_h), sub-index 02_h.
For the other interface versions the default value represents the settings for the first of ten preconfigured movement profiles; see object User profile velocity (2004_h); sub-index 01_h.

10.4.90 6083_h Profile acceleration

The object prescribes the acceleration after starting positioning. If the value is greater than the limit value of the maximum profile acceleration, object Max acceleration (60C5_h), the drive limits the value of the maximum value and issues an SDO error message.

Object description

Name	Profile acceleration		
Idx	Code	DT	
6083 _h	VAR	U32	

Values description

Meaning	Profile acceleration							
Sdx	DT	AC	MP	VR	DF	AcI	SV	
00 _h	U32	rw	-	U32	-	AM	Yes	

Sub-index 00_h Entry of the acceleration value takes place in Acceleration units; see object Acceleration dimension index (608E_h). For the compact drive the specification represents an increase in motor increments per second squared.

Default value For option "standard interface", object Drive data (6510_h), sub-index Interface option type 0A_h=0, the drive changes after switching on automatically into manual operation (default operating mode). The default value represents the settings for the manual movement acceleration, see object Manuell mode settings (2011_h), sub-index 03_h.
For the other interface versions the default value represents the settings for the first of ten preconfigured movement profiles; see object User profile acceleration (2005_h); sub-index 01_h.

10.4.91 6084_h Profile deceleration

The object prescribes the delay needed to reach the target position. If the value is greater than the limit value of the maximum profile deceleration, object Max deceleration (60C6_h), the drive limits the value of the maximum value and issues a SDO-error message.

Object description

Name	Profile deceleration		
Idx	Code	DT	
6084 _h	VAR	U32	

Values description

Meaning		Profile deceleration					
Sdx	DT	AC	MP	VR	DF	AcI	SV
00 _h	U32	rw	-	U32	-	AM	Yes

Sub-index 00_h

Entry of the deceleration value takes place in Acceleration units; see object `Acceleration dimension index (608Eh)`. For the compact drive the specification represents an increase in motor increments per second squared.

Default value

For option "standard interface", object `Drive data (6510h)`, sub-index `Interface option type 0Ah=0` the drive changes after switching on automatically into manual operation (default operating mode). The default value represents the settings for the manual movement deceleration, see object `Manuell mode settings (2011h)`, sub-index 04_h.

For the other interface versions the default value represents the settings for the first of ten preconfigured movement profiles; see object `User profile deceleration (2006h)`, sub-index 01_h.

10.4.92 6085_h Quick stop deceleration

The object prescribes the delay for a rapid stop (Quick stop).

Object description

Name	Quick stop deceleration		
Idx	Code	DT	
6085 _h	VAR	U32	

Values description

Meaning		Quick stop deceleration					
Sdx	DT	AC	MP	VR	DF	AcI	SV
00 _h	U32	rw	-	U32	-	-	-

Sub-index 00_h

Specification of the rapid stop deceleration is in acceleration units; see object `Acceleration dimension index (608Eh)`. For a compact drive the specification represents an increase in motor increments per second squared.

Default value

The default value for the rapid stop deceleration represents the minimum deceleration ramp of the compact drive, see object `Max deceleration (60C6h)`. The rapid stop deceleration cannot be adjusted.

10.4.93 6086_h Motion profile type

The object is used to set a drive movement eingestellt according to the type of movement profile.

Object description

Name	Motion profile type		
Idx	Code	DT	
6086 _h	VAR	I16	

Values description

Meaning		Motion profile type					
Sdx	DT	AC	MP	VR	DF	Accl	SV
00 _h	116	rw	-	0..0	0	-	-

Sub-index 00_h

0	Linear ramp (trapezoid profile)
1	Sin ² Ramp (not used)
2	jerk-free ramp (not used)
3	jerk-limited ramp (not used)
4 ... 32767	(reserved for future profile types)
-32768 ... -1	Manufacturer-specific (not used)

Default value

The compact drive only supports trapezoid movement profiles (linear ramp, value="0").

10.4.94 6089_h Position notation index

The position units of the compact drive are scaled by the object.

Object description

Name Position notation index		
Idx	Code	DT
6089 _h	VAR	I8

Values description

Meaning		Position notation index					
Sdx	DT	AC	MP	VR	DF	Accl	SV
00 _h	I8	rw	-	0..0	0	-	-

Scaling

The position units of the compact drive cannot be scaled.

Position units

see object Position dimension index (608A_h).

10.4.95 608A_h Position dimension index

The position units of the compact drive are set by the object (Position units). The units of the following object are determined in this way:

- Position demand value (6062_h)
- Position actual value (6064_h)
- Following error window (6065_h)
- Position window (6067_h)
- Target position (607A_h)
- Position range limit (607B_h)
- Home offset (607C_h)
- Software position limit (607D_h)
- Following error actual value (60F4_h)
- Target velocity (60FF_h)

*Object description***Name** Position dimension index**Idx Code DT**608A_h VAR U8*Values description***Meaning** Position dimension index**Sdx DT AC MP VR DF Acl SV**00_h U8 rw - 0..0 0 - -

See device profile CiA DSP-402 for a detailed description.

Position units

The position units arise from position detection via the Hall sensors; the position units cannot be adjusted.

All position values are stored in increments (Inc).**10.4.96 608B_h Velocity notation index**The object 608B_h is used to scale the speed units of the compact drive.*Object description***Name** Velocity notation index**Idx Code DT**608B_h VAR I8*Values description***Meaning** Velocity notation index**Sdx DT AC MP VR DF Acl SV**00_h I8 rw - 0..0 0 - -*Scaling*

The speed units of the compact drive cannot be scaled.

*Speed units*see object Velocity dimension index (608C_h).**10.4.97 608C_h Velocity dimension index**

The speed units of the compact drive are set by the object (Velocity units). The units of the following object are determined in this way:

- Velocity demand value (606B_h)
- Velocity actual value (606C_h)
- Velocity window (606D_h)
- Velocity threshold (606F_h)
- Max profile velocity (607F_h)
- Profile velocity (6081_h)
- End velocity (6082_h)
- Homing speeds (6099_h)
- Max slippage (60F8_h)

- Target velocity (60FF_h)

Object description

Name Velocity dimension index

Idx	Code	DT
608C _h	VAR	U8

Values description

Meaning Velocity dimension index

Sdx	DT	AC	MP	VR	DF	ACL	SV	CP
00 _h	U8	rw	-	0..0	0	-	-	

See device profile CiA DSP-402 for a detailed description.

Speed units

Speed of rotation measurement takes place in the same way as position detection via the Hall sensors; the speed units cannot be adjusted.



All speed values are stored in increments per second (Inc/sec).

For positioning movements the advance sign of the speed comes from the position difference.

10.4.98 608D_h Acceleration notation index

The acceleration units of the compact drive are scaled by the object.

Object description

Name Acceleration notation index

Idx	Code	DT
608D _h	VAR	I8

Values description

Meaning Acceleration notation index

Sdx	DT	AC	MP	VR	DF	ACL	SV
00 _h	I8	rw	-	0..0	0	-	-

Scaling

The acceleration units of the compact drive cannot be scaled.

Acceleration units

see object Acceleration dimension index (608E_h).

10.4.99 608E_h Acceleration dimension index

The acceleration units of the compact drive are set by the object (acceleration units). The units of the following object are determined in this way:

- Profile acceleration (6083_h)
- Profile deceleration (6084_h)
- Quick stop deceleration (6085_h)
- Homing acceleration (609A_h)
- Max acceleration (60C5_h)
- Max deceleration (60C6_h)

Object description

Name	Acceleration dimension index					
Idx	Code	DT				
608E _h	VAR	U8				

Values description

Meaning	Acceleration dimension index								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	U8	rw	-	0..0	0	-	-		

See device profile CiA DSP-402 for a detailed description.

Acceleration units

The acceleration units are given as an increase; the acceleration units cannot be adjusted.



All acceleration and deceleration values are stored in increments per second squared (Inc/sec²).

10.4.100 608F_h Position encoder resolution

The object indicates the resolution of the positions detection based on one turn of the gear output shaft.

Object description

Name	Encoder increments					
Idx	Code	DT				
608F _h	ARR	U32				

Values description

Meaning	Number of elements								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
00 _h	U32	ro	-	U32	2	-	-		

Meaning	Encoder increments								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
01 _h	U32	rw	-	U32	-	-	-		

Meaning	Motor revolutions								
Sdx	DT	AC	MP	VR	DF	Acl	SV		
02 _h	U32	rw	-	U32	-	-	-		

The resolution follows from the motor data:

Resolution =
Hall sensor number × 2 × motor pole pairs × gear ratio

- Hall sensor number = 3, see Drive data (6510_h), sub-index 06_h

- Motor pole pair number, see `Motor data (6410h)`, sub-index 0B_h
- Gear ratio is dependent on the drive type, see object `Gear ratio (6091h)`

The resolution of the position detection at the gear output cannot be adjusted.

10.4.101 6091_h Gear ratio

The object indicates the gear ratio of a compact drive. It comes from the relationship of engine revolutions to revolutions of the gear output shaft.

Object description

Name		
Gear ratio		
Idx	Code	DT
6091 _h	ARR	U32

Values description

Meaning		Number of elements					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U32	ro	-	U32	2	-	-

Meaning		Motor revolutions					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	-	-	-

Meaning		Shaft revolutions					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	rw	-	U32	-	-	-

Gear ratio = value (sub-index 02_h) / value (sub-index 01_h)

The gear ratio of the compact drive cannot be adjusted.

10.4.102 6098_h Homing method

The object indicates the method of performing homing.

Homing methods

The following homing methods are available, according to the connected sensor:

- to the reference sensor (Home-switch)
- to an end position sensor (Limit-switch)
- to the reference sensor with reverse an end position sensor
- to the next right or link index pulse
- to the current position
- Based on a position assignment

Reference movement

A reference movement consists of two drive movements:

- Searching of the reference sensor in the valid operating range.

- Movement to the position 0 on the logical position memory

For both drive movements different speeds of travel can be selected for a reference movement; see object *Homing speeds* (6099_h).

Object description

Name	Homing method		
Idx	Code	DT	
6098 _h	VAR	I8	

Values description

Meaning	Homing method							
Sdx	DT	AC	MP	VR	DF	AcI	SV	
00 _h	I8	rw	-	I32	-1	AM	-	

Sub-index 00_h

Value	Meaning
-128..-2	Manufacturer-specific (not supported)
-1	Through assignment by means of a position counter
1	To a negative end position sensor and index pulse to the right
2	To a positive end position sensor and index pulse to the left
3	To a positive reference switch and index pulse to the left
4	To a positive reference switch and index pulse to the right
5	To a negative reference switch and index pulse to the right
6	To a negative reference switch and index pulse to the left
7	To a positive reference switch and index pulse to the left, first movement due to clockwise rotation
8	To a positive reference switch and index pulse to the right, first movement due to clockwise rotation
9	To a negative reference switch and index pulse to the left, first movement due to clockwise rotation
10	To a negative reference switch and index pulse to the right, first movement due to clockwise rotation
11	To a negative reference switch and index pulse to the right, first movement due to anticlockwise rotation
12	To a negative reference switch and index pulse to the left, first movement due to anticlockwise rotation
13	To a positive reference switch and index pulse to the right, first movement due to anticlockwise rotation
14	To a positive reference switch and index pulse to the left, first movement due to anticlockwise rotation
15..16	(reserved)
17	To a negative end position sensor (negative transition)
18	To a positive end position sensor (negative transition)
19	To a positive reference switch (negative transition)
20	To a positive reference switch (positive transition)
21	To a negative reference switch (negative transition)
22	To a negative reference switch (positive transition)

Value	Meaning
23	To a positive reference switch (negative transition), first movement due to clockwise rotation
24	To a positive reference switch (positive transition), first movement due to clockwise rotation
25	To a negative reference switch (positive transition), first movement due to clockwise rotation
26	To a negative reference switch (negative transition), first movement due to clockwise rotation
27	To a negative reference switch (negative transition), first movement due to anticlockwise rotation
28	To a negative reference switch (positive transition), first movement due to anticlockwise rotation
29	To a positive reference switch (positive transition), first movement due to anticlockwise rotation
30	To a positive reference switch (negative transition), first movement due to anticlockwise rotation
31..32	(reserved)
33	To an index pulse to the link
34	To an index pulse to the right
35	To the current position
36..127	(reserved)

Homing methods

Selection of the referencing method depends on which sensors are excluded from the application on the drive controller. The function and polarity of the sensor signals are established with the following objects:

- Negative limit-switch settings (2013_h)
- Positive limit-switch settings (2014_h)
- Home-switch settings (2015_h)

A reference movement is only possible for the product version with option "sensor interface"; siehe Objekt Drive data (6510_h), Subindex Interface option 0A_h=1. Bei den Optionen "Standardinterface" und "Sicherer Halt" kann ausschließlich die herstellereigene Methode durch Wertzuweisung gewählt werden (Methode -1).

Starting a reference movement

A reference movement is initiated in the operating mode Homing mode by setting the bit `Homing_start` (value 0 -> 1) in the control word of the status machine: Object `Controlword` (6040_h), bit 12. The Statemachine must therefore be brought into the status "Operation Enabled"; with the exception of method -1 (Homing by position-counter assignment).

Ending a reference movement

Ending of a reference movement is indicated in the status word of Statemachine, object `Statusword` (6041_h):

- Bit 12 (`Homing_attained`) indicates the successful end of a reference movement (value 0 -> 1); the drive is at the logical position 0.
- Bit 13 (`Homing_Error`) indicates that an error has occurred during the reference movement (value 1).

Homing...

... due to value assignment

The reference point is established via the object `Position` assignment value (`200Bh`).

Position specifications for the reference point refer to the current position of the drive. On starting homing the value of the object `Position` assignment value (`200Bh`) is adopted as a position value; `Position` actual value (`6064h`).

The reference position is mapped in the operating mode homing together with the control word of the status machine (`controlword`) in the receive-PDO `R_PDO2`; see object 2nd receive PDO mapping parameter (`1601h`).

... to the reference sensor

[To Be Continued]

... to an end position sensor

[To Be Continued]

... to the reference sensor with reversing an end position sensor

[To Be Continued]

... to the current position

[To Be Continued]

... to the index pulse

[To Be Continued]

Setting the operating mode See object `Modes of operation` (`6060h`).

10.4.103 6099_h Homing speeds

The speed of travel for a reference movement is set by the object. A reference movement consists of two drive movements:

- Searching of the reference sensor on the mechanical position memory
- Movement to the position 0 on the logical position memory

For both drive movements different speeds of travel can be selected for a reference movement;

Object description

Name	Homing speeds		
Idx	Code	DT	
6099 _h	ARR	U32	

Values description

Meaning	Number of elements								
Sdx	DT	AC	MP	VR	DF	ACL	SV		
00 _h	U32	ro	-	U32	2	-	-		

Meaning		Speed during search for switch					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U32	rw	-	U32	-	HM	Yes

Meaning		Speed during search for zero					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U32	rw	-	U32	-	HM	Yes

Sub-index 01_h, 02_h Entry of the speed value takes place in Velocity units; see object Velocity dimension index (608C_h). For a compact drive it represents entry in motor increments in seconds.

Limit value The entry for the speed value for a reference movement is limited by the value of the object Max profile velocity (607F_h) .

Searching of the sensor The value in sub-index 1 prescribes the speed of travel during searching of the reference sensor on the mechanical position memory.

Movement to the zero position The value in sub-index 2 prescribes the speed of travel for movement to the position 0 on the logical position memory.

Setting and storing values The values of the object are set in the operating mode homing and can be stored in the compact drive with the object Store parameters (1010_h), sub-index=03_h.

Homing See object Homing method (6098_h).

10.4.104 609A_h Homing acceleration

The object prescribes the acceleration for a reference movement. If the value is greater than the limit value of the maximum profile acceleration, object Max acceleration (60C5_h), the drive limits the value of the maximum value and issues an SDO error message.

Object description

Name			Homing acceleration
Idx	Code	DT	
609A _h	VAR	U32	

Values description

Meaning		Homing acceleration					
Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U32	rw	-	U32	-	HM	Yes

Sub-index 00_h Entry of the acceleration value takes place in Acceleration units; see object Acceleration dimension index (608E_h). For the compact drive the specification represents an increase in motor increments per second squared.

Setting and storing a value The values of the object are set in the operating mode homing and can be stored with the object Store parameters (1010_h), sub-index=03_h, in a compact drive.

Homing See Objekt Homing method (6098_h).

10.4.105 60C5_h Max acceleration

The object indicates the maximum permissible acceleration.

Object description

Name	Max acceleration		
Idx	Code	DT	
60C5 _h	VAR	U32	

Values description

Meaning		Max acceleration						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	rw	-	U32	-	-	-	

Sub-index 00_h

Specification of the maximum permissible profile acceleration takes place in Acceleration units; see object `Acceleration dimension index (608Eh)`. For the compact drive the specification represents an increase in motor increments per second squared.

Maximum acceleration

The default value for the maximum permissible acceleration represents the minimum acceleration ramp of the compact drive, see object `Drive data (6510h)`, sub-index=04_h. The maximum permissible acceleration cannot be adjusted.

10.4.106 60C6_h Max deceleration

The object indicates the maximum permissible deceleration.

Object description

Name	Max deceleration		
Idx	Code	DT	
60C6 _h	VAR	U32	

Values description

Meaning		Max deceleration						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	rw	-	U32	-	-	-	

Sub-index 00_h

Specification of the maximum permissible profile deceleration takes place in Acceleration units; see object `Acceleration dimension index (608Eh)`. For the compact drive the specification represents an increase in motor increments per second squared.

Maximum deceleration

The default value for the maximum permissible acceleration represents the minimum deceleration ramp of the compact drive, see object `Drive data (6510h)`, sub-index=05_h. The maximum permissible acceleration cannot be adjusted.

10.4.107 60F9_h Velocity control parameter set

The object contains all adjustable parameters of the speed regulator.

Object description

Name	Velocity control parameter set
------	--------------------------------

Idx	Code	DT
60F9 _h	REC	UD

Values description

Meaning		Number of entries						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U8	ro	-	U8	9	-	-	

Meaning		V: gain						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
01 _h	U16	rw	-	U16	-	CM	Yes	

Meaning		Ti: integration time constant						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
02 _h	U16	rw	-	U16	-	CM	Yes	

Meaning		Start-up timeout						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
03 _h	U16	rw	-	U16	-	CM	Yes	

Meaning		Constant drive delay						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
04 _h	U8	rw	-	U8	-	CM	Yes	

Meaning		Acceleration current factor						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
05 _h	U8	rw	-	U8	-	CM	Yes	

Meaning		Max current events						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
06 _h	U16	rw	-	U16	-	CM	Yes	

Meaning		Block deceleration						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
07 _h	U16	rw	-	U16	-	CM	Yes	

Meaning		Reserved						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
08 _h								

Meaning		Kp cmd						
Sdx	DT	AC	MP	VR	DF	Acl	SV	

	09 _h	U16	rw	-	U16	-	CM	Yes
<i>Store values</i>	The settings can be set in configuration mode (object 6060 _h , sub-index 00 _h =80 _h) and stored with the object <i>Store parameters</i> (1010 _h), sub-index=03 _h , in the compact drive.							
<i>Factory setting</i>	The factory setting can be accessed through loading the application parameter in configuration mode. Details about restoring the factory setting are described for the communication object <i>Restore default parameters</i> (1011 _h).							
<i>Sub-index 01_h</i>	V: gain							
	The parameter <i>Gain</i> (amplification) is used to set the parameter <i>Kp</i> of the speed of rotation controller principle. The DC bus voltage <i>U_{Zwi}</i> is standardised to the maximum value 24V and the speeds of rotation <i>n_{Nominal}</i> and <i>n_{Actual}</i> to <i>n_{Max}</i> in motor increments per second.							
	The specification takes place in [1/1000]; Value range 0 to 50000.							
	Controller principle							
	$U_{zwi} = Kp * (n_{soll} - n_{ist}) + Kp_{cmd} * n_{soll} + \frac{Kp}{Tn} * \int (n_{soll} - n_{ist}) dt$							
<i>Sub-index 02_h</i>	Ti: integration time constant							
	The parameter <i>Integration time constant</i> (integration time constants) is used to set the parameter <i>TI</i> of the controller principle. The DC bus voltage <i>U_{Zwi}</i> is standardised to the maximum value 24V and the speeds of rotation <i>n_{Nominal}</i> and <i>n_{Actual}</i> to <i>n_{Max}</i> in motor increments per second.							
	The specification takes place in [ms]; value range 1 to 4100.							
<i>Sub-index 03_h</i>	Start-up timeout							
	If the motor does not start within the time window rotational speed monitoring motor start, the bit <i>Motor start-up error</i> in the status register, object <i>Manufacturer status register</i> (1002 _h), bit 17 is set.							
	The specification takes place in [ms]; value range 50 - 8000.							
<i>Sub-index 04_h</i>	Constant drive delay							
	The parameter <i>Constant drive delay</i> is used to set the deceleration at the end of the acceleration phase. Monitoring of the speed of rotation begins after expiry of this time. The current limitation is also altered from the acceleration value (adjustable with sub-index 05 _h ; <i>Acceleration current factor</i>) to the value <i>Max Current</i> (6073 _h).							
	The specification takes place in [ms]; value range 0 to 255.							
<i>Sub-index 05_h</i>	Acceleration current factor							
	The parameter <i>Acceleration current factor</i> is to increase the current limitation during the acceleration phase compared to the value							

Max Current (6073_h). The current is set according to the acceleration phase and after expiry of the time Constant drive delay (sub-index 04_h) to the value Max Current (6073_h). The acceleration current is limited by the values Max motor current 6410_h), sub-index 0E_h) and Max drive current (6510_h), sub-index 01_h.

The specification takes place in [percent]; value range 100 to 255.

Sub-index 06_h **Max current events**

The parameter Max current events is used to set the event counter limit for the maximum current (object 6073_h; Max Current). During every regulating cycle there is a check made to see whether current limitation was active in the last cycle. If this is the case then the counter increments upwards, otherwise downwards. If the counter reaches the value "Max current events" then the bit Current limitation in the status register (object 1002_h: Manufacturer status register, bit 18) is set.

If the maximum value is set then setting of the status flag Current limitation is switched off. The current will however be limited.

The parameter is dimensionless; Value range 50 to 65535.

Sub-index 07_h **Block deceleration**

Block movement deceleration provides for a drive stop (e.g. at meeting an obstacle), when within a fixed time window of ten milliseconds the speed drops the value set in block deceleration, and at the same time the preset current limitation is exceeded. The bit Block movement in the status register, object Manufacturer status register (1002_h), bit 20, is set and the drive is stopped immediately.

The value for the block movement deceleration should not be selected too small in order to avoid premature triggering. Internally the controller operates with unfiltered speed of rotation values in order to recognise a drop in speed of rotation without deceleration. Thus wrong measurements can particularly occur in the start up phase and for small current values.

The specification takes place in [Inc/s per 10ms]; Value range 200 to 5000.

Sub-index 09_h **Kp cmd**

With the parameter K_p cmd, the speed controller can be expanded by an additional reference variable input. The DC bus voltage U_{Zwi} is standardised to the maximum value 24V and the speeds of rotation n_{Nominal} and n_{Actual} to n_{Max} in motor increments per second.

Controller principle:

$$U_{zwi} = K_p * (n_{soll} - n_{ist}) + K_{p\ cmd} * n_{soll} + \frac{K_p}{T_n} * \int (n_{soll} - n_{ist}) dt$$

The specification takes place in [1/1000]; Value range 0 to 5000.

10.4.108 60FB_h Position control parameter set

The object contains all adjustable parameters of the position controller.

Object description

Name	Position control parameter set							
Idx	Code	DT						
60FB _h	REC	UD						

Values description

Meaning	Number of entries							
Sdx	DT		AC	MP	VR	DF	Acl	SV
00 _h	U8		ro	-	U8	2	-	-

Meaning	Holding torque time							
Sdx	DT		AC	MP	VR	DF	Acl	SV
01 _h	U16		rw	-	U16	-	CM	Yes

Meaning	Holding torque current							
Sdx	DT		AC	MP	VR	DF	Acl	SV
02 _h	U16		rw	-	U16	-	CM	Yes

Store values The settings can be set in configuration mode (object 6060_h, sub-index 00_h=80_h) and stored with the object *Store parameters* (1010_h), sub-index=03_h, in the compact drive.

Factory setting The factory setting can be accessed through loading the application parameter in configuration mode. Details about restoring the factory setting are described for the communication object *Restore default parameters* (1011_h).

Sub-index 01_h Holding torque time The parameter *Holding torque time* is used to specify the period of the holding torque which comes into force in positioning mode on achieving the target position.

The specification takes place in [ms]; value range 0 to 5000.

Sub-index 02_h Holding torque current The parameter *Holding torque current* is used to set the level of the current during the stopping torque phase. The current is limited by the values *Max motor current* (6410_h), sub-index 0E_h and *Max drive current* (6510_h), sub-index 01_h.

The specification takes place in [mA]; value range 50 to a minimum *MaxMotorCurrent* and *MaxDriveCurrent*.

10.4.109 60FD_h Digital inputs

The object indicates the signal state of digital inputs to the device. The value "1" represents the signal state "High" and means: Input "actuated".

Object description

Name	Digital inputs							
-------------	----------------	--	--	--	--	--	--	--

Idx	Code	DT
60FD _h	VAR	U32

Values description

Meaning		Digital inputs						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	ro	Yes	U32	–	–	–	

Sub-index 00_h

Bit	Meaning
31-30	(not used)
29	(not used)
28	(not used)
27	Emergency-Stop signal EMERGENCY STOP
26	Hall sensor W
25	Hall sensor V
24	Hall sensor U
23	Absolute sensor 1
22	Absolute sensor 2
21-18	(not used)
17	Input signal MAN-P
16	Input signal MAN-N
15-4	(reserved)
3	Interlock (not used)
2	Homing switch (Home switch, REF)
1	Positive end position sensor (Positive limit switch, LIM-P)
0	Negative end position sensor (Negative limit switch, LIM-N)

10.4.110 60FF_h Target velocity

The object is used to enter the set speed of a drive movement in the operating mode "Profile velocity mode".

Object description

Name	Target velocity	
Idx	Code	DT
60FF _h	VAR	I32

Values description

Meaning		Target velocity						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	I32	rww	Yes	I32	–	AM	–	

Sub-index 01_h

Specification of the speed value takes place in Velocity units; see object Velocity dimension index (608C_h). For a compact drive it represents entry in motor increments per second.

Setpoint speed A drive movement in Profile Velocity mode is started by deleting the bit `Halt` (value 1 -> 0) in the control word of the status machine: Object `Controlword` (6040_h), bit 8. Drive movements can only be executed from the status "Operation Enabled" if the speed mode (Profile Velocity mode) is activated.

Software limit switches If the software limit switches are active (object 607D_h), then these will be applied, also in speed mode (Profile Velocity mode). If the drive moves out of the referenced operating range W0 - W1 then the drive movement is broken off. The status machine of the drive control branches into the status "Quick stop active", object `Statusword` (6041_h). The operating range W0 - W1 is established over the object `Software position limit` (607D_h). The reaction of the drive to leaving the operating range is established with object `Quick stop option code` (605A_h).

PDO-Mapping The speed value is mapped in bytes 2..5 of Receive-PDO R_PDO3; see object `3rd receive PDO mapping parameter` (1602_h).

10.4.111 6402_h Motor type

The motor type used can be queried using the object.

Object description

Name	Motor type		
Idx	Code	DT	
6402 _h	VAR	U16	

Values description

Meaning		Motor type						
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U16	rw	-	U16	11	-	-	

Sub-index 00_h

0	Non-standard motor
1	Phase modulated DC Motor
2	Frequency-controlled DC Motor
3	PM synchronous motor
4	FE Synchronous motor
5	Switched reluctance motor
6	Wound rotor induction motor
7	Squirrel cage induction motor
8	Stepper motor
9	Micro-step stepper motor
10	Sinus form PM BL motor
11	Trapezoid PM BL motor

Sub-index 00_h, default value For drive control IcIA this is a block commutated, brush-less DC motor (value="11"). The value cannot be altered.

10.4.112 6404_h Motor manufacturer

The object indicates the motor manufacturer.

Object description

Name Motor manufacturer

Idx Code DT

6404_h VAR VS

Values description

Meaning Motor manufacturer

Sdx DT AC MP VR DF Acl SV

00_h VS rw – VS – – –

The object `Device information (2100h)` contains further information about the device. The value cannot be altered.

10.4.113 6406_h Motor calibration date

The object shows the manufacture date or the date of the last inspection.

Object description

Name Motor calibration date

Idx Code DT

6406_h VAR Date

Values description

Meaning Motor calibration date

Sdx DT AC MP VR DF Acl SV

00_h Date rw – Date – PM Yes

10.4.114 6410_h Motor data

The object indicates the technical data and settings for the connected motor and gear. The setting value are dependent on the device type.

Object description

Name Motor data

Idx Code DT

6410_h REC UD

Values description

Meaning Number of entries

Sdx DT AC MP VR DF Acl SV

00_h U8 ro – U8 21 – –

Meaning Max speed

Sdx DT AC MP VR DF Acl SV

01_h U16 rw – U16 – PM Yes

Meaning		Nominal speed					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Nominal motor current					
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Motor torque constant					
Sdx	DT	AC	MP	VR	DF	Acl	SV
04 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Gear shaft revolutions					
Sdx	DT	AC	MP	VR	DF	Acl	SV
05 _h	U32	rw	–	U32	–	PM	Yes

Meaning		Gear motor revolutions					
Sdx	DT	AC	MP	VR	DF	Acl	SV
06 _h	U32	rw	–	U32	–	PM	Yes

Meaning		Gear stages					
Sdx	DT	AC	MP	VR	DF	Acl	SV
07 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Gear efficiency					
Sdx	DT	AC	MP	VR	DF	Acl	SV
08 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Nominal gear torque					
Sdx	DT	AC	MP	VR	DF	Acl	SV
09 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Gear detent torque					
Sdx	DT	AC	MP	VR	DF	Acl	SV
0Ah	U16	rw	–	U16	–	PM	Yes

Meaning		Pole pairs					
Sdx	DT	AC	MP	VR	DF	Acl	SV
0B _h	U8	rw	–	U8	–	PM	Yes

Meaning	Encoder resolution						
Sdx	DT	AC	MP	VR	DF	Acl	SV
0C _h	U16	rw	-	U16	-	PM	Yes

Meaning	Continuous motor current						
Sdx	DT	AC	MP	VR	DF	Acl	SV
0D _h	U16	rw	-	U16	-	PM	Yes

Meaning	Max motor current						
Sdx	DT	AC	MP	VR	DF	Acl	SV
0E _h	U16	rw	-	U16	-	PM	Yes

Meaning	Max overload time						
Sdx	DT	AC	MP	VR	DF	Acl	SV
0F _h	U16	rw	-	U16	-	PM	Yes

Meaning	Rotor inertia						
Sdx	DT	AC	MP	VR	DF	Acl	SV
10 _h	U16	rw	-	U16	-	PM	Yes

Meaning	Terminal resistance						
Sdx	DT	AC	MP	VR	DF	Acl	SV
11 _h	U16	rw	-	U16	-	PM	Yes

Meaning	Terminal inductivity						
Sdx	DT	AC	MP	VR	DF	Acl	SV
12 _h	U16	rw	-	U16	-	PM	Yes

Meaning	Generator voltage constant						
Sdx	DT	AC	MP	VR	DF	Acl	SV
13 _h	U16	rw	-	U16	-	PM	Yes

Meaning	GV 5th harmonic content						
Sdx	DT	AC	MP	VR	DF	Acl	SV
14 _h	I16	rw	-	I16	-	PM	Yes

Meaning	GV 7th harmonic content						
Sdx	DT	AC	MP	VR	DF	Acl	SV
15 _h	I16	rw	-	I16	-	PM	Yes

The motor and gear in a compact drive are not exchangeable. Therefore data cannot be altered.

Sub-index 01_h **Max speed**

The parameter `Max speed` (max. speed at the gear output) is used to specify the maximum speed of rotation of the drive at the shaft output of the gear.

The specification takes place in [min^{-1}].

Sub-index 02_h **Nominal speed**

The parameter `Nominal speed` (measuring speed of rotation at the gear output) indicates the measuring speed of rotation of the drive at the shaft output of the gear.

The specification takes place in [min^{-1}].

Sub-index 03_h **Nominal motor current**

The parameter `Nominal motor current` (measuring current of the (gear) motor) indicates the peak value of the measuring current in the motor phase. This value is either determined by the motor or by the measuring torque of the gear

The specification takes place in [mA];

Sub-index 04_h **Motor torque constant**

The parameter `Motor torque constant` (torque constant) show the relationship between torque and the rms value of the phase current.

The specification takes place in [10^{-3} Ncm/A].

Sub-index 05_h **Gear shaft revolutions**

The parameter `Gear shaft revolutions` (gear step-down, output) indicates the reduction ratio of the gear together with the parameter gear step-down (motor).

The parameter does not have a unit.

Sub-index 06_h **Gear motor revolutions**

The parameter `Gear motor revolutions gear step-down, motor` indicates the reduction ratio of the gear together with the parameter gear step-down (output).

The parameter does not have a unit.

Sub-index 07_h **Gear stages**

The parameter `Gear stages` (number of gear stages) is used to establish how many gear stages the drive is designed for.

The parameter does not have a unit.

Sub-index 08_h **Gear efficiency**

The parameter `Gear efficiency` (gear efficiency) indicates the efficiency of the gear.

The specification takes place in [parts per thousand].

- Sub-index 09_h* **Nominal gear torque**
- The parameter `Nominal gear torque` (measuring torque of the gear) indicates the measuring torque at the shaft output of the gear.
- The specification takes place in [10^{-3} Nm].
- Sub-index 0A_h* **Gear detent torque**
- The parameter `Gear detent torque` (detent torque of the gear) indicates which torque must be produced to move the gear axle for a stationary motor.
- The specification takes place in [10^{-3} Nm].
- Sub-index 0B_h* **Pole pairs**
- The parameter `Pole pairs` (pole pair number) indicates the number of pair of poles on the motor.
- The parameter does not have a unit.
- Sub-index 0C_h* **Encoder resolution**
- The parameter `Encoder resolution` (resolution of the incremental encoder) indicates the resolution of the incremental encoder in pulses per revolution.
- The parameter does not have a unit. The value 0 means that no incremental encoder is installed on the device vorhanden ist.
- Sub-index 0D_h* **Continuous motor current**
- The parameter `Continuous motor current` indicates the permanent load current (rms value in the motor phase) of the motor. This current describes the thermal loading limit of the motor and is used for for I^2t monitoring.
- The specification takes place in [mA];
- Sub-index 0E_h* **Max motor current**
- The parameter `Max motor current` indicates the maximum phase current (rms value) of the (gear) motor. This value is either determined by the motor or by the maximum torque of the gear. The parameter limits the adjustable operating current (object 6073_h). The parameter is also used for the limit value in the I^2t monitoring.
- The specification takes place in [mA];
- Sub-index 0F_h* **Max overload time**
- The parameter `Max overload time` indicates the maximum time for which the (gear) motor can be driven at maximum current (max/ gear motor current, sub-index 0E_h). The parameter is also used for the limit value in the I^2t monitoring.
- The specification takes place in [s].
- Sub-index 10_h* **Rotor inertia**
- The parameter `Rotor inertia` indicates the mass moment of inertia of the rotor.

- The specification takes place in [gcm²]
- Sub-index 11_h* **Terminal resistance**
 The parameter `Terminal resistance` (connection resistance) indicates the ohm resistance existing between two motor terminals.
 The specification takes place in [mW].
- Sub-index 12_h* **Terminal inductivity**
 The parameter `Terminal inductivity` (connection inductivity) indicates the winding inductance existing between two motor terminals.
 The specification takes place in [μH].
- Sub-index 13_h* **Generator voltage constant**
 The parameter `Generator voltage constant` (alternator voltage constants) indicates for operation of an alternator the amplitude of the sinus form open-circuit voltage based on the speed of rotation.
 The specification takes place in [μV/min⁻¹].
- Sub-index 14_h* **GV 5th harmonic content**
 The parameter `GV 5th harmonic content` indicates the part of the 5th harmonic harmonic wave in the alternator voltage based on the alternator voltage constants (sub-index 13_h).
 The specification takes place in [1/1000].
- Sub-index 15_h* **GV 7th harmonic content**
 The parameter `GV 7th harmonic content` indicates the part of the 7th harmonic harmonic wave in the alternator voltage based on the alternator voltage constants (sub-index 13_h).
 The specification takes place in [1/1000].

10.4.115 6502_h Supported drive modes

The object indicates the operating modes which can be executed with the device.

Object description

Name	Supported drive modes		
Idx	Code	DT	
6502 _h	VAR	U32	

Values description

Meaning	Supported drive modes							
Sdx	DT	AC	MP	VR	DF	Acl	SV	
00 _h	U32	ro	-	U32	-	-	-	

Sub-index 00_h

Bit	Access	Value	Meaning
31	ro	1 _b	Configuration mode (manufacturer-specific)
30..19	ro	000 _h	(not used)

Bit	Access	Value	Meaning
18	ro	1 _b	Simulated manual mode (manufacturer-specific)
17	ro	1 _b	Manufacturer-specific Profile Position mode
16	ro	X _b	Manual mode (manufacturer-specific)
15..7	ro	00 _h	(reserved)
6	ro	0 _b	Interpolated Position mode
5	ro	1 _b	Homing mode
4	ro	0 _b	(reserved)
3	ro	0 _b	Profile Torque mode
2	ro	1 _b	Profile Velocity mode
1	ro	0 _b	Velocity mode
0	ro	1 _b	Profile Position mode

The operating mode Manual Mode (bit 16) is only supported for option "standard interface"; see object Drive data (6510_h), sub-index Interface option type 0A_h=0.

10.4.116 6504_h Drive manufacturer

The object indicates the device manufacturer.

Object description

Name Drive manufacturer

Idx	Code	DT
6504 _h	VAR	VS

Values description

Meaning Drive manufacturer

Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	VS	rw	-	VS	-	-	-

The object Device information (2100_h) contains further information about the device. The value cannot be altered.

10.4.117 6510_h Drive data

The object indicates technical data and settings for the device.

Object description

Name Drive data

Idx	Code	DT
6510 _h	REC	UD

Values description

Meaning Number of entries

Sdx	DT	AC	MP	VR	DF	Acl	SV
00 _h	U8	ro	-	U8	10	-	-

Meaning		Max drive current					
Sdx	DT	AC	MP	VR	DF	Acl	SV
01 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Excess temperature					
Sdx	DT	AC	MP	VR	DF	Acl	SV
02 _h	U8	rw	–	U8	–	PM	Yes

Meaning		Temperature threshold					
Sdx	DT	AC	MP	VR	DF	Acl	SV
03 _h	U8	rw	–	U8	–	PM	Yes

Meaning		Min ramp acceleration					
Sdx	DT	AC	MP	VR	DF	Acl	SV
04 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Min ramp deceleration					
Sdx	DT	AC	MP	VR	DF	Acl	SV
05 _h	U16	rw	–	U16	–	PM	Yes

Meaning		Hall sensors					
Sdx	DT	AC	MP	VR	DF	Acl	SV
06 _h	U8	rw	–	U8	–	PM	Yes

Meaning		Reserved					
Sdx	DT	AC	MP	VR	DF	Acl	SV
07 _h	U8	rw	–	U8	0x80	–	–

Meaning		Reserved					
Sdx	DT	AC	MP	VR	DF	Acl	SV
08 _h	U16	rw	–	U16	300	–	–

Meaning		Reserved					
Sdx	DT	AC	MP	VR	DF	Acl	SV
09 _h	U16	rw	–	U16	5000	–	–

Meaning		Interface option type					
Sdx	DT	AC	MP	VR	DF	Acl	SV
0Ah	I8	rw	–	I8	–	PM	Yes

Sub-index 0A_h

0	Standard interface type
---	-------------------------

	1	Sensor interface type
	2	"Guard" interface type
<i>Sub-index 01_h</i>		<p>Max drive current</p> <p>The parameter <code>Max drive current</code> (maximum current of the electronics) indicates which maximum operating current for the control electronic are permissible.</p> <p>The specification takes place in [mA];</p>
<i>Sub-index 02_h</i>		<p>Excess temperature</p> <p>The parameter <code>Excess temperature</code> (maximum temperature of the power output stage) indicates the maximum temperature of the drive for which it is still ready.</p> <p>If the compact drive exceeds the limit temperature then the electronics switch off the power amplifier and send the message excess temperature with bit 22 in the status register, object <code>Manufacturer status register (1002_h)</code>.</p> <p>The specification takes place in [°C].</p>
<i>Sub-index 03_h</i>		<p>Temperature threshold</p> <p>The parameter <code>Temperature threshold</code> (temperature threshold value) indicates from which temperature the drive will find itself in a critical but still not operation-endangering status.</p> <p>After excess temperature the temperature of the power output stage must fall under this value so that the error status can be reset.</p> <p>The specification takes place in [°C].</p>
<i>Sub-index 04_h</i>		<p>Min ramp acceleration</p> <p>The parameter <code>Min ramp acceleration</code> (minimum acceleration ramp) indicates the minimum time the drive needs in order to accelerate out of a stationary condition up to the maximum speed of rotation.</p> <p>The specification takes place in [ms].</p>
<i>Sub-index 05_h</i>		<p>Min ramp deceleration</p> <p>The parameter <code>Min ramp deceleration</code> (minimum deceleration ramp) indicates the minimum time needed for deceleration of the drive from the maximum speed of rotation to a stationary condition.</p> <p>The specification takes place in [ms].</p>
<i>Sub-index 06_h</i>		<p>Hall sensors</p> <p>3 Hall sensors detect position and speed of rotation in the compact drive. 2 further Hall sensor are also used to check the dehoming.</p> <p>The parameter does not have a unit.</p>
<i>Sub-index 0A_h</i>		<p>Interface option type</p> <p>The parameter <code>Interface option type</code> (interface version) indicates the version of the plug interface. One differentiates between:</p> <ul style="list-style-type: none"> • Standard interface with the inputs MAN-L and MAN-R.

- Sensor interface with the inputs LIM-L, LIM-R and REF.

The parameter can also be changed in configuration mode (object 6060_h, sub-index 00_h = 80_h).

The activation in terms of hardware of the newly set interface variant is executed with the next Power-On first.

11 Glossary

11.1 Terms and Abbreviations

<i>Actual position</i>	Current absolute or relative position of moving components in the drive system.
<i>Address</i>	Memory location which can be accessed by its unique number. See also Slave address.
<i>Broadcast</i>	Type of data transmission in the network, one device sends a message to all devices on the network
<i>Bus arbitration</i>	Device on the fieldbus for prevention of data collisions when multiple bus devices transmit simultaneously. The message with the highest priority takes priority over all other messages in the case of a collision. The priority is specified by the COB ID.
<i>CAN</i>	(Controller Area Network) , standardized open Fieldbus over which the drives and other devices from different manufacturers communicate with one another.
<i>CAN connection</i>	Communications interface on the compact drive for connection to the CAN bus
<i>CANopen</i>	Device and manufacturer-independent description language for communication in the CAN bus
<i>ccd</i>	Command code: Command code, part of a SDO message
<i>CiA</i>	CAN in Automation , CAN interest group, sets standards for CAN and CANopen.
<i>Client</i>	First the sender, then the receiver of CAN messages in the client-server relationship starts the transmission with a transmission to the server; the reference point is the server object directory customer)
<i>COB</i>	(Communication Object) communication object, transport unit in a CAN network.
<i>COB-ID</i>	(Communication Object-Identifier) uniquely identifies every communications object in a CAN network
<i>Consumer</i>	Receiver of CAN messages in the producer-consumer relationship of network users (consumer).
<i>CS</i>	Command Specifier : Identifier for identification of LSS services
<i>DC</i>	Direct current
<i>Default value</i>	Factory settings.
<i>Drive system</i>	System consisting of controller, power electronics and motor.
<i>DS 301</i>	standardises the CANopen communications profile
<i>DSP 402</i>	standardises the CANopen device profile for drives and positioning controls
<i>EC</i>	European Community
<i>EDS</i>	Electronic Data Sheet Contains the technical data for the motor and gearbox and is loaded in the factory.

<i>EMC</i>	Electromagnetic compatibility
<i>EMCY object</i>	Emergency object: Object for rapid transmission of error messages in the network
<i>Error class</i>	Classification of operational faults into groups corresponding to the error responses
<i>Fieldbus</i>	A bus optimised for data transmission between field devices. A Fieldbus is “open”, meaning that it is not proprietary (not supported by only one manufacturer). The parameter settings of the drive system can be called and modified via the Fieldbus, inputs can be monitored and outputs controlled and diagnosis and error monitoring functions enabled.
<i>Hall sensor</i>	Sensor for determining position
<i>Heartbeat</i>	used for unconfirmed connection message from network devices.
<i>I²t-monitoring</i>	Predictive temperature monitoring. The expected temperature rise of unit components is calculated in advance on the basis of the motor current. If a limit value is exceeded, the drive system reduces the motor current.
<i>Idx</i>	Index value of a parameter
<i>Inc</i>	Increment
<i>Limit switch</i>	Switch that signals an overrun of the permissible travel range.
<i>LSB</i>	Least Significant Bit, the least significant bit of a bit sequence, e. g. of a byte
<i>LSS</i>	Layer setting services, setting services of the CAN application layers
<i>Master</i>	Active bus user that controls the data traffic in the network.
<i>MSB</i>	Most significant bit, the most significant bit in a sequence of bits, e.g. of a byte
<i>Life-Guarding</i>	(monitoring for signs of life) for monitoring the connection of a NMT master
<i>NMT</i>	network management (NMT), component of the CANopen communications profile, tasks: initialising network and devices, starting, stopping, monitoring devices
<i>Node address</i>	Address of a device in the network; every device in the network has a unique node address
<i>Node Guarding</i>	Monitoring function with slave at an interface for cyclic communication.
<i>node ID</i>	Node address assigned to a device on the network.
<i>OSI</i>	O pen S ystems I nterconnection, reference model for data communication, presentation as a layers model with distributed tasks for every layer
<i>Parameter</i>	Device functions and values that can be set and called by the user.
<i>PC</i>	Personal Computer
<i>PDO</i>	Process Data Object
<i>PLC</i>	Programmable Logic Controller
<i>power electronic system</i>	This is the unit that controls the motor. The power electronics generate currents for controlling the motor in accordance with the positioning signals from the control unit.

<i>Producer</i>	Creator of CAN messages in the producer-consumer relationship of network devices (producer)
<i>Protocol</i>	Guideline that specifies the format required for transmitting data.
<i>Quick Stop</i>	Quick stop, function used to provide quick braking of the motor via a command or in the event of a fault.
<i>R_PDO</i>	Receive PDO
<i>Register</i>	Memory range of specified size (generally 8, 16 or 32 bits) for temporary storage of data transmitted from one system unit to another.
<i>RS422 level</i>	The signal status is calculated from the differential voltage arising from one positive and one inverted negative signal. Two signal wires must therefore be connected for one signal.
<i>SDO</i>	Service Data Object
<i>Server</i>	First the sender, then the receiver of CAN messages in the client-server relationship responds to the request of a clients; the reference point is the server object directory (server)
<i>Slave</i>	Passive bus user that receives control commands and sends data to the master.
<i>Slave address</i>	Direct communication between master and slave devices is only possible after assignment of addresses.
<i>Status machine</i>	A status machine defines operating statuses and transitions with which the network or the behaviour of network users can be controlled and altered under CANopen. The status machine of the NMT services describes the initialisation and start phase for operating the network users. The status machine for propulsion equipments defines the control points and setting options for operating a compact drive or a positioning controller.
<i>SYNC object</i>	Synchronisation object, object for synchronisation of users in the network
<i>T_PDO</i>	Transmit PDO
<i>Timeout</i>	Error caused by exceeding the maximum allowable time between query and response of devices.
<i>Watchdog</i>	Equipment that monitors cyclic basic functions in the drive system. Power electronics and outputs are switched off in the event of error.

11.2 Product name

Abbreviation	Product designation	Term used
IcIA	Integrated Closed Loop Actuator	Intelligent compact drive

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