

SANMOTION

AC SERVO SYSTEMS

R

TYPE S

with CANopen Interface

For Rotary Motor

CANopen Manual

SANYO DENKI

About This Manual

Overview

This document is part of SANMOTION R-series servo amplifier manual, provided by SANYO DENKI Co., Ltd.

This manual contains the technical specifications of the CANopen communication interface; how to embed into CAN network, to adjust the physical parameters, and to activate the functions. The reader is expected to have an appropriate knowledge of servo drives, motion controls, networks, and CANopen.

Related Documentation

- For more information about SERVO Drives, ***especially for the safety precautions***, refer to SANMOTION R TYPE-S Instruction Manual.
- Further information about CAN and CANopen are available from the CiA (CAN in Automation) worldwide website; <http://www.can-cia.org>

Trademarks

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CANopen manual

1 Introduction

1.1 CANopen profile

DS301 (CANopen application layer and communication profile)

The CANopen Communication Profile (DS-301) defines the basic communication mechanisms for exchanging data via a CANopen-based networks. This includes the structure of the object dictionary, the network management and boot-up as well as communication objects like PDO, SDO, SYNC and time stamp. The object dictionary provides a standard interface for accessing of communication parameters as well as process data. The part of the object dictionary which describes the general device and communication parameters is common for all devices types.

DS306 (Electronic data sheet specification for CANopen)

The usage of devices in a communication network requires configuration of the device parameters and communication facilities. CANopen defines a standardized way to access these parameters via the object dictionary. For handling of the complexity of CANopen systems software tools are required. This reduces the complexity of the planning, configuration and analysis process and significantly increases the security of the system. For this purpose software tools need an electronic description of the CANopen devices. To allow the usage of manufacturer independent tools, this document defines a standardized file format - called Electronic Data Sheet. Furthermore some derived file formats are specified. The Device Configuration File describes a concrete incarnation of a device configuration.

DSP402 (CANopen device profile drives and motion control)

The device profile for drives and motion control (CiA DSP 402) defines the functional behavior of controllers for servo drives, frequency inverters and stepper motors. The specification includes a state machine description of the drive. A single state represents a special internal or external behavior. The state of the drive also determines which commands are accepted. E.g. it is only possible to start a point-to-point move if the drive is in the state 'Operation Enabled'. States may be changed using the Control word and/or according to internal events. The current state can be read using the status-word.

1.2 Reference Model

CAN-based networks use the following reference model, device model, and communication model.

Table 1-1: Compare OSI reference model and CANopen model

OSI reference model	CANopen model
Application	Application
Presentation	
Session	
Transport	
Network	
Data link	LLC
	MAC
Physical	PLS
	PMA
	MDI

Architecture of the drive

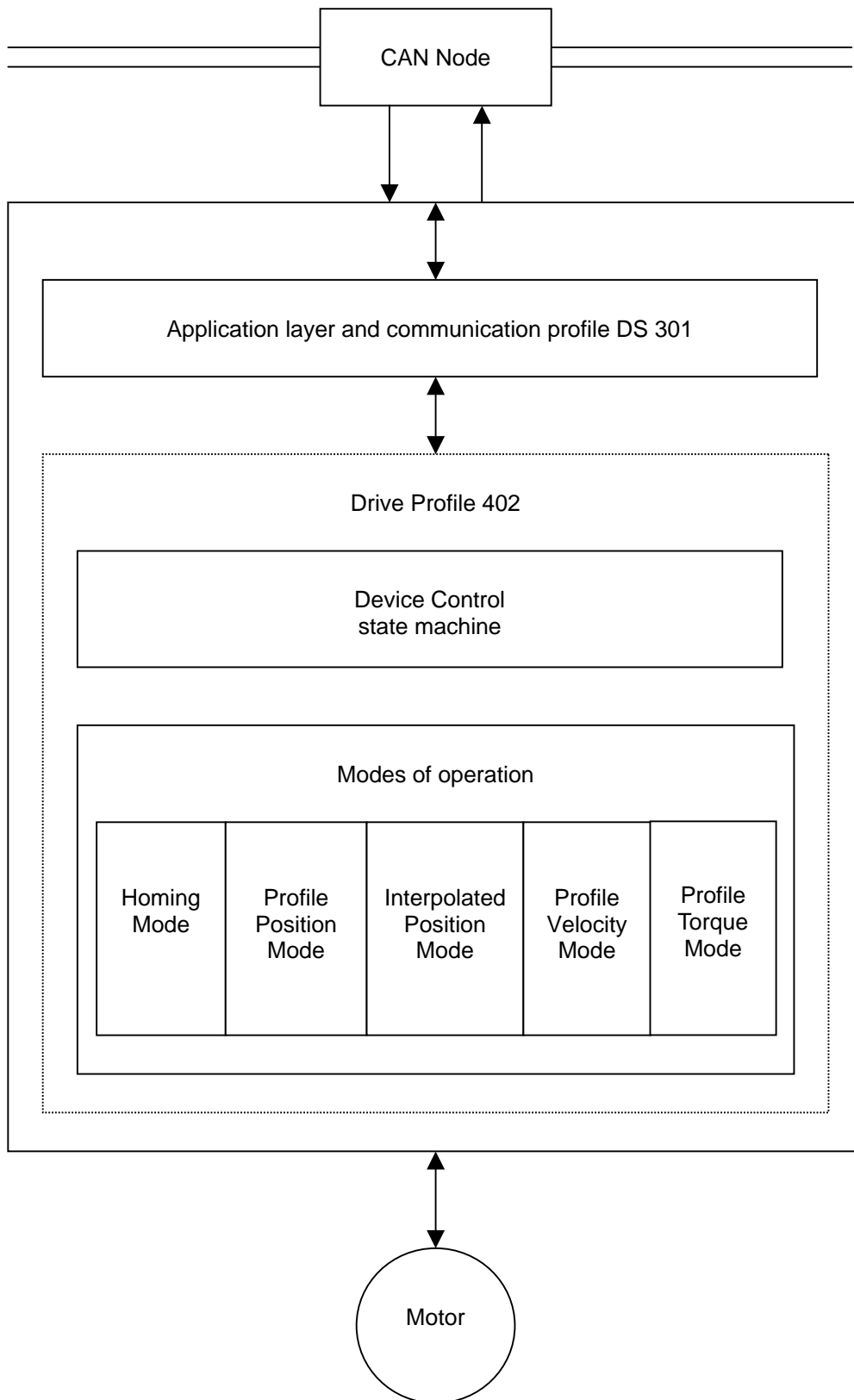



Figure 1-1: Communication architecture

2 Cabling

2.1 Pin assignment

SANMOTION R CANopen interface amplifier has two ports of RJ-45 modular connector for CAN connection. Pin assignment of both connectors is just the same, and it is shown in following figure.

Table 2-1: Pin assignment

CN3, CN4	Pin	Signal	Notes
	1	CAN_H	1. CN3 has two LEDs which show the status of CAN communication. (see chapter 5.3.2) 2. A termination resistor (120ohm) is integrated in this amplifier that can be connected between CAN_H and CAN_L by plugging a modular connector with a jumper between pins 1 and 5.
	2	CAN_L	
	3	CAN_GND	
	4	No connection	
	5	Terminator	3. CAN_GND pin is connected to amplifier internal signal ground. 4. CAN_SHLD is optional.
	6	(CAN_SHLD)	
	7	CAN_GND	
	8	No connection	

2.2 Cabling Example

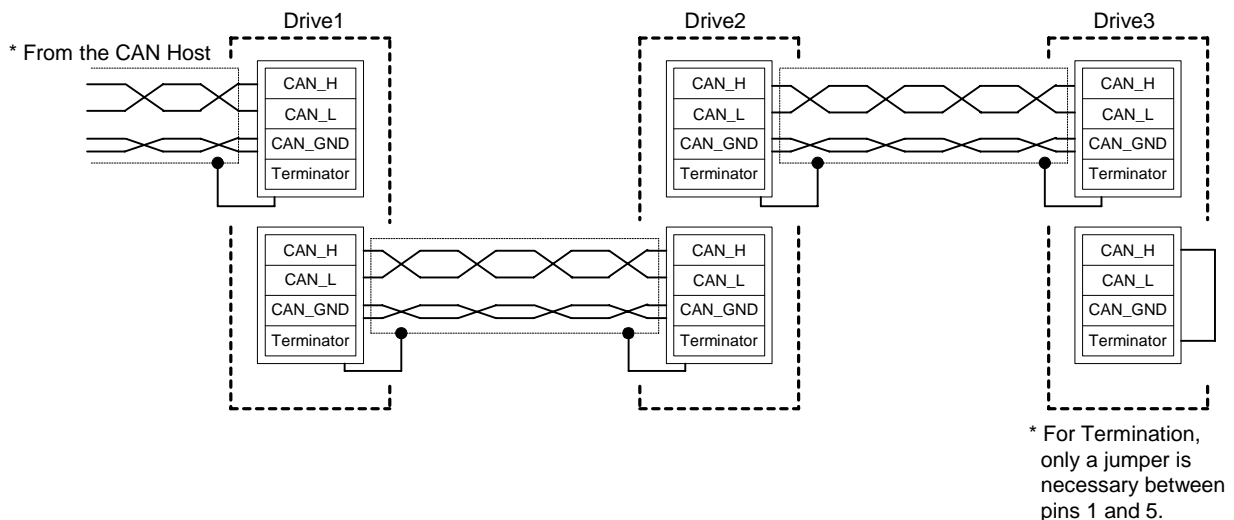


Figure 2-1: Cabling schema

- To avoid malfunction of communication, it is recommended to use shielded cable with two twisted pair.
 - One twisted pair is used for CAN_H (Pin 1) and CAN_L (Pin 2).
 - Another twisted pair is used for CAN_GND (Pins 3 and 7).
 - Cable shield has to be connected to metal body plug of RJ45 type connector.
- The two ends of the CAN cable have to be terminated by a resistor of 120 ohm. SANMOTION R CANopen interface amplifier has a termination resistor inside, it is necessary to plug a modular connector with a jumper between pins 1 and 5 for termination. **However, in this case please do not connect "Terminator" pin of each drive mutually. Otherwise, the termination resistor in all connected drives becomes effective.**

3 Setting

3.1 Node-ID

Each drive within the CANopen network has to have an unique Node-ID number. Basically, Node-ID of this servo amplifier is decided by two pieces of 16(0h to Fh) position rotary switch on the front panel of amplifier [from 1(RSW2: 0h, RSW1: 1h) to 127(RSW2: 7h, RSW1: Fh)].

If both rotary switches are set to '0h' or 'Fh' position, the value that has already been stored in non-volatile memory by using R-Setup Software or written via SDO (Object Index 2250h) becomes effective as Node-ID number.

If the setting of Node-ID is changed while the control power is ON, it is necessary to be turned OFF the control power once or 'Reset node' execution to activate new set Node-ID number.

3.2 Bit rate and Bus length

Bit rate can change via R-Setup Software or via SDO (Object Index 2251h). Selectable Bit rate and maximum bus length depending on the bit rate are shown in following table.

If the setting of Bit Rate is changed while the control power is ON, it is necessary to be turned OFF the control power once or 'Reset node' execution to activate new set Bit Rate.

Table 3-1: Bit rate and Bus length

Bit rate	Maximum Bus length	Bit rate code
1 Mbit/s	25m	8
800 Kbit/s	50m	7
500 Kbit/s (default setting)	100m	6
250 Kbit/s	250m	5
125 Kbit/s	500m	4
(100 Kbit/s not supported)	---	3 (can not select)
50 Kbit/s	1000m	2
20 Kbit/s	2500m	1
10 Kbit/s	5000m	0

The bit rate must be the same for all units in one network.

3.3 Control mode setting

It is necessary to set control mode appropriately in order to achieve CANopen communication.

Parameter Type	Page	Description	
System parameter	08	Control mode	
		Setting	Description
		06: _CANopen	CANopen mode

The factory default setting to control mode is "CANopen mode". The set value is enabled after control power is turned ON again.

3.4 Other configuration parameters in CANopen mode

Please refer/set to configuration parameters below as needed.

Index	Sub-index	Name
607Bh	02h	Max Position Range Limit
607Eh		Polarity
6093h	01h	Position Factor - Numerator
	02h	Position Factor - Divisor
2105h		Position Data Format
2106h		Command Value for Modulo Format
2107h		Modulo Value
2109h		Absolute Encoder Effective Bit Length
2120h		System Parameter Switch

Note) When these parameters are changed in "Operational state", the drive outputs the alarm state in order to inform user that it is necessary to execute "Store Parameter (see Object 1010h)" and to be cycled control power.

4 Communication specification

4.1 Device Model

- Communication
This function unit provides the communication objects and the appropriate functionality to transport data items via the underlying network structure.
- Object Dictionary
The Object Dictionary is a collection of all the data items, which have an influence on the behavior of the application objects, the communication objects and the state machine used on this device.
- Application
The application comprises the functionality of the device with respect to the interaction with the process environment.

Thus the Object Dictionary serves as an interface between the communication and the application. The complete description of a device's application with respect to the data items in the Object Dictionary is named device profile.

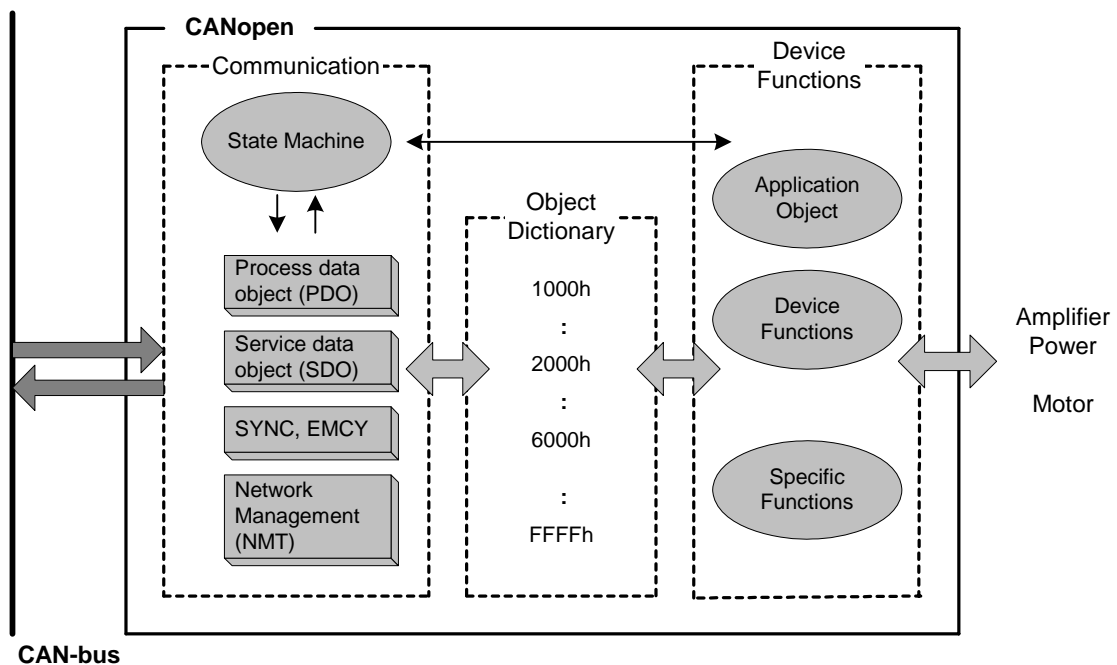


Figure 4-1: Device Model with object dictionary

- Object Index
Every object is addressed over a 16-bit index, which is displayed as a four character hexadecimal number. The objects are arranged in groups in the object dictionary. The following table shows an overview of the object directory as per the CANopen agreement.

Table 4-1: Arrangement of the object index

Index (hex)	Object
1000-1FFF	Communication Profile Area
2000-5FFF	Manufacturer Specific Profile Area
6000-9FFF	Standardized Device Profile Area
A000-FFFF	Reserved for further use

4.2 Communication Object

In order to reduce configuration effort for simple networks a mandatory default identifier allocation scheme is standardized with the DS301 CANopen communication profile. These identifiers are available in the PRE-OPERATIONAL state directly after initialization.

All of CANopen message contains 11bits of Identifier field, which is called "COB-ID". COB-ID comprises following two parts.

- Function Code, 4 bit size
- Node-ID, 7 bit size

They are shown in following figure.

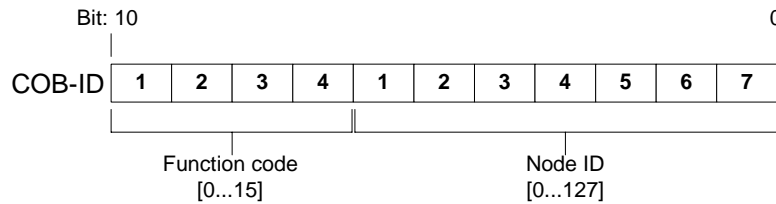


Figure 4-2: COB-ID allocation scheme

The following Table shows the COB-IDs of all supported communication objects in the drive.

Table 4-2: The supported objects and allocated COB-IDs

Communication Object	Function code	Node ID [1...127]	COB-ID decimal (hexadecimal)	Index of object parameters
NMT service	0 0 0 0	0 0 0 0 0 0 0 0	0 (0h)	-
SYNC object	0 0 0 1	0 0 0 0 0 0 0 0	128 (80h)	1005h...1007h
EMCY object	0 0 0 1	x x x x x x x x	128 (80h) + node-id	1014h
T_PDO1	0 0 1 1	x x x x x x x x	384 (180h) + node-id	1800h
R_PDO1	0 1 0 0	x x x x x x x x	512 (200h) + node-id	1400h
T_PDO2	0 1 0 1	x x x x x x x x	640 (280h) + node-id	1801h
R_PDO2	0 1 1 0	x x x x x x x x	768 (300h) + node-id	1401h
T_PDO3	0 1 1 1	x x x x x x x x	896 (380h) + node-id	1802h
R_PDO3	1 0 0 0	x x x x x x x x	1024 (400h) + node-id	1402h
T_PDO4	1 0 0 1	x x x x x x x x	1152 (480h) + node-id	1803h
R_PDO4	1 0 1 0	x x x x x x x x	1280 (500h) + node-id	1403h
T_SDO	1 0 1 1	x x x x x x x x	1408 (580h) + node-id	1200h
R_SDO	1 1 0 0	x x x x x x x x	1536 (600h) + node-id	1200h
NMT Error Control	1 1 1 0	x x x x x x x x	1792 (700h) + node-id	1016h, 1017h

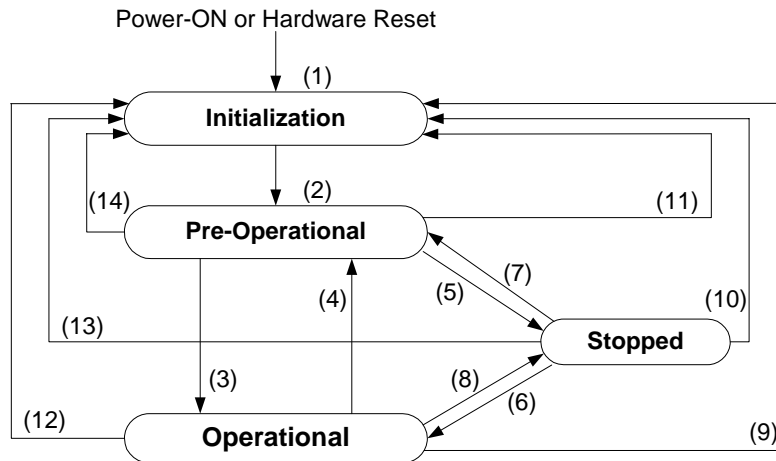
4.3 Network management (NMT service)

4.3.1 State Machine

All CANopen devices can be triggered via the network management.

Devices enter the PRE-OPERATIONAL state directly after finishing the device initialization. During this state device parameterization and Id allocation via SDO is possible. Then the nodes can be switched directly into the OPERATIONAL state.

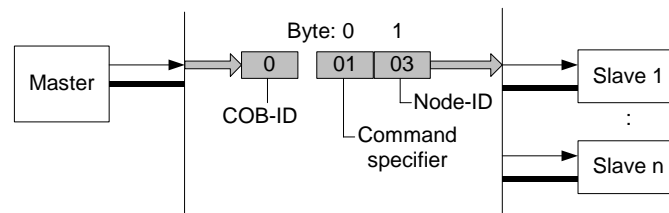
The NMT state machine determines the behavior of the Communication function unit. The coupling of the application state machine to the NMT state machine is device dependent and falls into the scope of device profiles.



(1)	At Power-ON the initialization state is entered autonomously
(2)	Initialization finished – enter Pre-operational automatically
(3), (6)	Start Remote Node indication
(4), (7)	Enter Pre-Operational State indication
(5), (8)	Stop Remote Node indication
(9), (10), (11)	Reset Node indication
(12), (13), (14)	Reset Communication indication

Figure 4-3: NMT-State machine

The structure of each indication message is as follows.



Command specifier	Meaning
01h	Start Remote Node
02h	Stop Remote Node
80h	Enter Pre-Operational
81h	Reset Node (*)
82h	Reset Communication

(*) “Reset Node” has the same meaning as “Reset Communication” in this drive.

Figure 4-4: NMT-Message

4.3.2 Device Monitoring Protocols

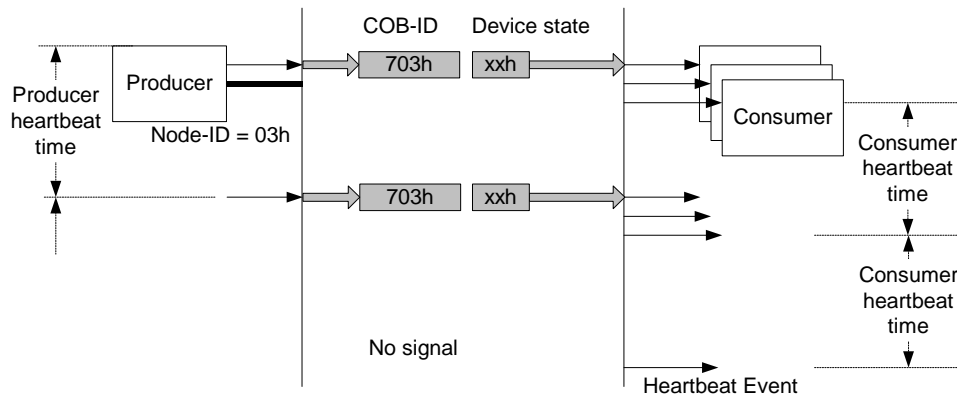
Using the monitoring protocols, network connection and communication status between master module and drive can be monitored. Monitoring services use one of two protocols:

- Heartbeat
- Node/life guarding (not implemented)

4.3.2.1 Heartbeat

The Heartbeat protocol defines an error control service without need for remote flames. A Heartbeat Producer transmits a Heartbeat message cyclically. Transmit cycle of heartbeat message is defined in the object '**Producer heartbeat time (1017h)**'. One or more Heartbeat Consumer receive the indication. The relationship between producer and consumer is configurable via the object dictionary. The Heartbeat Consumer guards the reception of the Heartbeat within the object '**Consumer heartbeat time (1016h-01h)**'. If the Heartbeat is not received within that time a Heartbeat Event will be generated.

The structure of heartbeat message is as follows.



Device state	Meaning
0 (00h)	Boot Up
4 (04h)	Stopped
5 (05h)	Operational
127 (7Fh)	Pre-Operational

Figure 4-5: Heartbeat message

If the Producer Heartbeat Time is configured on a device the Heartbeat Protocol begins immediately. If a device starts with a value for the Producer Heartbeat Time unequal to 0 the Heartbeat Protocol starts on the state transition from "Initialization" to "Pre-Operational". In this case the Boot-up Message is regarded as first heartbeat message.

4.3.2.2 Node/Life guarding (not implemented)

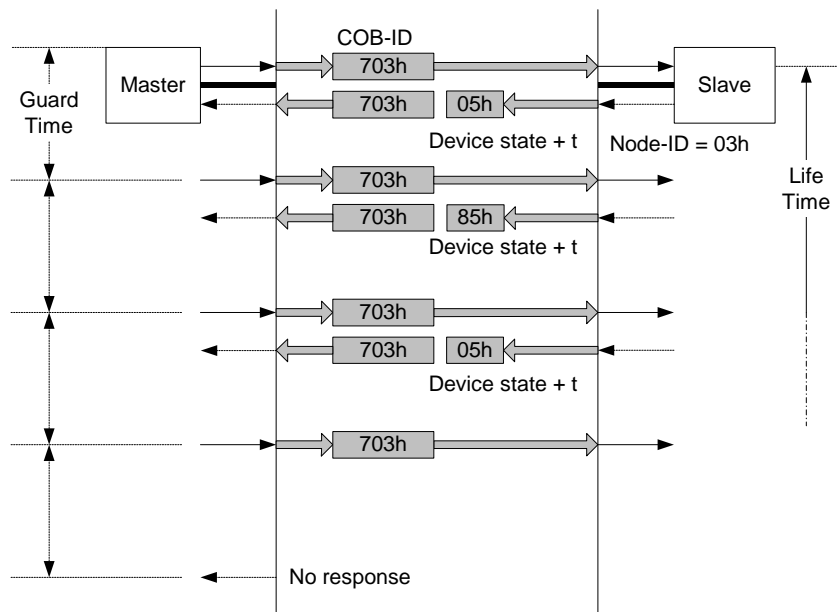
The Node guarding protocol is similar to the heartbeat, but it allows both the device and the network manager to monitor the connection each other. The network manager configures the device (node) to expect node-guarding messages at some interval. Transmit interval of node-guarding message is defined in the object '**guard time (100Ch)**'. The network manager then sends a message to the configured device at that frequency, and the device responds with a node-guarding message. The network manager detects a connection error if:

- the slave does not respond within the 'guard time' period
- the NMT status of the slave has changed without the intention of the network manager

On the other hand, the slave also expects node-guarding message to be sent frequently within its life time. The node life time is given by the 'guard time' multiplied by the '**life time factor (100Dh)**'. If the slave has not been polled during its life time, a remote node error is indicated through the 'Life guarding event' service.

This allows both the network manager and the device to identify a network failure if the guarding messages stop.

The structure of node/life guarding message is as follows.



Device state (Bit 6...0)	Meaning
4 (04h)	Stopped
5 (05h)	Operational
127 (7Fh)	Pre-Operational

Bit 7 is toggle bit (t). The value of this bit must alternate between consecutive responses from the NMT slave. The value of the toggle bit of the first response after the guarding protocol becomes active is 0.

Figure 4-6: Node guarding message

4.4 Synchronization Object (SYNC)

The synchronization object controls the synchronous exchange of messages between network devices for purposes such as the simultaneous start of multiple drives. The time period between the SYNCs is specified by the standard parameter '**communication cycle period (1006h)**', which may be written by a network manager to the application devices during the boot-up process. The SYNC object is sent to all devices by a network manager and can be evaluated by all devices that support synchronous PDOs.

In order to guarantee timely access to the CAN bus the SYNC is given a very high priority identifier, that is, set value to '**COB-ID SYNC Message (1005h)**' should be as smaller as possible.

The synchronous time window specifies the time interval in which the synchronous PDO messages must be received and sent. The time window is defined with the object '**Synchronous Window Length (1007h)**'.

4.5 Emergency Object (EMCY)

Emergency objects are triggered by the occurrence of a drive internal error situation and are transmitted from the drive. An emergency object is transmitted only once per 'error event'. As long as no new errors occur on a device, no further emergency objects must be transmitted.

The structure of emergency message is as follows.

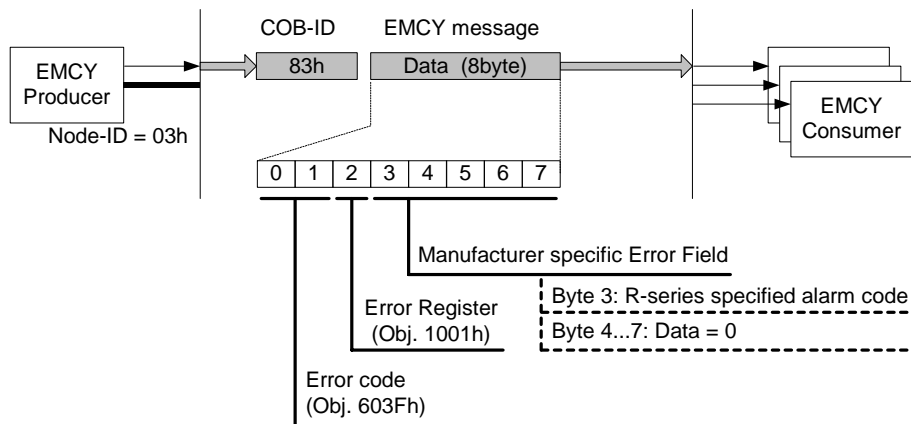


Figure 4-7: EMCY message

Detailed explanation for "Error code" is shown in '**chapter 5.4 R-Amplifier Specified Alarm Code and CANopen Error Code**'.

4.6 Accessing the Object Dictionary

CANopen provides following two ways to access a device's object dictionary.

- The Service Data Object (SDO)
- The Process Data Object (PDO)

Each can be described as a channel for access to an object dictionary.

4.6.1 Service Data Object (SDO)

4.6.1.1 Overview

R-CANopen Servo Amplifier provides on SDO. The CANopen network manager (master) can use this SDO to configure, monitor, and control the device by reading from and writing to its object dictionary via index and sub-index of each entry.

The SDO transfer employs a client/server communication model. The CANopen network manager (master) is the sole client. The device is the server. The CANopen master application should provide a client SDO for each device under its control.

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.

4.6.1.2 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. Most of handled parameters with R-CANopen Servo Amplifier have up to 4 bytes long, therefore expedited transfer for SDO is mainly used to access with object dictionary.

The structure example of SDO message is as follows.

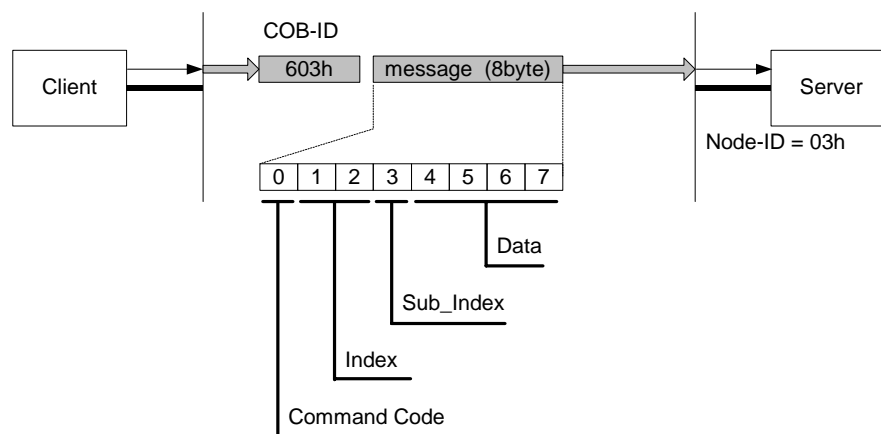


Figure 4-8: SDO message (example)

4.6.1.3 Write Data via SDO

The client starts a write request by sending command code, index, sub-index, and data. The server sends a response indicating whether the data were correctly processed. The response contains the same index, sub-index, but no data, in case of positive response.

If a message could not be accepted for some reason, the server sends an error message. For details of the error message, see chapter 4.6.1.5 'SDO error message'.

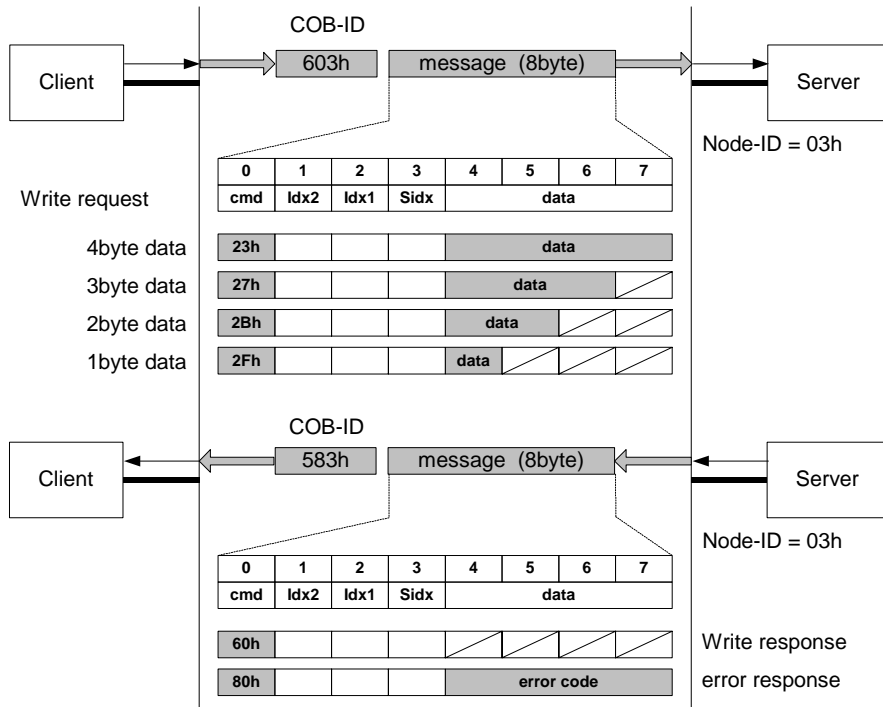


Figure 4-9: Writing data

4.6.1.4 Read Data via SDO

The client starts a read request by sending command code (read request), index, sub-index. The server responds to the request with the desired data.

The SDO response contains the same index and sub-index. The length of the response data is specified in the SDO command code (cmd).

If a message could not be accepted for some reason, the server sends an error message. For details of the error message, see chapter 4.6.1.5 'SDO error message'.

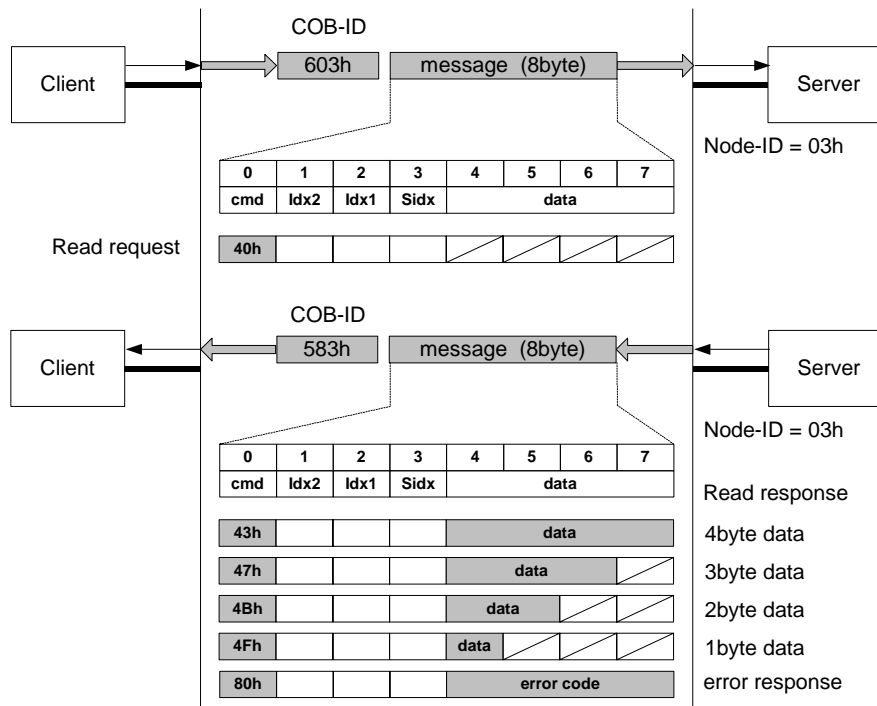


Figure 4-10: Reading data

4.6.1.5 SDO Error Message

If a SDO message could not be accepted for some reason (e.g. the value is out of range), the servo drive sends an error message as a response for SDO request.

The details of the error message are as follows.

Table 4-3: SDO Error Code

SDO Error Code	Description
0503 0000h	Toggle bit not alternated
0504 0000h	SDO protocol timeout
0504 0001h	Client/server command specifier not valid or unknown
0601 0000h	Unsupported access to an object
0601 0001h	Attempt to read a write only object
0601 0002h	Attempt to write a read only object
0602 0000h	Object does not exist in the object dictionary
0604 0041h	Object can not be mapped to the PDO
0604 0042h	The number and length of the objects to be mapped would exceed PDO length
0604 0043h	General parameter incompatibility reason
0604 0047h	General internal incompatibility in the device
0606 0000h	Access failed due to an hardware error
0607 0010h	Data type does not match, length of service parameter does not match
0607 0012h	Data type does not match, length of service parameter too high
0607 0013h	Data type does not match, length of service parameter too low
0609 0011h	Sub-index does not exist
0609 0030h	Value range of parameter exceeded (only for write access)
0609 0031h	Value of parameter written too high
0609 0032h	Value of parameter written too low
0609 0036h	Maximum value less than minimum value
0800 0020h	Data can not be transferred or stored to the application
0800 0021h	Data can not be transferred or stored to the application because of local control
0800 0022h	Data can not be transferred or stored to the application because of the present device state
0800 0023h	No Object Dictionary present

4.6.2 Process Data Object (PDO)

4.6.2.1 Overview

The real-time data transfer is performed by means of "Process Data Objects (PDO)". The transfer of PDOs is performed with no protocol overhead.

There are two kinds of use for PDOs. The first is data transmission and the second data reception. It is distinguished in Transmit-PDOs (T_PDOs: Drive ⇒ Host) and Receive-PDOs (R_PDOs: Host ⇒ Drive). Peer-to-peer relationships are established by matching the transmit PDO identifier of sending node to a receive PDO identifier of one or more other nodes on the network.

R-CANopen Servo Amplifier supports variable (dynamic) PDO mapping, the number of PDOs and the mapping of application objects into a PDO may be transmitted to a device during the device configuration process by applying the SDO services to the corresponding entries of the Object Dictionary. A PDO message can send up to 8 bytes of data. If only 2 bytes are occupied, only 2 data bytes are sent.

4.6.2.2 PDO configuration

PDO configuration allows the user to optimize...

- CAN message's 8 bytes data area (PDO Mapping)
- Sending or receiving data transmission style (Transmission Type), Triggering style

PDO Mapping

R-CANopen Servo Amplifier supports variable (dynamic) PDO mapping, which allows the CANopen network manager to change the mapping of a PDO during operation.

For changing of the mapping, objects 'Receive PDO Mapping Parameter (1600h...1603h)' for R_PDO and objects 'Transmit PDO Mapping Parameter (1A00h...1A03h)' for T_PDO is used.

The host has to parameterize the index, the sub-index and the length of each object that should be transmitted by the PDO. The length has to match with the length stored in the object dictionary.

The following is a format example to T_PDO3.

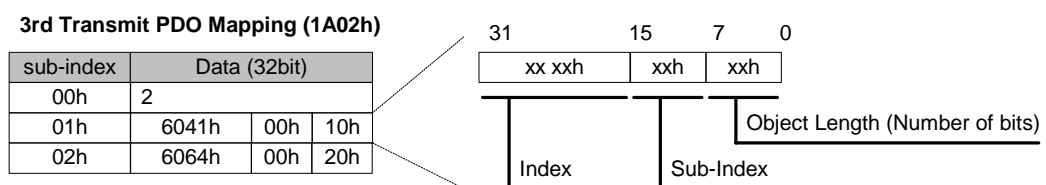


Figure 4-11: PDO Mapping

To simplify the mapping the following sequence has to be used:

- 1) The number of mapped object (sub-index0) is set to 0.
- 2) The parameter first mapped object (sub-index1) ... fourth mapped object (sub-index4) can be parameterized.
- 3) The number of mapped object is set to a value between 1 ... 4.
The length of all mapped objects may not exceed 64 bit.

Default PDO Mapping is shown as follows.

Table 4-4: Default Receive PDOs

PDO No.	Mapping object index	Mapping object name	Comment
1	6040h	Control word	Controls the state machine
2	---	(no mapping)	
3	---	(no mapping)	
4	---	(no mapping)	

Table 4-5: Default Transmit PDOs

PDO No.	Mapping object index	Mapping object name	Comment
1	6041h	Status word	Shows status
2	---	(no mapping)	
3	---	(no mapping)	
4	---	(no mapping)	

Transmission Type

For each PDO it can be parameterized which event results in sending T_PDO response or evaluating R_PDO.

Transmission type can be set in **sub-index2** of objects '**Receive PDO Parameter (1400h...14003h)**' for R_PDO and objects '**Transmit PDO Parameter (1800h...1803h)**' for T_PDO.

The following is a table, which includes supported value as the transmission type.

Table 4-6: Transmission type

Value	Description
0 (00h) – 240 (F0h)	<u>SYNC message</u> The value determines how many SYNC messages will be ignored before the PDO will be - sent (T_PDO) response
254 (FEh)	<u>Cyclic</u> A T_PDO will be updated and sent cyclic. The period is determined by the object inhibit-time (sub-index3 of object 180xh) . R_PDO will be evaluated immediately after receipt.
255 (FFh)	<u>On change</u> The T_PDO will be sent, if at least one bit of the PDO data has changed. Therefore the object inhibit-time (sub-index3 of object 180xh) determines the minimal period between two PDOs.

5 Device Control

5.1 Control and Status Words

As illustrated in Figure 5-1, the object '**Control word (6040h)**' manages device mode and state changes. The object '**Status word (6041h)**' identifies the current state of the drive.

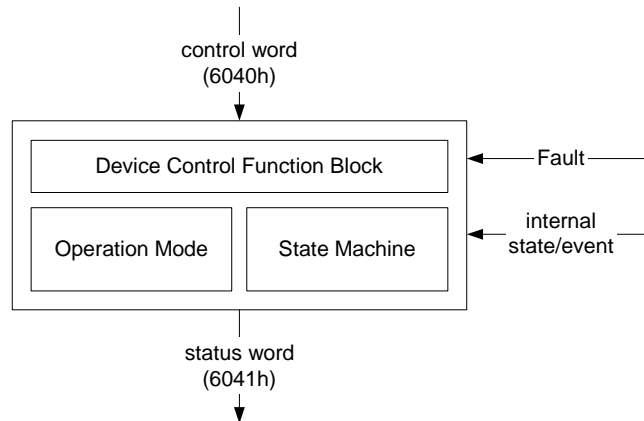


Figure 5-1: Control and Status Words

The Control word consist of bits for:

- controlling of the state
- controlling of each operation modes
- manufacturer specific options

Table 5-1: The bits of the Control word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Manufacturer specific					Reserved		Halt
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fault Reset	Operation mode specific			Enable Operation	Quick stop	Enable voltage	Switch on

The Status word consist of bits for:

- current state of the drive
- the operating state of each operation modes
- manufacturer specific options

Table 5-2: The bits of the Status word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Manufacturer specific		Operation mode specific		Internal limit active	Target reached	Remote	Manufacturer specific
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enabled	Switched on	Ready to Switch on

5.2 State Machine

The state machine describes the device status and the possible control sequence of the drive. A single state represents a special internal or external behavior. The state of the drive also determines which commands are accepted. E.g. it is only possible to start a point-to-point move when the drive is in state OPERATION ENABLE.

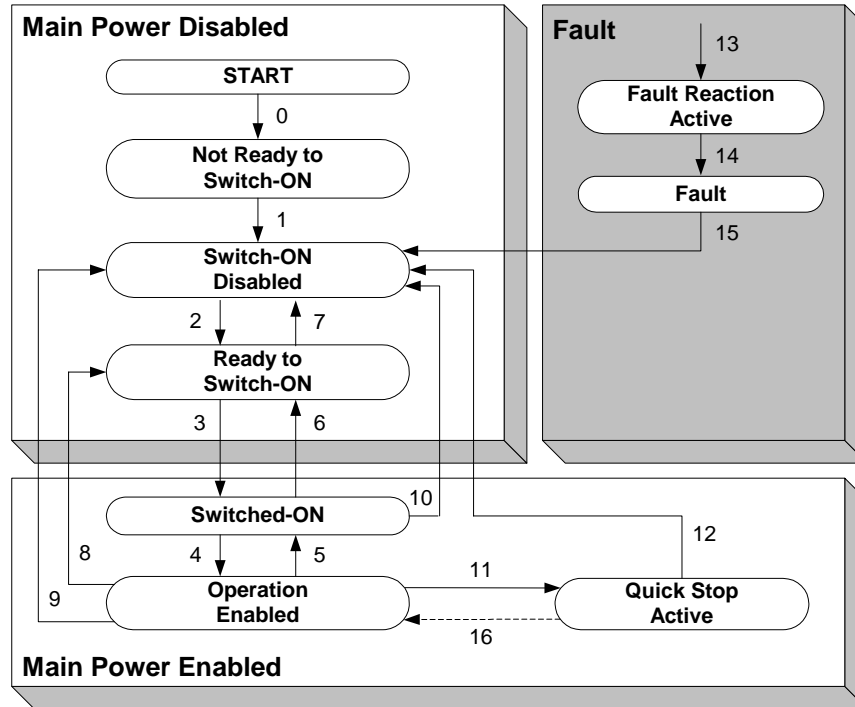


Figure 5-2: Drive State Machine

In the following Table, all status and their meaning are listed:

Table 5-3: Explanation of each drive state

State	Meaning
Not Ready to Switch-ON	Control Power has been applied to the drive. The drive is being initialized or is running self-test.
Switch-ON Disabled	Drive initialization has been completed. The drive parameters can be set up. High voltage may not be applied to the drive.
Ready to Switch-ON	Main Power may be applied to the drive. The drive parameters may be changed. The drive function is disabled.
Switched-ON	Main Power has been applied to the drive. The power amplifier is ready to be enabled. The drive parameters may be changed.
Operation Enabled	No faults have been detected. The drive function is enabled and power is applied to the motor. The drive parameters may be changed.
Quick Stop Active	The quick stop function is being executed. The drive function is enabled and power is applied to the motor.
Fault Reaction Active	A fault has occurred in the drive. The quick stop function is being executed. The drive function is enabled and power is applied to the motor.
Fault	A fault has occurred in the drive, and Fault reaction completed. Main Power switch-on/-off depends on the application. The drive function is disabled.

Table 5-4 lists all state transitions and their meaning:

Table 5-4: State Transitions

No.	From State	To State	Event / Action
0	Start	Not Ready to Switch-ON	Event: Reset. Action: The drive does self-tests and/or self-initializes.
1	Not Ready to Switch-ON	Switch-ON Disabled	Event: The drive has self-tested and/or initialized successfully. Action: Activate communication.
2	Switch-ON Disabled	Ready to Switch-ON	Event: ' <u>Shutdown</u> ' command received from host. Action: None
3	Ready to Switch-ON	Switched ON	Event: ' <u>Switch On</u> ' command received from host. Action: The power section is switched on if it is not already switched on.
4	Switched ON	Operation Enabled	Event: ' <u>Enable Operation</u> ' command received from host. Action: The drive function is enabled.
5	Operation Enabled	Switched ON	Event: ' <u>Disable Operation</u> ' command received from host. Action: The drive operation is disabled.
6	Switched ON	Ready to Switch-ON	Event: ' <u>Shutdown</u> ' command received from host. Action: The power section is switched off.
7	Ready to Switch-ON	Switch-ON Disabled	Event: ' <u>Quick Stop</u> ' command received from host. Action: None
8	Operation Enabled	Ready to Switch-ON	Event: ' <u>Shutdown</u> ' command received from host. Action: The power section is switched off immediately, and the motor is free to rotate if the drive doesn't brake.
9	Operation Enabled	Switch-ON Disabled	Event: ' <u>Disable Voltage</u> ' command received from host. Action: The power section is switched off immediately, and the motor is free to rotate if the drive doesn't brake
10	Switched ON	Switch-ON Disabled	Event: ' <u>Disable Voltage</u> ' or ' <u>Quick Stop</u> ' command received from host. Action: The power section is switched off immediately, and the motor is free to rotate if the drive doesn't brake
11	Operation Enabled	Quick Stop Active	Event: ' <u>Quick Stop</u> ' command received from host. Action: The quick stop function is executed.
12	Quick Stop Active	Switch-ON Disabled	Event: ' <u>Quick Stop</u> ' is completed or ' <u>Disable Voltage</u> ' command received from host. This transition is possible, if the Quick-Stop-Option-Code is different 5 or 6 (stay in the state 'Quick Stop Active'). Action: The power section is switched off.
13	Fault Event	Fault Reaction Active	Event: A fault has occurred in the drive. Action: Execute appropriate fault reaction.
14	Fault Reaction Active	Fault	Event: The fault reaction is completed. Action: The drive function is disabled. The power section may be switched off.
15	Fault	Switch-ON Disabled	Event: ' <u>Fault Reset</u> ' command received from host. Action: A reset of the fault condition is carried out if no fault exists currently on the drive. After leaving the state Fault the Bit 'Fault Reset' of the Control word has to be cleared by the host.
16	Quick Stop Active	Operation Enabled	Event: ' <u>Enable Operation</u> ' command received from host. This transition is possible if the Quick-Stop-Option-Code is 5 or 6. Action: The drive function is enabled.

For each transition, Bit pattern of Control Word shown in Table 5-5 is recognized as a command:

Table 5-5: Bit pattern of Control Word for State Transition

Command	Bit of the Control word					Transitions
	Bit7	Bit3	Bit2	Bit1	Bit0	
Shutdown	0	x	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Disable voltage	0	x	x	0	x	7,9,10,12
Quick stop	0	x	0	1	x	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset	0 → 1	x	x	x	x	15

“x” means “don’t care”.

In each state, the actual state of drive is displayed by following Bit pattern of Status Word.

Table 5-6: Bit pattern of Status Word for State Display

State	Bit of the Status word					
	Bit6	Bit5	Bit3	Bit2	Bit1	Bit0
Not ready to switch on	0	x	0	0	0	0
Switch on disabled	1	x	0	0	0	0
Ready to switch on	0	1	0	0	0	1
Switched on	0	1	0	0	1	1
Operation enabled	0	1	0	1	1	1
Quick stop active	0	0	0	1	1	1
Fault reaction active	0	x	1	1	1	1
Fault	0	x	1	0	0	0

“x” means “don’t care”.

5.3 Status Display on Front panel of Servo Amplifier

5.3.1 7-segment LED

One digit of 7-segment LED displays following drive states.

- Settled Node-ID for CAN communication
- Servo Status
- Alarm Codes

5.3.1.1 Settled Node-ID for CAN communication Display

[CANopen operating mode only]

Right after the control power is turned ON, timeshared 3-digits of Settled Node-ID for CAN communication are displayed.









If their display were '1', '2' and '3', it means that the settled Node-ID is '123' decimal.

After displaying these series of number, 7-segment LED displays following 'Drive Status'.

5.3.1.2 Drive Status Display

After displaying 'settled Node-ID', the following display is appeared, if there is no error occurrence.

Table 5-7: Drive status display

Servo amplifier status	Display
Control Power supply established (NOT RDY) Control power supply established, but amplifier (RDY) is OFF, because the state of CAN communication has not been raised up to 'Ready to switched ON' state [CANopen operating mode only]	 Flashing
Control Power supply established (RDY) Control power supply established, and amplifier (RDY) is ON	
Main Power supply being established Main Power supply is ON or is established, but amplifier (RDY) is OFF, because the state of CAN communication has not been raised up to 'Ready to switched ON' state [CANopen operating mode only]	 Flashing
Main Power supply being established Main Power supply is ON or is established, but Operation Preparation Completion signal is OFF	
Main Power supply established Main Power supply is established and Operation Preparation Completion signal is ON	
Servo is ON Continuously draws the character '8'	
Over Travel status at Positive rotation Positive rotation is in 'Over Travel' status	
Over Travel status at Negative rotation Negative rotation is in 'Over Travel' status	

5.3.1.3 Alarm Code Display

In case of alarm occurrence, timeshared 2-digit of 'Alarm Code (R-CANopen amplifier specific)' will be displayed, continuously.

5.3.2 Red and Green LED on CN3

The status of CAN communication can be displayed by following two single LEDs on CN3.

- Red LED: ERR LED, displays error state of CAN communication
- Green LED: RUN LED, displays running state of CAN communication

The following Table shows how to display the error state by one ERR LED.

Table 5-8: CANopen Error LED Truth Table

State	ERR LED	Description
No Error	Off	The Device is in working condition
Warning limit reached	Single flash (Note)	At least one of the error counters of the CAN controller has reached or exceeded the warning level ($REC \geq 96$ or $TEC \geq 96$)
Error control event	Double flash	A guard event or a heartbeat event has occurred
Sync error	Triple flash	The sync message has not been received within the configured communication cycle period time
Bus off	On	The CAN controller is bus off

Note) The differences between 'Single flash', 'Double flash' and 'Triple flash' are distinguished by flashing rate of each indicator that is shown in Figure 5-3.

The following Table shows how to display the running state by RUN LED.

Table 5-9: CANopen RUN LED Truth Table

State	RUN LED	Description
PRE-OPERATIONAL	Blinking (Note)	The Device is in state PRE-OPERATIONAL
STOPPED	Single flash	The Device is in state STOPPED
OPERATIONAL	On	The Device is in state OPERATIONAL

Note) The differences between 'Blinking', 'Single flash', 'Double flash' and 'Triple flash' are distinguished by flashing rate of each indicator that is shown in Figure 5-3.

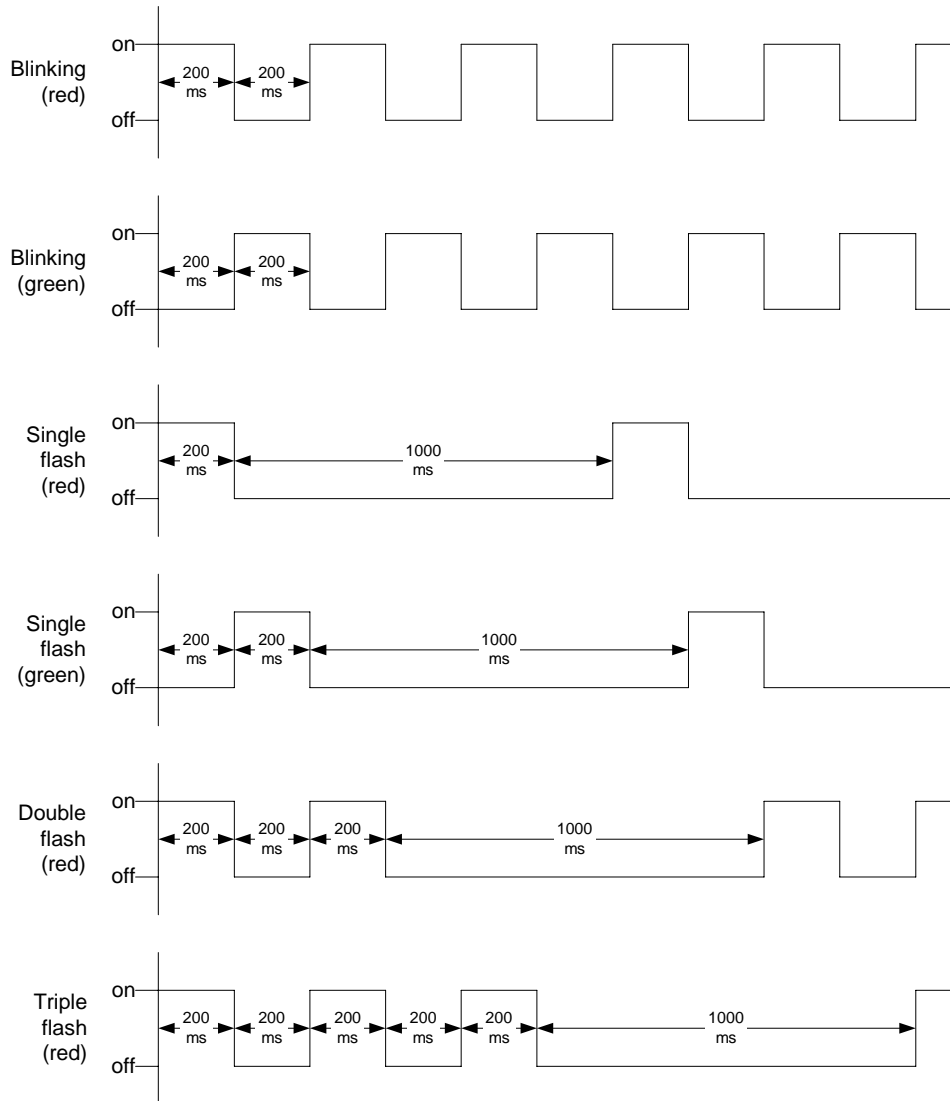


Figure 5-3: Indicator states and flash rates

5.4 R-Amplifier Specified Alarm Code and CANopen Error Code

The following Table shows the R-Amplifier specified Alarm Codes and CANopen Error Codes for each cause of alarm occurrence.

Table 5-10: Alarm Code

Alarm Code (R-Amp. Specific)	CANopen Error Code	Alarm Name
21h	5400h	Power Module Error (Over-current)
22h	2300h	Current Detection Error 0
23h	2300h	Current Detection Error 1
24h	2300h	Current Detection Error 2
41h	4310h	Overload 1
42h	2220h	Overload 2
43h	3212h	Regenerative Error
51h	4100h	Amplifier Overheat
52h	4210h	RS Overheat
53h	4210h	Dynamic Brake Resistor Overheat
54h	4310h	Internal Overheat
55h	4210h	External Overheat
61h	3211h	Over-voltage
62h	3220h	Main Circuit Under-voltage
63h	3130h	Main Power Supply Fail Phase
71h	5114h	Control Power Supply Under-voltage
72h	5120h	Control Power Error
81h	7380h	Encoder Pulse Error 1
82h	7380h	Absolute Encoder Signal Disconnect
83h	7380h	External Encoder Pulse Error
84h	7380h	Communication Error Between Encoder and Amplifier
85h	7380h	Encoder Initial Process Error
87h	7380h	CS Signal Disconnection
91h	7380h	Encoder Command Error
92h	7380h	Encoder FORM Error
93h	7380h	Encoder SYNC Error
94h	7380h	Encoder CRC Error
A1h	7390h	Encoder Error 1
A2h	7390h	Absolute Encoder Battery Error
A3h	7390h	Encoder Overheat
A5h	7390h	Encoder Error 3
A6h	7390h	Encoder Error 4
A7h	7390h	Encoder Error 5
A8h	7390h	Encoder Error 6
A9h	7390h	Failure of Encoder
B2h	7390h	Encoder Error 2
B3h	7390h	Absolute Encoder Multi-Turn Counter Error
B4h	7390h	Absolute Encoder Single-Turn Counter Error
B5h	7390h	Over-allowable Speed of Absolute Encoder at Turning ON
B6h	7390h	Encoder Memory Error
B7h	7390h	Acceleration Error
C1h	8480h	Over-speed
C2h	8481h	Speed Control Error
C3h	8482h	Speed Feedback Error
D1h	8611h	Following Error (Excessive Position Deviation)
D2h	8681h	Faulty Position Command Pulse Frequency 1
D3h	8682h	Faulty Position Command Pulse Frequency 2

Alarm Code (R-Amp. Specific)	CANopen Error Code	Alarm Name
DEh	8683h	Wrap Around Error
DFh	FF00h	Test Run Close
E1h	5530h	EEPROM Error
E2h	5581h	EEPROM Check Sum Error
E3h	5510h	Internal RAM Error
E4h	5220h	Process Error Between CPU and ASIC
E5h	5582h	Parameter Error 1
E6h	5583h	Parameter Error 2
EDh	5530h	EEPROM Error (sub CPU)
EEh	FF01h	Cycling of Control Power is necessary because some systematic parameters had been changed
EFh	5221h	Dual-port RAM Initialization Failed
F1h	6100h	Task Process Error
F2h	6010h	Initial Process Timeout
FCh	6101h	Task Synchronization Error
FDh	FF02h	CANopen Initial Setting Error
FEh	Host Communication Error	
	8180h	Bus Off detected by CAN Controller
	8181h	Rx Timeout detected
	8182h	No Sync Message
	8183h	Driver can not generate demand position any more
	8184h	Average SYNC message cycle is too small (-1%)
	8185h	Average SYNC message cycle is too big (+1%)
FFh	6011h	Malfunction on Interface Processor

The following Table shows the events which are lead to the transmission of an emergency message but not the driver alarms.

Table 5-11: EMCY messages

Value	Meaning
6265h	The mapped object does not exist.
8110h	The CAN controller has signaled a lost message.
8120h	The CAN controller has reached the warning limit due to error frames.
8130h	An error control event (heartbeat) has been occurred. (*)
8140h	The CAN controller has recovered from BUS OFF.
8150h	A COB-ID collision was detected.
8210h	A received PDO was smaller than specified by the valid mapping table.
8220h	The DLC of a received PDO exceeded the length of the valid mapping.

Note) If an error control event has been occurred in 'Operation Enabled State', the drive changes own state machine to 'Switched-ON' state. 'Disable Operation Option Code (Object 605Ch)' defines what action should be taken in this case.

5.5 Trouble Shooting <CANopen Mode Specific Error>

Alarm code DEh (Wrap Around Error)

Situation when alarm occurrence	Cause	
	1	2
Occurred when control power supply is turned ON. (Absolute encoder combination)	X	
Occurred while operating.		X

Corrective actions

Cause		Investigation and corrective actions
1	Internal coordination exceeded the limit	- Execute Absolute encoder clear - Check and modify the position factor (6093h)
2	Internal coordination exceeded the limit	- Correct the position command of the host - Check and modify the position factor (6093h) - Disable the wrap around (2108h)

Alarm code EDh (EEPROM Error (sub CPU))

Situation when alarm occurrence	Cause	
	1	2
Occurred when control power supply is turned ON.	X	
Occurred while operating. After 'save' or 'load' command via CAN communication.		X

Corrective actions

Cause		Investigation and corrective actions
1	Abnormality in control circuit of servo amplifier	- Replace the servo amplifier
2	Abnormality in control circuit of servo amplifier	- Replace the servo amplifier

Alarm code EEh (Cycling of Control Power Supply is necessary (Information))

Situation when alarm occurrence	Cause
	1
Occurred when write access via SDO	X

Corrective actions

Cause		Investigation and corrective actions
1	The parameter which is necessary to be cycling of Control power supply was written via SDO	- Execute 'Store Parameter (Object 1010h)', then turn OFF the control power supply once

Parameters that cause this alarm are as follows.

- Modulo setting parameter: Object 2105h, 2106h, 2107h and 607Bh sub-index 02h
- Absolute encoder setting: Object 2109h
- System parameter switch: Object 2120h
- Motor Parameter: Object 22E0h sub-index 01h-36h
- System Parameter: Object 22F0h-22FBh
- Polarity: Object 607Eh
- Position Factor: Object 6093h sub-index 01h, 02h
- Interpolation Sub Mode Select: Object 60C0h

Alarm code EFh (Dual-port RAM Initialization Failed)

Situation when alarm occurrence	Cause
	1
Occurred when control power supply is turned ON.	X

Corrective actions

Cause		Investigation and corrective actions
1	Abnormality in control circuit of servo amplifier	- Replace the servo amplifier

Alarm code FCh (Task Synchronization Error)

Situation when alarm occurrence	Cause	
	1	2
Occurred when control power supply is turned ON.	X	
Occurred while operating.		X

Corrective actions

Cause		Investigation and corrective actions
1	Abnormality in control circuit of servo amplifier	- Replace the servo amplifier
2	Task synchronization between control CPU and communication (sub) CPU was slipped.	- Confirm proper grounding of the amplifier - Replace the servo amplifier

Alarm code FDh (CANopen Initial Setting Error)

Situation when alarm occurrence	Cause
	1
Occurred when control power supply is turned ON.	X

Corrective actions

Cause		Investigation and corrective actions
1	Setting of Node-ID is out of range Setting of Bit Rate is not correct	- Check the setting of CAN Node-ID - Check the setting of CAN Bit Rate

Alarm code FEh-8180h (Bus Off detected by CAN controller)

Situation when alarm occurrence	Cause	
	1	2
Occurred when control power supply is turned ON.	X	
Occurred while CAN Communication.		X

Corrective actions

Cause		Investigation and corrective actions
1	Abnormality in control circuit of servo amplifier	- Replace the servo amplifier
2	Malfunction in CAN Communication due to cabling or noise	- Check the wiring of CAN Communication and repair any abnormalities. - Confirm proper grounding of the amplifier - Attach ferrite core or similar countermeasures against noise

Alarm code FEh-8181h (Rx Timeout detected)

Situation when alarm occurrence	Cause	
	1	2
Occurred when control power supply is turned ON.	X	
Occurred while CAN Communication.	X	X

Corrective actions

Cause		Investigation and corrective actions
1	Timeout setting is too small against the message sending cycle.	- Check 'Bus Break Error Detection Time (2121h)'
2	Malfunction in CAN Communication due to cabling or noise	- Check the wiring of CAN Communication and repair any abnormalities. - Confirm proper grounding of the amplifier - Attach ferrite core or similar countermeasures against noise

Alarm code FEh-8182h (No Sync Message)

Situation when alarm occurrence	Cause
	1
Occurred while CAN Communication.	X

Corrective actions

Cause		Investigation and corrective actions
1	One SYNC message missed	- Correct the setting of communication cycle

Alarm code FEh-8183h (Driver can not generate demand position any more)

Situation when alarm occurrence	Cause
	1
Occurred while CAN Communication.	X

Corrective actions

Cause		Investigation and corrective actions
1	Driver could not receive two consecutive R_PDO commands.	- Correct SYNC related system. - Correct R_PDO related system.

Alarm code FEh-8184h (Average SYNC message cycle is too small (-1%))

Situation when alarm occurrence	Cause
	1
Occurred while CAN Communication.	X

Corrective actions

	Cause	Investigation and corrective actions
1	Average cycle time of SYNC message is too small comparing to communication cycle period (Object 1006h).	- Correct SYNC related system. - Correct the setting of communication cycle period.

Alarm code FEh-8185h (Average SYNC message cycle is too big (+1%))

Situation when alarm occurrence	Cause
	1
Occurred while CAN Communication.	X

Corrective actions

	Cause	Investigation and corrective actions
1	Average cycle time of SYNC message is too big comparing to communication cycle period (Object 1006h).	- Correct SYNC related system. - Correct the setting of communication cycle period.

Alarm code FFh (Malfunction on Interface Processor)

Situation when alarm occurrence	Cause
	1
Occurred when control power supply is turned ON. Occurred while drive operation.	X

Corrective actions

	Cause	Investigation and corrective actions
1	Abnormality in control circuit of servo amplifier	- Replace the servo amplifier

6 Operation Mode

R-CANopen Servo Amplifier supports following five modes of operations that is also shown in object '**Supported Drive Mode (6502h)**'.

- Profile Position Mode (p.p)
- Profile Velocity Mode (p.v)
- Profile Torque Mode (t.q)
- Homing Mode (h.m)
- Interpolated Position Mode (i.p)

For switching of operation modes, object '**Modes of Operation (6060h)**' is used, and current operation mode can be seen in object '**Modes of Operation Display (6061h)**'.

For each operation mode, following Bits are assigned in Control Word and in Status Word.

Table 6-1: Mode specific bits in the Control word

Operation mode	Bit8	Bit6	Bit5	Bit4
Profile position mode	Halt	Abs(0) / Rel(1)	Change set immediately	New set-point
Profile velocity mode	Halt	Reserved	Reserved	Reserved
Profile torque mode	Halt	Reserved	Reserved	Reserved
Homing mode	Halt	Reserved	Reserved	Homing operation start
Interpolated position mode	Halt	Reserved	Reserved	Enable Interpolated position mode

Table 6-2: Mode specific bits in the Status word

Operation mode	Bit13	Bit12
Profile position mode	Reserved	Set-point acknowledge
Profile velocity mode	Reserved	Speed
Profile torque mode	Reserved	Reserved
Homing mode	Homing error	Homing attained
Interpolated position mode	Reserved	Interpolated position mode active

6.1 Profile Position mode

Profile Position Mode defines a point-to-point (PTP) positioning of the drive using the trajectory generator. It generates a position demand value to the control loop, depending on the input values (Target position, Profile velocity, Profile acceleration, Profile deceleration and so on). These inputs to the trajectory generator are given in user units, then normalized to encoder increments internally.

Table 6-3: Objects treated in this Mode

Index	Sub-index	Name	Type	Access
6040h		Control Word	Unsigned16	RW
6041h		Status Word	Unsigned16	RO
6060h		Modes of Operation	Integer8	RW
6061h		Modes of Operation Display	Integer8	RO
6064h		Position Actual Value	Integer32	RO
606Ch		Velocity Actual Value	Integer32	RO
6072h		Max Torque	Unsigned16	RW
6077h		Torque Actual Value	Integer16	RO
6078h		Current Actual Value	Integer16	RO
607Ah		Target Position	Integer32	RW
607Dh		Software Position Limit		
	01h	Min Position Limit	Integer32	RW
	02h	Max Position Limit	Integer32	RW
607Eh		Polarity	Unsigned8	RW
607Fh		Max Profile Velocity	Unsigned32	RW
6081h		Profile Velocity	Unsigned32	RW
6083h		Profile Acceleration	Unsigned32	RW
6084h		Profile Deceleration	Unsigned32	RW
6085h		Quick Stop Deceleration	Unsigned32	RW
6086h		Motion Profile Type	Integer16	RW
608Fh		Position Encoder Resolution	Unsigned32	RO
6093h		Position Factor		
	01h	Numerator	Unsigned32	RW
	02h	Divisor	Unsigned32	RW
60F4h		Following error actual value	Integer32	RO
2050h		Torque Compensation Command	Integer16	RW
2100h		Software Limit Enable	Unsigned8	RW
2101h		Software Limit Action	Unsigned8	RW
2102h		Hardware Limit Action	Unsigned8	RW
2105h		Position Data Format	Unsigned8	RW
2106h		Command Value for Modulo Format	Unsigned8	RW
2107h		Modulo Value	Integer32	RW
2110h		Moving Average Filter Time Constant	Integer16	RW
2116h		Bipolar Torque Limit Value 1	Unsigned16	RW
2117h		Bipolar Torque Limit Value 2	Unsigned16	RW
2119h		Sequence Torque Limit Value	Unsigned16	RW
2286h		In-Position window	Unsigned16	RW
22B9h		Following Error Limit	Unsigned16	RW

*The Objects written in **bold face letter** can be arranged to PDO Transfer.

Bit assignment of Control Word / Status Word for this mode

Control Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
(Reserved)	(Reserved)	(Reserved)	ABS Enc Clr	Trq. Lim Sw	---	---	Halt
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fault Reset	Abs (0) / Rel (1)	Change set immediately	New set point	Enable operation	Quick stop	Enable voltage	Switch on

Status Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Actual pos invalid	Synchronized	(Reserved)	Set point ack.	Internal limit active	Target reached	(Remote)	Trq. Lim status
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enabled	Switched on	Ready to Switch on

Functional description

Two different ways to apply target positions to a drive are supported by this device profile.

Set of set points:

After receiving new command the drive unit immediately processes the next target position, which results in a move where the velocity of the drive normally is not reduced to zero while switching of a set point.

Single set point:

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

The timing of the bits 'new set-point' and 'change set immediately' in the controlword and 'set-point acknowledge' in the statusword controls the two modes. These bits allow to set up a request response mechanism in order to prepare a set of set-points while another set still is processed in the drive unit. This minimizes reaction times within a control program on a host computer.

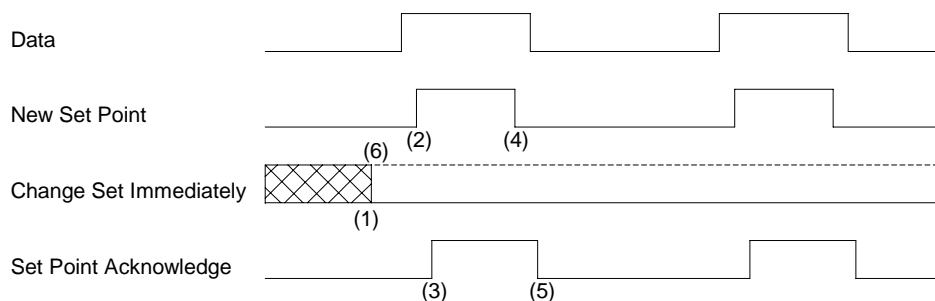


Figure 6-1: Sequence Diagram for Profile Position Mode

If the bit 'change set immediately' is "0" a single set point is expected by the drive (1). After data is applied to the drive, a host signals that the data is valid by changing the bit 'new set-point' to "1" in the controlword (2). The drive responds with 'set-point acknowledge' set to "1" in the statusword (3) after it recognized and buffered the new valid data. Now the host may release 'new set-point' (4). This mechanism results in a velocity of zero after ramping down in order to reach a target position x_1 at t_1 . After signaling to the host, that the set point is reached like described above, the next target position x_2 is processed at t_2 and reached at t_3 .

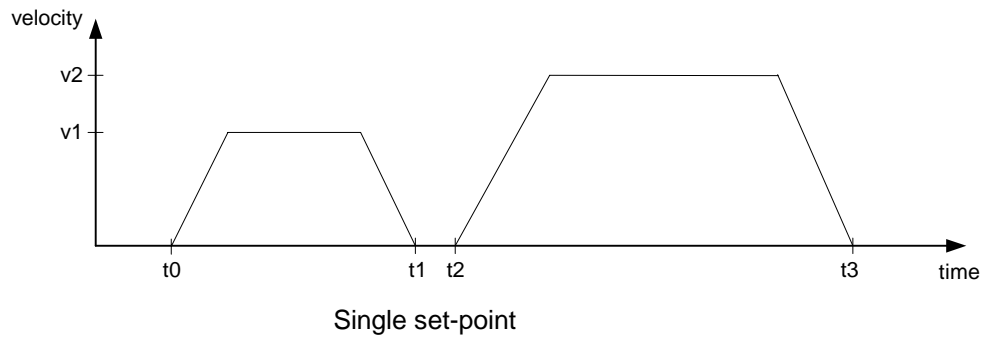


Figure 6-2: Profile Position Mode (Single set-point)

If the bit 'change set immediately' is "1" the new target position will be active immediately. The drive receives the first target position at t_0 . At the time point t_1 the drive receives a second target position. The drive readapts the actual move to the new target position immediately.

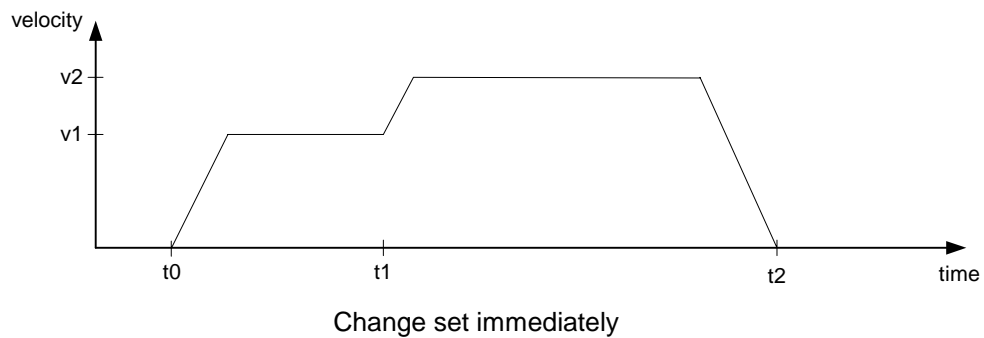


Figure 6-3: Profile Position Mode (Change set immediately)

6.2 Profile Velocity Mode

Profile Velocity Mode is used to control velocity of the drive with no special regard of the position. It supplies limit functions and trajectory generation.

Table 6-4: Objects treated in this Mode

Index	Sub-index	Name	Type	Access
6040h		Control Word	Unsigned16	RW
6041h		Status Word	Unsigned16	RO
6060h		Modes of Operation	Integer8	RW
6061h		Modes of Operation Display	Integer8	RO
6064h		Position Actual Value	Integer32	RO
606Ch		Velocity Actual Value	Integer32	RO
606Dh		Velocity Window	Unsigned16	RW
6072h		Max Torque	Unsigned16	RW
6077h		Torque Actual Value	Integer16	RO
6078h		Current Actual Value	Integer16	RO
607Eh		Polarity	Unsigned8	RW
6083h		Profile Acceleration	Unsigned32	RW
6084h		Profile Deceleration	Unsigned32	RW
6085h		Quick Stop Deceleration	Unsigned32	RW
608Fh	01h	Position Encoder Resolution	Unsigned32	RO
6093h		Position Factor		
	01h	Numerator	Unsigned32	RW
	02h	Divisor	Unsigned32	RW
60FFh		Target Velocity	Integer32	RW
2050h		Torque Compensation Command	Integer16	RW
2102h		Hardware Limit Action	Unsigned8	RW
2116h		Bipolar Torque Limit Value 1	Unsigned16	RW
2117h		Bipolar Torque Limit Value 2	Unsigned16	RW
2119h		Sequence Torque Limit Value	Unsigned16	RW
2287h		Speed Zero Range	Unsigned16	RW

*The Objects written in **bold face letter** can be arranged to PDO Transfer.

Bit assignment of Control Word / Status Word for this mode

Control Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
(Reserved)	(Reserved)	(Reserved)	ABS Enc Clr	Trq. Lim Sw	---	---	Halt
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fault Reset	---	---	---	Enable operation	Quick stop	Enable voltage	Switch on

Status Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Actual pos invalid	Synchronized	(Reserved)	Speed (zero velo)	Internal limit active	Target reached	(Remote)	Trq. Lim status
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enabled	Switched on	Ready to Switch on

Meaning of Profile velocity mode specific bit (in status word)

Name	Value	Description
Target reached	0	Halt=0: Target velocity not (yet) reached Halt=1: Axle decelerates
	1	Halt=0: Target velocity reached Halt=1: Axle has velocity 0
Speed	0	Speed is not equal 0
	1	Speed is equal 0

Functional description

In profile velocity mode, the target velocity is updated as soon as the object 'Target Velocity (60FFh)' is set or changed.

To start a move in profile velocity mode, set the profile parameters (profile acceleration, profile deceleration, and the target velocity). The amplifier will generate as long as the halt bit (Bit 8 of control word) is not set. If the halt bit is set, the amplifier will stop the move using the deceleration value and object 'Halt Option Code (605Dh)'.

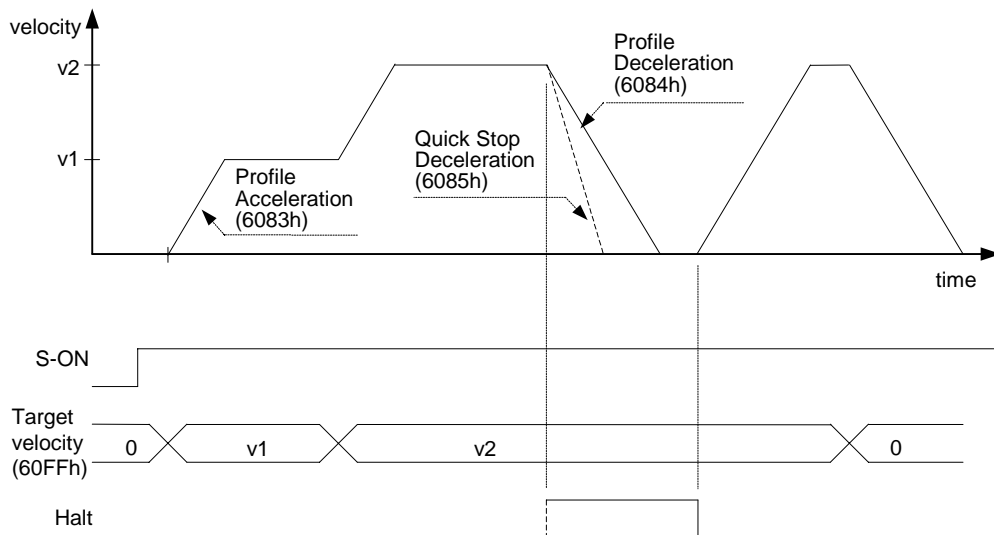


Figure 6-4: Profile Velocity Mode

6.3 Homing Mode

Homing Mode describes the various methods to find a home position, reference point, data, or zero point.

Table 6-5: Objects treated in this Mode

Index	Sub-index	Name	Type	Access
6040h		Control Word	Unsigned16	RW
6041h		Status Word	Unsigned16	RO
6060h		Modes of Operation	Integer8	RW
6061h		Modes of Operation Display	Integer8	RO
6064h		Position Actual Value	Integer32	RO
6077h		Torque Actual Value	Integer16	RO
6078h		Current Actual Value	Integer16	RO
607Ch		Home offset	Integer32	RW
6093h		Position Factor		
	01h	Numerator	Unsigned32	RW
	02h	Divisor	Unsigned32	RW
6098h		Homing method	Integer8	RW
6099h		Homing speed		
	01h	During Search for Switch	Unsigned32	RW
	02h	During Search for Zero	Unsigned32	RW
609Ah		Homing acceleration	Unsigned32	RW
2050h		Torque Compensation Command	Integer16	RW
2111h		Home position	Integer32	RW

*The Objects written in **bold face letter** can be arranged to PDO Transfer.

Table 6-6: Supported Homing method in this Drive

Method	Description
1	Homing on the negative limit switch and index pulse
2	Homing on the positive limit switch and index pulse
7	Homing on the negative side of home switch and index pulse
11	Homing on the positive side of home switch and index pulse
17	Homing on the negative limit switch, without index pulse
18	Homing on the positive limit switch, without index pulse
23	Homing on the negative side of home switch, without index pulse
27	Homing on the positive side of home switch, without index pulse
33	Homing on the index pulse in the negative direction
34	Homing on the index pulse in the positive direction
35	Homing on the current position

*Note: In case the battery backup method Absolute encoder combination, only 'without index pulse' methods can be selected. In case the 'Absolute encoder for incremental system (PA035S)' or 'PA035C encoder is used without battery (GroupC_Page00 = 01)', methods 'with index pulse' can be selected by setting Bit4 of Object 2120h properly.

Bit assignment of Control Word / Status Word for this mode

Control Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
(Reserved)	(Reserved)	(Reserved)	ABS Enc Clr	Trq. Lim Sw	---	---	Halt
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fault Reset	---	---	Start homing	Enable operation	Quick stop	Enable voltage	Switch on

Status Word

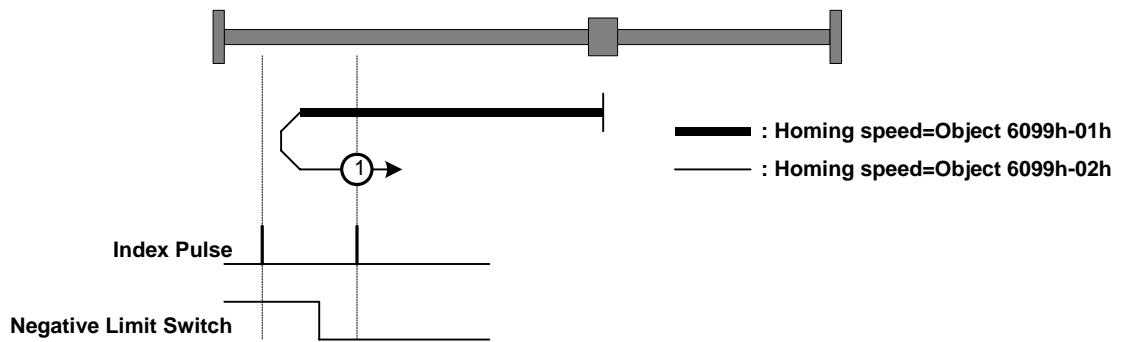
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Actual pos invalid	Synchronized	Homing error	Homing completed	Internal limit active	Target reached	Remote	Trq. Lim Status
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enabled	Switched on	Ready to Switch on

Functional description

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

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

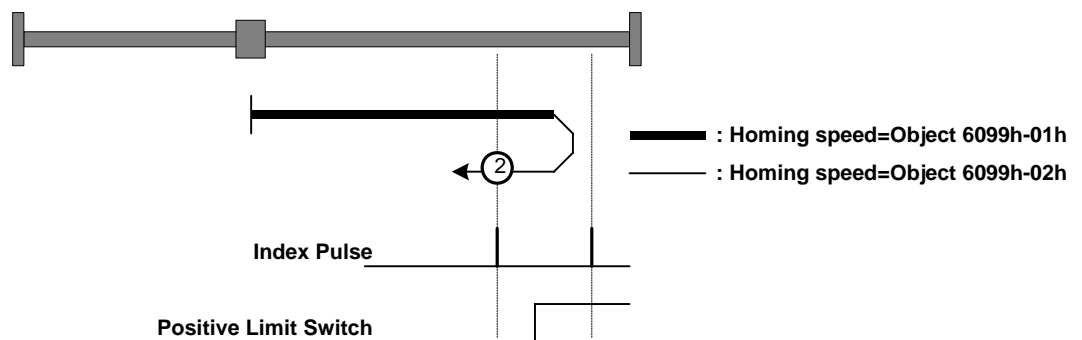
Homing on the negative limit switch and index pulse



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

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

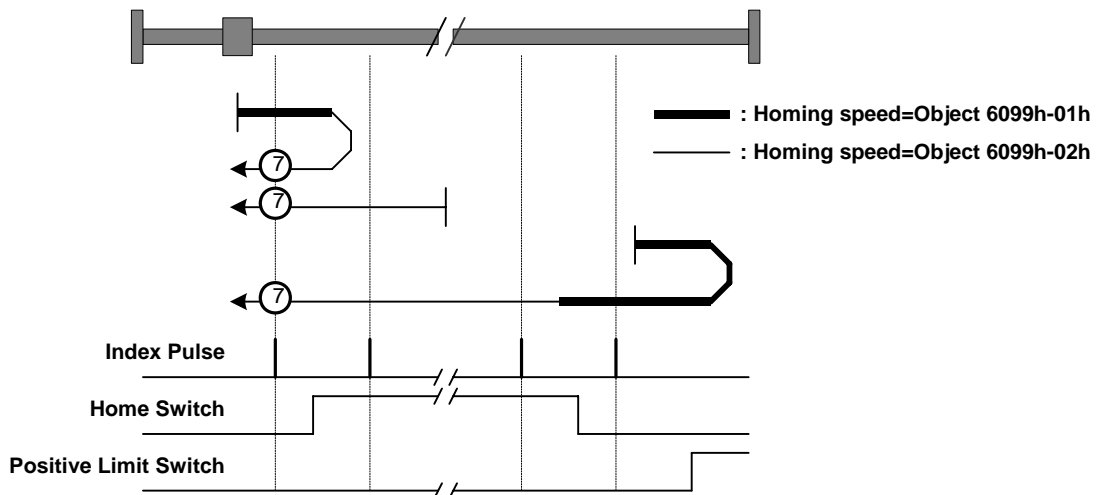
Homing on the positive limit switch and index pulse



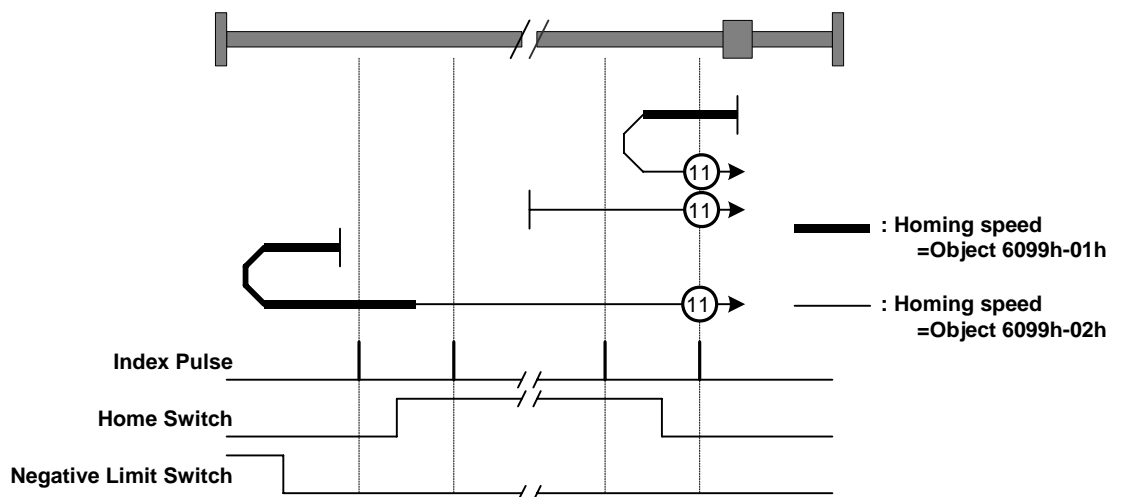
Methods 7, 11: Homing on the home switch and index pulse

These methods use a home switch which is active over only portion of the travel, in effect the switch has a 'momentary' action as the axle's position sweeps past the switch. Using method 7 the initial direction of movement is to the right, and using method 11 the initial direction of movement is to the left except if the home switch is active at the start of the motion. The home position is at the index pulse on falling edge of the home switch, as shown in the following two diagrams. If the initial direction of movement leads away from the home switch, the drive must reverse on encountering the relevant limit switch.

Homing on the home switch and index pulse - positive initial move

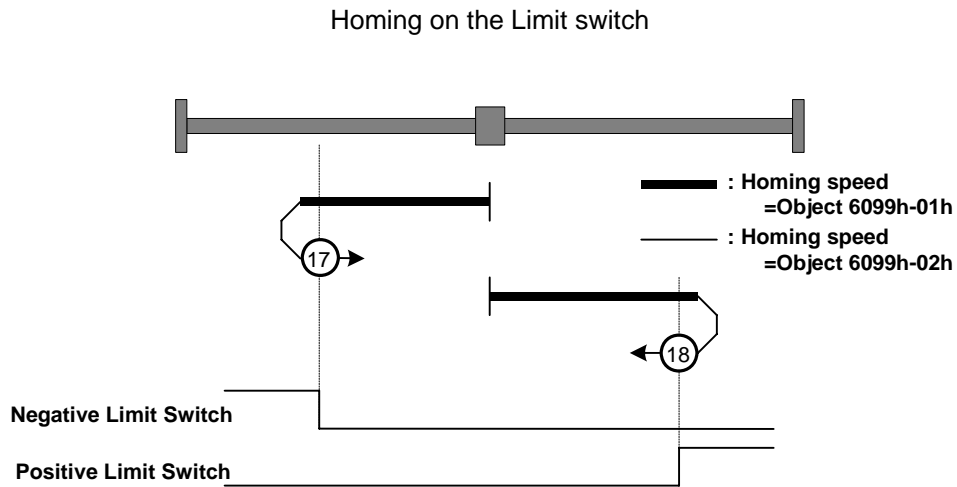


Homing on the home switch and index pulse - negative initial move



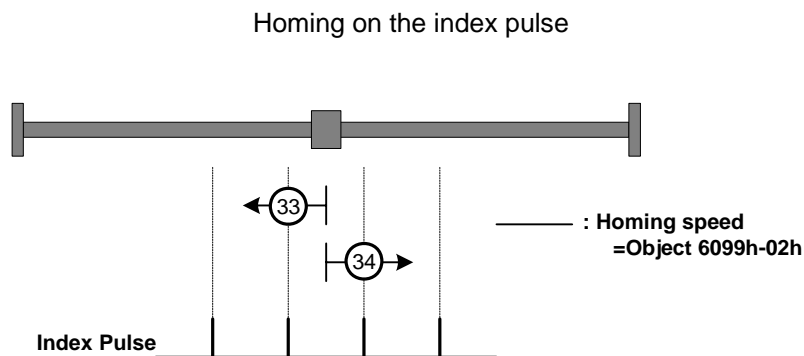
Methods 17, 18, 23 and 27: Homing without an index pulse

These methods are similar to methods 1, 2, 7 and 11 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions. For example methods 17 and 18 are similar to methods 1 and 2 as shown in the following diagram.

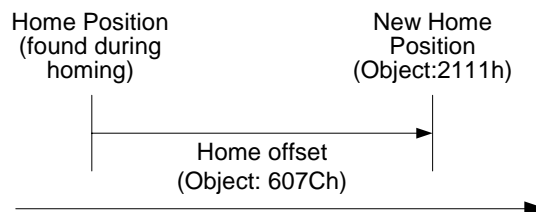


Methods 33 and 34: Homing on the index pulse

Using methods 33 or 34 the direction of homing is negative or positive respectively. The home position is at the index pulse found in the selected direction.



Homing offset (607Ch) and Home position (2111h)



Home offset : Sets the shift value from 'Home position found during homing' to 'Homing end point where the user wants to make finish homing sequence'.

Home position : After finishing of homing sequence, the actual position becomes the value that is set to this object.

6.4 Interpolated Position Mode

Interpolated Position Mode describes the time interpolation of single axles and the spatial interpolation of coordinated axles. Synchronization mechanisms are covered as well.

Table 6-7: Objects treated in this Mode

Index	Sub-index	Name	Type	Access
6040h		Control Word	Unsigned16	RW
6041h		Status Word	Unsigned16	RO
6060h		Modes of Operation	Integer8	RW
6061h		Modes of Operation Display	Integer8	RO
6064h		Position Actual Value	Integer32	RO
606Ch		Velocity Actual Value	Integer32	RO
6072h		Max Torque	Unsigned16	RW
6077h		Torque Actual Value	Integer16	RO
6078h		Current Actual Value	Integer16	RO
607Dh		Software Position Limit		
	01h	Min Position Limit	Integer32	RW
	02h	Max Position Limit	Integer32	RW
607Eh		Polarity	Unsigned8	RW
6085h		Quick Stop Deceleration	Unsigned32	RW
6086h		Motion Profile Type	Integer16	RW
608Fh	01h	Position Encoder Resolution	Unsigned32	RO
6093h		Position Factor		
	01h	Numerator	Unsigned32	RW
	02h	Divisor	Unsigned32	RW
60C0h		Interpolation sub mode select	Integer16	RW
60C1h		Interpolation data record		
	01h	Interpolation data position	Integer32	RW
60C2h		Interpolation time period		
	01h	Interpolation time units	Unsigned8	RW
	02h	Interpolation time index	Integer8	RO
60C3h		Interpolation sync definition		
	01h	Synchronize on group	Unsigned8	RW
	02h	Ip sync every n event	Unsigned8	RW
60C4h		Interpolation data configuration		
	01h	Maximum buffer size	Unsigned32	RO
	02h	Actual buffer size	Unsigned32	RW
	03h	Buffer organization	Unsigned8	RW
	04h	Buffer position	Unsigned16	RW
	05h	Size of data record	Unsigned8	RO
	06h	Buffer clear	Unsigned8	WO
60F4h		Following error actual value	Integer32	RO
2050h		Torque Compensation Command	Integer16	RW
2100h		Software Limit Enable	Unsigned8	RW
2101h		Software Limit Action	Unsigned8	RW
2102h		Hardware Limit Action	Unsigned8	RW
2105h		Position Data Format	Unsigned8	RW
2106h		Command Value for Modulo Format	Unsigned8	RW
2107h		Modulo Value	Integer32	RW
2110h		Moving Average Filter Time Constant	Integer16	RW
2116h		Bipolar Torque Limit Value 1	Unsigned16	RW
2117h		Bipolar Torque Limit Value 2	Unsigned16	RW
2119h		Sequence Torque Limit Value	Unsigned16	RW
2286h		In-Position window	Unsigned16	RW
22B9h		Following Error Limit	Unsigned16	RW

*The Objects written in **bold face letter** can be arranged to PDO Transfer.

State transitions of the internal states

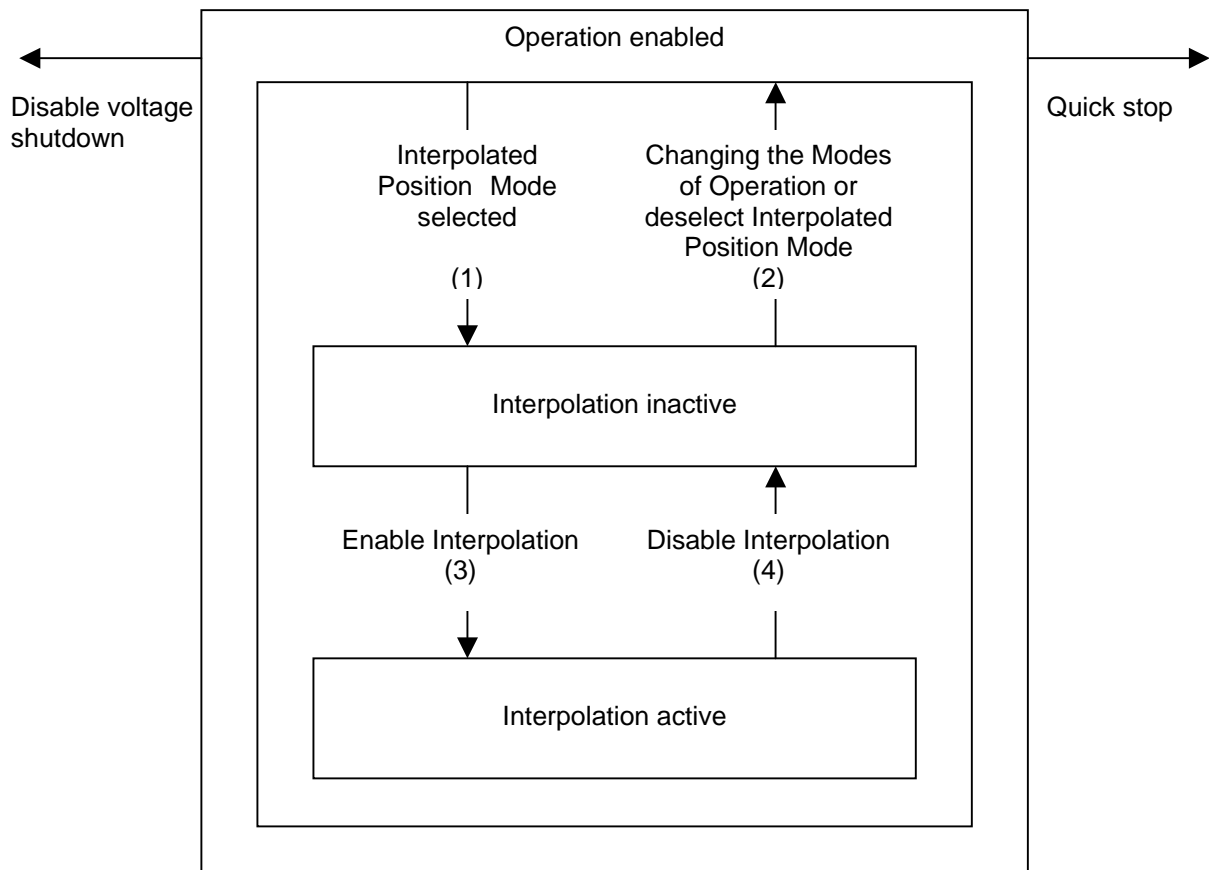


Figure 6-5: Internal states for the Interpolated position mode

Interpolation inactive

This state is entered when the device is in state OPERATION ENABLE and the Interpolated position mode is selected. The drive unit will accept input data and will buffer it for interpolation calculations, but it does not move the axles.

Interpolation active

This state is entered when the device is in state OPERATION ENABLE, the Interpolated position mode is selected and enabled. The drive unit will accept input data and it moves the axles.

- State Transition 1: NO IP-MODE SELECTED => IP-MODE INACTIVE
Event: Enter in the state OPERATION ENABLE with Control word and select ip mode with modes of operation
- State Transition 2: IP-MODE INACTIVE => NO IP-MODE SELECTED
Event: Leave the state OPERATION ENABLE with controlword or select any other mode with modes of operation if it is allowed inside the state OPERATION ENABLE
- State Transition 3: IP-MODE INACTIVE => IP-MODE ACTIVE
Event: Set bit enable ip mode (bit4) of the controlword while in ip mode and OPERATION ENABLE
- State Transition 4: IP-MODE ACTIVE => IP-MODE INACTIVE
Event: Reset bit enable ip mode (bit4) of the controlword while in ip mode and OPERATION ENABLE

Bit assignment of Control Word / Status Word for this mode

Control Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
(Reserved)	(Reserved)	(Reserved)	ABS Enc Clr	Trq. Lim Sw	---	---	Halt
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fault Reset	---	---	Enable I.p. mode	Enable operation	Quick stop	Enable voltage	Switch on

Status Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Actual pos invalid	Synchronized	(Reserved)	I.p. mode active	Internal limit active	Target reached	Remote	Trq. Lim Status
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enabled	Switched on	Ready to Switch on

Functional description

A drive can be controlled and supervised by the controlword and the statusword respectively. To choose the operation mode, the modes of operation is used. The activated operation mode is monitored by modes of operation display.

In order to operate at this mode, SYNC cycle time should be selected between 2ms to 10ms at software version 000B or before, between 2ms to 30ms at software version 000C or later.

In case a large cycle time is set, it is recommended to use some smoothing function (Moving average filter: Object2110h, 6086h, or 2nd order spline: Object 60C0h = -2) in order to eliminate “jumps” of motor speed.

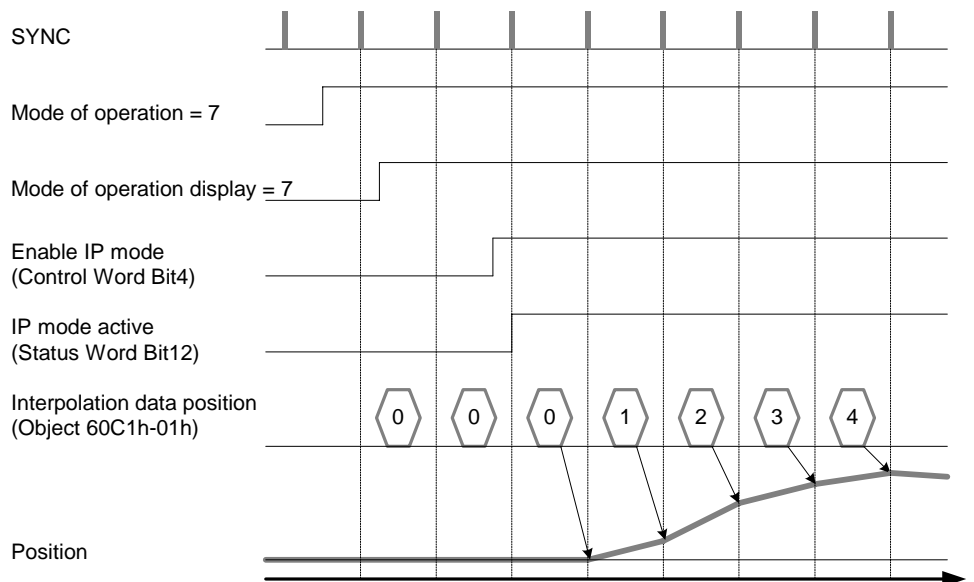


Figure 6-6: Data processing with SYNC Signal

6.5 Profile Torque Mode

Profile Torque Mode offers the chance to demand an external torque value (**target torque**), which can be smoothed by the trajectory generator. The **torque slope** object controls the maximum rate of change of torque command internally.

All definitions within this document refer to rotary motors. If linear motors are used all “torque” objects correspond to “force” instead. For reasons of simplicity the objects do not exist twice and their names should not be modified.

Table 6-8: Objects treated in this Mode

Index	Sub-index	Name	Type	Access
6040h		Control Word	Unsigned16	RW
6041h		Status Word	Unsigned16	RO
6060h		Modes of Operation	Integer8	RW
6061h		Modes of Operation Display	Integer8	RO
6071h		Target Torque	Integer16	RW
6072h		Max Torque	Unsigned16	RW
6075h		Motor Rated Current	Unsigned32	RO
6076h		Motor Rated Torque	Unsigned32	RO
6077h		Torque Actual Value	Integer16	RO
6078h		Current Actual Value	Integer16	RO
607Eh		Polarity	Unsigned8	RW
6087h		Torque Slope	Unsigned32	RW
6088h		Torque Profile Type	Insigned16	RW
2116h		Bipolar Torque Limit Value 1	Unsigned16	RW
2117h		Bipolar Torque Limit Value 2	Unsigned16	RW
2119h		Sequence Torque Limit Value	Unsigned16	RW

*The Objects written in **bold face letter** can be arranged to PDO Transfer.

Bit assignment of Control Word / Status Word for this mode

Control Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
(Reserved)	(Reserved)	(Reserved)	ABS Enc Clr	Trq. Lim Sw	---	---	Halt
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fault Reset	---	---	---	Enable operation	Quick stop	Enable voltage	Switch on

Status Word

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Actual pos invalid	Synchronized	(Reserved)	(Reserved)	Internal limit active	Target reached	(Remote)	Trq. Lim status
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enabled	Switched on	Ready to Switch on

Functional description

In profile torque mode, the target torque is updated as soon as the object 'Target Torque (6071h)' is set or changed.

To start a move in profile torque mode, set the profile parameters (torque slope, torque profile type, and the target torque). The amplifier will generate torque demand value as long as the halt bit (Bit 8 of control word) is not set. If the halt bit is set, the trajectory generator reduces the torque down to zero. Correspondingly it raises it again to the target torque if bit 8 is cleared.

If the hardware limit switch (positive or negative side) becomes active while this mode, torque command is limited by "Sequence Torque Limit Value (Object 2119h)".

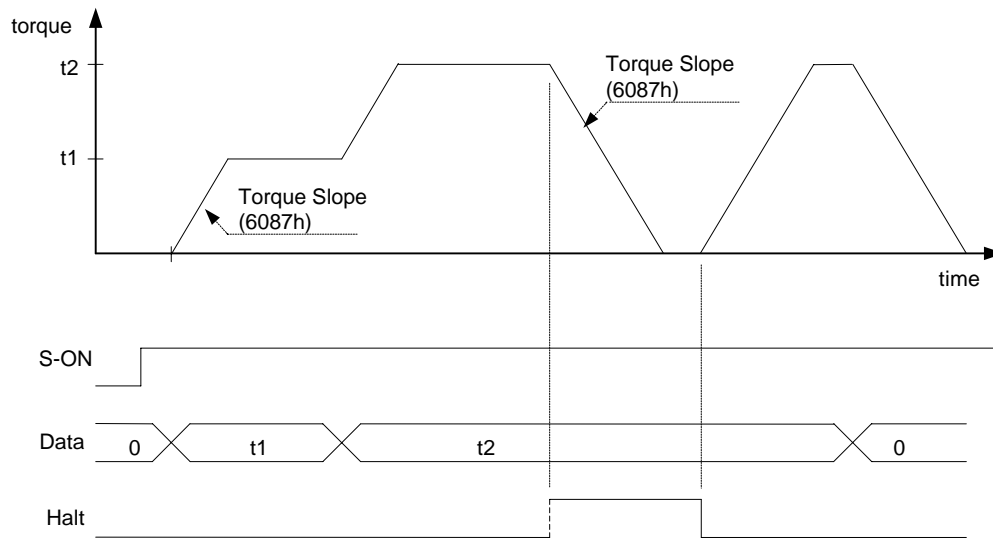


Figure 6-7: Profile Torque Mode

7 Object Dictionary

7.1 Object Group 1000h

7.1.1 List of Object Group 1000h

Index	Sub-index	Name	Obj. code	Data type	Access	PDO
1000h		Device Type	VAR	Unsigned32	RO	
1001h		Error Register	VAR	Unsigned8	RO	
1003h		Predefined Error Field	ARR			
	00h	Number of Errors	VAR	Unsigned8	RW	
	01h	Error Field	VAR	Unsigned32	RO	
1005h		COB-ID SYNC Message	VAR	Unsigned32	RW	
1006h		Communication Cycle Period	VAR	Unsigned32	RW	
1007h		Synchronous Window Length	VAR	Unsigned32	RW	
1008h		Manufacturer Device Name	VAR	Visible String	RO	
1009h		Manufacturer Hardware Version	VAR	Visible String	RO	
100Ah		Manufacturer Software Version	VAR	Visible String	RO	
100Ch		Guard Time (not implemented)	VAR	Unsigned16	RW	
100Dh		Life Time Factor (not implemented)	VAR	Unsigned8	RW	
1010h		Store Parameters	ARR			
	01h	Save All Parameters	VAR	Unsigned32	RW	
1011h		Restore Default Parameters	ARR			
	01h	Restore All Default Parameters	VAR	Unsigned32	RW	
1014h		COB-ID Emergency Message	VAR	Unsigned32	RW	
1016h		Consumer Heartbeat Time	ARR			
	01h	Consumer Heartbeat Time	VAR	Unsigned32	RW	
1017h		Producer Heartbeat Time	VAR	Unsigned16	RW	
1018h		Identity Object	REC			
	01h	Vender ID	VAR	Unsigned32	RO	
	02h	Product code	VAR	Unsigned32	RO	
	03h	Revision number	VAR	Unsigned32	RO	
1200h		1 st Server SDO Parameter	REC			
	01h	COB-ID Client -> Server	VAR	Unsigned32	RO	
	02h	COB-ID Server -> Client	VAR	Unsigned32	RO	

Index	Sub-index	Name	Obj. code	Data type	Access	PDO
1400h		1 st Receive PDO Parameter	REC			
	01h	COB-ID R_PDO1	VAR	Unsigned32	RW	
	02h	Transmission Type R_PDO1	VAR	Unsigned8	RW	
1401h		2 nd Receive PDO Parameter	REC			
	01h	COB-ID R_PDO2	VAR	Unsigned32	RW	
	02h	Transmission Type R_PDO2	VAR	Unsigned8	RW	
1402h		3 rd Receive PDO Parameter	REC			
	01h	COB-ID R_PDO3	VAR	Unsigned32	RW	
	02h	Transmission Type R_PDO3	VAR	Unsigned8	RW	
1403h		4 th Receive PDO Parameter	REC			
	01h	COB-ID R_PDO4	VAR	Unsigned32	RW	
	02h	Transmission Type R_PDO4	VAR	Unsigned8	RW	
1600h		1 st Receive PDO Mapping	REC			
	00h	Number of Elements to R_PDO1	VAR	Unsigned8	RW	
	01h	First Mapped Object to R_PDO1	VAR	Unsigned32	RW	
	02h	Second Mapped Object to R_PDO1	VAR	Unsigned32	RW	
	03h	Third Mapped Object to R_PDO1	VAR	Unsigned32	RW	
	04h	Fourth Mapped Object to R_PDO1	VAR	Unsigned32	RW	
1601h		2 nd Receive PDO Mapping	REC			
	00h	Number of Elements to R_PDO2	VAR	Unsigned8	RW	
	01h	First Mapped Object to R_PDO2	VAR	Unsigned32	RW	
	02h	Second Mapped Object to R_PDO2	VAR	Unsigned32	RW	
	03h	Third Mapped Object to R_PDO2	VAR	Unsigned32	RW	
	04h	Fourth Mapped Object to R_PDO2	VAR	Unsigned32	RW	
1602h		3 rd Receive PDO Mapping	REC			
	00h	Number of Elements to R_PDO3	VAR	Unsigned8	RW	
	01h	First Mapped Object to R_PDO3	VAR	Unsigned32	RW	
	02h	Second Mapped Object to R_PDO3	VAR	Unsigned32	RW	
	03h	Third Mapped Object to R_PDO3	VAR	Unsigned32	RW	
	04h	Fourth Mapped Object to R_PDO3	VAR	Unsigned32	RW	
1603h		4 th Receive PDO Mapping	REC			
	00h	Number of Elements to R_PDO4	VAR	Unsigned8	RW	
	01h	First Mapped Object to R_PDO4	VAR	Unsigned32	RW	
	02h	Second Mapped Object to R_PDO4	VAR	Unsigned32	RW	
	03h	Third Mapped Object to R_PDO4	VAR	Unsigned32	RW	
	04h	Fourth Mapped Object to R_PDO4	VAR	Unsigned32	RW	

Index	Sub-index	Name	Obj. code	Data type	Access	PDO
1800h		1 st Transmit PDO Parameter	REC			
	01h	COB-ID T_PDO1	VAR	Unsigned32	RW	
	02h	Transmission Type T_PDO1	VAR	Unsigned8	RW	
	03h	Inhibit Time T_PDO1	VAR	Unsigned16	RW	
	05h	Event Timer T_PDO1	VAR	Unsigned16	RW	
1801h		2 nd Transmit PDO Parameter	REC			
	01h	COB-ID T_PDO2	VAR	Unsigned32	RW	
	02h	Transmission Type T_PDO2	VAR	Unsigned8	RW	
	03h	Inhibit Time T_PDO2	VAR	Unsigned16	RW	
	05h	Event Timer T_PDO2	VAR	Unsigned16	RW	
1802h		3 rd Transmit PDO Parameter	REC			
	01h	COB-ID T_PDO3	VAR	Unsigned32	RW	
	02h	Transmission Type T_PDO3	VAR	Unsigned8	RW	
	03h	Inhibit Time T_PDO3	VAR	Unsigned16	RW	
	05h	Event Timer T_PDO3	VAR	Unsigned16	RW	
1803h		4 th Transmit PDO Parameter	REC			
	01h	COB-ID T_PDO4	VAR	Unsigned32	RW	
	02h	Transmission Type T_PDO4	VAR	Unsigned8	RW	
	03h	Inhibit Time T_PDO4	VAR	Unsigned16	RW	
	05h	Event Timer T_PDO4	VAR	Unsigned16	RW	
1A00h		1 st Transmit PDO Mapping	REC			
	00h	Number of Elements to T_PDO1	VAR	Unsigned8	RW	
	01h	First Mapped Object to T_PDO1	VAR	Unsigned32	RW	
	02h	Second Mapped Object to T_PDO1	VAR	Unsigned32	RW	
	03h	Third Mapped Object to T_PDO1	VAR	Unsigned32	RW	
	04h	Fourth Mapped Object to T_PDO1	VAR	Unsigned32	RW	
1A01h		2 nd Transmit PDO Mapping	REC			
	00h	Number of Elements to T_PDO2	VAR	Unsigned8	RW	
	01h	First Mapped Object to T_PDO2	VAR	Unsigned32	RW	
	02h	Second Mapped Object to T_PDO2	VAR	Unsigned32	RW	
	03h	Third Mapped Object to T_PDO2	VAR	Unsigned32	RW	
	04h	Fourth Mapped Object to T_PDO2	VAR	Unsigned32	RW	
1A02h		3 rd Transmit PDO Mapping	REC			
	00h	Number of Elements to T_PDO3	VAR	Unsigned8	RW	
	01h	First Mapped Object to T_PDO3	VAR	Unsigned32	RW	
	02h	Second Mapped Object to T_PDO3	VAR	Unsigned32	RW	
	03h	Third Mapped Object to T_PDO3	VAR	Unsigned32	RW	
	04h	Fourth Mapped Object to T_PDO3	VAR	Unsigned32	RW	
1A03h		4 th Transmit PDO Mapping	REC			
	00h	Number of Elements to T_PDO4	VAR	Unsigned8	RW	
	01h	First Mapped Object to T_PDO4	VAR	Unsigned32	RW	
	02h	Second Mapped Object to T_PDO4	VAR	Unsigned32	RW	
	03h	Third Mapped Object to T_PDO4	VAR	Unsigned32	RW	
	04h	Fourth Mapped Object to T_PDO4	VAR	Unsigned32	RW	

7.1.2 Parameter Description for Object Group 1000h

Object 1000h: Device Type

This object describes the type of device and its functionality.

Object description	Index	1000h				
	Name	Device type				
	Object code	VAR				
	Data type	Unsigned32				
Entry description	Sub-index	00h, Device type				
	Meaning	Device type and profile				
	Access	RO				
	PDO mapping	---				
	Value range	---				
	Default value	---				
Data description	MSB				LSB	
		Additional Information		Device profile number		
		Mode bits	Type	402d (192h)		
	31	24	23	16	15	0
		Device profile number: 402d (device profile)				
	Type: 02 (servo drive)					
	Mode bits: 0 (manufacturer-specific)					

Object 1001h: Error Register

This object shows the error status of the unit. And more detailed error information is made available in Object 1003h (Predefined error field).

Object description	Index	1001h			
	Name	Error register			
	Object code	VAR			
	Data type	Unsigned8			
Entry description	Sub-index	00h, Error register			
	Meaning	Error register			
	Access	RO			
	PDO mapping	---			
	Value range	---			
	Default value	---			
Bit coding	Bit	Description	Bit	Description	
	0	Generic error	4	Communication error	
	1	Current	5	Device profile specific	
	2	Voltage	6	(reserved)	
	3	Temperature	7	Manufacturer specific	

Object 1003h: Predefined Error Field

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

- The entry at sub-index 00h contains the number of saved error messages.
- Every new error is stored at sub-index 01h, the older ones move down the list.
- Write a '0' to sub-index 00h resets the error history.

Object description	Index	1003h
	Name	Predefined error field
	Object code	ARRAY
	Data type	Unsigned32

Entry description	Sub-index	00h, Number of errors
	Meaning	Number of error entries
	Access	RW *Write: only 0 (means information clear) is accepted
	PDO mapping	---
	Value range	0..2
	Default value	0

Sub-index	01h...02h, Error field
Meaning	Standard error field
Access	RO
PDO mapping	----
Value range	Unsigned32
Default value	---

Bit coding	MSB			LSB
		Additional information	Error code	
	31	16	15	0
	Bit	Meaning		
	31 - 24	(reserved)		
	23 - 16	R amplifier specified Alarm Code		
	15 - 0	Error Code defined in DSP-402		

Object 1005h: COB-ID SYNC Message

The object shows the COB-ID of the Synchronization Object (SYNC) and specifies whether a unit sends or receives SYNC messages.

The unit can only receive SYNC messages.

The COB-ID can be changed in the NMT "Pre-Operational" state.

Object description	Index	1005h
	Name	COB-ID SYNC Message
	Object code	VAR
	Data type	Unsigned32

Entry description	Sub-index	00h, COB-ID SYNC Message
	Meaning	Identifier of the synchronization object
	Access	RW
	PDO mapping	---
	Value range	0000 0001...0000 07FFh
	Default value	0000 0080h

Bit coding	Bit	Value	Meaning
	31(MSB)	X	Do not care
	30	0	Device does not generate SYNC message
		1	Device generates SYNC message
	29	0	11-bit ID (CAN 2.0A)
		1	29-bit ID (CAN 2.0B)
	28 – 11	0	If Bit 29 = 0
		X	If Bit 29 = 1: Bits 28 – 11 of 29-bit-SYNC COB-ID
10 – 0 (LSB)	X	Bits 10 – 0 of SYNC COB-ID	

Object 1006h: Communication Cycle Period

This object defines the communication cycle period in micro second. This period defines the SYNC interval. It is 0 if not used.

'Interpolation Time Units (object 60C2h-subindex 01h)' and this object are treated as the same meaning in this drive.

Written value given in micro second to this object is divided by 1000 then copied to object 60C2h-subindex 01h automatically.

Object description	Index	1006h
	Name	Communication cycle period
	Object code	VAR
	Data type	Unsigned32

Entry description	Sub-index	00h, Communication cycle period
	Meaning	Communication cycle period
	Access	RW
	PDO mapping	---
	Value range	0, 2000...100000 (only the multiple of 1000 can be set)
	Default value	0

Object 1007h: Synchronous Window Length

Contains the length of the time window for synchronization PDOs in micro second. It is 0 if not used.

Object description	Index	1007h
	Name	Synchronous window length
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Synchronous window length
	Meaning	Synchronous window length
	Access	RW
	PDO mapping	---
	Value range	---
	Default value	0

Object 1008h: Manufacturer Device Name

This object shows the manufacturer device name.

Object description	Index	1008h
	Name	Manufacturer device name
	Object code	VAR
	Data type	Visible String
Entry description	Sub-index	00h, Manufacturer device name
	Meaning	Manufacturer device name
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	RS1□△△AL

Object 1009h: Manufacturer Hardware Version

Contains the manufacturer hardware version description.

Object description	Index	1009h
	Name	Manufacturer hardware version
	Object code	VAR
	Data type	Visible String
Entry description	Sub-index	00h, Manufacturer hardware version
	Meaning	Hardware Identifier
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	---

Object 100Ah: Manufacturer Software Version

Contains the manufacturer software version description.

Object description	Index	100Ah
	Name	Manufacturer software version
	Object code	VAR
	Data type	Visible String
Entry description	Sub-index	00h, Manufacturer software version
	Meaning	Software Identifier
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	V. **-**

Object 100Ch: Guard Time (not implemented)

The objects at index 100Ch and 100Dh include the guard time in milliseconds and the life time factor. The life time factor multiplied with the guard time gives the life time for the Life Guarding Protocol. It is 0 if not used.

Object description	Index	100Ch
	Name	Guard time
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Guard time
	Meaning	Time span for node guarding [ms]
	Access	RW
	PDO mapping	---
	Value range	0..65535
	Default value	0

Note) Node/life guarding function is not implemented in this drive.

Object 100Dh: Life Time Factor (not implemented)

The life time factor multiplied with the guard time gives the life time for the node guarding protocol. It is 0 if not used.

Object description	Index	100Dh
	Name	Life time factor
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Life time factor
	Meaning	Repeat factor for the node guarding protocol
	Access	RW
	PDO mapping	---
	Value range	0..255
	Default value	0

Note) Node/life guarding function is not implemented in this drive.

Object 1010h: Store Parameters

The object is used to save parameters.

- Sub-index 01h: all savable parameters

Object description	Index	1010h
	Name	Store parameters
	Object code	ARRAY
	Data type	Unsigned32

Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	1

Sub-index	01h, Save all parameters
Meaning	Saves all parameters
Access	RW
PDO mapping	---
Value range	---

Command Data In order to avoid storage of parameters by misstate, storage is only executed when a specific signature is written to the 'sub-index 1'. The signature is "save".

MSB			LSB
e	v	a	s
65h	76h	61h	73h

Note

1. List of all savable objects is shown in next page.
2. Keep the control power 'ON' more than 5 seconds, after the 'save' command.
3. 'Confirmed message' via SDO means 'Command Accepted', not 'Parameter Saving Completed' for this object.

Object 1011h: Restore Default Parameters

The object is used to restore the default parameters.

- Sub-index 01h: all parameters

Object description	Index	1011h
	Name	Restore default parameters
	Object code	ARRAY
	Data type	Unsigned32

Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	1

Sub-index	01h, Restore default of all parameters
Meaning	Resets all parameter values to the default setting
Access	RW

PDO mapping	---
Value range	---

Command Data

In order to avoid the restoring of default parameters by misstate, restoring is only executed when a specific signature is written to the 'sub-index 1'. The signature is "load".

MSB			LSB
d	a	o	l
64h	61h	6Fh	6Ch

Note

1. List of all restored objects and default data is shown in following table.
2. Keep the control power 'ON' more than 5 seconds, after the 'load' command.
3. 'Confirmed message' via SDO means 'Command Accepted', not 'Parameter Loading Completed' for this object.

Table 7-1: Stored (saved), Restored (loaded) Objects

Index	Sub-index	'save'	'load'	Data type	Default Data
1005h	00h	X	X	Unsigned32	0000 0080h
1006h	00h	X	X	Unsigned32	0000 0000h
1007h	00h	X	X	Unsigned32	0000 0000h
100Ch	00h	X	X	Unsigned16	0000h
100Dh	00h	X	X	Unsigned8	00h
1014h	00h	X	X	Unsigned32	0000 0080h
1017h	00h	X	X	Unsigned16	0000h
1400h	01h	X	X	Unsigned32	0000 0200h + Node ID
	02h	X	X	Unsigned8	FFh
1401h	01h	X	X	Unsigned32	0000 0300h + Node ID
	02h	X	X	Unsigned8	FFh
1402h	01h	X	X	Unsigned32	0000 0400h + Node ID
	02h	X	X	Unsigned8	FFh
1403h	01h	X	X	Unsigned32	0000 0500h + Node ID
	02h	X	X	Unsigned8	FFh
1600h	00h	X	X	Unsigned8	01h
	01h	X	X	Unsigned32	6040 0010h
	02h	X	X	Unsigned32	0000 0000h
	03h	X	X	Unsigned32	0000 0000h
	04h	X	X	Unsigned32	0000 0000h
1601h	00h	X	X	Unsigned8	00h
	01h	X	X	Unsigned32	0000 0000h
	02h	X	X	Unsigned32	0000 0000h
	03h	X	X	Unsigned32	0000 0000h
	04h	X	X	Unsigned32	0000 0000h
1602h	00h	X	X	Unsigned8	00h
	01h	X	X	Unsigned32	0000 0000h
	02h	X	X	Unsigned32	0000 0000h
	03h	X	X	Unsigned32	0000 0000h
	04h	X	X	Unsigned32	0000 0000h
1603h	00h	X	X	Unsigned8	00h
	01h	X	X	Unsigned32	0000 0000h
	02h	X	X	Unsigned32	0000 0000h
	03h	X	X	Unsigned32	0000 0000h
	04h	X	X	Unsigned32	0000 0000h

*The character 'X' means 'supported'.

Index	Sub-index	'save'	'load'	Data type	Default Data
1800h	01h	X	X	Unsigned32	0000 0180h + Node ID
	02h	X	X	Unsigned8	FFh
	03h	X	X	Unsigned16	0000h
	05h	X	X	Unsigned16	0000h
1801h	01h	X	X	Unsigned32	0000 0280h + Node ID
	02h	X	X	Unsigned8	FFh
	03h	X	X	Unsigned16	0000h
	05h	X	X	Unsigned16	0000h
1802h	01h	X	X	Unsigned32	0000 0380h + Node ID
	02h	X	X	Unsigned8	FFh
	03h	X	X	Unsigned16	0000h
	05h	X	X	Unsigned16	0000h
1803h	01h	X	X	Unsigned32	0000 0480h + Node ID
	02h	X	X	Unsigned8	FFh
	03h	X	X	Unsigned16	0000h
	05h	X	X	Unsigned16	0000h
1A00h	00h	X	X	Unsigned8	01h
	01h	X	X	Unsigned32	6041 0010h
	02h	X	X	Unsigned32	0000 0000h
	03h	X	X	Unsigned32	0000 0000h
	04h	X	X	Unsigned32	0000 0000h
1A01h	00h	X	X	Unsigned8	00h
	01h	X	X	Unsigned32	0000 0000h
	02h	X	X	Unsigned32	0000 0000h
	03h	X	X	Unsigned32	0000 0000h
	04h	X	X	Unsigned32	0000 0000h
1A02h	00h	X	X	Unsigned8	00h
	01h	X	X	Unsigned32	0000 0000h
	02h	X	X	Unsigned32	0000 0000h
	03h	X	X	Unsigned32	0000 0000h
	04h	X	X	Unsigned32	0000 0000h
1A03h	00h	X	X	Unsigned8	00h
	01h	X	X	Unsigned32	0000 0000h
	02h	X	X	Unsigned32	0000 0000h
	03h	X	X	Unsigned32	0000 0000h
	04h	X	X	Unsigned32	0000 0000h
605Ah	00h	X	X	Integer16	0002h
605Bh	00h	X	X	Integer16	0000h
605Ch	00h	X	X	Integer16	0000h
605Dh	00h	X	X	Integer16	0001h
605Eh	00h	X	X	Integer16	FFFFh
6060h	00h	X	X	Integer8	01h
606Dh	00h	X	X	Unsigned16	03E8h
607Ch	00h	X	X	Integer32	0000 0000h
607Dh	01h	X	X	Integer32	8000 0001h
	02h	X	X	Integer32	7FFF FFFFh
607Eh	00h	X	X	Unsigned8	00h
607Fh	00h	X	X	Unsigned32	07FF FFFFh
6081h	00h	X	X	Unsigned32	007F FFFFh
6083h	00h	X	X	Unsigned32	07FF FFFFh
6084h	00h	X	X	Unsigned32	07FF FFFFh

*The character 'X' means 'supported'.

Index	Sub-index	'save'	'load'	Data type	Default Data
6085h	00h	X	X	Unsigned32	7FFF FFFFh
6086h	00h	X	X	Integer16	0000h
6087h	00h	X	X	Unsigned32	0007 FFFFh
6093h	01h	X	X	Unsigned32	0000 0001h
	02h	X	X	Unsigned32	0000 0001h
6098h	00h	X	X	Integer8	01h
6099h	01h	X	X	Unsigned32	007F FFFFh
	02h	X	X	Unsigned32	0007 FFFFh
609Ah	00h	X	X	Unsigned32	007F FFFFh
60C0h	00h	X	X	Integer16	FFFFh
60C2h	01h	X	X	Unsigned8	00h
60FEh	02h	X	X	Unsigned32	FFFF FFFFh
2100h	00h	X	X	Unsigned8	01h
2101h	00h	X	X	Unsigned8	00h
2102h	00h	X	X	Unsigned8	00h
2105h	00h	X	X	Unsigned8	00h
2106h	00h	X	X	Unsigned8	00h
2107h	00h	X	X	Integer32	7FFF FFFFh
2108h	00h	X	X	Unsigned8	00h
2109h	00h	X	X	Unsigned8	20h
2110h	00h	X	X	Integer16	0064h
2111h	00h	X	X	Integer32	0000 0000h
2116h	00h	X	X	Unsigned16	0064h
2117h	00h	X	X	Unsigned16	0064h
2119h	00h	X	X	Unsigned16	0078h
2120h	00h	X	X	Unsigned16	0000h
2121h	00h	X	X	Unsigned16	0000h
2122h	00h	X	X	Unsigned8	00h

*The character 'X' means 'supported'.

Object 1014h: COB-ID Emergency Message

This object defines the COB-ID of the Emergency Object (EMCY).

Object description	Index	1014h	
	Name	COB-ID EMCY	
	Object code	VAR	
	Data type	Unsigned32	
Entry description	Sub-index	00h, COB-ID EMCY	
	Meaning	Identifier of the emergency object	
	Access	RW	
	PDO mapping	---	
	Value range	1...4294967295	
	Default value	0000 0080h + Node-ID	
Bit coding	Bit	Value	Meaning
	31(MSB)	0	EMCY exists / is valid
		1	EMCY does not exist / is not valid
	30	0	(reserved)
		29	0
	28 – 11	1	29-bit ID (CAN 2.0B)
		0	If Bit 29 = 0
	10 – 0 (LSB)	X	If Bit 29 = 1: Bits 28 – 11 of 29-bit COB-ID
X		Bits 10 – 0 of COB-ID	

Object 1016h: Consumer Heartbeat Time

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

Monitoring starts after the reception of the first heartbeat. If the heartbeat time is 0 the corresponding entry is not used. The time has to be a multiple of 1ms.

Object description	Index	1016hh
	Name	Consumer heartbeat time
	Object code	ARRAY
	Data type	Unsigned32

Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	1

	Sub-index	01h, Consumer heartbeat time
	Meaning	Time interval for monitoring of heartbeat
	Access	RW
	PDO mapping	---
	Value range	Unsigned32
	Default value	0

Data description

Bits	31	24	23	16	15	0
Value	reserved		Node-ID		Heartbeat time	
Encoded as	---		Unsigned8		Unsigned16	

Object 1017h: Producer Heartbeat Time

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

Object description	Index	1017h
	Name	Producer heartbeat time
	Object code	VAR
	Data type	Unsigned16

Entry description	Sub-index	00h, Producer heartbeat time
	Meaning	Time interval for producer "Heartbeat"
	Access	RW
	PDO mapping	---
	Value range	0..65535
	Default value	0

Object 1018h: Identity Object

This object shows information on the device.

- Sub-index 01h (vender ID) contains the identification identifier of the manufacturer,

Object description	Index	1018h
	Name	Identity object
	Object code	RECORD
	Data type	Identity

Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	1

	Sub-index	01h, Vender ID
	Meaning	Vender ID
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	0000 01B9h

	Sub-index	02h, Product code
	Meaning	Product code
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	---

	Sub-index	03h, Revision number
	Meaning	Revision number
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	---

Object 1200h: 1st Server SDO Parameter

The object saves the settings for the first server SDO.

Object description	Index	1200h
	Name	1 st server SDO parameter
	Object code	RECORD
	Data type	SDO parameter

Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2

Sub-index	01h, COB-ID Client -> Server
Meaning	Identifier Client -> Server
Access	RO
PDO mapping	---
Value range	0000 0000h...FFFF FFFFh
Default value	1536 (600h) + Node-ID

Sub-index	02h, COB-ID Server -> Client
Meaning	Identifier Server -> Client
Access	RO
PDO mapping	---
Value range	0000 0000h...FFFF FFFFh
Default value	1408 (580h) + Node-ID

Object 1400h: 1st Receive PDO Parameter

The object saves the settings for the first receive PDO R_PDO1.

Object description	Index	1400h
	Name	1 st receive PDO parameter
	Object code	RECORD
	Data type	PDO Communication Parameter

Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2

Sub-index	01h, COB-ID used by PDO
Meaning	Identifier of the R_PDO1
Access	RW
PDO mapping	---
Value range	0000 0001h...FFFF FFFFh
Default value	512 (200h) + Node-ID

Sub-index	02h, transmission type
Meaning	Transmission type
Access	RW
PDO mapping	---
Value range	0...255
Default value	255

Bit coding, Sub-index 01h	Bit	Value	Meaning
	31(MSB)	0	PDO exists / is valid
		1	PDO does not exist / is not valid
	30	0	RTR allowed on this PDO
		1	No RTR allowed on this PDO
	29	0	11-bit ID (CAN 2.0A)
		1	29-bit ID (CAN 2.0B)
	28 – 11	0	If Bit 29 = 0
X		If Bit 29 = 1: Bits 28 – 11 of 29-bit COB-ID	
10 – 0 (LSB)	X	Bits 10 – 0 of COB-ID	

Bit coding,
Sub-index 02h

Transmission type	cyclic	acyclic	synchronous	asynchronous	RTR only
0		X	X		
1 - 240	X		X		
241 - 254			- reserved -		
255				X	

Note If an R_PDO is transmitted synchronously (transmission type=0..240), the device evaluates the received data in accordance with the SYNC object. Receive PDOs are always triggered by the following SYNC upon reception of the data independent of the transmission types 0 to 240. R_PDOs with the value 255 are updated immediately with receipt of the PDOs.

T_PDOs with the value 0 or 255 are sent immediately with some change of output data.

If the transmission types for T_PDOs are set from 1 to 240, the number of value means intervals (how many SYNCs should be counted) until T_PDOs transmission.

Sub-index 3h contains the inhibit time. This time defines a minimum interval for PDO transmission.

Sub-index 5h contains the event timer. The time is the maximum interval for PDO transmission if the transmission type is set to FFh(255).

All values other than Bit31 of sub-index 1 in these objects are not allowed to change while the PDO exists (Bit31 of sub-index 1 is 0). If it does so, SDO error message '0800 0021h' would be output.

Object 1401h: 2nd Receive PDO Parameter

The object saves the settings for the first receive PDO R_PDO2.

Object description	Index	1401h
	Name	2 nd receive PDO parameter
	Object code	RECORD
	Data type	PDO Communication Parameter
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2
	Sub-index	01h, COB-ID used by PDO
	Meaning	Identifier of the R_PDO2
	Access	RW
	PDO mapping	---
	Value range	0000 0001h...FFFF FFFFh
	Default value	768 (300h) + Node-ID
	Sub-index	02h, transmission type
	Meaning	Transmission type
	Access	RW
	PDO mapping	---
	Value range	0...255
	Default value	255

Object 1402h: 3rd Receive PDO Parameter

The object saves the settings for the first receive PDO R_PDO3.

Object description	Index	1402h
	Name	3 rd receive PDO parameter
	Object code	RECORD
	Data type	PDO Communication Parameter
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2
	Sub-index	01h, COB-ID used by PDO
	Meaning	Identifier of the R_PDO3
	Access	RW
	PDO mapping	---
	Value range	0000 0001h...FFFF FFFFh
	Default value	1024 (400h) + Node-ID
Sub-index	02h, transmission type	
Meaning	Transmission type	
Access	RW	
PDO mapping	---	
Value range	0...255	
Default value	255	

Object 1403h: 4th Receive PDO Parameter

The object saves the settings for the first receive PDO R_PDO4.

Object description	Index	1403h
	Name	4 th receive PDO parameter
	Object code	RECORD
	Data type	PDO Communication Parameter
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2
	Sub-index	01h, COB-ID used by PDO
	Meaning	Identifier of the R_PDO4
	Access	RW
	PDO mapping	---
	Value range	0000 0001h...FFFF FFFFh
	Default value	1280 (500h) + Node-ID
Sub-index	02h, transmission type	
Meaning	Transmission type	
Access	RW	
PDO mapping	---	
Value range	0...255	
Default value	255	

Object 1600h: 1st Receive PDO Mapping Parameter

This object shows which objects are mapped in R_PDO1 and transmitted with the PDO. When reading the object sub-index 00h the number of mapped objects is given.

Object description	Index	1600h
	Name	1 st receive PDO mapping parameter
	Object code	RECORD
	Data type	PDO mapping
Entry description	Sub-index	00h, Number of mapped objects
	Meaning	Number of values for the object
	Access	RW
	PDO mapping	---
	Value range	0...4
	Default value	1
	Sub-index	01h, R_PDO1 mapping entry 1
	Meaning	First object for the mapping in R_PDO1
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	6040 0010h (6040h, Control Word)
	Sub-index	02h, R_PDO1 mapping entry 2
	Meaning	Second object for the mapping in R_PDO1
	Access	RW
	PDO mapping	---
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	03h, R_PDO1 mapping entry 3	
Meaning	Third object for the mapping in R_PDO1	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	04h, R_PDO1 mapping entry 4	
Meaning	Fourth object for the mapping in R_PDO1	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	

Object 1601h: 2nd Receive PDO Mapping Parameter

This object shows which objects are mapped in R_PDO2 and transmitted with the PDO. When reading the object sub-index 00h the number of mapped objects is given.

Object description	Index	1601h
	Name	2 nd receive PDO mapping parameter
	Object code	RECORD
	Data type	PDO mapping
Entry description	Sub-index	00h, Number of mapped objects
	Meaning	Number of values for the object
	Access	RW
	PDO mapping	---
	Value range	0..4
	Default value	0
	Sub-index	01h, R_PDO2 mapping entry 1
	Meaning	First object for the mapping in R_PDO2
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	0000 0000h
	Sub-index	02h, R_PDO2 mapping entry 2
	Meaning	Second object for the mapping in R_PDO2
	Access	RW
	PDO mapping	---
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	03h, R_PDO2 mapping entry 3	
Meaning	Third object for the mapping in R_PDO2	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	04h, R_PDO2 mapping entry 4	
Meaning	Fourth object for the mapping in R_PDO2	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	

Object 1602h: 3rd Receive PDO Mapping Parameter

This object shows which objects are mapped in R_PDO3 and transmitted with the PDO. When reading the object sub-index 00h the number of mapped objects is given.

Object description	Index	1602h
	Name	3 rd receive PDO mapping parameter
	Object code	RECORD
	Data type	PDO mapping
Entry description	Sub-index	00h, Number of mapped objects
	Meaning	Number of values for the object
	Access	RW
	PDO mapping	---
	Value range	0..4
	Default value	0
	Sub-index	01h, R_PDO3 mapping entry 1
	Meaning	First object for the mapping in R_PDO3
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	0000 0000h
	Sub-index	02h, R_PDO3 mapping entry 2
	Meaning	Second object for the mapping in R_PDO3
	Access	RW
	PDO mapping	---
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	03h, R_PDO3 mapping entry 3	
Meaning	Third object for the mapping in R_PDO3	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	04h, R_PDO3 mapping entry 4	
Meaning	Fourth object for the mapping in R_PDO3	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	

Object 1603h: 4th Receive PDO Mapping Parameter

This object shows which objects are mapped in R_PDO4 and transmitted with the PDO. When reading the object sub-index 00h the number of mapped objects is given.

Object description	Index	1603h
	Name	4 th receive PDO mapping parameter
	Object code	RECORD
	Data type	PDO mapping
Entry description	Sub-index	00h, Number of mapped objects
	Meaning	Number of values for the object
	Access	RW
	PDO mapping	---
	Value range	0..4
	Default value	0
	Sub-index	01h, R_PDO4 mapping entry 1
	Meaning	First object for the mapping in R_PDO4
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	0000 0000h
	Sub-index	02h, R_PDO4 mapping entry 2
	Meaning	Second object for the mapping in R_PDO4
	Access	RW
	PDO mapping	---
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	03h, R_PDO4 mapping entry 3	
Meaning	Third object for the mapping in R_PDO4	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	04h, R_PDO4 mapping entry 4	
Meaning	Fourth object for the mapping in R_PDO4	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	

Object 1800h: 1st Transmit PDO Parameter

The object saves the settings for the first send PDO T_PDO1.

Object description	Index	1800h
	Name	1 st transmit PDO parameter
	Object code	RECORD
	Data type	PDO Communication Parameter
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	3
	Sub-index	01h, COB-ID used by PDO
	Meaning	Identifier of the T_PDO1
	Access	RW
	PDO mapping	---
	Value range	0000 0001h...FFFF FFFFh
	Default value	384 (180h) + Node-ID
	Sub-index	02h, Transmission type
	Meaning	Transmission type
	Access	RW
	PDO mapping	---
	Value range	0...255
	Default value	255
	Sub-index	03h, Inhibit time
	Meaning	Inhibit time
	Access	RW
	PDO mapping	---
	Value range	0...20000 [0.1ms]
	Default value	0
	Note	It is not allowed to change the value while the PDO exists (Bit31 of Sub-index 01h is 0).
	Sub-index	04h, reserved
	Meaning	(reserved)
	Access	---
PDO mapping	---	
Value range	---	
Default value	---	
Sub-index	05h, Event timer	
Meaning	Event timer	
Access	RW	
PDO mapping	---	
Value range	0...20000 [1ms]	
Default value	0 (not used)	

Note The meaning of the bit states and sub-index values is described with the object "1st receive PDO parameter (1400h)".

Object 1801h: 2nd Transmit PDO Parameter

The object saves the settings for the first send PDO T_PDO2.

Object description	Index	1801h
	Name	2 nd transmit PDO parameter
	Object code	RECORD
	Data type	PDO Communication Parameter
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	3
	Sub-index	01h, COB-ID used by PDO
	Meaning	Identifier of the T_PDO2
	Access	RW
	PDO mapping	---
	Value range	0000 0001h...FFFF FFFFh
	Default value	640 (280h) + Node-ID
	Sub-index	02h, transmission type
	Meaning	Transmission type
	Access	RW
	PDO mapping	---
	Value range	0...255
	Default value	255
	Sub-index	03h, Inhibit time
	Meaning	Inhibit time
	Access	RW
	PDO mapping	---
	Value range	0...20000 [0.1ms]
	Default value	0
Sub-index	04h, reserved	
Meaning	(reserved)	
Access	---	
PDO mapping	---	
Value range	---	
Default value	---	
Sub-index	05h, Event timer	
Meaning	Event timer	
Access	RW	
PDO mapping	---	
Value range	0...20000 [1ms]	
Default value	0 (not used)	

Object 1802h: 3rd Transmit PDO Parameter

The object saves the settings for the first send PDO T_PDO3.

Object description	Index	1802h
	Name	3 rd transmit PDO parameter
	Object code	RECORD
	Data type	PDO Communication Parameter
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	3
	Sub-index	01h, COB-ID used by PDO
	Meaning	Identifier of the T_PDO3
	Access	RW
	PDO mapping	---
	Value range	0000 0001h...FFFF FFFFh
	Default value	896 (380h) + Node-ID
	Sub-index	02h, transmission type
	Meaning	Transmission type
	Access	RW
	PDO mapping	---
	Value range	0...255
	Default value	255
	Sub-index	03h, Inhibit time
	Meaning	Inhibit time
	Access	RW
	PDO mapping	---
	Value range	0...20000 [0.1ms]
	Default value	0
	Sub-index	04h, reserved
	Meaning	(reserved)
	Access	---
	PDO mapping	---
Value range	---	
Default value	---	
Sub-index	05h, Event timer	
Meaning	Event timer	
Access	RW	
PDO mapping	---	
Value range	0...20000 [1ms]	
Default value	0 (not used)	

Object 1803h: 4th Transmit PDO Parameter

The object saves the settings for the first send PDO T_PDO4.

Object description	Index	1803h
	Name	4 th transmit PDO parameter
	Object code	RECORD
	Data type	PDO Communication Parameter
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	3
	Sub-index	01h, COB-ID used by PDO
	Meaning	Identifier of the T_PDO4
	Access	RW
	PDO mapping	---
	Value range	0000 0001h...FFFF FFFFh
	Default value	1152 (480h) + Node-ID
	Sub-index	02h, transmission type
	Meaning	Transmission type
	Access	RW
	PDO mapping	---
	Value range	0...255
	Default value	255
	Sub-index	03h, Inhibit time
	Meaning	Inhibit time
	Access	RW
	PDO mapping	---
	Value range	0...20000 [0.1ms]
	Default value	0
Sub-index	04h, reserved	
Meaning	(reserved)	
Access	---	
PDO mapping	---	
Value range	---	
Default value	---	
Sub-index	05h, Event timer	
Meaning	Event timer	
Access	RW	
PDO mapping	---	
Value range	0...20000 [1ms]	
Default value	0 (not used)	

Object 1A00h: 1st Transmit PDO Mapping Parameter

This object shows which objects are mapped in T_PDO1 and transmitted with the PDO. When reading the object sub-index 00h the number of mapped objects is given.

Object description	Index	1A00h
	Name	1 st transmit PDO mapping parameter
	Object code	RECORD
	Data type	PDO mapping
Entry description	Sub-index	00h, Number of mapped objects
	Meaning	Number of values for the object
	Access	RW
	PDO mapping	---
	Value range	0...4
	Default value	1
	Sub-index	01h, T_PDO1 mapping entry 1
	Meaning	First object for the mapping in T_PDO1
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	6041 0010h (6041h, Status Word)
	Sub-index	02h, T_PDO1 mapping entry 2
	Meaning	Second object for the mapping in T_PDO1
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	0000 0000h
	Sub-index	03h, T_PDO1 mapping entry 3
	Meaning	Third object for the mapping in T_PDO1
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	04h, T_PDO1 mapping entry 4	
Meaning	Fourth object for the mapping in T_PDO1	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	

Object 1A01h: 2nd Transmit PDO Mapping Parameter

This object shows which objects are mapped in T_PDO2 and transmitted with the PDO. When reading the object sub-index 00h the number of mapped objects is given.

Object description	Index	1A01h
	Name	2 nd transmit PDO mapping parameter
	Object code	RECORD
	Data type	PDO mapping
Entry description	Sub-index	00h, Number of mapped objects
	Meaning	Number of values for the object
	Access	RW
	PDO mapping	---
	Value range	0...4
	Default value	0
	Sub-index	01h, T_PDO2 mapping entry 1
	Meaning	First object for the mapping in T_PDO2
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	0000 0000h
	Sub-index	02h, T_PDO2 mapping entry 2
	Meaning	Second object for the mapping in T_PDO2
	Access	RW
	PDO mapping	---
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	03h, T_PDO2 mapping entry 3	
Meaning	Third object for the mapping in T_PDO2	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	04h, T_PDO2 mapping entry 4	
Meaning	Fourth object for the mapping in T_PDO2	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	

Object 1A02h: 3rd Transmit PDO Mapping Parameter

This object shows which objects are mapped in T_PDO3 and transmitted with the PDO. When reading the object sub-index 00h the number of mapped objects is given.

Object description	Index	1A02h
	Name	3 rd transmit PDO mapping parameter
	Object code	RECORD
	Data type	PDO mapping
Entry description	Sub-index	00h, Number of mapped objects
	Meaning	Number of values for the object
	Access	RW
	PDO mapping	---
	Value range	0...4
	Default value	0
	Sub-index	01h, T_PDO3 mapping entry 1
	Meaning	First object for the mapping in T_PDO3
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	0000 0000h
	Sub-index	02h, T_PDO3 mapping entry 2
	Meaning	Second object for the mapping in T_PDO3
	Access	RW
	PDO mapping	---
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	03h, T_PDO3 mapping entry 3	
Meaning	Third object for the mapping in T_PDO3	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	04h, T_PDO3 mapping entry 4	
Meaning	Fourth object for the mapping in T_PDO3	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	

Object 1A03h: 4th Transmit PDO Mapping Parameter

This object shows which objects are mapped in T_PDO4 and transmitted with the PDO. When reading the object sub-index 00h the number of mapped objects is given.

Object description	Index	1A03h
	Name	4 th transmit PDO mapping parameter
	Object code	RECORD
	Data type	PDO mapping
Entry description	Sub-index	00h, Number of mapped objects
	Meaning	Number of values for the object
	Access	RW
	PDO mapping	---
	Value range	0...4
	Default value	0
	Sub-index	01h, T_PDO4 mapping entry 1
	Meaning	First object for the mapping in T_PDO4
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	0000 0000h
	Sub-index	02h, T_PDO4 mapping entry 2
	Meaning	Second object for the mapping in T_PDO4
	Access	RW
	PDO mapping	---
	Value range	0000 0000h...FFFF FFFFh
	Default value	0000 0000h
	Sub-index	03h, T_PDO4 mapping entry 3
	Meaning	Third object for the mapping in T_PDO4
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	
Sub-index	04h, T_PDO4 mapping entry 4	
Meaning	Fourth object for the mapping in T_PDO4	
Access	RW	
PDO mapping	---	
Value range	0000 0000h...FFFF FFFFh	
Default value	0000 0000h	

7.2 Object Group 6000h

7.2.1 List of Object Group 6000h

Index	Sub-index	Name	Obj. code	Data type	Access	PDO
603Fh		Error Code	VAR	Unsigned16	RO	
6040h		Control Word	VAR	Unsigned16	RW	RPDO
6041h		Status Word	VAR	Unsigned16	RO	TPDO
605Ah		Quick Stop Option Code	VAR	Integer16	RW	
605Bh		Shut Down Option Code	VAR	Integer16	RW	
605Ch		Disable Operation Option Code	VAR	Integer16	RW	
605Dh		Halt Option Code	VAR	Integer16	RW	
605Eh		Fault Reaction Option Code	VAR	Integer16	RW	
6060h		Modes Of Operation	VAR	Integer8	RW	RPDO
6061h		Modes Of Operation display	VAR	Integer8	RO	TPDO
6064h		Position Actual Value	VAR	Integer32	RO	TPDO
606Ch		Velocity Actual Value	VAR	Integer32	RO	TPDO
606Dh		Velocity Window	VAR	Unsigned16	RW	
6071h		Target Torque	VAR	Integer16	RW	RPDO
6072h		Max Torque	VAR	Unsigned16	RW	RPDO
6075h		Motor rated current	VAR	Unsigned32	RO	
6076h		Motor rated torque	VAR	Unsigned32	RO	
6077h		Torque Actual Value	VAR	Integer16	RO	TPDO
6078h		Current Actual Value	VAR	Integer16	RO	TPDO
607Ah		Target Position	VAR	Integer32	RW	RPDO
607Bh		Position Range Limit	ARR			
	01h	Min Position Range Limit	VAR	Integer32	RW	
	02h	Max Position Range Limit	VAR	Integer32	RW	
607Ch		Home Offset	VAR	Integer32	RW	
607Dh		Software Position Limit	ARR			
	01h	Min Position Limit	VAR	Integer32	RW	
	02h	Max Position Limit	VAR	Integer32	RW	
607Eh		Polarity	VAR	Unsigned8	RW	
607Fh		Max Profile Velocity	VAR	Unsigned32	RW	
6081h		Profile Velocity (in pp mode)	VAR	Unsigned32	RW	RPDO
6083h		Profile Acceleration	VAR	Unsigned32	RW	RPDO
6084h		Profile Deceleration	VAR	Unsigned32	RW	RPDO
6085h		Quick Stop Deceleration	VAR	Unsigned32	RW	
6086h		Motion Profile Type	VAR	Integer16	RW	
6087h		Torque Slope	VAR	Unsigned32	RW	RPDO
6088h		Torque Profile Type	VAR	Integer16	RW	
608Fh		Position Encoder Resolution	ARR			
	01h	Encoder Increments	VAR	Unsigned32	RO	
	02h	Motor Revolutions	VAR	Unsigned32	RO	
6093h		Position Factor	ARR			
	01h	Numerator	VAR	Unsigned32	RW	
	02h	Divisor	VAR	Unsigned32	RW	

Index	Sub-index	Name	Obj. code	Data type	Access	PDO
6098h		Homing Method	VAR	Integer8	RW	
6099h		Homing Speeds	ARR			
	01h	Speed during search for Switch	VAR	Unsigned32	RW	
	02h	Speed during search for Zero	VAR	Unsigned32	RW	
609Ah		Homing Acceleration	VAR	Unsigned32	RW	
60B8h		Touch Probe Function	VAR	Unsigned16	RW	RPDO
60B9h		Touch Probe Status	VAR	Unsigned16	RO	TPDO
60BAh		Touch Probe Pos1 Pos Value	VAR	Integer32	RO	TPDO
60BBh		Touch Probe Pos1 Neg Value	VAR	Integer32	RO	TPDO
60BCh		Touch Probe Pos2 Pos Value	VAR	Integer32	RO	TPDO
60BDh		Touch Probe Pos2 Neg Value	VAR	Integer32	RO	TPDO
60C0h		Interpolation Sub Mode Select	VAR	Integer16	RW	
60C1h		Interpolation Data Record	ARR			
	00h	Number of Entries	VAR	Integer32	RO	
	01h	Interpolation Data Position	VAR	Integer32	RW	RPDO
60C2h		Interpolation Time Period	ARR			
	01h	Interpolation Time Units	VAR	Unsigned8	RW	
	02h	Interpolation Time Index	VAR	Integer8	RW	
60C3h		Interpolation Sync Definition	ARR			
	01h	Synchronize On Group	VAR	Unsigned8	RW	
	02h	Ip Sync Every n Event	VAR	Unsigned8	RW	
60C4h		Interpolation Data Configuration	REC			
	01h	Maximum Buffer Size	VAR	Unsigned32	RO	
	02h	Actual buffer Size	VAR	Unsigned32	RW	
	03h	Buffer Organization	VAR	Unsigned8	RW	
	04h	Buffer Position	VAR	Unsigned16	RW	
	05h	Size Of Data Record	VAR	Unsigned8	RO	
	06h	Buffer Clear	VAR	Unsigned8	WO	
60F4h		Following Error Actual Value	VAR	Integer32	RO	TPDO
60FDh		Digital Inputs	VAR	Unsigned32	RO	TPDO
60FEh		Digital Outputs	ARR			
	01h	Physical Outputs	VAR	Unsigned32	RW	RPDO
	02h	Bit Mask	VAR	Unsigned32	RW	
60FFh		Target Velocity	VAR	Integer32	RW	RPDO
6502h		Supported Drive Modes	VAR	Unsigned32	RO	

7.2.2 Parameter Description for Object Group 6000h

Object 603Fh: Error Code

The Error Code captures the code of the last error that occurred in the drive. It corresponds to the value of the lower 16 bits of object 'Pre-defined error field (1003h).

Object description	Index	603Fh
	Name	Error Code
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Error code
	Meaning	Last error code
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	---

Object 6040h: Control Word

The Control Word consists of bits for:

- controlling of the state
- controlling of each operation modes
- manufacturer specific options

Object description	Index	6040h
	Name	Control Word
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Control word
	Meaning	Controls the drive
	Access	RW
	PDO mapping	Possible
	Value range	---
	Default value	---

Bits 0...3 and 7

Command	Bit of the Control word					Transitions
	Bit7	Bit3	Bit2	Bit1	Bit0	
Shutdown	0	x	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Disable voltage	0	x	x	0	x	7,9,10,12
Quick stop	0	x	0	1	x	7,10,11
Disable operation	0	0	1	1	1	5
Enable Operation	0	1	1	1	1	4,16
Fault reset	0 → 1	x	x	x	x	15

Bits 4, 5, 6 and 8

Operation mode	Bit8	Bit6	Bit5	Bit4
Profile position mode	Halt	Abs / Rel	Change set immediately	New set-point
Profile velocity mode	Halt	Reserved	Reserved	Reserved
Profile torque mode	Halt	Reserved	Reserved	Reserved
Homing mode	Halt	Reserved	Reserved	Homing operation start
Interpolated position mode	Halt	Reserved	Reserved	Enable Interpolated position mode

Bit 11 (Manufacturer specific bit: Torque Limit Switch)

This bit is used to select whether to use object 'Bipolar Torque Limit Value 1 (2116h) (= 0)' or object 'Bipolar Torque Limit Value 2 (2117h)(=1)' as the Torque Limit Value.

Bit 12 (Manufacturer specific bit: Absolute Encoder Clear)

If this bit is changed from 0 to 1, servo amplifier executes 'Absolute Encoder Clear' function. Proper setting to object 22C8h is necessary, before the execution of this function.

Object 6041h: Status Word

The Status Word consists of bits for:

- current state of the drive
- the operating state of each operation modes
- manufacturer specific options

Object description	Index	6041h
	Name	Status Word
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Status word
	Meaning	Indicate the drive state
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Bits 0...3, 5, and 6

State	Bit of the Status word					
	Bit6	Bit5	Bit3	Bit2	Bit1	Bit0
Not ready to switch on	0	x	0	0	0	0
Switch on disabled	1	x	0	0	0	0
Ready to switch on	0	1	0	0	0	1
Switched on	0	1	0	0	1	1
Operation enabled	0	1	0	1	1	1
Quick stop active	0	0	0	1	1	1
Fault reaction active	0	x	1	1	1	1
Fault	0	x	1	0	0	0

* Bit2 shows 'command values acceptable' state, not simply 'motor excitation' state.

Bit 4 (Voltage enabled)

High voltage is applied to the drive when this bit is set to 1.

Bit 7 (Warning)

A drive warning is present if bit 7 is set.

Bit 8 (Manufacturer specific bit: Torque limit Active)

This bit is used to show whether output torque is limited (=1) or not by the set value of object 2116h (6072h) or 2117h.

Bit 9 (Remote)

Not implemented.

Bit 10 (Target reached)

This bit is set (=1) in case...

Operation mode	State
Profile position mode (*)	The actual position is in 'in-position' range for the target position.
Profile velocity mode (*)	The actual velocity is in 'velocity window' range for the target velocity.
Profile torque mode	The output torque command equal to the Target Torque.
Homing mode (*)	The actual position is in 'in-position' range for the homing end position.
Interpolated position mode	The actual position is in 'in-position' range for the current interpolation command.

(*) Common to above 3 modes: Halt bit = 1 AND the actual velocity is in 'Low speed range'.

Bit 11 (Internal limit active)

This bit is set (=1) in case...

Operation mode	Cause
Profile position mode	Position command is out of range, invalid data, Software limit, Positive/negative limit switch
Profile velocity mode	Velocity command is out of range, invalid data, Positive/negative limit switch
Profile torque mode	Target torque is out of range, invalid data
Homing mode	Selected homing method is not supported
Interpolated position mode	Position command is out of range, invalid data, Software limit, Positive/negative limit switch

Object 2021h shows detailed cause of 'Internal limit active'.

Bits 12 and 13

Operation mode	Bit13	Bit12
Profile position mode	Reserved	Set-point acknowledge
Profile velocity mode	Reserved	Speed
Profile torque mode	Reserved	Reserved
Homing mode	Homing error	Homing attained
Interpolated position mode	Reserved	Interpolated position mode active

Bit 14 (Manufacturer specific bit: Synchronized)

This bit is used to show whether internal process of servo amplifier is synchronizing with the SYNC message or not.

0: Synchronized, 1: Not synchronized

Bit 15 (Manufacturer specific bit: Actual position value invalid)

In 'Absolute encoder clear function' execution, this bit is set to 1, because, multi-turn information from the absolute encoder is cleared, then actual position is re-calculated.

In homing operation, this bit is set to 1 also.

Object 605Ah: Quick Stop Option Code

This parameter determines what action should be taken if the Quick Stop Function is executed or External stop Input is enabled.

Object description	Index	605Ah
	Name	Quick stop option code
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Quick stop option code
	Meaning	Defines how to react, in case of quick stop
	Access	RW
	PDO mapping	---
	Value range	0..6
	Default value	2
Data Description	Option Code	Meaning
	0	Disable drive function
	1	Slowdown on slowdown ramp (6084h)
	2	Slowdown on quick stop ramp (6085h)
	5	Slowdown on slowdown ramp and stay in QUICK STOP
	6	Slowdown on quick stop ramp and stay in QUICK STOP

Object 605Bh: Shut Down Option Code

This parameter determines what action should be taken if there is a transition
OPERATION ENABLE ⇒ READY TO SWITCH ON.

Object description	Index	605Bh
	Name	Shut down option code
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Shut down option code
	Meaning	Defines how to react, in case of shutdown command
	Access	RW
	PDO mapping	---
	Value range	0..2
	Default value	0
Data Description	Option Code	Meaning
	0	Disable drive function
	2	Slowdown on quick stop ramp; disable of the drive function

Object 605Ch: Disable Operation Option Code

This parameter determines what action should be taken if there is a transition
OPERATION ENABLE ⇒ SWITCHED ON.

Object description	Index	605Ch
	Name	Disable operation option code
	Object code	VAR
	Data type	Integer16

Entry description	Sub-index	00h, Disable operation option code
	Meaning	Defines how to react, in case of disable command
	Access	RW
	PDO mapping	---
	Value range	0...2
	Default value	0

Data Description	Option Code	Meaning
	0	Disable drive function
	2	Slowdown on quick stop ramp; disable of the drive function

Object 605Dh: Halt Option Code

This parameter determines what action should be taken if the bit (halt) in the control word is active.

Object description	Index	605Dh
	Name	Halt option code
	Object code	VAR
	Data type	Integer16

Entry description	Sub-index	00h, Halt option code
	Meaning	Defines how to react, in case of halt active
	Access	RW
	PDO mapping	---
	Value range	0...2
	Default value	1

Data Description	Option Code	Meaning
	0	Disable drive function
	1	Slowdown on slowdown ramp
	2	Slowdown on quick stop ramp

Object 605Eh: Fault Reaction Option Code

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

Object description	Index	605Eh
	Name	Fault reaction option code
	Object code	VAR
	Data type	Integer16

Entry description	Sub-index	00h, Fault reaction option code
	Meaning	Defines how to react, in case of a fault occurrence
	Access	RW
	PDO mapping	---
	Value range	-1...-1
	Default value	-1

Data Description	Option Code	Meaning
	-1	R-series specific; dynamic brake or servo brake. It depends on the kind of alarm.

Object 6060h: Modes of Operation

This parameter determines switches the actually chosen operation mode.

Object description	Index	6060h
	Name	Modes of operation
	Object code	VAR
	Data type	Integer8
Entry description	Sub-index	00h, Modes of operation
	Meaning	Select the drive operation mode
	Access	RW
	PDO mapping	Possible
	Value range	0...7
	Default value	1
Data Description	Value	Description
	0	Reserved
	1	Profile Position Mode
	3	Profile Velocity Mode
	4	Profile Torque Mode
	6	Homing Mode
	7	Interpolated Position Mode

Note 1) A read of modes of operation shows only the set value of 'modes of operation'. The actual mode of the drive is reflected in the object 'Modes of Operation Display (6061h)'.

Note 2) Changed parameter becomes effective (is accepted) only when...

- Main power 'OFF' state
- Drive disable state
- Drive enabled but 'idle (non motor operation)' state

Note 3) In case of mode change from Profile Torque Mode to others, please confirm the motor shaft stopped completely. Otherwise, a positional slippage (gap) is generated. In that case, homing procedure is necessary.

Object 6061h: Modes of Operation Display

This parameter shows the current mode of operation in the drive. The meaning of the returned value corresponds to that of the modes of operation (6060h).

Object description	Index	6061h
	Name	Modes of operation display
	Object code	VAR
	Data type	Integer8
Entry description	Sub-index	00h, Modes of operation display
	Meaning	Shows the actual drive operation mode
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---
Data Description	Same as for object 'Modes of operation (6060h)	

Object 6064h: Position Actual Value

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

Object description	Index	6064h
	Name	Position Actual Value
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Position actual value
	Meaning	Shows the actual position
	Access	RO
	PDO mapping	Possible
	Value range	Integer32
	Default value	---

Object 606Ch: Velocity Actual Value

This object represents the actual value of the motor velocity in the velocity units of user defined position units per second.

Object description	Index	606Ch
	Name	Velocity Actual Value
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Velocity actual value
	Meaning	Shows the actual speed
	Access	RO
	PDO mapping	Possible
	Value range	Integer32
	Default value	---

Object 606Dh: Velocity Window

This object is used to monitor whether the required process velocity has been achieved after an eventual acceleration (Bit 10 of Status Word in profile velocity mode; Target reached) or deceleration (braking) phase. It is given in velocity units of user defined position units per second.

Object description	Index	606Dh
	Name	Velocity window
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Velocity Window
	Meaning	Velocity target window
	Access	RW
	PDO mapping	---
	Value range	Unsigned16
	Default value	1000

Object 6071h: Target Torque

The *target torque* is the input value for the torque controller in Profile Torque Mode. The value is given in per thousand of rated torque [0.1% / LSB].

Object description	Index	6071h
	Name	Target Torque
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Target torque
	Meaning	Target torque
	Access	RW
	PDO mapping	Possible
	Value range	Integer16
	Default value	---

Object 6072h: Max Torque

This object is prepared only for compatibility use to DSP-402 defined object. Written value given in per thousand of rated torque [0.1% / LSB] to this object is divided by 10 [becomes 1% / LSB] then copied to object 2116h. Also if this object is requested to read, the value of object 2116h is multiplied by 10 then output.

Object description	Index	6072h
	Name	Max torque
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Max torque
	Meaning	Limits the output torque
	Access	RW
	PDO mapping	Possible
	Value range	0...(Maximum allowable torque command)
	Default value	1000

Object 6075h: Motor Rated Current

This value shows the root-mean-square (RMS) of rated current of selected motor in the unit of milliamp.

Object description	Index	6075h
	Name	Motor rated current
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Motor rated current
	Meaning	The value of rated current of selected motor
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	---

Note) Motor rated current is only displayed when Q or R-series standard motor is combined.

Object 6076h: Motor Rated Torque

This value shows rated torque of selected motor in the unit of milli-Newtonmeter (mNm).

Object description	Index	6076h
	Name	Motor rated torque
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Motor rated torque
	Meaning	The value of rated torque of selected motor
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	---

Note) Motor rated torque is only displayed when Q or R-series standard motor is combined.

Object 6077h: Torque Actual Value

The *torque actual value* refers to the instantaneous torque in the drive motor. The value is given per thousand of rated torque [0.1% / LSB].

Object description	Index	6077h
	Name	Torque actual value
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Torque actual value
	Meaning	Actual torque value
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 6078h: Current Actual Value

The *current actual value* refers to the instantaneous current in the drive motor. The value is given per thousand of rated current [0.1% / LSB].

Object description	Index	6078h
	Name	Current value
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Current value
	Meaning	Actual current value
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 607Ah: Target Position

The *target position* is the position that the drive should move to in position profile mode using the current setting of motion control parameters such as velocity, acceleration, deceleration and motion profile type. The target position is given in user defined position units. The target position is interpreted as absolute or relative depending on the 'abs(=0)/rel(=1)' flag in the control word.

Object description	Index	607Ah
	Name	Target position
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Target position
	Meaning	Target position value
	Access	RW
	PDO mapping	Possible
	Value range	Integer32
	Default value	---

Object 607Bh: Position Range Limit

These position range limit values are used only in modulo format in this drive. (see object 2105h: Position data format)

This object is prepared only for compatibility use to DSP-402 defined object.

Minimum position range limit is fixed to 0. Written value to sub-index 02h is simply copied to object 2107h: Modulo value. If sub-index 02h is requested to read, the value of object 2107h is output.

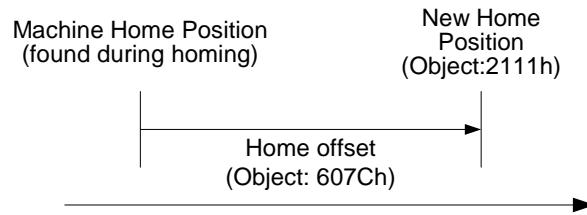
Object description	Index	607Bh
	Name	Position range limit
	Object code	ARRAY
	Data type	Integer32
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2
	Sub-index	01h, Min position range limit
	Meaning	Position range limit value in minimum side
	Access	RW
	PDO mapping	---
	Value range	0...0
	Default value	0
	Sub-index	02h, Max position range limit
	Meaning	Position range limit value in maximum side
	Access	RW
PDO mapping	---	
Value range	100...2147483647	
Default value	2147483647	

Note) When this parameter is changed in "Operational State", the drive outputs the alarm state in order to inform user that it is necessary to execute "Store Parameter (see Object 1010h)" and to be cycled control power.

Object 607Ch: Home Offset

The home offset object is the differences between the 'new home position (set by **object 2111h**)' for the application and the machine home position (found during homing), it is measured in user defined position units. During homing the machine home position is found and once the homing is completed the 'new home position' is offset from the home position by adding the home offset to the home position. All subsequent absolute moves shall be taken relative to this new home position. This is illustrated in the following diagram.

If the value of object 'Home position (2111h)' is set to 0, the new home position becomes equal to 'Zero Position'.



Object description	Index	607Ch
	Name	Home offset
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Home offset
	Meaning	Offset between the home position to homing end position
	Access	RW
	PDO mapping	---
	Value range	Integer32
	Default value	0

Object 607Dh: Software Position Limit

Software position limit contains the sub-parameters 'min position limit' and 'max position limit'. These parameters define the absolute position limits for the position demand value and the position actual value. Every new target position is checked against these limits. The limit positions are specified in user defined position units and are always relative to the machine home position.

Object description	Index	607Dh
	Name	Software position limit
	Object code	ARRAY
	Data type	Integer32
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2
	Sub-index	01h, Min position limit
	Meaning	Position limit value in minimum side
	Access	RW
	PDO mapping	---
Value range	Integer32	
Default value	$-2^{31}-1$	

Sub-index	02h, Max position limit
Meaning	Position limit value in maximum side
Access	RW
PDO mapping	---
Value range	Integer32
Default value	2 ³¹ -1

Note) Since the actually used limit value includes Home Offset (Object 607Ch), it is normalized internally before being compared with position value.

Minimum Position Limit for Normalization = Min Position Limit - Home Offset

Maximum Position Limit for Normalization = Max Position Limit - Home Offset

Object 607Eh: Polarity

Each position, velocity and torque values are multiplied by 1 or -1, depending on the value of the polarity flag.

Object description

Index	607Eh
Name	Polarity
Object code	VAR
Data type	Unsigned8

Entry description

Sub-index	00h, Polarity
Meaning	Polarity definitions
Access	RW
PDO mapping	---
Value range	Unsigned8
Default value	0

Data description

	7	6	5	4 ...	0
Position polarity	Velocity polarity	* Torque polarity	Reserved		

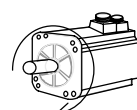
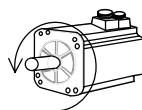
* CiA DSP-402 does not define 'Torque polarity bit' in this object. Bit5 definition above was done only in this drive for user convenience.

Each Bit	Description
0	Multiply by 1
1	Multiply by -1

Motor direction

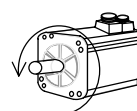
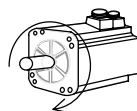
When the settings of each polarity bits are "Bit7=0, Bit6=0, Bit5=0", then...

- Motor shaft rotates counter clockwise (CCW) by 'negative command'.
- Motor shaft rotates clockwise (CW) by 'positive command'.



When the settings of each polarity bits are "Bit7=1, Bit6=1, Bit5=1", then...

- Motor shaft rotates clockwise (CW) by 'negative command'.
- Motor shaft rotates counter clockwise (CCW) by 'positive command'.



Note) When this parameter is changed in "Operational State", the drive outputs the alarm state in order to inform user that it is necessary to execute "Store Parameter (see Object 1010h)" and to be cycled control power.

Object 607Fh: Max Profile Velocity

The *max profile velocity* is the maximum speed allowed in either direction during a profiled move. It is given in the same units as *profile velocity*.

Object description	Index	607Fh
	Name	Max profile velocity
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Max profile velocity
	Meaning	Maximum value of profile velocity
	Access	RW
	PDO mapping	---
	Value range	Unsigned32
	Default value	07FF FFFFh

Object 6081h: Profile Velocity

The *profile velocity* is the velocity normally attained at the end of the acceleration ramp during a profiled move and is valid for both directions of motion. The profile velocity is given in the user defined position units per second.

Object description	Index	6081h
	Name	Profile velocity
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Profile velocity
	Meaning	Profile velocity in p.p. mode
	Access	RW
	PDO mapping	Possible
	Value range	Unsigned32
	Default value	007F FFFFh

Object 6083h: Profile Acceleration

The *profile acceleration* determines the maximum acceleration used during a positioning motion. It is given in the units of 'Velocity units' per second.

Object description	Index	6083h
	Name	Profile acceleration
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Profile acceleration
	Meaning	Profile acceleration in p.p. mode
	Access	RW
	PDO mapping	Possible
	Value range	Unsigned32
	Default value	07FF FFFFh

Object 6084h: Profile Deceleration

The *profile deceleration* determines the maximum deceleration used during a positioning motion. It is specified in the same units as the object *Profile acceleration*.

Object description	Index	6084h
	Name	Profile deceleration
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Profile deceleration
	Meaning	Profile deceleration in p.p. mode
	Access	RW
	PDO mapping	Possible
	Value range	Unsigned32
	Default value	07FF FFFFh

Object 6085h: Quick Stop Deceleration

The *quick stop deceleration* determines the deceleration if a Quick stop event will be executed. It is specified in the same units as the object *Profile deceleration*.

Object description	Index	6085h
	Name	Quick stop deceleration
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Quick stop deceleration
	Meaning	Deceleration value in quick stop event
	Access	RW
	PDO mapping	---
	Value range	Unsigned32
	Default value	7FFF FFFFh

Object 6086h: Motion Profile Type

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

Object description	Index	6086h
	Name	Motion profile type
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Motion profile type
	Meaning	Defines the type of motion profile
	Access	RW
	PDO mapping	---
	Value range	-1...0
	Default value	0
	Data description	Value
-1		Smoothing by "moving average filter" (S-Curve profile) See object 'Moving Average Filter Time Constant (2110h)' also.
0		Linear ramp (trapezoidal profile)

Object 6087h: Torque Slope

The *torque slope* describes the configured rate of change of torque. The value is given per thousand of rated torque per second.

Object description	Index	6087h
	Name	Torque slope
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Torque slope
	Meaning	Change rate of torque
	Access	RW
	PDO mapping	Possible
	Value range	Unsigned32
	Default value	0007 FFFFh

Object 6088h: Torque Profile Type

This object defines the type of motion profile in Profile Torque Mode.

Object description	Index	6088h
	Name	Torque profile type
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Torque profile type
	Meaning	Defines the type of torque profile
	Access	RW
	PDO mapping	---
	Value range	0...0
	Default value	0
Data description	Value	Description
	0	Linear ramp (trapezoidal profile)

Object 608Fh: Position Encoder Resolution

This object defines the ratio of encoder increments per motor resolution:

$$position_encoder_resolution = \frac{encoder_increments}{motor_revolutions}$$

Object description	Index	608Fh	
	Name	Position encoder resolution	
	Object code	ARRAY	
	Data type	Unsigned32	
Entry description	Sub-index	00h, Number of entries	
	Meaning	Number of values for the object	
	Access	RO	
	PDO mapping	---	
	Value range	---	
	Default value	2	
	Sub-index	01h, Encoder increments	
	Meaning	Shows the setting value of encoder resolution	

Access	RO
PDO mapping	---
Value range	Unsigned32
Default value	---
Sub-index	02h, Motor revolutions
Meaning	Motor revolutions
Access	RO
PDO mapping	---
Value range	Unsigned32
Default value	1

Object 6093h: Position Factor

This object converts the desired position (in position units) into the internal format (in increments). The object entries are the numerator and the divisor.

Object description	Index	6093h
	Name	Position factor
	Object code	ARRAY
	Data type	Unsigned32

Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2

Sub-index	01h, Numerator
Meaning	Numerator
Access	RW
PDO mapping	---
Value range	1...131072
Default value	1

Sub-index	02h, Divisor
Meaning	Divisor
Access	RW
PDO mapping	---
Value range	1...131072
Default value	1

Data description

To decide the Position factor (Numerator, Divisor), the following factor should be decided first.

Gear ratio: Ratio between revolutions of the motor shaft (R_{IN}) and revolutions of the gear output shaft (R_{OUT}); R_{IN} / R_{OUT} .

Feed constant: Ratio between revolutions of the gear output shaft (R_{OUT}) and equivalent motion in Position_units.

Then the calculation of the Position factor is done with the following equation.

$$position_factor = \frac{numerator}{divisor} = \frac{Gear_ratio \times Encoder_resolution}{Feed_constant}$$

Note) When these parameters are changed in "Operational State", the drive outputs the alarm state in order to inform user that it is necessary to execute "Store Parameter (see Object 1010h)" and to be cycled control power.

Object 6098h: Homing Method

This object determines the method used during homing.

Object description	Index	6098h
	Name	Homing Method
	Object code	VAR
	Data type	Integer8
Entry description	Sub-index	00h, Homing method
	Meaning	Homing method
	Access	RW
	PDO mapping	---
	Value range	0...35
	Default value	1
Data description	Value	Description
	0	No homing operation required
	1	Homing on the negative limit switch and index pulse
	2	Homing on the positive limit switch and index pulse
	7	Homing on the negative side of home switch and index pulse
	11	Homing on the positive side of home switch and index pulse
	17	Homing on the negative limit switch, without index pulse
	18	Homing on the positive limit switch, without index pulse
	23	Homing on the negative side of home switch, without index pulse
	27	Homing on the positive side of home switch, without index pulse
	33	Homing on the index pulse in the negative direction
	34	Homing on the index pulse in the positive direction
	35	Homing on the current position

Object 6099h: Homing Speeds

This entry in the object dictionary defines the speeds used during homing, in velocity units. Typically, a high speed is used when searching for home switch and the slow speed is used when searching for the index.

Object description	Index	6099h
	Name	Homing speeds
	Object code	ARRAY
	Data type	Unsigned32
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2
	Sub-index	01h, Speed during search for switch
	Meaning	Speed setting during searching for home switch
	Access	RW
	PDO mapping	---
	Value range	Unsigned32
	Default value	007F FFFFh
Sub-index	02h, Speed during search for zero	
Meaning	Speed setting during searching for index pulse	
Access	RW	
PDO mapping	---	
Value range	Unsigned32	
Default value	0007 FFFFh	

Object 609Ah: Homing Acceleration

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

Object description	Index	609Ah
	Name	Homing acceleration
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Homing acceleration
	Meaning	Homing acceleration
	Access	RW
	PDO mapping	---
	Value range	Unsigned32
	Default value	007F FFFFh

Object 60B8h: Touch Probe Function

This object controls touch probing function in the drive.

Object description	Index	60B8h
	Name	Touch probe function
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Touch probe function
	Meaning	Controls touch probing function.
	Access	RW
	PDO mapping	Possible
	Value range	---
	Default value	0000 0000h

Bit coding	Bit	Value	Meaning
	15	0	Switch off digital filter for Inputs Probe1, 2
		1	Apply digital filter for Inputs Probe1, 2
	14	---	Reserved
	13	0	Switch off sampling at negative edge of touch probe 2
		1	Enable sampling at negative edge of touch probe 2
	12	0	Switch off sampling at positive edge of touch probe 2
		1	Enable sampling at positive edge of touch probe 2
	11	---	Reserved
	10	X	Trigger with touch probe 2 input
	9	X	Continuous
	8	0	Switch off touch probe 2
		1	Enable touch probe 2
	6, 7	---	Reserved
	5	0	Switch off sampling at negative edge of touch probe 1
		1	Enable sampling at negative edge of touch probe 1
	4	0	Switch off sampling at positive edge of touch probe 1
		1	Enable sampling at positive edge of touch probe 1
	3	---	Reserved
	2	X	Trigger with touch probe 1 input
	1	X	Continuous
	0	0	Switch off touch probe 1
		1	Enable touch probe 1

Note) Refer to “Figure 7-1: Bit and data sequence diagram” in following page.

Object 60B9h: Touch Probe Status

This object represents touch probing status in the drive.

Object description	Index	60B9h
	Name	Touch probe status
	Object code	VAR
	Data type	Unsigned16

Entry description	Sub-index	00h, Touch probe status
	Meaning	Shows touch probing status.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Bit coding	Bit	Value	Meaning
	15	0	Copy of fault bit (equivalent of bit3 of object 6041h) No fault
		1	Fault
	12_14	---	Reserved
	11	0	Physical state of probe 2 input Off
		1	On
	10	0	Touch probe 2 no negative edge value stored
		1	Touch probe 2 negative edge position stored
	9	0	Touch probe 2 no positive edge value stored
		1	Touch probe 2 positive edge position stored
	8	0	Touch probe 2 is switched off
		1	Touch probe 2 is enabled
	4_7	---	Reserved
	3	0	Physical state of probe 1 input Off
		1	On
	2	0	Touch probe 1 no negative edge value stored
		1	Touch probe 1 negative edge position stored
	1	0	Touch probe 1 no positive edge value stored
		1	Touch probe 1 positive edge position stored
	0	0	Touch probe 1 is switched off
		1	Touch probe 1 is enabled

Note - Bit1 and Bit2 are set to 0 when touch probe 1 is switched off.
(object 60B8h bit0 is 0)
- Bit9 and Bit10 are set to 0 when touch probe 2 is switched off.
(object 60B8h bit8 is 0)

Note) Refer to "Figure 7-1: Bit and data sequence diagram" in following page.

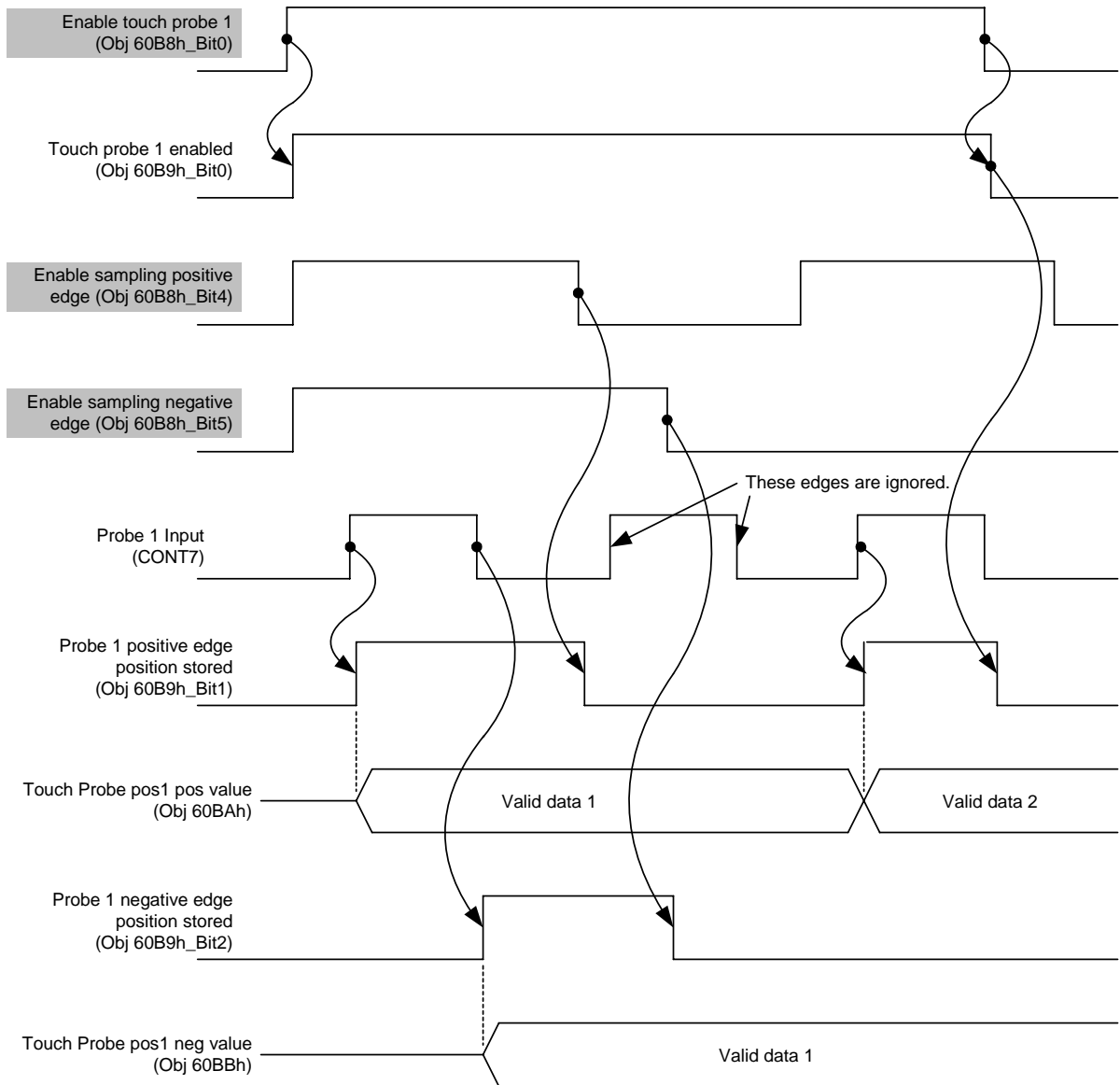


Figure 7-1: Bit and data sequence diagram (example for Probe 1)

Object 60BAh: Touch Probe Pos1 Pos Value

This object stores the position value of the touch probe 1 at positive edge.
The value is given in user-defined position units.

Object description	Index	60BAh
	Name	Touch probe pos1 pos value
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Touch probe pos1 pos value
	Meaning	Position value at touch probe 1 positive edge.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 60BBh: Touch Probe Pos1 Neg Value

This object stores the position value of the touch probe 1 at negative edge.
The value is given in user-defined position units.

Object description	Index	60BBh
	Name	Touch probe pos1 neg value
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Touch probe pos1 neg value
	Meaning	Position value at touch probe 1 negative edge.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 60BCh: Touch Probe Pos2 Pos Value

This object stores the position value of the touch probe 2 at positive edge.
The value is given in user-defined position units.

Object description	Index	60BCh
	Name	Touch probe pos2 pos value
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Touch probe pos2 pos value
	Meaning	Position value at touch probe 2 positive edge.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 60BDh: Touch Probe Pos2 Neg Value

This object stores the position value of the touch probe 2 at negative edge.
The value is given in user-defined position units.

Object description	Index	60BDh
	Name	Touch probe pos2 neg value
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Touch probe pos2 neg value
	Meaning	Position value at touch probe 2 negative edge.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 60C0h: Interpolation Sub Mode Select

For the interpolated position mode a manufacturer may offer different interpolation algorithms. This object shows the actually chosen interpolation mode in R-CANopen Amplifier.

Object description	Index	60C0h
	Name	Interpolation sub mode select
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Interpolation sub mode select
	Meaning	Shows the type of interpolation algorithm
	Access	RW
	PDO mapping	---
	Value range	-2...-1
	Default value	-1
Data description	Value	Description
	-1	R-CANopen Amplifier specific mode Linear interpolation without buffer
	-2	R-CANopen Amplifier specific mode Square position interpolation (2 nd order spline)

Note) When this parameter is changed in "Operational State", the drive outputs the alarm state in order to inform user that it is necessary to execute "Store Parameter (see Object 1010h)" and to be cycled control power.

Object 60C1h: Interpolation Data Record

The interpolation data records are the data words which are necessary to perform the interpolation algorithm.

Object description	Index	60C1h
	Name	Interpolation data record
	Object code	ARRAY
	Data type	Integer32
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	1
	Sub-index	01h, Interpolation data position
	Meaning	Interpolation position command
	Access	RW
	PDO mapping	Possible
	Value range	Integer32
	Default value	---

Object 60C2h: Interpolation Time Period

This parameter is used for time synchronized interpolation position modes. The unit of the interpolation time units is given in $10^{(interpolation\ time\ index)}$ second.

Object description	Index	60C2h
	Name	Interpolation time period
	Object code	ARRAY
	Data type	Interpolation time period record (0080h)
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2
	Sub-index	01h, Interpolation time units
	Meaning	'Communication cycle period (object 1006h)' and this object are treated as the same meaning in this drive. Written value given in (msec) to this object is multiplied by 1000 then copied to object 1006h automatically.
	Access	RW
	PDO mapping	---
	Value range	0, 2...100
	Default value	100
	Sub-index	02h, Interpolation time index
	Meaning	Interpolation time index
	Access	RW
	PDO mapping	---
	Value range	-3...-3
	Default value	-3 (ms)

Object 60C3h: Interpolation Sync Definition

This object determines the kind of synchronization 'synchronize on group' and the number 'ip sync every n event' of synchronizations message (SYNC) per synchronization interval. For the R-CANopen Amplifier only the standard SYNC telegram and 1SYNC per interval can be set.

Object description	Index	60C3h	
	Name	Interpolation sync definition	
	Object code	ARRAY	
	Data type	Unsigned8	
Entry description	Sub-index	00h, Number of entries	
	Meaning	Number of values for the object	
	Access	RO	
	PDO mapping	---	
	Value range	---	
	Default value	2	
	Sub-index	01h, Synchronize on group	
	Meaning	Synchronize on group	
	Access	RW	
	PDO mapping	---	
	Value range	0...0	
	Default value	0	
	Data description	Value	Description
		0	Use standard SYNC telegram
Sub-index		02h, Ip sync every n event	
Meaning		Ip sync every n event	
Access		RW	
PDO mapping		---	
Value range		1...1	
Default value		1	

Object 60C4h: Interpolation Data Configuration

By this object record the kind and size of a possibly available buffer can be confirmed.

Object description	Index	60C4h
	Name	Interpolation sync definition
	Object code	ARRAY
	Data type	Interpolation data configuration record (0081h)
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	6
	Sub-index	01h, Maximum buffer size
	Meaning	Buffer size in maximum
	Access	RO
	PDO mapping	---
	Value range	0...0
	Default value	0

Sub-index	02h, Actual buffer size
Meaning	Actual buffer size
Access	RW
PDO mapping	---
Value range	0...0
Default value	0

Sub-index	03h, Buffer organization
Meaning	Buffer organization
Access	RW
PDO mapping	---
Value range	0...0
Default value	0

Data description

Value	Description
0	FIFO

Sub-index	04h, Buffer position
Meaning	Buffer position
Access	RW
PDO mapping	---
Value range	0...0
Default value	0

Sub-index	05h, Size of data record
Meaning	Data size
Access	RO
PDO mapping	---
Value range	4...4
Default value	4 (byte)

Sub-index	06h, Buffer clear
Meaning	Clear command for buffer
Access	WO
PDO mapping	---
Value range	0...1
Default value	0

Object 60F4h: Following Error Actual Value

This object represents the actual value of the following error. It is given in the user defined position units.

Object description	Index	60F4h
	Name	Following error actual value
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Following error actual value
	Meaning	Following error actual value
	Access	RO
	PDO mapping	Possible
	Value range	Integer32
	Default value	---

Object 60FDh: Digital Inputs

This object defines simple digital inputs for drives.

The reflected functions are:

- Negative limit switch
- Positive limit switch
- Home switch

Object description	Index	60FDh
	Name	Digital inputs
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Digital inputs
	Meaning	Digital inputs
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Data description

31	24	23	16	15	4	3	2	1	0
Reserved	Digital input 1-8		Reserved	Interlock	Home switch	Positive limit SW	Negative limit SW		

- Notes
- The 'Interlock' is always 0.
 - Bit 23-16 shows the actual logic input value of 'input 1-8'.

Object 60FEh: Digital Outputs

This object defines simple digital outputs for drives.

Object description	Index	60FEh
	Name	Digital outputs
	Object code	ARRAY
	Data type	Unsigned32
Entry description	Sub-index	00h, Number of entries
	Meaning	Number of values for the object
	Access	RO
	PDO mapping	---
	Value range	---
	Default value	2
	Sub-index	01h, Physical outputs
	Meaning	Digital outputs data
	Access	RW
	PDO mapping	Possible
	Value range	Unsigned32
	Default value	0
Sub-index	02h, Bit mask	
Meaning	Digital outputs mask	
Access	RW	
PDO mapping	---	
Value range	Unsigned32	
Default value	FFFF FFFFh	

Data description

31	24	23	16	15	1	0
Reserved	Digital output 1-8			Reserved	Set brake (Read only)	

Note - Brake output can not be controlled by setting bit0.

Object 60FFh: Target Velocity

The *target velocity* is the input for the trajectory generator. The value is given in the user defined position units par second.

Object description	Index	60FFh
	Name	Target velocity
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Target velocity
	Meaning	Target velocity
	Access	RW
	PDO mapping	Possible
	Value range	Integer32
	Default value	---

Object 6502h: Supported Drive Modes

This object gives an overview of the implemented operating modes in the drive.

Object description	Index	6502h
	Name	Supported drive modes
	Object code	VAR
	Data type	Unsigned32
Entry description	Sub-index	00h, Supported drive modes
	Meaning	Supported drive modes
	Access	RO
	PDO mapping	---
	Value range	Unsigned32
	Default value	6Dh

Data description

31	16	15	7	6	5	4	3	2	1	0
Reserved	Reserved	Reserved	ip	hm	Reserved	tq	pv	vl	pp	

Note

- pp : Profile Position Mode
- pv : Profile Velocity Mode
- tq : Profile Torque Mode
- hm : Homing Mode
- ip : Interpolated Position Mode

7.3 Object Group 2000h-21FFh

7.3.1 List of Object Group 2000h-21FFh

Index	Sub-index	Name	Obj. code	Data type	Access	PDO
2000h		Servo Amplifier Status	VAR	Unsigned8	RO	TPDO
2001h		Warning Status 1	VAR	Unsigned8	RO	TPDO
2002h		Warning Status 2	VAR	Unsigned8	RO	TPDO
2003h		Digital Input (CONT1-8 of CN1) monitor	VAR	Unsigned8	RO	TPDO
2004h		Digital Output (OUT1-8 of CN1) monitor	VAR	Unsigned8	RO	TPDO
2008h		Load Inertia Ratio Monitor	VAR	Integer16	RO	TPDO
2009h		Position Loop Proportional Gain Monitor	VAR	Integer16	RO	TPDO
200Ah		Position Loop Integral Time Constant Monitor	VAR	Integer16	RO	TPDO
200Bh		Velocity Loop Proportional Gain Monitor	VAR	Integer16	RO	TPDO
200Ch		Velocity Loop Integral Time Constant Monitor	VAR	Integer16	RO	TPDO
200Dh		Torque Command Filter Monitor	VAR	Integer16	RO	TPDO
2010h		Interpolation data position lower-16bits	VAR	Integer16	RW	RPDO
2018h		Position actual value lower-16bits	VAR	Integer16	RO	TPDO
201Ch		Touch probe pos1 pos value lower-16bits	VAR	Integer16	RO	TPDO
201Dh		Touch probe pos1 neg value lower-16bits	VAR	Integer16	RO	TPDO
201Eh		Touch probe pos2 pos value lower-16bits	VAR	Integer16	RO	TPDO
201Fh		Touch probe pos2 neg value lower-16bits	VAR	Integer16	RO	TPDO
2020h		Drive Disable Cause Monitor	VAR	Unsigned16	RO	TPDO
2021h		Internal Limit Active Cause Monitor	VAR	Unsigned8	RO	TPDO
2030h		Encoder counter at index pulse	VAR	Integer32	RO	
2040h		Digital Input via Field-bus	VAR	Unsigned8	RW	RPDO
2050h		Torque Compensation Command	VAR	Integer16	RW	RPDO
2100h		Software Limit Enable	VAR	Unsigned8	RW	
2101h		Software Limit Action	VAR	Unsigned8	RW	
2102h		Hardware Limit Action	VAR	Unsigned8	RW	
2105h		Position Data Format	VAR	Unsigned8	RW	
2106h		Command Value for Modulo Format	VAR	Unsigned8	RW	
2107h		Modulo Value	VAR	Integer32	RW	
2108h		Wrap Around Enable	VAR	Unsigned8	RW	
2109h		Absolute Encoder Effective Bit Length	VAR	Unsigned8	RW	
2110h		Moving Average Filter Time Constant	VAR	Integer16	RW	
2111h		Home Position	VAR	Integer32	RW	
2115h		Torque Command Value (not implemented)	VAR	Integer16	RW	RPDO
2116h		Bipolar Torque Limit Value 1	VAR	Unsigned16	RW	RPDO
2117h		Bipolar Torque Limit Value 2	VAR	Unsigned16	RW	RPDO
2119h		Sequence Torque Limit Value	VAR	Unsigned16	RW	
2120h		System Parameter Switch	VAR	Unsigned16	RW	
2121h		Bus Break Error Detection Time	VAR	Unsigned16	RW	
2122h		Communication Error Action	VAR	Unsigned8	RW	
2123h		CAN Controller Tx Error Counter	VAR	Unsigned8	RO	
2124h		CAN Controller Rx Error Counter	VAR	Unsigned8	RO	
2125h		Password	VAR	Unsigned32	RW	

7.3.2 Parameter Description for Object Group 2000h-21FFh

Object 2000h: Servo Amplifier Status Monitor

This object displays 'Servo Amplifier Status' which is also shown in the monitor function of R-Setup software.

Object description	Index	2000h
	Name	Servo amplifier status monitor
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Servo amplifier status monitor
	Meaning	Shows internal status of servo amplifier
	Access	RO
	PDO mapping	Possible
	Value range	Unsigned8
	Default value	---
Data description	Value	Description
	00h	Control power established
	02h	Main power being established
	04h	Main power established
	08h	Servo ON status

Object 2001h: Warning Status 1 Monitor

This object displays 'Warning Status 1' which is also shown in the monitor function of R-Setup software.

Object description	Index	2001h
	Name	Warning status 1 monitor
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Warning status 1 monitor
	Meaning	Shows internal warning status 1 of servo amplifier
	Access	RO
	PDO mapping	Possible
	Value range	Unsigned8
	Default value	---
Data description	See Table 7-1	

Object 2002h: Warning Status 2 Monitor

This object displays 'Warning Status 2' which is also shown in the monitor function of R-Setup software.

Object description	Index	2002h
	Name	Warning status 2 monitor
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Warning status 2 monitor
	Meaning	Shows internal warning status 2 of servo amplifier
	Access	RO
	PDO mapping	Possible
	Value range	Unsigned8
	Default value	---
Data description	See Table 7-1	

Object 2003h: Digital Input (CONT1-8) Monitor

This object displays 'Digital Input Status' which is also shown in the monitor function of R-Setup software.

Object description	Index	2003h
	Name	Digital input monitor
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Digital input monitor
	Meaning	Shows digital input status of servo amplifier
	Access	RO
	PDO mapping	Possible
	Value range	Unsigned8
	Default value	---
Data description	See Table 7-1	

Object 2004h: Digital Output (OUT1-8) Monitor

This object displays 'Digital Output Status' which is also shown in the monitor function of R-Setup software.

Object description	Index	2004h
	Name	Digital output monitor
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Digital output monitor
	Meaning	Shows digital output status of servo amplifier
	Access	RO
	PDO mapping	Possible
	Value range	Unsigned8
	Default value	---
Data description	See Table 7-1	

Table 7-1: Bit arrangements of Object 2001h-2004h

Object	Bit							
	7	6	5	4	3	2	1	0
2001h	Excessive deviation warning	x	Speed limit operation running	Torque limit operation running	Regeneration overload warning	Overload warning	x	Amplifier temperature warning
2002h	x	Low battery warning	x	x	x	x	x	Main circuit power being charged
2003h	CONT8	CONT7	CONT6	CONT5	CONT4	CONT3	CONT2	CONT1
2004h	OUT8	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1

Object 2008h: Load Inertia Ratio Monitor

This object displays 'Load inertia ratio monitor' which is also shown in the monitor function of R-Setup software.

Object description	Index	2008h
	Name	Load inertia ratio monitor
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Load inertia ratio monitor
	Meaning	Shows load inertia ratio monitor
	Access	RO
	PDO mapping	Possible
	Value range	0...15000 [%]
	Default value	---

Object 2009h: Position Loop Proportional Gain Monitor

This object displays 'Position loop proportional gain monitor' which is also shown in the monitor function of R-Setup software.

Object description	Index	2009h
	Name	Position loop proportional gain monitor
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Position loop proportional gain monitor
	Meaning	Shows position loop proportional gain monitor
	Access	RO
	PDO mapping	Possible
	Value range	1...3000 [S ⁻¹]
	Default value	---

Object 200Ah: Position Loop Integral Time Constant Monitor

This object displays 'Position loop integral time constant monitor' which is also shown in the monitor function of R-Setup software.

Object description	Index	200Ah
	Name	Position loop integral time constant monitor
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Position loop integral time constant monitor
	Meaning	Shows position loop integral time constant monitor
	Access	RO
	PDO mapping	Possible
	Value range	5...10000 [0.1 ms]
	Default value	---

Object 200Bh: Velocity Loop Proportional Gain Monitor

This object displays 'Velocity loop proportional gain monitor' which is also shown in the monitor function of R-Setup software.

Object description	Index	200Bh
	Name	Velocity loop proportional gain monitor
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Velocity loop proportional gain monitor
	Meaning	Shows velocity loop proportional gain monitor
	Access	RO
	PDO mapping	Possible
	Value range	1...2000 [Hz]
	Default value	---

Object 200Ch: Velocity Loop Integral Time Constant Monitor

This object displays 'Velocity loop integral time constant monitor' which is also shown in the monitor function of R-Setup software.

Object description	Index	200Ch
	Name	Velocity loop integral time constant monitor
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Velocity loop integral time constant monitor
	Meaning	Shows velocity loop integral time constant monitor
	Access	RO
	PDO mapping	Possible
	Value range	5...10000 [0.1 ms]
	Default value	---

Object 200Dh: Torque Command Filter Monitor

This object displays 'Torque command filter monitor' which is also shown in the monitor function of R-Setup software.

Object description	Index	200Dh
	Name	Torque command filter monitor
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Torque command filter monitor
	Meaning	Shows torque command filter monitor
	Access	RO
	PDO mapping	Possible
	Value range	1...2000 [Hz]
	Default value	---

Object 2010h: Interpolation Data Position Lower-16bits

This object enables the user to minimize R_PDO mapping data in limited application. The input data to this object is expanded to 32bits internally taking the sign bit into consideration, then copied to internal buffer for Object 60C1h-sub01h.

Object description	Index	2010h
	Name	Interpolation data position lower-16bits
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Interpolation data position lower-16bits
	Meaning	Interpolation data position lower-16bits
	Access	RW
	PDO mapping	Possible
	Value range	Integer16
	Default value	---

Object 2018h: Position Actual Value Lower-16bits

This object represents the lower 16bits of Object 6064h. (Actual value of the position measurement device in the user units)

Object description	Index	2018h
	Name	Position Actual Value Lower-16bits
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Position actual value lower-16bits
	Meaning	Shows the actual position
	Access	RO
	PDO mapping	Possible
	Value range	Integer16
	Default value	---

Object 201Ch: Touch Probe Pos1 Pos Value Lower-16bits

This object represents the lower 16bits of Object 60BAh. (Position value of the touch probe1 at positive edge.) The value is given in user-defined position units.

Object description	Index	201Ch
	Name	Touch probe pos1 pos value lower-16bits
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Touch probe pos1 pos value lower-16bits
	Meaning	Lower-16bits of Object 60BAh.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 201Dh: Touch Probe Pos1 Neg Value Lower-16bits

This object represents the lower 16bits of Object 60BBh. (Position value of the touch probe1 at negative edge.) The value is given in user-defined position units.

Object description	Index	201Dh
	Name	Touch probe pos1 neg value lower-16bits
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Touch probe pos1 neg value lower-16bits
	Meaning	Lower-16bits of Object 60BBh.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 201Eh: Touch Probe Pos2 Pos Value Lower-16bits

This object represents the lower 16bits of Object 60BCh. (Position value of the touch probe2 at positive edge.) The value is given in user-defined position units.

Object description	Index	201Eh
	Name	Touch probe pos2 pos value lower-16bits
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Touch probe pos2 pos value lower-16bits
	Meaning	Lower-16bits of Object 60BCh.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 201Fh: Touch Probe Pos2 Neg Value Lower-16bits

This object represents the lower 16bits of Object 60BDh. (Position value of the touch probe2 at negative edge.) The value is given in user-defined position units.

Object description	Index	201Fh
	Name	Touch probe pos2 neg value lower-16bits
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Touch probe pos2 neg value lower-16bits
	Meaning	Lower-16bits of Object 60BDh.
	Access	RO
	PDO mapping	Possible
	Value range	---
	Default value	---

Object 2020h: Drive Disable Cause Monitor

This object shows the reason why a drive is currently in disable state.

Object description	Index	2020h
	Name	Drive disable cause monitor
	Object code	VAR
	Data type	Unsigned16

Entry description	Sub-index	00h, Drive disable cause monitor
	Meaning	Drive disable cause
	Access	RO
	PDO mapping	Possible
	Value range	Unsigned16
	Default value	---

Bit coding	Bit	Meaning
	15	Drive state machine is not 'Operation enabled' state
	14	Depends on the 'Halt' bit
	13	Drive state machine is 'Quick stop' state
	12	Communication error
	11_8	(Reserved)
	7	Depends on the 'Negative Software Limit'
	6	Depends on the 'Positive Software Limit'
	5	Depends on the 'Positive Limit Switch'
	4	Depends on the 'Negative Limit Switch'
	3	(Reserved)
	2	Depends on the 'Emergency Stop Switch'
	1	Main power is not supplied
	0	Drive alarm

Object 2021h: Internal Limit Active Cause Monitor

This object shows the reason why the 'Internal Limit Active Bit' was set.

Object description	Index	2021h
	Name	Internal limit active cause monitor
	Object code	VAR
	Data type	Unsigned8

Entry description	Sub-index	00h, Internal limit active cause monitor
	Meaning	Internal limit active cause
	Access	RO
	PDO mapping	Possible
	Value range	Unsigned8
	Default value	---

Bit coding	Bit	Meaning
	7	(Reserved)
	6	Depends on the 'Halt' bit
	5	Depends on the 'Negative Limit Switch'
	4	Depends on the 'Positive Limit Switch'
	3	Depends on the 'Negative Software Limit'
	2	Depends on the 'Positive Software Limit'
	1	Drive state conflict (Quick Stop, Drive disable)
	0	Command value is improper

Object 2030h: Encoder Counter at Index Pulse

This object displays latched encoder counter at Index pulse, which has captured during homing.

Object description	Index	2030h
	Name	Encoder counter at index pulse
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Encoder counter at index pulse
	Meaning	Shows encoder counter at index pulse
	Access	RO
	PDO mapping	---
	Value range	Integer32
	Default value	---

Object 2040h: Digital Input via Field-bus

This object is used to enable(1)/disable(0) the functions that are allocated to 'Parameter Group 9 of R-series servo amplifier', if its enabling condition is selected 'from field-bus input'.

Object description	Index	2040h
	Name	Digital input via field-bus
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Digital input via field-bus
	Meaning	Digital input via field-bus
	Access	RW
	PDO mapping	Possible
	Value range	Unsigned8
	Default value	---

Object 2050h: Torque Compensation Command

This parameter is used as a torque addition command, when 'torque compensation command, input selection (General Parameter Group 8 – Page 30)' is set to '03:_CANopen'. The unit of this value is [0.1% / LSB] of rated torque.

Object description	Index	2050h
	Name	Torque compensation command
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Torque compensation command
	Meaning	Torque addition command
	Access	RW
	PDO mapping	Possible
	Value range	Integer16
	Default value	0

- Note
- The setting of 'Torque polarity (Bit 5 of Object 607Eh)' influences the polarity of this parameter as well as 'Target torque (Object 6071h)' etc.
 - This value is effective in all operation modes except for 'Profile torque mode'.

Object 2100h: Software Limit Enable

This object sets enable/disable of the software limit detection.
Software position limit range can be set in Object 607Dh.

Object description	Index	2100h
	Name	Software limit enable
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Software limit enable
	Meaning	Enables the software limit detection
	Access	RW
	PDO mapping	---
	Value range	Unsigned8
	Default value	1
Data description	Value	Description
	0h	Software limit function is disabled
	1h	Software limit function is enabled

Object 2101h: Software Limit Action

This object sets an action in case of software limit occurrence.

Object description	Index	2101h
	Name	Software limit action
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Software limit action
	Meaning	Selects an action after the software limit detection
	Access	RW
	PDO mapping	---
	Value range	Unsigned8
	Default value	0
Data description	Value	Description
	0h	Servo Off
	1h	Slowdown on slowdown ramp
	2h	Slowdown on quick stop ramp
	255h	No action

Object 2102h: Hardware Limit Action

This object sets an action in case of hardware limit occurrence.

Object description	Index	2102h
	Name	Hardware limit action
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Hardware limit action
	Meaning	Selects an action after the hardware limit detection
	Access	RW
	PDO mapping	---
	Value range	Unsigned8
	Default value	0

Data description	Value	Description
	0h	Servo Off
	1h	Slowdown on slowdown ramp
	2h	Slowdown on quick stop ramp
	255h	No action

Object 2105h: Position Data Format

Selects format of Position data.

Object description	Index	2105h
	Name	Position data format
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Position data format
	Meaning	Selects format of Position data
	Access	RW
	PDO mapping	---
	Value range	Unsigned8
	Default value	0
Data description	Value	Description
	0h	Absolute format
	1h	Modulo format

Note) When this parameter is changed in “Operational State”, the drive outputs the alarm state in order to inform user that it is necessary to execute “Store Parameter (see Object 1010h)” and to be cycled control power.

Object 2106h: Command Value for Modulo Format

Defines direction of positioning move when modulo format is selected.

Object description	Index	2106h
	Name	Command value for modulo format
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Command value for modulo format
	Meaning	Command value for modulo format
	Access	RW
	PDO mapping	---
	Value range	Unsigned8
	Default value	2
Data description	Value	Description
	0h	Negative direction
	1h	Positive direction
	2h	Shortest path

Note) When this parameter is changed in “Operational State”, the drive outputs the alarm state in order to inform user that it is necessary to execute “Store Parameter (see Object 1010h)” and to be cycled control power.

Object 2107h: Modulo Value

Defines the value of modulo format. When object 'position data format' is set to '1' (modulo format), parameter range of actual position and command position are limited from 0 to (modulo value -1).

Object description	Index	2107h
	Name	Modulo value
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Modulo value
	Meaning	Modulo value
	Access	RW
	PDO mapping	---
	Value range	100...2147483647
	Default value	2147483647

Note) When this parameter is changed in "Operational State", the drive outputs the alarm state in order to inform user that it is necessary to execute "Store Parameter (see Object 1010h)" and to be cycled control power.

Object 2108h: Wrap Around Enable

While this value is set to 1, a wrap around alarm does not occur even if a wrap around is detected.

Object description	Index	2108h
	Name	Wrap around enable
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Wrap around enable
	Meaning	Enables the wrap around enable
	Access	RW
	PDO mapping	---
	Value range	Unsigned8
	Default value	0
	Data description	Value
0h		Wrap around alarm occurs when a wrap around is detected
1h		Wrap around alarm does not occur even if a wrap around is detected

Object 2109h: Absolute Encoder Effective Bit Length

This value sets the effective bit length of combined absolute encoder.
If actual effective bit length is more than 32bit, the value '32' should be set.

Object description	Index	2109h
	Name	Absolute encoder effective bit length
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Absolute encoder effective bit length
	Meaning	Effective bit length of absolute encoder
	Access	RW
	PDO mapping	---
	Value range	16...32
	Default value	32

Note) When this parameter is changed in "Operational State", the drive outputs the alarm state in order to inform user that it is necessary to execute "Store Parameter (see Object 1010h)" and to be cycled control power.

Object 2110h: Moving Average Filter Time Constant

Moving average filter is used to make smooth the position demand value.

This parameter sets smoothing time constant (T_s) of the filter.

To enable the filter, it is necessary to set object 'Motion profile type (6086h)' properly.

Object description	Index	2110h
	Name	Moving average filter time constant
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Moving average filter time constant
	Meaning	Moving average filter time constant
	Access	RW
	PDO mapping	---
	Value range	2...1024 [ms]
	Default value	100

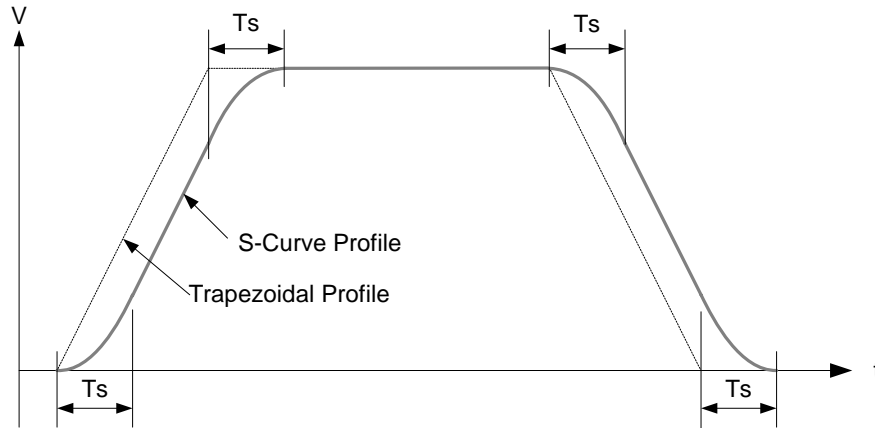


Figure 7-2: Smoothing Function

Object 2111h: Home Position

When homing procedure is completed, the actual position and internal commanded position values are reset to this object value.

Object description	Index	2111h
	Name	Home position
	Object code	VAR
	Data type	Integer32
Entry description	Sub-index	00h, Home position
	Meaning	Home position
	Access	RW
	PDO mapping	---
	Value range	Integer32
	Default value	0

Object 2115h: Torque Command Value (not implemented)

Set this value to change the motor output torque (in Torque Mode only; **not implemented**).

The unit of this value is [1% / LSB] of rated torque.

Object description	Index	2115h
	Name	Torque command value
	Object code	VAR
	Data type	Integer16
Entry description	Sub-index	00h, Torque command value
	Meaning	Torque command value
	Access	RW
	PDO mapping	Possible
	Value range	0...(Maximum allowable torque command)
	Default value	---

Object 2116h, 2117h: Bipolar Torque Limit Value 1, 2

This parameter limits both direction of motor output torque value.

Value1 and value2 is switched by Bit_11 of Control word (6040h).

The unit of this value is [1% / LSB] of rated torque.

Object description	Index	2116h, 2117h
	Name	Bipolar torque limit value 1, 2
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Bipolar torque limit value 1, 2
	Meaning	Bipolar torque limit value 1, 2
	Access	RW
	PDO mapping	Possible
	Value range	0...(Maximum allowable torque command)
	Default value	100

Object 2119h: Sequence Torque Limit Value

This parameter limits both direction of motor output torque value only in case of the sequence action (Quick stop, Position limit, etc...).

The unit of this value is [1% / LSB] of rated torque.

Object description	Index	2119h
	Name	Sequence torque limit value
	Object code	VAR
	Data type	Unsigned16
Entry description	Sub-index	00h, Sequence torque limit value
	Meaning	Sequence torque limit value
	Access	RW
	PDO mapping	---
	Value range	0...(Maximum allowable torque command)
	Default value	120

Object 2120h: System Parameter Switch

Defines the systematic actions of drive.

Object description	Index	2120h
	Name	System parameter switch
	Object code	VAR
	Data type	Unsigned16

Entry description	Sub-index	00h, System parameter switch
	Meaning	System parameter switch
	Access	RW
	PDO mapping	---
	Value range	Unsigned16
	Default value	0000h

Data description

	15	6	5	4	3	1	0
	Reserved (must be set to 0)		Dummy mapping enable	Absolute encoder selection	Reserved (set to 0)	Password enable	
Bit 5	0: Dummy-mapping disable (Node-ID area in COB-ID of R_PDO depends on the fixed Drive NODE-ID.) 1: Dummy-mapping enable (See chapter 8-1)						
Bit 4	0: Battery backup method absolute encoder (PA035C) 1: Absolute encoder for incremental system (PA035S) or PA035C encoder is used without battery (GroupC_Page00 = 01)						
Bit 0	Password enable (Refer to Object 2125h (Password))						

Note) When this parameter is changed (except for Bit 0) in “Operational State”, the drive outputs the alarm state in order to inform user that it is necessary to execute “Store Parameter (see Object 1010h)” and to be cycled control power.

Object 2121h: Bus Break Error Detection Time

This parameter sets CAN bus break detection time.

If no communication objects are received more than the set value to this timer, Servo drive detects 'CAN bus break error'.

Set value '0' disables this function.

Object description	Index	2121h
	Name	Bus break error detection time
	Object code	VAR
	Data type	Unsigned16

Entry description	Sub-index	00h, Bus break error detection time
	Meaning	Bus break error detection time
	Access	RW
	PDO mapping	---
	Value range	Unsigned16 [unit : msec]
	Default value	0

Object 2122h: Communication Error Action

This object sets an action in case of CAN communication error occurrence.

Object description	Index	2122h
	Name	Communication error action
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Communication error action
	Meaning	Selects an action after the communication error detection
	Access	RW
	PDO mapping	---
	Value range	0...2
	Default value	0
Data description	Value	Description
	0h	Servo brake, Servo Off, then Alarm occurs
	1h	Slowdown on slowdown ramp, then Alarm occurs
	2h	Slowdown on quick stop ramp, then Alarm occurs

Object 2123h: CAN Controller Tx Error Counter

This object is used to monitor the Transmit error counter in CAN controller.

Object description	Index	2123h
	Name	CAN controller Tx error counter
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, CAN controller Tx error counter
	Meaning	CAN controller Tx error counter
	Access	RO
	PDO mapping	---
	Value range	Unsigned8
	Default value	---

Object 2124h: CAN Controller Rx Error Counter

This object is used to monitor the Receive error counter in CAN controller.

Object description	Index	2124h
	Name	CAN controller Rx error counter
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, CAN controller Rx error counter
	Meaning	CAN controller Rx error counter
	Access	RO
	PDO mapping	---
	Value range	Unsigned8
	Default value	---

Object 2125h: Password

In order to change 'Motor parameter (Object 22E0h, Sub 01h...36h)' and/or 'System parameter (Objects 22F0h...22FDh)' in servo drive via SDO communication, special procedure for 'opening the lock' is necessary before writing. Password is used in this procedure.

Object description	Index	2125h
	Name	Password
	Object code	ARRAY
	Data type	Unsigned32

Entry description	Sub-index	00h, Password
	Meaning	Password
	Access	RW
	PDO mapping	---
	Value range	---
	Default value	0000 0000h

Password Data In the following 'opening the lock' procedure, writing of a specific signature to 'sub-index 0' is necessary. The signature is "open".

MSB			LSB
n	e	p	o
6Eh	65h	70h	6Fh

Procedure

1. Write Password '0000 0000h'.
 2. Write Object 2120h Bit0 (Password enable) = 1.
 3. Write Password '6E65 706Fh'.
 4. Write Object 2120h Bit0 (Password enable) = 0.
- Now lock was opened (released).

Note

If write access to 'Motor parameter (Object 22E0h, Sub 01h...36h)' and/or 'System parameter (Objects 22F0h...22FDh)' was done unless special procedure above, servo drive generates SDO Error Message 'Attempt to write a read only object (SDO Error Code: 0601 0002h)'.

7.4 Object Group 2200h-22FFh

7.4.1 List of Object Group 2200h-22FFh

Objects 2200h – 22FFh corresponds to R-series General Parameter [Group0...GroupC, Motor parameter and System parameter]. For detailed information of each parameter, see the 'Instruction manual of SANMOTION R-series typeS'.

All parameters in this group are stored in non-volatile memory automatically when they are written via SDO.

The column "CAN Mode" denotes whether the parameter is effective ('X') in CANopen Mode or not ('---').

<Parameter Group 0>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2200h		Auto Tuning Function Settings	REC								
	01h	Auto Tuning Mode	VAR	Integer8	RW	---	---	00	02	X	Group0 - Page00
	02h	Auto Tuning Characteristic	VAR	Integer8	RW	---	---	00	04	X	Group0 - Page01
	03h	Auto Tuning Response	VAR	Integer8	RW	---	---	1	30	X	Group0 - Page02
	04h	Auto Tuning Parameter Saving	VAR	Integer8	RW	---	---	00	01	X	Group0 - Page03
2205h		Automatic Notch Filter Tuning, Torque Command	VAR	Integer16	RW	1	%	10	100	X	Group0 - Page10
2208h		Automatic Vibration Suppressor Frequency Tuning Function Settings	REC								
	01h	Automatic Vibration Suppressor Frequency Tuning, Torque Command	VAR	Integer16	RW	1	%	10	100	X	Group0 - Page20
	02h	Automatic Vibration Suppressor Frequency Tuning, Friction Compensation Value	VAR	Integer16	RW W	1	%	0	50	X	Group0 - Page21

<Parameter Group 1>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2210h		Position Command Filter	VAR	Integer16	RW	0.1	ms	0.0	2000.0	X	Group1 - Page01
2211h		Gain Parameter 1	REC								
	01h	Position Loop Proportional Gain 1	VAR	Integer16	RW	1	1/s	1	3000	X	Group1 - Page02
	02h	Position Loop Integral Time Constant 1	VAR	Integer16	RW	0.1	ms	0.5	1000.0	X	Group1 - Page03
	03h	Velocity Loop Proportional Gain 1	VAR	Integer16	RW	1	Hz	1	2000	X	Group1 - Page13
	04h	Velocity Loop Integral Time Constant 1	VAR	Integer16	RW	0.1	ms	0.5	1000.0	X	Group1 - Page14
	05h	Load Inertia Ratio 1	VAR	Integer16	RW	1	%	0	15000	X	Group1 - Page15
	06h	Torque Command Filter 1	VAR	Integer16	RW	1	Hz	1	2000	X	Group1 - Page20
2212h		Higher Tracking Control, Position Compensation Gain	VAR	Integer16	RW	1	%	0	100	X	Group1 - Page04
2213h		Feed Forward Gain	VAR	Integer16	RW	1	%	0	100	X	Group1 - Page05
2214h		Feed Forward Filter	VAR	Integer16	RW	1	Hz	1	2000	X	Group1 - Page08
2215h		Velocity Command Filter	VAR	Integer16	RW	1	Hz	1	2000	X	Group1 - Page10
2216h		Velocity Feedback Filter	VAR	Integer16	RW	1	Hz	1	2000	X	Group1 - Page12
2217h		Higher Tracking Control, Velocity Compensation Gain	VAR	Integer16	RW	1	%	0	100	X	Group1 - Page16
2218h		Acceleration Feedback Gain	VAR	Integer16	RW	0.1	%	-100.0	100.0	X	Group1 - Page17
2219h		Acceleration Feedback Filter	VAR	Integer16	RW	1	Hz	1	2000	X	Group1 - Page18
221Ah		Torque Command Filter Order	VAR	Integer8	RW	1	Order	1	3	X	Group1 - Page21

<Parameter Group 2>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2220h		Vibration Suppressor Frequency 1	VAR	Integer16	RW	1	Hz	5	500	X	Group2 - Page00
2221h		Vibration Suppressor Level Selection	VAR	Integer8	RW	---	---	00	03	X	Group2 - Page01
2225h		Velocity Command Notch Filter	VAR	Integer16	RW	1	Hz	50	500	X	Group2 - Page10
2228h		Torque Command Notch Filter (A)	REC								
	01h	Torque Command Notch Filter (A) Frequency	VAR	Integer16	RW	1	Hz	100	2000	X	Group2 - Page20
	02h	Torque Command Notch Filter (A) Low Frequency Phase Delay Improvement	VAR	Integer8	RW	---	---	00	02	X	Group2 - Page21
2229h		Torque Command Notch Filter (B)	REC								
	01h	Torque Command Notch Filter (B) Frequency	VAR	Integer16	RW	1	Hz	100	2000	X	Group2 - Page22
	02h	Torque Command Notch Filter (B) Depth Selection	VAR	Integer8	RW	---	---	00	03	X	Group2 - Page23
222Ah		Torque Command Notch Filter (C)	REC								
	01h	Torque Command Notch Filter (C) Frequency	VAR	Integer16	RW	1	Hz	100	2000	X	Group2 - Page24
	02h	Torque Command Notch Filter (C) Depth Selection	VAR	Integer8	RW	---	---	00	03	X	Group2 - Page25
222Bh		Torque Command Notch Filter (D)	REC								
	01h	Torque Command Notch Filter (D) Frequency	VAR	Integer16	RW	1	Hz	100	2000	X	Group2 - Page26
	02h	Torque Command Notch Filter (D) Depth Selection	VAR	Integer8	RW	---	---	00	03	X	Group2 - Page27
222Ch		Observer Function Parameters	REC								
	01h	Observer Characteristic	VAR	Integer8	RW	---	---	00	01	X	Group2 - Page30
	02h	Observer Compensation Gain	VAR	Integer16	RW	1	%	0	100	X	Group2 - Page31
	03h	Observer Output, Low Pass Filter	VAR	Integer16	RW	1	Hz	1	2000	X	Group2 - Page32
	04h	Observer Output, Notch Filter	VAR	Integer16	RW	1	Hz	100	2000	X	Group2 - Page33

<Parameter Group 3>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2230h		Gain Parameter 2	REC								
	01h	Position Loop Proportional Gain 2	VAR	Integer16	RW	1	1/s	1	3000	X	Group3 - Page00
	02h	Position Loop Integral Time Constant 2	VAR	Integer16	RW	0.1	ms	0.5	1000.0	X	Group3 - Page01
	03h	Velocity Loop Proportional Gain 2	VAR	Integer16	RW	1	Hz	1	2000	X	Group3 - Page02
	04h	Velocity Loop Integral Time Constant 2	VAR	Integer16	RW	0.1	ms	0.5	1000.0	X	Group3 - Page03
	05h	Load Inertia Ratio 2	VAR	Integer16	RW	1	%	0	15000	X	Group3 - Page04
	06h	Torque Command Filter 2	VAR	Integer16	RW	1	Hz	1	2000	X	Group3 - Page05
2231h		Gain Parameter 3	REC								
	01h	Position Loop Proportional Gain 3	VAR	Integer16	RW	1	1/s	1	3000	X	Group3 - Page10
	02h	Position Loop Integral Time Constant 3	VAR	Integer16	RW	0.1	ms	0.5	1000.0	X	Group3 - Page11
	03h	Velocity Loop Proportional Gain 3	VAR	Integer16	RW	1	Hz	1	2000	X	Group3 - Page12
	04h	Velocity Loop Integral Time Constant 3	VAR	Integer16	RW	0.1	ms	0.5	1000.0	X	Group3 - Page13
	05h	Load Inertia Ratio 3	VAR	Integer16	RW	1	%	0	15000	X	Group3 - Page14
	06h	Torque Command Filter 3	VAR	Integer16	RW	1	Hz	1	2000	X	Group3 - Page15
2232h		Gain Parameter 4	REC								
	01h	Position Loop Proportional Gain 4	VAR	Integer16	RW	1	1/s	1	3000	X	Group3 - Page20
	02h	Position Loop Integral Time Constant 4	VAR	Integer16	RW	0.1	ms	0.5	1000.0	X	Group3 - Page21
	03h	Velocity Loop Proportional Gain 4	VAR	Integer16	RW	1	Hz	1	2000	X	Group3 - Page22
	04h	Velocity Loop Integral Time Constant 4	VAR	Integer16	RW	0.1	ms	0.5	1000.0	X	Group3 - Page23
	05h	Load Inertia Ratio 4	VAR	Integer16	RW	1	%	0	15000	X	Group3 - Page24
	06h	Torque Command Filter 4	VAR	Integer16	RW	1	Hz	1	2000	X	Group3 - Page25
2235h		Low Pass Filter of Gain Switching	VAR	Integer16	RW	1	ms	0	100	X	Group3 - Page30
2238h		Vibration Suppressor Frequency 2	VAR	Integer16	RW	1	Hz	5	500	X	Group3 - Page40
2239h		Vibration Suppressor Frequency 3	VAR	Integer16	RW	1	Hz	5	500	X	Group3 - Page41
223Ah		Vibration Suppressor Frequency 4	VAR	Integer16	RW	1	Hz	5	500	X	Group3 - Page42

<Parameter Group 4>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2240h		Command Velocity, Low Pass Filter	VAR	Integer16	RW	1	Hz	1	2000	---	Group4 - Page00
2241h		Command Velocity, Threshold	VAR	Unsigned16	RW	1	min ⁻¹	0	65535	---	Group4 - Page01
2242h		Acceleration Compensation	VAR	Integer16	RW	50	Pulse	-9999	+9999	X	Group4 - Page02
2243h		Deceleration Compensation	VAR	Integer16	RW	50	Pulse	-9999	+9999	X	Group4 - Page03

<Parameter Group 5>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2250h		CAN Node-ID Number	VAR	Unsigned8	RW	---	---	1	127	X	Group5 - Page00
2251h		CAN Communication Bit Rate Code	VAR	Unsigned8	RW	---	---	0	8	X	Group5 - Page01
2252h		Touch Probe 1 Signal Input	VAR	Unsigned8	RW	---	---	0	2	X	Group5 - Page02
2253h		Touch Probe 2 Signal Input	VAR	Unsigned8	RW	---	---	0	2	X	Group5 - Page03

Note) Refer to chapter 7.4.2.

<Parameter Group 8>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2280h		Command Input Polarity	VAR	Integer8	RW	---	---	00	07	---	Group8 - Page00
2281h		Analog Input Dead Band	VAR	Integer8	RW	---	---	00	01	---	Group8 - Page01
2282h		Position command Pulse Settings	REC								
	01h	Position Command Pulse, Form Selection	VAR	Integer8	RW	---	---	00	02	---	Group8 - Page11
	02h	Position Command Pulse, Count Polarity	VAR	Integer8	RW	---	---	00	03	---	Group8 - Page12
	03h	Position Command Pulse, Digital Filter	VAR	Integer8	RW	---	---	00	07	---	Group8 - Page13
	04h	Position Command Pulse, Multiplier	VAR	Integer16	RW	---	---	1	63	---	Group8 - Page14
	05h	Electric Gear 1 Numerator	VAR	Integer16	RW	---	---	1	32767	---	Group8 - Page15
	06h	Electric Gear 1 Divisor	VAR	Integer16	RW	---	---	1	32767	---	Group8 - Page15
	07h	Electric Gear 2 Numerator	VAR	Integer16	RW	---	---	1	32767	---	Group8 - Page16
	08h	Electric Gear 2 Divisor	VAR	Integer16	RW	---	---	1	32767	---	Group8 - Page16
	09h	Positioning Method	VAR	Integer8	RW	---	---	00	01	X	Group8 - Page17
	0Ah	Inposition / Position Deviation Monitor	VAR	Integer8	RW	---	---	00	01	X	Group8 - Page18
	0Bh	Deviation Clear Selection	VAR	Integer8	RW	---	---	00	03	X	Group8 - Page19
2283h		Velocity Control Command Settings	REC								
	01h	Preset Velocity Command 1	VAR	Integer16	RW	1	min ⁻¹	0	32767	---	Group8 - Page20
	02h	Preset Velocity Command 2	VAR	Integer16	RW	1	min ⁻¹	0	32767	---	Group8 - Page21
	03h	Preset Velocity Command 3	VAR	Integer16	RW	1	min ⁻¹	0	32767	---	Group8 - Page22
	04h	Velocity Compensation Command, Input Selection	VAR	Integer8	RW	---	---	01	02	---	Group8 - Page23
	05h	Preset Velocity Compensation Command	VAR	Integer16	RW	1	min ⁻¹	-9999	+9999	---	Group8 - Page24
	06h	Analog Velocity Command, Reference (Analog Velocity Compensation Command Reference)	VAR	Integer16	RW	1	min ⁻¹ /V	0	4000	---	Group8 - Page25
	07h	Velocity Command Acceleration Time Constant	VAR	Integer16	RW	1	ms	0	16000	---	Group8 - Page26
	08h	Velocity Command Deceleration Time Constant	VAR	Integer16	RW	1	ms	0	16000	---	Group8 - Page27
	09h	Velocity Limit	VAR	Unsigned16	RW	1	min ⁻¹	1	65535	X	Group8 - Page28

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2284h		Torque Control Command Settings	REC								
	01h	Torque Compensation Command, Input Selection	VAR	Integer8	RW	---	---	01	03	X	Group8 – Page30
	02h	Preset Torque Compensation Command 1	VAR	Integer16	RW	1	%	-500	500	X	Group8 – Page31
	03h	Preset Torque Compensation Command 2	VAR	Integer16	RW	1	%	-500	500	X	Group8 – Page32
	04h	Analog Torque Command, Reference	VAR	Integer16	RW	1	%/V	0	500	---	Group8 – Page33
	05h	Analog Torque Compensation Command, Reference	VAR	Integer16	RW	1	%/V	0	500	---	Group8 – Page34
	06h	Torque Limit, Input Selection	VAR	Integer8	RW	---	---	00	03	---	Group8 – Page35
	07h	Internal Torque Limit	VAR	Integer16	RW	1	%	10	500	---	Group8 – Page36
	08h	Torque Limit at Sequence Operation	VAR	Integer16	RW	1	%	10	500	---	Group8 – Page37
2285h		In-position Near Range	VAR	Unsigned16	RW	1	Pulse	1	65535	X	Group8 – Page40
2286h		In-position Window	VAR	Unsigned16	RW	1	Pulse	1	65535	X	Group8 – Page41
2287h		Speed Zero Range	VAR	Unsigned16	RW	1	min ⁻¹	50	500	X	Group8 – Page42
2288h		Low Speed Range	VAR	Unsigned16	RW	1	min ⁻¹	0	65535	X	Group8 – Page43
2289h		Speed Matching Width	VAR	Unsigned16	RW	1	min ⁻¹	0	65535	X	Group8 – Page44
228Ah		High Speed Range	VAR	Unsigned16	RW	1	min ⁻¹	0	65535	X	Group8 – Page45

<Parameter Group 9>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2290h		Function Enabling Condition Settings	REC								
	01h	Positive Over-Travel Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page00
	02h	Negative Over-Travel Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page01
	03h	Alarm Reset Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page02
	04h	Absolute Encoder Clear Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page03
	05h	Deviation Clear Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page04
	06h	SERVO-ON Function	VAR	Integer8	RW	---	---	00h	27h	---	Group9 – Page05
	07h	Control Mode Switching Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page10
	08h	Position Command Pulse Inhibit Function and Velocity Command Zero Clamp Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page11
	09h	Electric Gear Switching Function	VAR	Integer8	RW	---	---	00h	27h	---	Group9 – Page12
	0Ah *	Gain Switching Function, Select Input 1	VAR	Integer8	RW	---	---	00h	2Fh	X	Group9 – Page13
	0Bh *	Gain Switching Function, Select Input 2	VAR	Integer8	RW	---	---	00h	2Fh	X	Group9 – Page14
	0Ch *	Vibration suppressor Frequency, Select Input 1	VAR	Integer8	RW	---	---	00h	2Fh	X	Group9 – Page15
	0Dh *	Vibration suppressor Frequency, Select Input 2	VAR	Integer8	RW	---	---	00h	2Fh	X	Group9 – Page16
	0Eh *	Position Loop Proportional Control, Switching Function	VAR	Integer8	RW	---	---	00h	2Fh	X	Group9 – Page17
	0Fh	Preset Velocity Command, Select Input 1	VAR	Integer8	RW	---	---	00h	27h	---	Group9 – Page20
	10h	Preset Velocity Command, Select Input 2	VAR	Integer8	RW	---	---	00h	27h	---	Group9 – Page21
	11h	Preset Velocity Command, Direction of Move	VAR	Integer8	RW	---	---	00h	27h	---	Group9 – Page22
	12h	Preset Velocity Command, Operation Start Signal Input	VAR	Integer8	RW	---	---	00h	27h	---	Group9 – Page23

Data setting range to 'Sub-indexes WITH sign (*)' above is from 00h to 2Fh.

Following options are added only them.

28h: FIELDBUS_INPUT0, 29h: FIELDBUS_INPUT1, 2Ah: FIELDBUS_INPUT2, 2Bh: FIELDBUS_INPUT3,

2Ch: FIELDBUS_INPUT4, 2Dh: FIELDBUS_INPUT5, 2Eh: FIELDBUS_INPUT6, 2Fh: FIELDBUS_INPUT7

Another options and data setting range to 'Sub-indexes WITHOUT sign (*)' are described in SANMOTION R TYPE-S Instruction Manual.

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
2290h	13h	Preset Velocity Command, Positive Move Signal Input	VAR	Integer8	RW	---	---	00h	27h	---	Group9 – Page24
	14h	Preset Velocity Command, Negative Move Signal Input	VAR	Integer8	RW	---	---	00h	27h	---	Group9 – Page25
	15h *	Velocity Loop Proportional Control, Switching Function	VAR	Integer8	RW	---	---	00h	2Fh	X	Group9 – Page26
	16h	Velocity Compensation Function, Select Input	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page27
	17h	Torque Compensation Function, Select Input 1	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page30
	18h	Torque Compensation Function, Select Input 2	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page31
	19h	Torque Limit, Input Selection	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page32
	1Ah *	Disturbance Observer	VAR	Integer8	RW	---	---	00h	2Fh	X	Group9 – Page33
	1Bh	External Error Input	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page40
	1Ch	Main Power Discharge Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page41
	1Dh	Emergency Stop Function	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page42
	1Eh	Commutation Sensor Detection Command	VAR	Integer8	R/W	---	---	00h	27h	---	
	1Fh	Home switch Input	VAR	Integer8	RW	---	---	00h	27h	X	Group9 – Page50

Data setting range to 'Sub-indexes WITH sign (*)' above is from 00h to 2Fh.

Following options are added only them.

28h: FIELDBUS_INPUT0, 29h: FIELDBUS_INPUT1, 2Ah: FIELDBUS_INPUT2, 2Bh: FIELDBUS_INPUT3,

2Ch: FIELDBUS_INPUT4, 2Dh: FIELDBUS_INPUT5, 2Eh: FIELDBUS_INPUT6, 2Fh: FIELDBUS_INPUT7

Another options and data setting range to 'Sub-indexes WITHOUT sign (*)' are described in SANMOTION R TYPE-S Instruction Manual.

<Parameter Group A>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
22A0h		General Output Terminal Configurations	REC								
	01h	General Purpose Output 1	VAR	Integer8	RW	---	---	00h	6Bh	X	GroupA – Page00
	02h	General Purpose Output 2	VAR	Integer8	RW	---	---	00h	6Bh	X	GroupA – Page01
	03h	General Purpose Output 3	VAR	Integer8	RW	---	---	00h	6Bh	(X)	GroupA – Page02
	04h	General Purpose Output 4	VAR	Integer8	RW	---	---	00h	6Bh	(X)	GroupA – Page03
	05h	General Purpose Output 5	VAR	Integer8	RW	---	---	00h	6Bh	(X)	GroupA – Page04
	06h	General Purpose Output 6	VAR	Integer8	RW	---	---	00h	6Bh	(X)	GroupA – Page05
	07h	General Purpose Output 7	VAR	Integer8	RW	---	---	00h	6Bh	(X)	GroupA – Page06
	08h	General Purpose Output 8	VAR	Integer8	RW	---	---	00h	6Bh	(X)	GroupA – Page07
22A1h		Digital Monitor, Output Signal Selection	VAR	Integer8	RW	---	---	00h	6Bh	X	GroupA – Page10
22A2h		Analog Monitor Output Selection	REC								
	01h	Analog Monitor 1, Output Signal Selection	VAR	Integer8	RW	---	---	00h	15h	X	GroupA – Page11
	02h	Analog Monitor 2, Output Signal Selection	VAR	Integer8	RW	---	---	00h	15h	X	GroupA – Page12
	03h	Analog Monitor Output Polarity	VAR	Integer8	RW	---	---	00h	08h	X	GroupA – Page13
22A3h		Setup Software Communication Setting	REC								
	01h	Axis Number	VAR	Integer8	RW	---	---	1	127	X	GroupA – Page20
	02h	Baud Rate	VAR	Integer8	RW	---	---	00h	08h	X	GroupA – Page21

Note) (X) in column 'CAN Mode' are only supported in AC400V input type.

<Parameter Group B>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
22B0h		JOG Velocity Command	VAR	Integer16	RW	1	min ⁻¹	0	32767	---	GroupB – Page00
22B1h		Dynamic Brake Action Selection	VAR	Integer8	RW	---	---	00	05	X	GroupB – Page10
22B2h		Over-Travel Action Selection	VAR	Integer8	RW	---	---	00	06	---	GroupB – Page11
22B3h		Emergency Stop Operation	VAR	Integer8	RW	---	---	00	01	---	GroupB – Page12
22B4h		Delay Time of Engaging Holding Brake (holding brake holding delay time)	VAR	Unsigned16	RW	1	ms	0	1000	X	GroupB – Page13
22B5h		Delay Time of Releasing Holding Brake (holding brake release delay time)	VAR	Unsigned16	RW	1	ms	0	1000	X	GroupB – Page14
22B6h		Brake Operation Beginning Time	VAR	Unsigned16	RW	1	ms	0	65535	X	GroupB – Page15
22B7h		Power Failure Detection Delay Time	VAR	Unsigned16	RW	1	ms	20	1000	X	GroupB – Page16
22B8h		Following Error Warning Level	VAR	Unsigned16	RW	1024	Pulse	1	65535	X	GroupB – Page20
22B9h		Following Error Limit	VAR	Unsigned16	RW	1024	Pulse	1	65535	X	GroupB – Page21
22BAh		Overload Warning Level	VAR	Integer16	RW	1	%	20	100	X	GroupB – Page22
22BBh		Speed Feedback Error (ALM_C3) Detection	VAR	Integer8	RW	---	---	00	01	X	GroupB – Page23
22BCh		Speed Control Error (ALM_C2) Detection	VAR	Integer8	RW	---	---	00	01	X	GroupB – Page24

<Parameter Group C>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
22C0h		Position Detection System Selection	VAR	Integer8	RW	---	---	00	01	X	GroupC – Page00
22C1h		Motor Incremental Encoder, Digital Filter	VAR	Integer8	RW	---	---	00	07	X	GroupC – Page01
22C2h		External Incremental Encoder, Digital Filter	VAR	Integer8	RW	---	---	00	07	X	GroupC – Page02
22C3h		External Encoder Polarity Reversal	VAR	Integer8	RW	---	---	00	07	X	GroupC – Page03
22C4h		Encoder Pulse Divided Output, Selection	VAR	Integer8	RW	---	---	00	01	(X)	GroupC – Page04
22C5h		Encoder Output Pulse, Divide Ratio	REC								
	01h	Divide Ratio, Numerator	VAR	Integer16	RW	---	---	1	8191	(X)	GroupC – Page05
	02h	Divide Ratio, Divisor	VAR	Integer16	RW	---	---	1	8192	(X)	GroupC – Page05
22C6h		Encoder Pulse Divided Output, Polarity	VAR	Integer8	RW	---	---	00	03	(X)	GroupC – Page06
22C7h		Encoder Signal Output (PS), Format	VAR	Integer8	RW	---	---	00	02	(X)	GroupC – Page07
22C8h		Absolute Encoder Clear Function Selection	VAR	Integer8	RW	---	---	00	01	X	GroupC – Page08

Note) (X) in column 'CAN Mode' are only supported in AC400V input type.

<Motor Parameter>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp General parameter
<p>In order to change 'Motor parameter (Object 22E0h, Sub 01h...36h)' and/or 'System parameter (Objects 22F0h...22FDh)' in servo drive via SDO communication, special procedure for 'opening the lock' is necessary before writing. Password (Object 2125h) is used in this procedure.</p> <p>The motor parameter of each combined motor is provided if necessary by SANYO DENKI Co., Ltd. Please consult the person in charge of sales.</p> <p>When these parameters are changed, the drive outputs the alarm state in order to inform user that it is necessary to be cycled control power.</p>											
22E0h		Motor Parameters	REC								
	01h	Motor Parameter 1	VAR	Unsigned16	RW	---	---	---	---	X	
	02h	Motor Parameter 2	VAR	Unsigned16	RW	---	---	---	---	X	
	:	:	:	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	:	:	:	
	36h	Motor Parameter 54	VAR	Unsigned16	RW	---	---	---	---	X	

<System Parameter>

Index	Sub-index	Name	Obj. code	Data type	Access	1LSB	Unit	Min	Max	CAN Mode	R-Amp System parameter
<p>In order to change 'Motor parameter (Object 22E0h, Sub 01h...36h)' and/or 'System parameter (Objects 22F0h...22FDh)' in servo drive via SDO communication, special procedure for 'opening the lock' is necessary before writing. Password (Object 2125h) is used in this procedure.</p> <p>When these parameters are changed, the drive outputs the alarm state in order to inform user that it is necessary to be cycled control power.</p>											
22F0h		Main Power, Input Type	VAR	Integer8	RW	---	---	00	01	X	Sys_Para-Page00
22F1h		Motor Encoder Type	VAR	Integer8	RW	---	---	00	01	X	Sys_Para-Page01
22F2h		Incremental Encoder, Function Setting	VAR	Integer8	RW	---	---	00	01	X	Sys_Para-Page02
22F3h		Incremental Encoder, Resolution Setting	VAR	Unsigned16	RW	1	P/R	500	65535	X	Sys_Para-Page03
22F4h		Absolute Encoder, Function Setting	VAR	Integer8	RW	---	---	04h	84h	X	Sys_Para-Page04
22F5h		Absolute Encoder, Resolution Setting	VAR	Unsigned8	RW	---	---	00h	0Ah	X	Sys_Para-Page05
22F8h		Control Mode (CANopen Mode = 06h)	VAR	Integer8	RW	---	---	00h	06h	X	Sys_Para-Page08
22F9h		Position Loop Encoder Selection	VAR	Integer8	RW	---	---	00	01	X	Sys_Para-Page09
22FAh		External Encoder, Resolution Setting	VAR	Unsigned16	RW	1	P/R	500	65535	X	Sys_Para-Page0A
22FBh		Regenerative Resistor Selection	VAR	Integer8	RW	---	---	00	02	X	Sys_Para-Page0B

7.4.2 Parameter Description for Object Group 2200h-22FFh

Object 2250h: CAN Node-ID Number

This parameter sets the node-ID number in CAN communication.
 This parameter is only active, if two pieces of rotary switches on the front panel of servo drive are both set to '0h, 0h' or 'Fh, Fh'.
 Reading of this parameter only represents the data in non-volatile memory, not active Node-id.
 New node-ID number becomes active after the control power was cycled once or after 'Reset node' was executed.

Object description	Index	2250h
	Name	CAN node-ID number
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, CAN node-ID number
	Meaning	CAN node-ID number
	Access	RW
	PDO mapping	---
	Value range	1...127
	Default value	100

For more information, see chapter 3.1 also.

Object 2251h: CAN Communication Bit Rate Code

This parameter sets the Bit rate used for CAN communication.
 New bit rate code becomes active after the control power was cycled once or after 'Reset node' was executed.

Object description	Index	2251h
	Name	CAN communication bit rate code
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, CAN communication bit rate code
	Meaning	CAN communication bit rate code
	Access	RW
	PDO mapping	---
	Value range	0, 1, 2, 4, 5, 6, 7, 8
	Default value	6 [6: 500Kbit per second]
Data description	Value	Bit rate
	0	10 Kbit/s
	1	20 Kbit/s
	2	50 Kbit/s
	(3)	Not used
	4	125 Kbit/s
	5	250 Kbit/s
	6	500 Kbit/s
	7	800 Kbit/s
8	1 Mbit/s	

For more information, see chapter 3.2 also.

Object 2252h: Touch Probe 1 Signal Input

This object selects signal input condition for Touch Probe 1.

Object description	Index	2252h
	Name	Touch probe 1 signal input
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Touch probe 1 signal input
	Meaning	Selects signal input condition for touch probe 1.
	Access	RW
	PDO mapping	---
	Value range	0...2
	Default value	0
Data description	Value	Description
	0h	CONT7 is not used as Probe1 input.
	1h	CONT7 input ON to OFF change is recognized as 'positive edge'.
	2h	CONT7 input OFF to ON change is recognized as 'positive edge'.

Object 2253h: Touch Probe 2 Signal Input

This object selects signal input condition for Touch Probe 2.

Object description	Index	2253h
	Name	Touch probe 2 signal input
	Object code	VAR
	Data type	Unsigned8
Entry description	Sub-index	00h, Touch probe 2 signal input
	Meaning	Selects signal input condition for touch probe 2.
	Access	RW
	PDO mapping	---
	Value range	0...2
	Default value	0
Data description	Value	Description
	0h	CONT8 is not used as Probe2 input.
	1h	CONT8 input ON to OFF change is recognized as 'positive edge'.
	2h	CONT8 input OFF to ON change is recognized as 'positive edge'.

8 Appendix

8.1 Dummy Mapping

Indices in the range 0005h – 0007h can be mapped as well in order to define the appropriate space in the R_PDO as not being used by the drive (do not care).

This feature is useful to transmit data to several drives using one R_PDO, and then each drive only obtains some part of PDO.

Index	Object	Name
0005h	DEFTYPE	UNSIGNED8
0006h	DEFTYPE	UNSIGNED16
0007h	DEFTYPE	UNSIGNED32

To apply 'Dummy mapping function' above, it is necessary to set Bit5 of Object2120h to '1' which is prepared in order to keep compatibility.

-Example-

<R_PDO1 sent by controller>

COB-ID	Length	Data (8bytes)			
201h	8	Byte 1, 2	Byte 3, 4	Byte 5, 6	Byte 7, 8

Byte1, 2: 'Interpolation Data Position lower-16bits (Obj 2010h)' for **Drive Axis 1**.
 Byte3, 4: 'Interpolation Data Position lower-16bits (Obj 2010h)' for **Drive Axis 2**.
 Byte5, 6: 'Interpolation Data Position lower-16bits (Obj 2010h)' for **Drive Axis 3**.
 Byte7, 8: 'Interpolation Data Position lower-16bits (Obj 2010h)' for **Drive Axis 4**.

<R_PDO1 setting for Drive Axis 1>

Index	Sub-Index	Data	Description
1400h	0h	2	Number of values for the object
1400h	1h	201h	COB-ID
1400h	2h	1	Transmission type
1600h	0h	4	Number of values for the objects
1600h	1h	2010 0010h	Interpolation Data Position lower-16bits
1600h	2h	0006 0010h	Dummy object 16bits
1600h	3h	0006 0010h	Dummy object 16bits
1600h	4h	0006 0010h	Dummy object 16bits

<R_PDO1 setting for Drive Axis 2>

Index	Sub-Index	Data	Description
1400h	0h	2	Number of values for the object
1400h	1h	201h	COB-ID
1400h	2h	1	Transmission type
1600h	0h	4	Number of values for the object
1600h	1h	0006 0010h	Dummy object 16bits
1600h	2h	2010 0010h	Interpolation Data Position lower-16bits
1600h	3h	0006 0010h	Dummy object 16bits
1600h	4h	0006 0010h	Dummy object 16bits

<R_PDO1 setting for Drive Axis 3>

Index	Sub-Index	Data	Description
1400h	0h	2	Number of values for the object
1400h	1h	201h	COB-ID
1400h	2h	1	Transmission type
1600h	0h	4	Number of values for the objects
1600h	1h	0006 0010h	Dummy object 16bits
1600h	2h	0006 0010h	Dummy object 16bits
1600h	3h	2010 0010h	Interpolation Data Position lower-16bits
1600h	4h	0006 0010h	Dummy object 16bits

<R_PDO1 setting for Drive Axis 4>

Index	Sub-Index	Data	Description
1400h	0h	2	Number of values for the object
1400h	1h	201h	COB-ID
1400h	2h	1	Transmission type
1600h	0h	4	Number of values for the object
1600h	1h	0006 0010h	Dummy object 16bits
1600h	2h	0006 0010h	Dummy object 16bits
1600h	3h	0006 0010h	Dummy object 16bits
1600h	4h	2010 0010h	Interpolation Data Position lower-16bits

8.2 Data types

Data Type shall indicate the index of the data type of the object in the object dictionary.
 Index 01h - 1Fh contain the standard data types, index 20h - 23h contain predefined complex data types.

Table 8-1: Object Dictionary Data Types

Index	Name
0001	BOOLEAN
0002	INTEGER8
0003	INTEGER16
0004	INTEGER32
0005	UNSIGNED8
0006	UNSIGNED16
0007	UNSIGNED32
0008	REAL32
0009	VISIBLE_STRING
000A	OCTET_STRING
000B	UNICODE_STRING
000C	TIME_OF_DAY
000D	TIME_DIFFERENCE
000F	DOMAIN
0010	INTEGER24
0011	REAL64
0012	INTEGER40
0013	INTEGER48
0014	INTEGER56
0015	INTEGER64
0016	UNSIGNED24
0018	UNSIGNED40
0019	UNSIGNED48
001A	UNSIGNED56
001B	UNSIGNED64
0020	PDO_COMMUNICATION_PARAMETER
0021	PDO_MAPPING
0022	SDO_PARAMETER
0023	IDENTITY

8.3 Object types

Object Type shall indicate the object code.

Table 8-2: Object Dictionary Object Definitions

Object Name	Comments	Object Code
NULL	A dictionary entry with no data fields	0
DOMAIN	Large variable amount of data e.g. executable program code.	2
DEFTYPE	Denotes a type definition such as a Boolean, UNSIGNED16, float and so on.	5
DEFSTRUCT	Defines a new record type e.g. the PDO Mapping structure at 21h.	6
VAR	A single value such as an UNSIGNED8, Boolean, float, Integer16, visible string etc.	7
ARRAY	A multiple data field object where each data field is a simple variable of the SAME basic data type e.g. array of UNSIGNED16 etc. Sub-index 0 is of UNSIGNED8 and therefore not part of the ARRAY data.	8
RECORD	A multiple data field object where the data fields may be any combination of simple variables. Sub-index 0 is of UNSIGNED8 and therefore not part of the RECORD data.	9

8.4 Access types

The Attribute column defines the access rights for a particular object. The viewpoint is from the bus into the device.

Table 8-3: Access Attributes for Data Objects

Attribute	Description
RW	Read and write access
WO	Write only access
RO	Read only access
RWR	Read and write on process input
RWW	Read and write on process output
Const	Read only access, value is constant

8.5 Terms and Abbreviations

cs

command-specifier

COB-Id

Communication-Object-Identifier. Each COB is uniquely identified in a CAN network by a number called the COB Identifier (COB-ID). The identifier determines the priority of that COB in the MAC sub-layer too.

CRC

Cyclic-Redundancy-Check

DLC

Data-Length-Code

EDS

Electronic-data-sheet

LLC:

Logical-Link-Control. One of the sub-layers of the Data Link Layer is in the CAN Reference Model that gives the user an interface that is independent from the underlying MAC layer.

MAC:

Medium-Access-Control. One of the sub-layers of the Data Link Layer is in the CAN Reference Model that gets access to the medium to send a message.

MDI:

Medium-Dependent-Interface. One of the sub-layers of the Physical Layer is in the CAN Reference Model that specifies the mechanical and electrical interface between the medium and a module.

NMT

Network-Management. One of the service elements of the application layer is in the CAN Reference Model. The NMT serves to configure, initialize, and handle errors in a CAN network.

Node-ID

The Node-ID of the NMT Slave has to be assigned uniquely, or 0. If 0, the protocol addresses all NMT Slaves.

PDO

Process-Data-Object. Object for data exchange between several devices.

PLS:

Physical-Layer-Signaling. One of the sub-layers of the Physical Layer is in the CAN Reference Model that specifies the bit representation, timing and synchronization.

PMA:

Physical-Medium-Attachment. One of the sub-layers of the Physical Layer is in the CAN Reference Model that specifies the functional circuitry for bus line transmission/reception and may provide means for failure detection.

SDO

Service-Data-Object. Peer to peer communication with access to the object dictionary of a device.

Release
Revision A Feb. 2008
Revision B Sep. 2008
Revision C Oct. 2010

Precautions For Adoption

Cautions

The possibility of moderate or minor injury and the occurrence of physical damage are assumed when the precautions at right column are not observed. Depending on the situation, this may cause serious consequences. Be sure to follow all listed precautions.

Cautions

- Be sure to read the instruction manual before using this product.
- Take sufficient safety measures and contact us before applying this product to medical equipment that may involve human lives.
- Contact us before adapting this product for use with equipment that could cause serious social or public effects.
- The use of this product in high motion environments where vibration is present, such as in vehicles or shipping vessels, is prohibited.
- Do not convert or modify any equipment components.

* Please contact our Business Division for questions and consultations regarding the above.

SANYO DENKI CO., LTD.

1-15-1, Kita-Otsuka, Toshima-ku, Tokyo 170-8451, Japan

<http://www.sanyodenki.com>

Phone: +81 3 3917 5157

SANYO DENKI AMERICA, INC.

468 Amapola Avenue Torrance, CA 90501 U.S.A.

Phone: +1 310 783 5400

SANYO DENKI EUROPE SA.

P.A. Paris Nord II 48 Allée des Erables-VILLEPINTE BP:57286 F-95958 ROISSY CDG Cedex France

Phone: +33 1 48 63 26 61

SANYO DENKI GERMANY GmbH

Frankfurter Strasse 63-69 65760 Eschborn Germany

Phone: +49 6196 76113 0

SANYO DENKI KOREA CO., LTD.

9F 5-2, Sunwha-dong Jung-gu Seoul, 100-130, Korea

Phone: +82 2 773 5623

SANYO DENKI SHANGHAI CO., LTD.

Rm2108-2109, Bldg A, Far East International Plaza, No.319, Xianxia Rd., Shanghai, 200051, China

Phone: +86 21 6235 1107

SANYO DENKI TAIWAN CO., LTD.

Room 1208, 12F, No.96 Chung Shan N. Rd., Sec.2, Taipei 104, Taiwan, R.O.C.

Phone: +886 2 2511 3938

SANYO DENKI (H.K.) CO., LIMITED

Room 2305, 23/F, South Tower, Concordia Plaza, 1 Science Museum Rd., TST East, Kowloon, Hong Kong

Phone: +852 2312 6250

SANYO DENKI SINGAPORE PTE. LTD.

10 Hoe Chiang Road #14-03A/04 Keppel Towers Singapore 089315

Phone: +65 6223 1071

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